Scientific Report of the 2025 Dietary Guidelines Advisory Committee

Advisory Report to the Secretary of Health and Human Services and Secretary of Agriculture

United States Department of Health and Human Services

United States Department of Agriculture

Scientific Report of the 2025 Dietary Guidelines Advisory Committee

Department of Health and Human Services
200 Independence Avenue, SW
Washington, DC 20201

Department of Agriculture
1400 Independence Avenue, SW
Washington, DC 20250

This first print of the Scientific Report of the 2025 Dietary Guidelines Advisory Committee is being published by the Department of Health and Human Services (HHS). The contents of this document may be used and reprinted without permission. Endorsements by HHS of derivative products developed from this work may not be stated or implied. Online-only supplementary materials for data analysis, systematic reviews, and food pattern modeling can be found through **DietaryGuidelines.gov**

Suggested citation: 2025 Dietary Guidelines Advisory Committee. 2024. *Scientific Report of the 2025 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Health and Human Services and Secretary of Agriculture*. U.S. Department of Health and Human Services.
https://doi.org/10.52570/DGAC2025

HHS complies with applicable Federal civil rights laws and does not discriminate on the basis of race, color, national origin, age, disability, religion, or sex (including pregnancy, sexual orientation, and gender identity). HHS does not exclude people or treat them differently because of race, color, national origin, age, disability, religion, or sex (including pregnancy, sexual orientation, and gender identity).

HHS provides free aids and services to people with disability to communicate effectively with us, such as qualified sign language interpreters and written information in other formats (large print, audio, accessible electronic formats, or other formats). HHS provides free language services to people whose primary language is not English, such as qualified interpreters and information written in other languages. If you need these services, contact HHS at 1-877-696-6775.

If you believe that HHS has failed to provide these services or discriminated in another way on the basis of race, color, national origin, age, disability, or sex, you can file a grievance with the U.S. Department of Health and Human Services, Office for Civil Rights, electronically through the **https://ocrportal.hhs.gov/ocr/smartscreen/main.jsf**, or by mail or phone at:

U.S. Department of Health and Human Services
200 Independence Avenue, SW
Room 509W, HHH Building
Washington, DC 20201
1800-368-1019, 800-537-7697 (TDD)

Table of Contents

The Honorable Xavier Becerra
Secretary of Health and Human Services
200 Independence Avenue, SW
Washington, DC 20201

The Honorable Thomas Vilsack
Secretary of Agriculture
1400 Independence Avenue, SW
Washington, DC 20250

Dear Secretaries Becerra and Vilsack,

On behalf of the 2025 Dietary Guidelines Advisory Committee, it is our privilege to submit the final report to inform the development of the *Dietary Guidelines for Americans, 2025–2030*. We are truly honored by this prestigious appointment and deeply appreciative for the trust and confidence you have placed in the Committee. During the past 22 months, we have engaged in extensive Committee deliberations, conducted rigorous reviews of data and scientific literature, and collaborated closely to prepare this report, gaining valuable insights from one another throughout the process. We had the privilege of working with the outstanding staff at HHS and USDA and were continually inspired by members of the public who submitted their thoughtful comments. It is our sincere hope that this report provides similar inspiration to the public whom this Committee was asked to serve.

In alignment with the Federal Advisory Committee Act and the Committee's charter, we were tasked with reviewing the current body of nutrition science on specific topics and questions and developing a scientific report that includes our independent, science-based advice for HHS and USDA to consider. In 2017, the National Academies of Sciences, Engineering, and Medicine (NASEM) issued the report, *Redesigning the Process for Establishing the Dietary Guidelines* and in 2023, issued the report, *Evaluating the Process to Develop the Dietary Guidelines for Americans, 2020–2025*. We implemented many of the recommendations from these NASEM reports. Such improvements have enabled the 2025 Dietary Guidelines Advisory Committee to include new scientific evidence in developing its conclusions. As we reflect on the evolution of the *Dietary Guidelines* process, we appreciate how NASEM has provided guidance to meet the highest standards for scientific rigor and integrity.

The Committee considered questions that examined relationships between diet and health across the lifespan through a health equity lens. We believe that emphasizing health equity throughout our report can inform the development of the *Dietary Guidelines for Americans, 2025–2030*, which will support U.S. individuals in meeting their dietary goals. Additionally, we encourage federal agencies and fellow researchers to consider the research priorities we identified during our deliberations. These priorities not only aim to deepen our understanding of what the American public eats and how it is linked to health outcomes, but also to expand the inquiry into why and how dietary patterns are shaped.

In his 2000 Dietary Guidelines Advisory Committee letter to the Secretaries of HHS and USDA, Dr. Cutberto Garza stated, “Although the committee reviewed the evidence objectively, no doubt some voices will question our collective and individual objectivity. Recognizing this inevitability, I hope that the rationally based controversy will stimulate scientific research.” We could not have expressed this better. We cannot stress enough that every member of this Committee has worked collaboratively and tirelessly, upholding the highest standards of integrity throughout the preparation of this report. The Committee considered public comments and responded to outstanding peer review. Differences in interpretation were discussed and debated with mutual respect, and for each decision, consensus was reached. Like Dr. Garza, we hope that the criticisms based on merit will stimulate new research that will benefit the American public. This process is only as strong as the data available for the Committee's review, and further research will strengthen the foundation on which future guidelines are built.

We look forward to seeing the contributions of our Committee incorporated in the *Dietary Guidelines for Americans, 2025–2030*.

Sincerely,

Sarah L. Booth, PhD
Chair

Angela Odoms-Young, PhD
Vice Chair

Dietary Guidelines Advisory Committee Membership and Federal Support Staff

2025 Dietary Guidelines Advisory Committee Membership

Chair

Sarah Booth, PhD
Tufts University

Vice Chair

Angela Odoms-Young, PhD, MS
Cornell University

Members

Steven Abrams, MD
University of Texas at Austin

Cheryl Anderson, PhD, MPH, MS
University of California San Diego

Aline Andres, PhD, RD
University of Arkansas for Medical Sciences

Carol Byrd-Bredbenner, PhD, RD, FAND
Rutgers, The State University of New Jersey

Andrea Deierlein, PhD, MPH, MS
New York University

Heather Eicher-Miller, PhD
Purdue University

Jennifer Orlet Fisher, PhD
Temple University

Teresa Fung, ScD, RD
Simmons University

Christopher Gardner, PhD
Stanford University

Edward Giovannucci, MD, ScD
Harvard University

Deanna Hoelscher, PhD, RDN, LD, CNS, FISBNPA
UT Health Houston School of Public Health

Valarie Blue Bird Jernigan, DrPH, MPH
Oklahoma State University

Cristina Palacios, PhD, MSc
Florida International University

Hollie Raynor, PhD, RD, LDN
University of Tennessee Knoxville

Fatima Cody Stanford, MD, MPH, MPA, MBA, MACP, FAAP, FAHA, FAMWA, FTOS
Harvard University

Sameera Talegawkar, PhD
The George Washington University

Christopher Taylor, PhD, RDN, LD, FAND
The Ohio State University

Deirdre Tobias, ScD
Harvard University

Federal Support Staff

The Departments of Health and Human Services (HHS) and Agriculture (USDA) are responsible for updating the *Dietary Guidelines for Americans* every 5 years. As part of this process, the Departments appoint an external Federal Advisory Committee to review the current body of nutrition science. HHS and USDA provided support to the Committee throughout its tenure. Federal staff support included assisting the Committee during its review of evidence, coordinating meetings, documenting decisions, and supporting transparency via regular updates to DietaryGuidelines.gov and NESR.usda.gov and corresponding list serv communications. The protocols, findings, conclusion statements, integration, and advice to the Departments contained in this report are the independent work of the Committee.

Within HHS, the Office of Disease Prevention and Health Promotion (ODPHP) in the Office of the Assistant Secretary for Health (OASH), and within USDA, the Center for Nutrition Policy and Promotion (CNPP) within Food and Nutrition Service (FNS), Food, Nutrition, and Consumer Services (FNCS) are the lead agencies that supported the 2025 Dietary Guidelines Advisory Committee. Staff listed below are from these respective agencies, unless otherwise noted.

Designated Federal Officers

HHS

Janet de Jesus, MS, RD
Designated Federal Officer (DFO)

USDA

Eve Stoody, PhD
DFO Representative

Agency Leadership

HHS

Paul Reed, MD
Rear Admiral, U.S. Public Health Service
Deputy Assistant Secretary for Health, Director
Office of Disease Prevention and Health Promotion

Katrina Piercy, PhD, RD, FACSM
Commander, U.S. Public Health Service
Director, Division of Prevention Science
Office of Disease Prevention and Health Promotion

USDA

Jackie Haven, MS, RD
(Through March 2024)
Deputy Administrator
Center for Nutrition Policy and Promotion
Food and Nutrition Service

Kelley Scanlon, PhD, RD
Acting Deputy Administrator
Center for Nutrition Policy and Promotion
Food and Nutrition Service

HHS and USDA Federal Liaisons

HHS

Dennis Anderson-Villaluz, MBA, RD, LDN, FAND

Kara Beckman, PhD

Jessica Bluto, MS, RDN, LD, CDCES, CSOWM
(Detail, Indian Health Service – through November 2023)

Carolyn Chung, PhD
(Detail, Food and Drug Administration – through May 2023)

Dana DeSilva, PhD, RD

Sarah Karp, MNSP, RD, LDN

Emily Levin, MPH, RDN

LCDR Joe Rorabaugh-Irwin, MS, RD, LD, CDCES
(Detail, Indian Health Service – through May 2023)

USDA

Elizabeth Rahavi, RD

Meghan Adler, MS, RDN

Jean Altman, MS
(Through July 2023)

Rachel Inman, MS, RD
(Presidential Management Fellow – beginning August 2024)

Tessa Lasswell, MPH, RD

Chinwe Obudulu, MS, RD

Julia Quam, MSPH, RDN

Data Analysis Team

HHS

Dana DeSilva, PhD, RD
Project Co-Lead

Kara Beckman, PhD

Sarah Karp, MNSP, RD, LDN

LDCR Joe Rorabaugh-Irwin, MS, RD, LD, CDCES
(Detail, Indian Health Service – through May 2023)

USDA

Colleen Cruz, MPH, RDN
Project Co-Lead

Meghan Adler, MS, RDN

Hazel Hiza, PhD

Kevin Kuczynski, MS, RD

Tessa Lasswell, MPH, RD

Chinwe Obudulu, MS, RD

TusaRebecca Pannucci, PhD, MPH, RD

Leigh Ann Richardson, PhD, MPH[a]

Kelley Scanlon, PhD, RD

---

[a]Contractor, Panum Telecom, LLC. Under contract with the Food and Nutrition Service, United States Department of Agriculture. Panum, LLC is a wholly owned subsidiary of Aretum

Nutrition Evidence Systematic Review Team

USDA

Julie Obbagy, PhD, RD
Project Lead

Charlotte Bahnfleth, PhD

Betsy Becker, PhD[a]

Emily H. Callahan, MS

Natasha Chong Cole, PhD, MPH, RD

Laural Kelly English, PhD

Amanda Fultz, PhD, RDN, LDN

Molly Higgins, MLIS

Shue Huang, PhD[a]

Julia H. Kim, PhD, MPH, RD

Brittany Kingshipp, PhD

Megan Lawless, PhD[a]

Jielin Ming, PhD[a]

Shabnam Momim, PhD[a]

Julie Nevins, PhD

Sara Pritschet, MS, RD[a]

Ramkripa Raghavan, DrPH, MPH, MSc

Nicole Reigh Rothrauff, PhD[a]

Sara Scinto-Madonich, MS

Joanne Spahn, MS, RD, FADA
(Through September 2023)

Ali Webster, PhD, RD

HHS

Gisela Butera, MEd, MLIS
National Institutes of Health, National Library of Medicine

Nancy Terry, MLIS
National Institutes of Health, National Library of Medicine

---

[a]Contractor, Panum Telecom, LLC. Under contract with the Food and Nutrition Service, United States Department of Agriculture. Panum, LLC is a wholly owned subsidiary of Aretum

Food Pattern Modeling Team

USDA

TusaRebecca Pannucci, PhD, MPH, RD
Project Lead

Meghan Adler, MS, RDN

Kevin Kuczynski, MS, RD

Emily Madan, PhD[a]
(Through June 2023)

Verena McClain, MSc[a]

Sara Pritschet, MS, RD[a]

Leigh Ann Richardson, PhD, MPH[a]

Kelley Scanlon, PhD, RD

Additional Staff Support

HHS

Holly McPeak, MS
(Through December 2023)

USDA

Stephenie Fu

Communications

HHS

Jennifer Bishop, ScD, MPH

Joellen Leavelle

Ted McCarthy

USDA

Sasha Chamberlain, MS, RDN

Jessica Larson, MS, RD

Jairea McClamb

Science Writer

Emily A. Callahan, MPH, RDN[b]
EAC Health and Nutrition, LLC

---

[a]Contractor, Panum Telecom, LLC. Under contract with the Food and Nutrition Service, United States Department of Agriculture. Panum, LLC is a wholly owned subsidiary of Aretum

[b]Under contract with the National Institutes of Health

Part A: Executive Summary

The Departments of Health and Human Services (HHS) and Agriculture (USDA) established the 2025 Dietary Guidelines Advisory Committee (Committee) to examine scientific evidence on specific nutrition and public health topics and provide independent, science-based advice and recommendations to be considered by the Departments in the development of the *Dietary Guidelines for Americans, 2025-2030*. HHS and USDA identified topics and scientific questions to potentially be examined by the 2025 Committee and posted them for public comment before establishing the Committee. After the Committee was appointed, it considered the proposed questions and determined if questions should be added, refined, or removed as it prioritized questions for its review. The Committee used the criteria of relevance, importance, potential impact to federal programs, avoiding duplication, and research availability during its prioritization process. The Committee used 3 approaches to examine the evidence: data analysis, systematic reviews, and food pattern modeling. Each of these approaches has its own rigorous, protocol-driven methodology, and each played a complementary role in examining the science. The type of information the Committee needed to answer each scientific question determined which approach it would use to review the evidence (see **Part C. Methodology** for more information on the Committee's process for examining the science and for a complete list of scientific questions addressed by the Committee).

As was true for recent Committees, the 2025 Committee's work took place against a backdrop of several significant nutrition-related issues in the United States (see **Part D. Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions**).

- Chronic health conditions for which poor nutrition is a risk factor—including overweight and obesity, type 2 diabetes, cardiovascular disease (CVD), metabolic syndrome, and certain cancers—are prevalent, presenting major public health challenges. For example, prevalence of overweight and obesity is 73 percent among U.S. adults ages 20 years and older and 36 percent among children and adolescents ages 2 through 19 years, and prevalence of prediabetes is 38 percent among individuals ages 12 through 19 years. The prevalence of conditions such as overweight, obesity, and prediabetes at young ages is of particular concern because of their effects on the current health of the child as well as the risks of persistent chronic conditions into adulthood.
- Data show significant disparities in prevalence of nutrition-related chronic health conditions between sociodemographic groups. For example, the prevalence of obesity is lower among non-Hispanic Asian children and adults compared to all other racial and/or ethnic groups examined, and the prevalence of obesity is also lower among children with higher family income compared to those with lower family income. Among adults, the prevalence of obesity is lower among non-Hispanic Asian adults and higher in non-Hispanic Black adults. Also among adults, the prevalence of obesity, hypertension, and type 2 diabetes is higher among families with lower incomes compared to higher incomes. Education data show that prevalence of

obesity and prevalence of hypertension among adults are both lower among those with higher educational attainment (college degree or above) than those with lower educational attainment.

Against this backdrop, the Committee's report is particularly notable for its intentional focus on health equity, which it defined as the state in which everyone has a fair and just opportunity to attain their highest level of health. Specifically, the Committee was tasked with examining the relationship between diet and health across all life stages using a health equity lens, ensuring that the implications of factors such as socioeconomic position, race, ethnicity, and culture were described and considered to the greatest extent possible for each scientific question and based on the information available in the scientific literature and data. A primary goal of centering health equity is to help HHS and USDA ensure that the resulting guidance in the *Dietary Guidelines for Americans (Dietary Guidelines)* is relevant to people of diverse racial, ethnic, socioeconomic, and cultural backgrounds, thereby increasing the potential of the guidance to meet nutrient needs, promote health, and reduce risk of chronic disease.

The Committee considered health equity as a guiding principle as it examined the evidence (see **Part B. Chapter 2: Health Equity and Nutrition**). From protocol development to evidence integration, the Committee worked to ensure that factors such as socioeconomic position, race, ethnicity, and culture were considered to the greatest extent possible based on the available evidence. For example, the Committee conducted an evidence scan on culturally tailored dietary interventions to describe the available evidence and make recommendations regarding future systematic review efforts to continue work on this important topic. As a second example, the Committee's data analysis efforts included a granular look at how dietary intakes and prevalence of chronic diseases vary among sociodemographic groups. As a third example, the Committee was the first Committee to use diet simulations—a systems science approach—to evaluate proposed dietary patterns, considering variability in the selection and consumption of foods and beverages representing differing preferences, cultures, and traditions.

The Committee's report also leverages advancements in the methods used to examine the evidence. The Committee established synthesis plans in each of its systematic review protocols, and answered select scientific questions using systematic review with meta-analysis. In addition, all systematic reviews and food pattern modeling reports underwent external peer review in an effort to further align with recommendations from a National Academies report.

The Committee addressed a broad range of important diet- and health-related questions, building on the work of previous Committees and expanding their reviews to new topics. The Committee addressed new topics, including food sources of saturated fat consumed and risk of CVD; dietary patterns with varying amounts of ultra-proceeded foods; strategies for improving diet quality and weight management, which involved new reviews on portion size and frequency of meals and/or snacking; and practical guidance about how to feed younger children in terms of caregiver feeding styles and practices that support children's consumption of healthy foods.

In addition to these distinguishing features, the Committee continued the lifespan approach by reviewing evidence on the period of birth through older adulthood, including during pregnancy and lactation.

The remainder of this Executive Summary provides brief summaries of the Committee's topic-specific reviews of the science through data analysis, systematic reviews, and food pattern modeling. Through these reviews the Committee also generated advice for the Departments, future Committees, and the research community, and outlined specific research needs to fill gaps in the current evidence (see **Part E. Chapter 2: Future Directions**). The Committee's report also includes a chapter that integrates its findings and conclusions and presents its overarching advice to the Departments for the *Dietary Guidelines for Americans, 2025-2030* (**Part E. Chapter 1: Overarching Advice to the Departments**); that chapter is summarized at the end of this Executive Summary.

Current Dietary Intakes Throughout the Lifespan

Consumption of nutrient-dense foods and beverages is critical to meeting nutrient needs essential for health throughout the lifespan, from growth and development during pregnancy and childhood through healthy aging during adulthood. Few U.S. individuals, however, consume a dietary pattern that aligns with *Dietary Guidelines* recommendations, regardless of age, race, ethnicity, or sociodemographic group examined. Therefore, nearly all U.S. individuals can benefit from shifting to healthier dietary patterns. Social determinants of health, which include economic, environmental, social, educational, and structural factors, play a role in dietary intakes throughout the lifespan because they impact the ability of individuals and population groups to access healthy foods and achieve nutrition recommendations.

The Committee's review of current U.S. dietary intakes indicates that across the lifespan, intakes of Vegetables; Fruits; Dairy and Fortified Soy Alternatives; Seafood; Nuts, Seeds, and Soy Products; and Whole Grains are generally lower than current recommendations, while intakes of total Grains (including Refined Grains); total Protein Foods; and Meat, Poultry, and Eggs are generally at or above current recommendations. These intakes have ramifications for nutrient intakes and status throughout life. Based on dietary intake, biomarker data, and relevance to health, for individuals ages 1 year and older, vitamin D, calcium, potassium, and dietary fiber are nutrients of public health concern due to underconsumption; and sodium, added sugars, and (for ages 2 years and older) saturated fat are nutrients of public health concern due to overconsumption. Additional nutrients are of public health concern for certain individuals only during specific life stages.

Each individual life stage holds unique implications for dietary intake and the risk of disease. In addition, during certain periods of the lifespan, dietary shortfalls and their associated risks may pose greater threats to long-term health. Diet quality is relatively higher in early childhood compared to later childhood and adolescence. The poor nutrient intakes of adolescents, particularly females—paired with potential for rapid growth and development during this period—are concerning, both at the individual level and for the possible intergenerational impacts. Diet quality is somewhat higher for older adults compared to younger adults, though several specific nutrient concerns remain. Also within each life stage, opportunities exist to provide specific advice to individuals about food components that provide key nutrients at that life stage and for ways they (and their caregivers, as applicable) can make healthy food choices and employ strategies to improve diet quality.

Dietary Patterns and Specific Dietary Components Across Life Stages

The Committee examined a range of topics related to dietary intakes across life stages, including the relationship between overall dietary patterns and specific dietary components and a series of broad health outcomes.

Dietary Patterns

Dietary patterns, which comprise usual quantities and frequencies of foods, beverages, and nutrients that are consumed during a given time frame or life stage, may be influenced by many factors such as population norms, personal preferences, and cultural foodways. The Committee examined evidence on relationships between dietary patterns and growth, body composition, and risk of obesity (including gestational weight gain and postpartum weight change); cardiovascular disease; type 2 diabetes; breast cancer; colorectal cancer; and age-related cognitive decline, dementia, Alzheimer's disease, and mild cognitive impairment. It also examined evidence on relationships between dietary patterns in pregnancy and maternal and infant outcomes, including risk of hypertensive disorders of pregnancy, risk of gestational diabetes mellitus, gestational age at birth, and birth weight. The studies reviewed included a variety of dietary patterns from multiple countries, which is consistent with the aim of the *Dietary Guidelines* to provide nutrition advice that represents a variety of cultural foodways.

As the Committee considered the evidence, which encompassed multiple life stages, a dietary pattern emerged that was consistently related to beneficial health. This healthy dietary pattern for individuals ages 2 years and older is higher in vegetables, fruits, legumes (i.e., beans, peas, lentils), nuts, whole grains, fish/seafood, and vegetable oils higher in unsaturated fat, and lower in red and processed meats, sugar-sweetened foods and beverages, refined grains, and saturated fat. Some of these healthy dietary patterns also include consumption of fat-free or low-fat dairy and foods lower in sodium, and/or may include plant-based dietary options.

Beverages

Beverages may be consumed as part of meals or snacks, as a meal or snack, or sipped throughout the day. Beverages are key contributors to hydration and to energy and nutrient intakes in U.S. dietary patterns. Although some beverages provide dietary and health benefits, consumption of higher quantities of certain beverages can contribute to excess intake of energy as well as certain nutrients that should be limited.

The Committee examined evidence on relationships between beverage consumption and growth, body composition, risk of obesity, and risk of type 2 diabetes across the lifespan. Given that beverages vary in energy content and nutrient composition—differences that may be associated with beverages' different impacts on health outcomes—various types of beverages were examined in separate questions. These beverages included dairy milk and milk alternatives, 100% juice, sugar-sweetened beverages (SSB), and low- and no-calorie sweetened beverages (LNCSB). Taken together, the Committee's findings showed that SSB are associated with unfavorable health outcomes in infants, children, adolescents, adults, and older adults, based on evidence graded as moderate, and that total milk and higher-fat milk may be associated with favorable health benefits for growth, body composition, and risk of obesity in younger children ages 2 through 5 years, based on evidence graded as limited. The Committee could not draw a conclusion about the relationship between consumption of milk with different fat content by older children, adolescents, adults, or older adults and these outcomes because of substantial concerns with the body of evidence. The Committee decided that evidence is not sufficient to advise changing current *Dietary Guidelines* recommendations for primary consumption of unsweetened fat-free and low-fat milk across the lifespan. The Committee's systematic reviews suggest that a relationship does not exist (i.e., neither a beneficial nor an adverse relationship exists) between 100% juice consumption or LNCSB consumption and growth, body composition, or risk of obesity in children, adolescents, adults, or older adults. Finally, no conclusion statements about beverages could be drawn for the life stages of pregnancy and postpartum, indicating this area should be a research priority so that comprehensive guidance on beverage intake can be developed.

These findings support existing general recommendations for beverage consumption provided in the *Dietary Guidelines*, which emphasize consuming water and beverages that contribute beneficial nutrients, such as fat-free and low-fat milk and 100% juices; and reducing intake of beverages (e.g., SSB) that contain calories while contributing limited or no beneficial nutrients. The Committee suggested enhancements to existing recommendations, including an emphasis on plain drinking water as the primary beverage for people to consume, specificity regarding unsweetened fat-free and low-fat dairy milk and unsweetened fortified soy beverages, and clarifying that SSB consumption should be limited.

Food Sources of Saturated Fat

Since the first edition of the *Dietary Guidelines* was published in 1980, each subsequent edition has consistently recommended limiting consumption of saturated fat. This is the first Committee to formally evaluate food-level comparisons of foods with higher or lower levels of saturated fat to inform potential guidance for which foods across the dietary pattern could be increased when saturated fat-containing foods are reduced, for cardiovascular disease risk reduction.

The Committee's findings reinforce the recommendations in the current (2020-2025) *Dietary Guidelines* to limit total saturated fat intake to less than 10 percent of calories per day starting at age 2 by replacing it with unsaturated fat, particularly polyunsaturated fats. Evidence indicates that when reducing butter, processed and unprocessed red meat, and dairy, substitution or replacement with a wide range of plant-based food sources, including plant-based protein foods (e.g., beans, peas, and lentils), whole grains, vegetables, or monounsaturated fatty acid (MUFA)- and PUFA-rich vegetable oils and spreads, is associated with cardiovascular disease risk reduction. The general lack of cardiovascular disease benefit observed for substitution or replacement within animal-based saturated fat foods, despite potential differences in saturated fat content, further highlights the importance of evaluating dietary exposures at the food level. Consuming foods lower in saturated fat may be related to decreased cardiovascular disease risk through their lower saturated fat content, as well as the other nutritional exposures within these foods, such as beneficial dietary factors (e.g., fiber, antioxidants). These findings support recommendations to replace saturated fat-containing foods with plant sources rich in MUFA, PUFA, and fiber, rather than other animal sources of saturated fat, for reduction in CVD risk. Further, the Committee's systematic review findings support replacement of plant sources higher in saturated fat, such as coconut oil, cocoa butter, and palm oil, with vegetable oils higher in unsaturated fats.

Dietary Practices and Behaviors in Birth Through Childhood

Childhood represents a critical window during which nutrition has a profound influence on cognitive and physical development; it also represents a focal period for the development and socialization of eating behaviors. The family is a first and fundamental context in which the development of eating behaviors occurs. The Committee examined relationships between the timing and types of foods and beverages introduced during the complementary feeding period, and of caregiver feeding styles and practices, with various outcomes.

Complementary Feeding and Feeding Styles and Practices During Childhood

Complementary feeding is a period of rapid nutritional transition when children are introduced to a variety of foods, flavors, and textures, and eating routines that reflect the diets of their family, culture, and environment. Complementary feeding begins around age 6 months and extends to 24 months, a period during which complementary foods and beverages (CFB) take on an increasingly important role in sustaining adequate growth and development. In addition to the timing of introduction, the types and amounts of CFB are important factors that may influence dietary intake, nutritional status, growth and body composition, and future health outcomes. Fruits, vegetables, and grains are complementary food options between ages 6 and 24 months that are not associated with unfavorable outcomes related to growth or risk of obesity, based on the Committee's systematic reviews. Conclusions for food groups beyond fruits, vegetables, and grains for these outcomes are not possible at this time.

Children's food acceptance and preferences are largely learned through experiences around eating, which emphasizes that *how* children are fed may be as important as *what* they are fed. The Committee's systematic reviews on relationships between caregiver feeding styles and practices and child food acceptance, dietary intake, and outcomes related to growth highlight the potentially supportive role of structured feeding practices in promoting young children's acceptance and consumption of healthful foods aligned with the *Dietary Guidelines*. Structured feeding practices, including repeated exposure—a practice that shows robust evidence of promoting children's acceptance of fruits and vegetables during the first 6 years of life—may support children's intakes of both fruits and vegetables by organizing children's physical and social eating environments: making readily accepted foods generally available to children (e.g., fruits), including vegetables in eating routines (e.g., providing vegetables at snacks), providing guided choices that include vegetables, and modeling enjoyment of eating vegetables. The lack of studies regarding relationships between other types of feeding practices and outcomes related to eating behavior and dietary intakes highlights notable scientific gaps in how to feed children for promoting healthy dietary patterns aligned with the *Dietary Guidelines*.

Strategies for Individuals and Families Related to Diet Quality and Weight Management

The Committee considered specific evidence-based strategies that individuals can use to follow a healthy dietary pattern with appropriate calories to achieve or maintain a healthy weight. These include strategies related to frequency of meals and/or snacking as well as portion size. The Committee also explored culturally responsive interventions to improve diet through an evidence scan.

Frequency of Meals and/or Snacking

The Committee examined evidence across the lifespan on relationships between frequency of meals and/or snacking and consuming a dietary pattern that is better aligned with the *Dietary Guidelines;* energy intake; and growth, body composition, and risk of obesity. The Committee's work evaluated scientific literature on occasion-based measures such as meals (e.g., breakfast), snacking, frequency of meals, and number of eating occasions as defined by the studies.

Among children and adolescents, regular breakfast consumption and a higher number of eating occasions may be associated with favorable outcomes related to growth, body composition, and/or lower risk of obesity; frequency of daily snacking among children may not be associated with outcomes related to growth, body composition, and/or risk of obesity; and meal frequency/skipping among children may not be associated with risk of overweight or obesity. Among adults and older adults, breakfast skipping, overall snacking, and number of eating occasions may not be associated with outcomes related to body composition, body weight, and/or risk of obesity, but after dinner/evening snacking may be associated with less favorable outcomes related to body composition and risk of obesity. Adequate evidence was not available for any life stage on the relationship between frequency of meals and/or snacking and energy intake, nor for consuming a dietary pattern that is better aligned with the *Dietary Guidelines*, highlighting the need for additional research on these topics. Similarly, not enough evidence was available to assess the relationship between frequency of meals and/or snacking and gestational weight gain or postpartum weight change.

Portion Size

To better understand how portion sizes influence selection and consumption of food, the Committee examined evidence on relationships between food and beverage portion sizes and energy intake and growth, body composition, and risk of obesity. The Committee prioritized integrating the concepts of food type, portion size, and energy density in its review of the evidence to identify specific evidence-based strategies that individuals can use to follow a healthy dietary pattern with appropriate calories to achieve or maintain a healthy weight.

Evidence indicated that large portions, particularly of energy-dense foods and beverages, promote energy intake among both adults and children. Portion size effects have been observed across a variety of different types of foods, participant characteristics, and packaging types and sizes, suggesting that larger portion sizes may have universal effects to promote food consumption. The implications of portion size for energy intake, however, may depend on food type. Among adults and older adults, portion size and energy density have independent and additive effects on daily energy intake. Among children, larger portion sizes of low energy-dense foods such as vegetables and fruits promote consumption of those foods without appreciable effects on daily energy intake. Strategies to promote portion control of energy-dense foods include selection of smaller package sizes and use of pre-portioned meals and snacks for foods and beverages. Although the body of evidence considered demonstrates robust influences of food and beverage portion size on intake among children and adults, a lack of evidence exists on the relationship between portion size and energy intake in young children, adolescents, and individuals during pregnancy and postpartum. A lack of evidence also exists on the role of portion size in achieving or maintaining a healthy weight and growth, body composition, and risk of obesity overall.

Culturally Responsive Interventions to Improve Diet

Dietary behaviors result from a complex interplay of psychological, sociological, economic, and sensory factors, all of which are influenced by culture. Culturally responsive (also referred to as culturally tailored) approaches and interventions have garnered significant interest based on their promise for improving equitable access to healthcare and nutrition services and in supporting health behavior change. Culturally responsive dietary interventions are designed to align with specific cultural practices, beliefs, and preferences of the target population, with the aim of improving the quality of their diet and health outcomes. The U.S. population has become more racially and ethnically diverse during the past decade, highlighting the need to ensure that the *Dietary Guidelines* are representative of the country's diverse populations and that community implementation appropriately reflects cultural preferences.

The Committee conducted an evidence scan to better understand the breadth and depth of the diverse body of evidence on culturally responsive dietary intervention studies, as such studies emphasize how cultural considerations have been incorporated into interventions to address the needs of a given population and explore the impact of culture on dietary intake and health. The Committee integrated concepts from 2 frameworks to provide a theoretical and practical foundation for the Committee to classify the intervention components within the evidence scan and interpret the scan's results within the broader context of the literature. This evidence scan also explored intervention opportunities, emphasizing the potential for social, economic, and environmental strategies to improve overall diet and overall diet quality among populations disproportionately affected by health disparities. The results demonstrated that many diverse culturally responsive dietary interventions have been conducted in the United States and Canada to improve diet and energy intake as well as various health outcomes such as growth, body composition, risk of obesity, and risk of cardiovascular disease and type 2 diabetes. The findings may provide insights on the importance of allowing for flexibilities around the Healthy U.S.-Style Dietary Pattern to be more culturally responsive, and could also serve as a springboard for future, more targeted systematic reviews that assess the effectiveness of the interventions on outcomes of interest.

Food Pattern Modeling

Food pattern modeling is a methodology used to illustrate how changes to the amounts or types of foods and beverages in a dietary pattern might affect meeting nutrient needs. These analyses are used to develop quantitative dietary patterns that reflect health-promoting patterns identified in systematic reviews to meet energy and nutrient needs. The Committee used food pattern modeling to inform, with consideration of each life stage, if changes should be made to the 3 USDA Dietary Patterns (Healthy U.S.-Style, Healthy Mediterranean-Style, and/or Healthy Vegetarian). The Committee also considered if additional Dietary Patterns should be developed/proposed based on the review of evidence.

Nutrient Profile Development

An initial step in the Committee's food pattern modeling process was development of nutrient profiles to use in all food pattern modeling analyses. Nutrient profiles are calculated for food groups and subgroups, and are based on the weighted average of nutrient-dense forms of foods considering a range of foods and beverages reported by individuals in the United States. Nutrient-dense versions of foods and beverages were used to calculate nutrient profiles in previous food pattern modeling analyses. This Committee examined an alternative approach that considered which, if any, foods and beverages lower in nutrient density should contribute toward the calculations of nutrient profiles. The nutrient profiles were modestly refined by excluding a limited list of foods and beverages lower in nutrient density with the intent to model nutrient-dense foods and beverages that better align as part of a healthy dietary pattern.

The Committee also examined whether nutrient profiles based on dietary intakes of the total U.S. population ages 1 and older are generalizable to individual population groups classified by race, Hispanic origin, and socioeconomic position using income measures related to federal assistance program income eligibility. Separate nutrient profiles were calculated based on each group's proportional intakes of foods and beverages, which represented the variation in dietary intakes among these population groups. The evaluation of nutrient profiles specific to individual population groups demonstrated some differences in the proportions of foods and beverages that contributed to the calculation of nutrient profiles, but had limited differences on the overall macronutrient and micronutrient composition of the nutrient profiles. No changes were made to the nutrient profiles used in subsequent food pattern modeling analyses based on this evaluation. The individual population group nutrient profiles were used, however, as part of the final synthesis to evaluate proposed food pattern(s) against nutritional goals.

Food Group and Subgroup Analysis

After developing the nutrient profile to use in all food pattern modeling analyses, the Committee explored how shifts in quantities of food groups and subgroups, mostly tested within the 2020 Healthy U.S.-Style Dietary Pattern (HUSS), could have implications for nutrient adequacy. This helped the Committee determine if modifications or flexibilities should be made to the existing patterns, or if new dietary pattern variations should be developed. Ultimately, the Committee did not propose the addition of an entirely new dietary pattern. It did, however, identify supporting evidence from food pattern modeling analyses to explore potential modifications to the 2020 HUSS that simultaneously modify at certain calorie levels: (1) Vegetable subgroups, specifically to increase Beans, Peas, and Lentils and decrease Starchy Vegetables while keeping Total Vegetables in the same quantities; and (2) reduce Total Protein Foods by reducing Meat, Poultry and Eggs. The Committee determined that based on the evidence reviewed, no scientific justification existed to recommend modifications for the quantities of other food groups or subgroups in any pattern. The Committee also recommended removal of the line for “Limits on Calories for Other Uses” that appears in the existing USDA Dietary Patterns for ages 2 years and older. This line represented a quantitative estimate of calories remaining after all other foods and beverages in the pattern are consumed in their most nutrient-dense forms. According to the current (2020-2025) *Dietary Guidelines*, these calories can be used for added sugars, saturated fat, and/or alcohol, or to eat more than the recommended amount of food in a food group. Given inherent variability in the energy estimates of nutrient-dense foods and beverages and the poor diet quality in the United States, presenting a quantified number of additional calories was not considered prudent and may be misleading because calories for other uses may not be available.

The Committee’s food pattern modeling analyses also demonstrated the unique but varied contributions that each of the food groups and subgroups across the HUSS make to meeting nutritional goals, underscoring the necessity of dietary variety and highlighting potential implications of excluding dietary components without thoughtful replacement. Findings from the Committee’s food pattern modeling analyses informed its development of a modified 2020 HUSS that continues to meet nutritional goals across life stages and age and sex groups, with few exceptions. The modified 2020 HUSS was then evaluated for potential refinement using diet simulations.

Diet Simulations

The Committee used diet simulations to evaluate the capacity of a wide range of foods and beverages consumed in the United States, including foods of lower nutrient density, to meet the modified 2020 HUSS. The addition of this systems modeling approach is the first use in the *Dietary Guidelines* development process and is also responsive to recommendations from a National Academies report. These data allowed the Committee to examine and consider refinement of the modified 2020 HUSS to ensure that it is inclusive of a broader range of dietary intakes. Given time constraints and the novelty of this approach, the Committee needed to limit the number of groups for whom the diet simulations would test the proposed pattern. The Committee unanimously decided to prioritize American Indian and Alaska Native populations in the pilot method to identify foods and beverages to use in a separate set of simulation analyses, with the recommendation that future work in this area be expanded to represent additional U.S. population groups.

Results from the Committee’s analyses indicate that nutrient requirements can generally be met with the modified 2020 HUSS dietary pattern when considering a wide variety of foods consumed in the United States and included in select American Indian and Alaska Native diets. Therefore, the Committee did not further refine the modified 2020 HUSS, but emphasized that recommended food group amounts should be met predominantly with foods and beverages lower in added sugars, saturated fat, and sodium. It is notable, however, that recommended limits for sodium intake were exceeded even when foods lower in nutrient density were excluded from the simulations. This suggests that decreasing sodium to levels expected to reduce chronic disease risk is unlikely without considerable efforts to decrease sodium in the U.S. food supply.

Overarching Advice to the Departments

Several key themes emerged throughout the Committee's work. First, the value of using multiple sources of evidence to inform comprehensive, actionable recommendations. The Committee leveraged and triangulated diverse evidence sources and methodological approaches that built iteratively upon one another—including findings from data analysis, systematic reviews, and food pattern modeling—to develop comprehensive and actionable advice for HHS and USDA in developing the *Dietary Guidelines for Americans, 2025-2030.* Second, the importance of considering—across approaches to examine evidence—select sociodemographic and economic indicators that are central to applying a health equity lens. Including these indicators allowed the Committee to examine their implications for recommending dietary patterns that promote health equity, specifically understanding how they impact dietary intake; how and if different populations are represented in the existing literature to ensure generalizability; and the potential of existing and revised dietary patterns to meet cultural, regional, social, and religious needs. Third, the expansion of the scope of the evidence reviewed to examine not only recommended amounts and types of foods but also strategies to effectively promote healthy dietary patterns across the life course; this recognizes that achieving a healthy dietary pattern involves a combination of dietary/feeding strategies and behavioral modifications. The Committee evaluated the effectiveness of strategies, including the frequency of meals/snacks, breakfast consumption, portion size, and child feeding styles and practices, for achieving a healthy dietary pattern and lower risk of obesity across the lifespan. The Committee also emphasized the importance of flexibility and inclusion in dietary recommendations—which is increasingly recognized as essential for promoting adherence to healthy eating patterns and improving overall health outcomes—as a core element across the 3 themes.

With regard to USDA Dietary Patterns, the Committee did not recommend modifications to the 2020 HUSS for young children ages 12 through 23 months who are no longer receiving human milk or infant formula. For individuals ages 2 years and older, results from the Committee's analyses indicate that nutrient requirements can generally be met with the modified 2020 HUSS dietary pattern when considering a wide variety of foods consumed in the United States and included in select American Indian and Alaska Native diets. Moreover, systematic reviews demonstrate that the 3 current USDA Dietary Patterns, as well as other healthy dietary patterns, have similar core elements. These core elements are retained in the *Eat Healthy Your Way* Dietary Pattern, which is the Committee's proposed dietary pattern—a single inclusive, flexible, dietary pattern that incorporates scientific evidence accumulated across many years and builds on the work of prior Committees. The proposed modifications are based on the Committee's systematic reviews and food pattern modeling analyses, informed by data analysis, supported by diet simulations, and reflective of the Committee's review of scientific evidence through a health equity lens. Key tenets include flexibility and inclusivity, acknowledging that all U.S. individuals with their diverse backgrounds and foodways can achieve the goal of eating a healthy dietary pattern by following the proposed dietary pattern.

The Committee recommends that the proposed *Eat Healthy Your Way Dietary Pattern* emphasizes dietary intakes of beans, peas, and lentils while reducing intakes of red and processed meats, as supported by systematic reviews as well as food pattern modeling analyses indicating that nutrient goals are generally met with such a shift from the 2020 HUSS to include more plant-based Protein Foods. The Committee also recommends moving Beans, Peas, and Lentils as a subgroup of the Vegetables Food Group to a subgroup of the Protein Foods Group to align with evidence to encourage plant sources of Protein Foods. The Committee also proposes reorganizing the order of the Protein Foods Group to list Beans, Peas, and Lentils first, followed by Nuts, Seeds, and Soy products, then Seafood, and finally Meats, Poultry, and Eggs. The Committee also recommends removing “Limits on Calories for Other Uses” from the quantitative pattern because variability in calorie content exists across the many food and beverage options that may be used to achieve the pattern’s food group and subgroup recommendations, meaning that it is possible that no calories may remain for other uses.

The Committee also reviewed the 4 overarching Guidelines in the *Dietary Guidelines for Americans, 2020-2025* and provides advice to the Departments regarding these 4 Guidelines for the *2025-2030* edition. The updates reflect the Committee’s emphasis on how and why individuals eat what they do and its commitment to building flexibilities into an inclusive framework such that the *Dietary Guidelines* can better meet individuals where they are and to meet the varied budgetary, cultural, and personal preferences of people living in the United States. Details of these suggested updates are provided in **Part E. Chapter 1: Overarching Advice to the Departments.**

The *Eat Healthy Your Way* Dietary Pattern proposes modifications and flexibilities to the modeled dietary pattern, which ensures food group recommendations meet nutrient requirements, with few exceptions. These modifications do not necessarily reflect changes needed to bring current dietary intakes at the individual or population levels into alignment with recommendations. Therefore, the Committee recommends that future Committees be composed of expertise in the disciplines of health equity, nutrition science, and behavioral and implementation sciences to assist HHS and USDA in their efforts to successfully implement dietary guidance for all Americans, regardless of their age, sex, race, ethnicity, and/or socioeconomic position, to narrow the gap between scientifically robust dietary guidance and actual dietary consumption by the U.S. population.

Part B. Chapter 1: Introduction

More than half of all U.S. adults have one or more preventable chronic conditions, many of which are related to unhealthy dietary intakes.[1] Food insecurity is present in 18 million U.S. households, including 3.2 million U.S. households with children.[2] The likelihood of having a chronic disease increases with increasing degree of food insecurity, and both disproportionally affect different population groups.[3] Availability and access to nutritious foods and beverages that support healthy living is important for all people in the United States. Up-to-date nutrition advice in the *Dietary Guidelines for Americans* can help improve the health of individuals in the United States by encouraging food and beverage choices that are affordable, enjoyable, promote health and sustainability, and help prevent chronic diseases.

By law (Public Law 101-445, Title III, 7 U.S.C. 5301 et seq.), the *Dietary Guidelines for Americans* is published by the federal government every 5 years. Since the 1985 edition, the U.S. Departments of Health and Human Services (HHS) and Agriculture (USDA) have fulfilled this requirement by establishing a Dietary Guidelines Advisory Committee (Committee) of nationally recognized experts in the field of nutrition and health to review the scientific and medical knowledge current at the time.

The 2025 Dietary Guidelines Advisory Committee was established for the single, time-limited task to examine the evidence on specific nutrition and public health topics, and for providing independent, science-based advice and recommendations to the federal government. The Committee considered all the conclusion statements generated from its scientific reviews to develop overarching advice for the Secretaries of Health and Human Services and Agriculture for use as HHS and USDA develop the *Dietary Guidelines for Americans, 2025–2030*.

An Evolving Focus for Dietary Guidance

To meet the nutrient needs of the U.S. population, the *Dietary Guidelines for Americans, 2020-2025* promotes consumption of a variety of nutrient-dense foods and beverages from food groups and subgroups in USDA Dietary Patterns. Each edition of the *Dietary Guidelines* builds on the previous edition, with scientific justification for changes informed by the Committee's scientific report, along with input from federal agencies and the public. Early editions focused on healthy members of the public but more recent editions, recognizing the growing prevalence of diet-related chronic diseases such as cardiovascular disease, type 2 diabetes, obesity, and some forms of cancer, have also addressed individuals with increased risk of chronic disease. More recent editions have also focused on dietary patterns, or combinations of foods eaten over time, with more quantitative information and refinements in guidance.

The 2025 Committee expanded the scope of work of the 2020 Committee to: (1) explore variability in intakes and the range of possible healthy diets; (2) refine patterns based on special considerations by life stage, if and where evidence is available; (3) provide a framework intended to be customized to individual needs and preferences; and (4) conduct work through a health equity lens to help HHS and USDA develop *Dietary Guidelines* that can support all people in the U.S. across racial, ethnic, socioeconomic, and cultural backgrounds in achieving a healthy dietary pattern. This Committee leveraged methodological refinements to those used in prior Committees; introduced new analytical tools, such as a new risk of bias tool for observational studies; and expanded transparency around its activities, including providing updated information for dedicated websites where all the protocols were posted for comment.

Several key themes emerged throughout the Committee's work. First, the value of leveraging multiple sources of evidence to inform comprehensive, actionable recommendations. Second, the importance of considering select sociodemographic and economic indicators across approaches to examine evidence, which is central to applying a health equity lens. Third, the expansion of the scope of the evidence reviewed to examine not only recommended amounts and types of foods but also strategies to effectively promote healthy dietary patterns across the life course; this recognizes that achieving a healthy dietary pattern involves a combination of dietary/feeding strategies and behavioral modifications. The Committee also emphasized the importance of flexibility and inclusion in dietary recommendations—which is increasingly recognized as essential for promoting adherence to healthy eating patterns and improving overall health outcomes—as a core element across the 3 themes.

Health Equity

This Committee was the first to be charged to and employ a comprehensive, systematic approach to incorporate a health equity lens throughout its work. Although prior Committees incorporated basic demographic factors such as age, race, and/or ethnicity into their reviews of the science, this Committee considered additional variables representing the social determinants of health (such as socioeconomic position) as it reviewed, interpreted, and synthesized evidence across data analysis, systematic review, and food pattern modeling. The importance of reviewing evidence through a health equity lens and considering factors like economic stability cannot be overstated. Income and employment have a significant impact on dietary choices through various factors, including time constraints, financial resources, and workplace food environments. Economic constraints can limit access to healthier food options, pushing individuals toward cheaper, less nutritious alternatives.[4,5]

Including these select sociodemographic and economic indicators allowed the Committee to examine their implications for recommending dietary patterns that promote health equity. Specifically, the inclusion of such indicators allowed the Committee to understand how they impact dietary risk, how and if different populations are represented in the existing literature to ensure generalizability, and the potential of existing and revised dietary patterns to meet cultural, regional, social, and religious needs. This approach is consistent with federal program and policy initiatives to improve health, improve food and nutrition security, and promote equity. The effort to center health equity builds on previous editions of the *Dietary Guidelines* as they continue to refine population-based dietary recommendations across life stages, reflecting changing dietary needs over the life course. Integrating social and structural considerations that affect the relationship between diet and health, such as influences of varying environments, financial circumstances, and cultural backgrounds, supports an inclusive approach to dietary guidance. While such evidence is still accumulating, integrating the available data can inform development of dietary guidance that is relevant to diverse population groups.

Flexibility and Inclusion

This Committee used food pattern modeling (FPM) to build on the current *Dietary Guidelines* to explore what modifications and flexibilities can be introduced in and between food groups in current USDA Dietary Patterns to enhance dietary guidance for all individuals. The integration of data analysis, systematic reviews, and FPM through a health equity lens allowed the Committee to explore different combinations of foods within the individual food groups and subgroups to maximize the capacity of the healthy dietary patterns to address individual differences while optimizing health. The Committee further built on this work by conducting novel diet simulations that can test the capacity of a wide range of foods and beverages to meet a given dietary pattern. The addition of this systems science approach allowed the Committee to test dietary patterns to ensure the final pattern recommended to the Departments is inclusive of a broader range of dietary intakes and considers health equity. Separately, a pilot was conducted to simulate foods and beverages identified by cultural experts as included in select American Indian and Alaska Native diets, the first time any country has conducted simulations to evaluate national dietary guidelines using only foods identified for specific cultural groups.

The importance of flexibility and inclusion in dietary recommendations is increasingly recognized as essential for promoting adherence to healthy eating patterns and improving overall health outcomes among a diverse population. Flexibility in dietary guidelines allows individuals to tailor their eating habits to fit personal preferences, cultural practices, and lifestyle needs, which can enhance motivation and compliance with dietary recommendations.[6,7] For instance, dietary guidelines that incorporate a variety of food choices rather than rigid restrictions can accommodate diverse dietary patterns, making it easier for individuals to integrate healthy foods into their daily lives.[8] Inclusion is equally vital, as it ensures that dietary recommendations are accessible and relevant to a broad audience, including those with specific health conditions, cultural backgrounds, and socioeconomic positions. This approach recognizes that individuals have unique dietary needs and preferences, which can significantly influence their ability to follow dietary guidelines. By allowing for flexibility in food choices, such as incorporating preferred foods in moderation, dietary recommendations can be more effective in promoting long-term behavior change. For example, studies have shown that individuals who follow more flexible dietary patterns tend to have higher adherence to recommended nutrient intakes and lower risks of diet-related diseases.[9] By recognizing the diverse needs of the population and allowing for personalized dietary choices, health professionals can foster a more inclusive approach to nutrition that supports long-term health and well-being. Ultimately, this work allowed the Committee to develop advice to the Departments recommending a single flexible, healthy dietary pattern, designed to meet people where they are and to meet the varied budgetary, cultural, and personal preferences of people living in the United States.

The How of Healthy Eating

This Committee emphasized the importance of extending its evidence review beyond *what* a healthy dietary pattern is to *how* to support consumption of a healthy dietary pattern across the lifespan. The Committee gave consideration not only to recommendations regarding the amounts and types of foods to consume but also evaluated the effectiveness of strategies—including frequency of meals/snacks, breakfast consumption, portion size, and child feeding styles and practices—for achieving a healthy dietary pattern and lower risk of obesity across the lifespan. Evidence indicates that achieving a healthy dietary pattern involves a combination of dietary/feeding strategies and behavioral modifications. For example, the Committee considered the timing and types of complementary foods, use of responsive feeding practices, and use of structure in guiding children's eating behaviors. During infancy the introduction of complementary foods is a critical milestone in a child's development, influencing not only one's nutritional status but also future eating behaviors and food preferences. During early childhood, child feeding styles and practices have been shown to influence children's food intake, dietary habits, and overall health outcomes. This helped the Committee consider guidance that can be provided to parents and caregivers to support them in both *what* to feed and *how* to feed.

Eating behaviors are important determinants of dietary intake, and some can be investigated as strategies to enhance health. Understanding how these behaviors influence food intake is critical for identifying effective strategies for improving dietary quality and weight management in childhood and adulthood. For example, understanding how portion sizes impact selection and consumption of food can inform recommendations for weight control and obesity prevention.

Lastly, recognizing that nutrient-dense foods that align with the dietary patterns recommended by the *Dietary Guidelines for Americans* are present in all cultural diets, the Committee conducted a novel evidence scan of culturally responsive approaches and interventions. This evidence scan on culturally tailored interventions may provide insights as to the importance of allowing for flexibilities around the Healthy U.S.-Style Dietary Pattern to be more culturally responsive, supporting the development of the Committee's flexible, healthy dietary pattern.

From the 2025 Dietary Guidelines Advisory Committee Report to the *Dietary Guidelines for Americans*

A major goal of the 2025 Committee is to summarize and synthesize the evidence to support HHS and USDA in developing the *Dietary Guidelines for Americans, 2025-2030* recommendations for meeting nutrient requirements and promoting health for all Americans. The *Dietary Guidelines* is developed and written for a professional audience including policymakers, healthcare providers, nutrition educators, and federal nutrition program operators. The federal government uses the *Dietary Guidelines for American*s as the basis of its food and nutrition assistance programs—in which about 1 in 4 people in the United States participate during a given year—and its nutrition education efforts, as well as decisions about national health objectives, and for providing information on diet and health to the general public.[10] For example, the National School Lunch Program incorporates the *Dietary Guidelines* in menu planning, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) applies the *Dietary Guidelines* in its program and educational materials, and the Healthy People objectives for the nation include objectives based on the *Dietary Guidelines.* The *Dietary Guidelines* also provides a critical framework for state and local health promotion and disease prevention initiatives.

A Guide to the Committee's Report

This report is organized into 5 major sections and several appendixes. Part A provides an Executive Summary of the Report. Part B sets the stage for the report (in this introductory chapter) and discusses the Committee's use of a health equity lens throughout its review of the evidence. Part C describes the methodology the Committee used to conduct its work and review the evidence on diet and health. Part D provides the results of the Committee's review of the evidence using data analysis, systematic review, and food pattern modeling. Part E presents the Committee's overarching advice to the Departments, as well as recommendations of topics for the nutrition and public health community to consider, including research recommendations. The report's appendices (Part F) include a glossary and list of abbreviations; a summary of the process used to collect public comments; biographical sketches of Committee members; a list of Subcommittee and Working Group members; and acknowledgements.

References

1. Cruz CM, DeSilva D, Beckman K, et al. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Prevalence of Nutrition-Related Chronic Health Conditions. 2024;U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion. doi:https://doi.org/10.52570/DA.DGAC2025.DA04
2. Rabbitt M, Reed-Jones M, Hales L, Burke M. Household Food Security in the United States in 2023. 2024; doi:https://doi.org/10.32747/2024.8583175.ers
3. Executive Office of the President, President's Council of Advisors on Science and Technology (PCAST), . *Report to The President A Vision for Advancing Nutrition Science in the United State*. 2024. www.whitehouse.gov/pcast
4. Laraia BA, Leak TM, Tester JM, Leung CW. Biobehavioral Factors That Shape Nutrition in Low-Income Populations: A Narrative Review. *Am J Prev Med*. Feb 2017;52(2S2):S118-S126. doi:https://doi.org/10.1016/j.amepre.2016.08.003
5. French SA, Tangney CC, Crane MM, Wang Y, Appelhans BM. Nutrition quality of food purchases varies by household income: the SHoPPER study. *BMC Public Health*. Feb 26 2019;19(1):231. doi:https://doi.org/10.1186/s12889-019-6546-2
6. Hess JM, Cifelli CJ, Fulgoni VL, 3rd. Modeling the Impact of Fat Flexibility With Dairy Food Servings in the 2015-2020 Dietary Guidelines for Americans Healthy U.S.-Style Eating Pattern. *Front Nutr*. 2020;7:595880. doi:https://doi.org/10.3389/fnut.2020.595880
7. Krebs JD, Parry-Strong A. Is there an optimal diet for patients with type 2 diabetes? Yes, the one that works for them! *The British Journal of Diabetes & Vascular Disease*. 2013/03/01 2013;13(2):60-66. doi:https://doi.org/10.1177/147465141347904
8. Dekker LH, Rijnks RH, Strijker D, Navis GJ. A spatial analysis of dietary patterns in a large representative population in the north of The Netherlands - the Lifelines cohort study. *Int J Behav Nutr Phys Act*. Dec 7 2017;14(1):166. doi:https://doi.org/10.1186/s12966-017-0622-8
9. Costello E, Goodrich J, Patterson WB, et al. Diet Quality Is Associated with Glucose Regulation in a Cohort of Young Adults. *Nutrients*. Sep 10 2022;14(18) doi:https://doi.org/10.3390/nu14183734
10. U.S department of Agriculture, Economic Research Service. Food Security and Nutrition Assistance. https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-security-and-nutrition-assistance/

Part B. Chapter 2: Health Equity and Nutrition

Introduction

All people in the United States deserve equitable access to information and guidance that supports them in achieving a healthy dietary pattern. Ensuring that everyone has the resources and knowledge needed to make informed choices about nutrition is essential for promoting health and reducing disparities across diverse communities. The 2025 Dietary Guidelines Advisory Committee (Committee) was tasked to apply a health equity lens to its review of the evidence on relationships between diet and health across all life stages. A primary goal of centering health equity in this scientific review was to help the U.S. Departments of Health and Human Services (HHS) and Agriculture (USDA) develop *Dietary Guidelines* that can support U.S. individuals across racial, ethnic, socioeconomic, and cultural backgrounds in achieving a healthy dietary pattern. Therefore, in the criteria HHS and USDA used to select the Committee, expertise related to health equity as well as a diverse membership reflective of the racial, ethnic, gender, and geographic diversity within the United States were specifically considered to achieve this goal.[1] Additional information about how the Committee was selected can be found in **Part C. Methodology**.

The Committee's health equity lens is consistent with federal program and policy initiatives to improve health, improve food and nutrition security, and promote equity, including the National Strategy on Hunger, Nutrition, and Health and the National Strategy on Gender Equity and Equality.[2,3] In addition, USDA released an Equity Action Plan in April 2022 (further updated in 2023) pursuant to Executive Order 13985,[4,5] "Advancing Racial Equity and Support for Underserved Communities Through the Federal Government"; and the HHS Strategic Plan for fiscal years 2022-2026 included a definition of equity and outlined actions "to shift its culture, resources, and approaches to institutionalize and sustain a focus on equity over time."[6] Furthermore, the Committee's efforts to center equity build on previous editions of the *Dietary Guidelines* as it continues to refine population-based dietary recommendations across life stages, reflecting changing dietary needs over the lifespan. Integrating health equity considerations, such as influences of varying environments, financial circumstances, and cultural backgrounds on diet and health relationships, supports an inclusive approach to dietary guidance. While such evidence is still accumulating, integrating the available data can inform development of dietary guidance that is relevant to diverse population groups.

This chapter provides a broad overview of how the Committee incorporated health equity throughout its work. Information about how the Committee incorporated health equity considerations into each of the 3 approaches it used to examine evidence—data analysis, systematic reviews, and food pattern modeling—can be found in **Part C. Methodology**, and in **Part D. Evidence on Diet and Health.** The integration of these three approaches to develop a recommended Dietary Pattern that considers variation in dietary intakes and accommodates flexibility can be found in **Part E. Chapter 1: Overarching Advice to the Departments**.

In addition, green callout boxes with the health equity icon (**Box B.2.1**) are used throughout this report to highlight examples of where health equity considerations strongly factored into the Committee's conclusions, reflecting the concerted approach the Committee took to incorporating health equity into the review of the science. Such examples include but are not limited to a health equity-focused systematic review on dietary patterns and cardiovascular disease (see **Part D. Chapter 2: Dietary Patterns**), an evidence scan on culturally tailored interventions (see **Part D. Chapter 8: Culturally Responsive Interventions to Improve Diet**), the development of nutrient profiles that considered dietary intakes across population groups and informed food pattern modeling (FPM) analyses (see **Part D. Chapter 9: Nutrient Profile Development**), and the diet simulations analyses that included simulations of foods included in select American Indian and Alaska Native foodways (see **Part C. Methodology** and **Part D. Chapter 11: Diet Simulations**).

Box B.2.1: Health Equity Callout Boxes

Look for green callout boxes with the health equity icon throughout the report to learn more about how the Committee incorporated health equity throughout its work.

Defining Health Equity

The Committee understands that choosing a healthy dietary pattern is a complex process influenced by structural, economic, social, cultural, and biological factors that are often outside of an individual's control. Therefore, centering equity means providing guidance to promote healthy dietary behaviors and patterns for individuals, families, and organizations across different environments and contexts including those where constraints exist to choosing healthy foods.[7-9] With this perspective in mind, and after considering other health equity definitions, concepts, and frameworks—such as those from the White House Health Equity Task Force, the Centers for Disease Control and Prevention (CDC), and USDA—the Committee used its collective health equity expertise to adapt those examples in developing its own definition of health equity.

The Committee defined health equity as the state in which everyone has a fair and just opportunity to attain their highest level of health. This includes the consistent and systematic treatment of all individuals in a fair, just, and impartial manner, including individuals who belong to communities that have often been denied such treatment, such as Black, Hispanic or Latino, Indigenous and Native American, Asian American, Native Hawaiian and Pacific Islander persons, and other persons of color; members of religious minorities; women and girls; LGBTQIA+ persons; persons with disabilities; persons who live in rural areas; persons who live in United States Territories; persons with stigmatized health conditions; persons otherwise adversely affected by persistent poverty or inequality; and individuals who belong to multiple such communities. This definition is presented in **Box B.2.2**, along with definitions for other key terms that are often used when discussing health equity.

Health disparities is one such term defined in **Box B.2.2**. Health disparities is a concept linked to health equity, to acknowledge health differences closely linked with economic, social, and/or environmental disadvantages.[10] Economic disadvantage in this definition refers to low income or lack of wealth, whereas social disadvantage is a broader concept that includes economic disadvantage as well as one's position or status in life, including race, ethnicity, gender, sexual orientation, and disability, all of which influence how one is treated within a society.[10] Both economic and social disadvantage are strongly linked to avoidable illness, disability, and early death.[10] Environmental disadvantage refers to residing in a neighborhood where there is concentrated poverty and/or the social disadvantages associated with low income.

Pursuing health equity means striving for the highest possible standard of health for all people and giving special attention to the needs of those at greatest risk of poor health, based on social conditions.[4] This requires ongoing societal efforts to:

- address historical and contemporary injustices;
- remove economic, social, and other obstacles to food, food access, health, and health care, such as poverty, discrimination, and their consequences, including powerlessness and lack of access to good jobs with fair pay, quality education and housing, safe environments, and healthcare; and
- eliminate differences in health outcomes.[11-14]

Box B.2.2: Key Terms

Health Equity: The state in which everyone has a fair and just opportunity to attain their highest level of health. This includes the consistent and systematic treatment of all individuals in a fair, just, and impartial manner, including individuals who belong to communities that have often been denied such treatment, such as Black, Hispanic or Latino, Indigenous and Native American, Asian American, Native Hawaiian and Pacific Islander persons, and other persons of color; members of religious minorities; women and girls; LGBTQIA+ persons; persons with disabilities; persons who live in rural areas; persons who live in United States Territories; persons with stigmatized health conditions; persons otherwise adversely affected by persistent poverty or inequality; and individuals who belong to multiple such communities.

Health Disparities: A particular type of health difference that is closely linked with economic, social, or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater social or economic obstacles to health based on their racial or ethnic group, religion, socioeconomic status, gender, age, or mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion.

Social Determinants of Health (SDOH): Conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks. These are also known as non-medical drivers of health.

Incorporating Health Equity Considerations Across the Dietary Guidelines Advisory Committee's Work

A key initial step that the Committee took to apply a health equity lens to its work was to form a Health Equity Working Group. The Working Group membership included representatives from each Subcommittee, creating a reinforcing feedback loop that provided continuity of dialogue and consistency in approaches used by each Subcommittee to apply a health equity lens to its work. This arrangement also facilitated opportunities for Subcommittee members to raise questions for the Health Equity Working Group between Committee meetings, as such questions could be routed through the Subcommittee's members who also served on the Working Group. At Committee's meetings, the Health Equity Working Group presented its progress to incorporate health equity throughout the Committee's work and provided suggestions for incorporating health equity considerations into topics discussed during the meetings.

Figure B.2.1 illustrates how the Committee incorporated health equity considerations throughout its work to develop this report. It considered factors such as race, ethnicity, socioeconomic position, and culture as it used the approaches of data analysis, systematic reviews, and food pattern modeling to review the science for diet and health relationships across the lifespan. Throughout the process, the Health Equity Working Group routinely reviewed public comments that provided input on health equity considerations (see **Appendix F-2: Public Comments**).

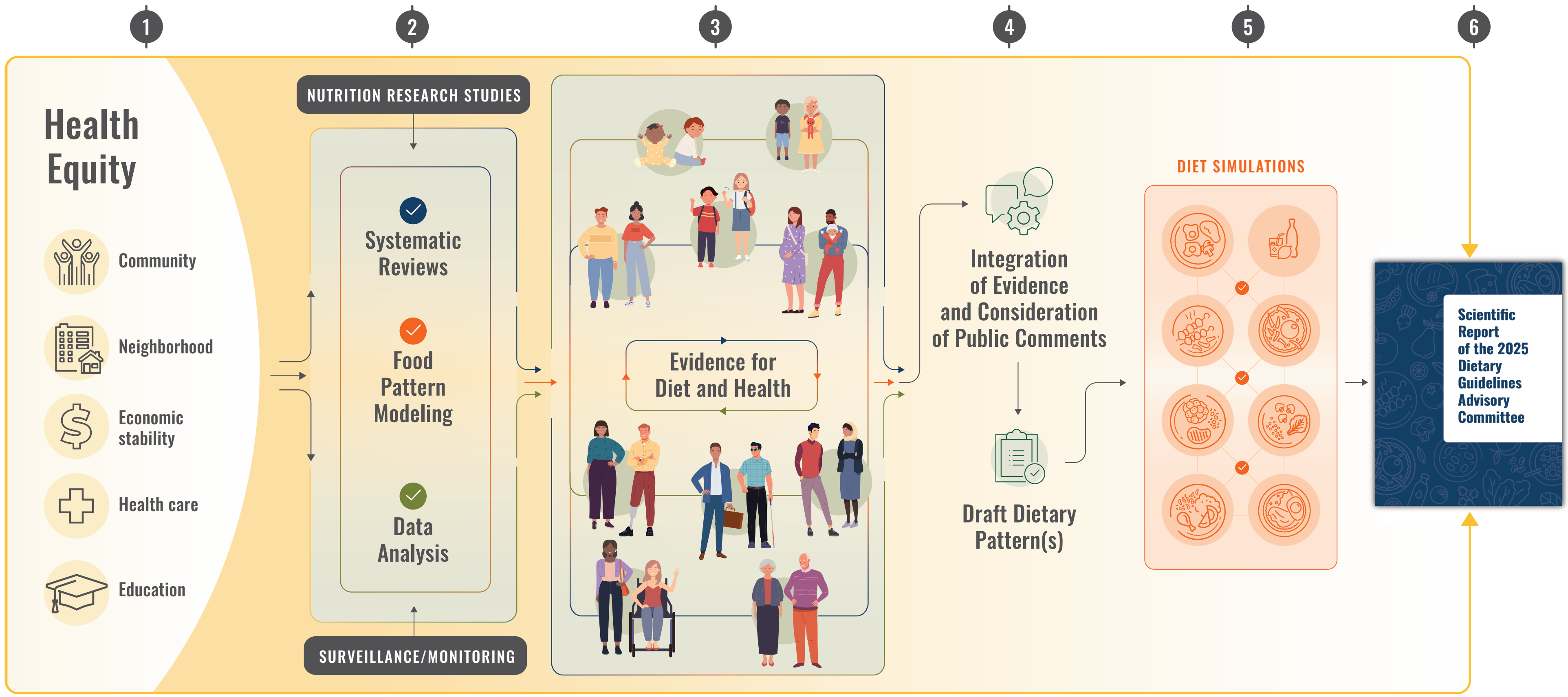
Figure B.2.2 details examples of how the 2025 Committee considered health equity through each approach it used to examine evidence. For example, the Committee was the first to use diet simulation to evaluate dietary patterns, a process further described in **Part C. Methodology** and **Part D. Chapter 11: Diet Simulations.** Briefly, simulations are a mathematical modeling approach used to describe a system process. In addition to food pattern modeling analyses, simulation analyses were used to computationally derive thousands of 7-day diets that met the modified 2020 Healthy U.S.-Style Dietary Pattern considering a broad range of foods and beverages. Furthermore, to evaluate whether the modified 2020 Healthy U.S.-Style Dietary Pattern tested by the Committee is applicable to dietary practices and cultural foodways of populations groups, a pilot was conducted to evaluate separate simulations of foods and beverages identified as integral to or consumed by select American Indian and Alaska Native populations. The Committee prioritized the population groups for the pilot based on public input calling for *Dietary Guidelines* to be inclusive of American Indian and Alaska Native populations by emphasizing traditional foods in the *Dietary Guidelines* and federal programs. The Committee also identified recommendations for future research to integrate health equity considerations and address knowledge gaps with regard to developing dietary guidance that is relevant to diverse population groups (see **Part E. Chapter 2: Future Directions**).

FIGURE B.2.1
INCORPORATING HEALTH EQUITY INTO THE DIETARY GUIDELINES ADVISORY COMMITTEE EVIDENCE REVIEW

Incorporating Health Equity into the Dietary Guidelines Advisory Committee Evidence Review

The Committee defines health equity as the state in which everyone has a fair and just opportunity to attain their highest level of health. Throughout its review of the science, the Committee centered health equity as a guiding principle. Reviewing evidence on nutrition and health through a lens of health equity among different population groups and across the lifespan will increase the potential of the *Dietary Guidelines for Americans* to provide guidance that promotes health, reduces risk of chronic disease, and meets nutrient needs.

1. Review available evidence through a health equity lens, considering factors such as socioeconomic position, race, ethnicity, and culture.*
2. Use three rigorous scientific approaches to examine the evidence.
3. Examine the relationship between diet and health throughout the lifespan.
4. Discuss and synthesize findings to develop draft dietary pattern(s) and advice.
5. Use diet simulations to evaluate proposed draft dietary pattern(s) for variation in dietary intake.
6. Develop and deliver advice to federal agencies in a scientific report.



* Healthy People 2030, U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. health.gov/healthypeople/objectives-and-data/social-determinants-health

FIGURE B.2.2
HEALTH EQUITY IS CONSIDERED THROUGHOUT EACH APPROACH TO EVIDENCE REVIEW

Health Equity is Considered Throughout Each Approach to Evidence Review

SURVEILLANCE/MONITORING

NUTRITION RESEARCH STUDIES

Data Analysis

- Identify sociodemographic variables to explore, such as:
  - Life stage
  - Race and/or ethnicity
  - Household food security status
- Analyze data to understand current health and dietary intake among sociodemographic groups.

Systematic Reviews

- Identify variables related to health equity – such as socioeconomic position or race and/or ethnicity.
- Gather and evaluate evidence, including whether health equity variables were considered.
- Draw conclusions and consider whether the evidence and results are generalizable to the U.S. context.

Food Pattern Modeling

- Evaluate the flexibility of a dietary pattern(s), using food pattern modeling and diet simulations, by analyzing the ability of the pattern(s) to meet nutritional goals when changes are made to the pattern(s) or when various foods and beverages are modeled to represent differing preferences, cultures and traditions.
- Consider if refinement of any dietary pattern(s) is needed to broaden generalizability to cultures and foodways while meeting nutritional goals based on food pattern modeling and diet simulation results.
- Use diet simulations to evaluate proposed dietary pattern(s), considering variability in the selection and consumption of foods and beverages.

EXAMPLE OF APPROACHES WORKING TOGETHER:

Utilized nationally representative data to understand cardiovascular health in the U.S. across life stages and sociodemographic groups, such as race and/or ethnicity, household food security, and educational attainment.

Updated a systematic review on the relationship between dietary patterns and cardiovascular disease and confirmed the conclusion statement graded as strong. Given the large body of evidence on this topic, additional analysis allowed for examination of a subset of studies with greater racial and ethnic and socioeconomic diversity, and the findings from this subset were consistent with the overall conclusions.

Used diet simulation to evaluate if a healthy dietary pattern associated with lower risk of cardiovascular disease is flexible enough to be achieved with a variety of foods and beverages, including simulations of diets using foods and beverages included in diets across the U.S. population and pilot simulations for select American Indians and Alaska Native diets.

Discussion

This Committee was the first to employ a systematic approach to incorporate a health equity lens throughout its work. Although prior Committees incorporated basic demographic factors such as age, race, and ethnicity into their reviews of the science, this Committee considered additional factors and did so in a holistic manner as it reviewed, interpreted, and synthesized evidence across data analysis, systematic reviews, and food pattern modeling. In particular, this Committee considered factors that reflect social determinants of health (SDOH). In doing so, the Committee could interpret the evidence based on both demographic factors (which are considered to be downstream, i.e., more proximal in terms of their influence on behavior) and socioeconomic and political factors (which are considered to be upstream, i.e., broader societal factors that influence the distribution of power and resources). Addressing SDOH is considered key to achieving a just, equitable society.[16-18]

Despite recognizing the importance of incorporating health equity in its review of evidence, the Committee was limited by the extent to which the evidence base considered factors such as race and/or ethnicity, socioeconomic position, and culture in research examining diet and health relationships.[17] The lack of representation of many population groups and/or lack of measurement of demographic variables (meaning that representation of population groups is unknown) led the Committee to realize that its conclusions would be limited to the populations reflected in the evidence base. This particularly was true when studies from outside of the United States were considered in systematic reviews. For example, it is common practice in several European countries to not collect information on race or ethnicity as a result of the General Data Protection Regulation.[19] Also, data analyses were conducted using nationally representative federal datasets, which do not adequately represent all population groups nor consistently incorporate factors such as geographic area or disability status. In addition, the Committee noted substantial concerns with generalizability in the grading process for many questions examined in systematic reviews. Moreover, it also observed a lack of precision in measuring factors of interest; for example, race and/or ethnicity are often measured as a proxy for SDOH, but a more precise measure of the SDOH of interest (e.g., housing security or food security status) could help enhance understanding of relationships between SDOH, diet, and health.[20]

These limitations point to the need for research that is more inclusive of diverse population groups and to the importance of standardized, consistent measuring and reporting on factors that characterize the populations being studied (including the needs of those populations). Sufficient funding as well as authentic engagement of community partners throughout all stages of the research process are critical supports for achieving an inclusive research base. The Committee elaborates on these future research needs, as well as advice for future Committees, in **Part E. Chapter 2: Future Directions**.

In summary, the Committee applied a health equity focus to all its activities, deliberations, review of the evidence, and consideration of public comments. Its development of research questions and protocols was conducted such that any resulting recommendations would support the health and wellbeing of all people living in the United States. The Committee is confident that despite limitations in the available evidence and datasets, it was able to achieve the overall goal of centering health equity to support all people in the

United States across racial, ethnic, socioeconomic, and cultural backgrounds in achieving a healthy dietary pattern. Pursuit of this goal will be supported by actions across sectors such as government, the food industry, and healthcare, that enable all individuals to consume healthy dietary patterns across the different environments and contexts in which they spend time. The Committee urges such actions to promote health equity, so that everyone has a fair and just opportunity to attain their highest level of health.

References

1. U.S. Department of Agriculture and U.S Department of Health and Human Services. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2025-2030 Development Process. https://www.dietaryguidelines.gov/learn-about-process#step-2-appoint-the-advisory-committee
2. White House Domestic Policy Council. *Biden-Harris National Strategy on Hunger, Nutrition and Health*. 2022. https://www.whitehouse.gov/wp-content/uploads/2022/09/White-House-National-Strategy-on-Hunger-Nutrition-and-Health-FINAL.pdf
3. The White House Gender Policy. *National Strategy on Gender Equity and Equality*. 2021. https://www.whitehouse.gov/wp-content/uploads/2021/10/National-Strategy-on-Gender-Equity-and-Equality.pdf
4. U.S. Department of Agriculture. *USDA Equity Action Plan*. 2023. https://www.usda.gov/sites/default/files/documents/usda-equity-action-plan-2023.pdf
5. Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (2021).
6. U.S. Department of Health and Human Services, Assistant Secretary for Planning and Evaluation. HHS Strategic Plan: 2022-2026. https://www.hhs.gov/about/strategic-plan/2022-2026/index.html
7. The White House. Executive Order on Further Advancing Racial Equity and Support for Underserved Communities Through the Federal Government. https://www.whitehouse.gov/briefing-room/presidential-actions/2023/02/16/executive-order-on-further-advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government/
8. Centers for Disease Control and Prevention. What is Health Equity? https://www.cdc.gov/health-equity/what-is/index.html
9. National Academies of Sciences, Engineering, and Medicine. *Communities in Action: Pathways to Health Equity*. 2017. https://www.ncbi.nlm.nih.gov/pubmed/28418632
10. Braveman P. What are health disparities and health equity? We need to be clear. *Public Health Rep*. Jan-Feb 2014;129(Suppl 2):5-8. doi:https://doi.org/10.2105/ajph.2010.300062
11. Braveman P. Health disparities and health equity: concepts and measurement. *Annu Rev Public Health*. 2006;27:167-94. doi:https://doi.org/10.1146/annurev.publhealth.27.021405.102103
12. Office of Disease Prevention and Health Promotion. Social Determinants of Health. https://health.gov/healthypeople/priority-areas/social-determinants-health
13. World Health Organization. *Closing the gap in a generation: Health equity through action on the social determinants of health*. 2008. https://www.who.int/publications/i/item/WHO-IER-CSDH-08.1
14. Krieger N. The ostrich, the albatross, and public health: an ecosocial perspective--or why an explicit focus on health consequences of discrimination and deprivation is vital for good science and public health practice. *Public Health Rep*. Sep-Oct 2001;116(5):419-23. doi:https://doi.org/10.1093/phr/116.5.419
15. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion. Social Determinants of Health. https://odphp.health.gov/healthypeople/priority-areas/social-determinants-health
16. Liu JJ, De Cuir N, Kia L, Issaka RB. Towards health equity: the urgent need for upstream intervention studies in gastroenterology and hepatology. *Lancet Gastroenterol Hepatol*. Mar 2022;7(3):203-204. doi:https://doi.org/10.1016/s2468-1253(22)00012-7
17. Gehlert S, Sohmer D, Sacks T, Mininger C, McClintock M, Olopade O. Targeting health disparities: a model linking upstream determinants to downstream interventions. *Health Aff (Millwood)*. Mar-Apr 2008;27(2):339-49. doi:https://doi.org/10.1377/hlthaff.27.2.339
18. Braveman P, Egerter S, Williams DR. The social determinants of health: coming of age. *Annu Rev Public Health*. 2011;32:381-98. doi:https://doi.org/10.1146/annurev-publhealth-031210-101218

19. Hoofnagle CJ, van der Sloot B, Borgesius FZ. The European Union general data protection regulation: what it is and what it means. *Information & Communications Technology Law*. 2019/01/02 2019;28(1):65-98. doi:https://doi.org/10.1080/13600834.2019.1573501
20. Duggan CP, Kurpad A, Stanford FC, Sunguya B, Wells JC. Race, ethnicity, and racism in the nutrition literature: an update for 2020. *Am J Clin Nutr*. Dec 10 2020;112(6):1409-1414. doi:https://doi.org/10.1093/ajcn/nqaa341

Part C. Methodology

Introduction

The 2025 Dietary Guidelines Advisory Committee (Committee) was established to review scientific evidence to be considered by the U.S. Departments of Health and Human Services (HHS) and Agriculture (USDA) as the Departments develop the *Dietary Guidelines for Americans, 2025-2030 (Dietary Guidelines)*. The Committee's work culminated in the development of this report, which summarizes the Committee's review of the science.

This chapter describes the process to identify the scientific questions to be examined by the Committee, the process to appoint members to the Committee, and the methods the Committee used to review scientific evidence and develop this report. These activities are shown as Step 1: Identify Scientific Questions; Step 2: Appoint the Committee; and Step 3: Committee Reviews Scientific Evidence and Develops and Releases Report in **Figure C.1**—which provides an overview of the timeline for each activity—and are further described in the sections that follow.

The Committee used 3 separate yet complementary scientific approaches to conduct its review of the science: data analysis, systematic reviews, and food pattern modeling. A description and detailed methodology for each approach is provided in the section on Step 3.

FIGURE C.1
TIMELINE FOR THE 2025 DIETARY GUIDELINES ADVISORY COMMITTEE PROCESS

Step 1: Identify Scientific Questions

Prior to the 2025 Committee's establishment, HHS and USDA identified scientific questions that the Committee could potentially examine. Proposing scientific questions before establishing the Committee allowed for a deliberative process that incorporated a broad diversity of expertise from both inside and outside the federal government. Other advantages included clearly defining the types of expertise needed on the Committee, allowing the Committee to focus its efforts on reviewing evidence related to the scientific questions, and ensuring that the Committee's work built on the 2020-2025 edition of the *Dietary Guidelines* and met the needs of federal nutrition policies and programs.

To identify the proposed scientific questions, the Departments conducted a year-long process beginning in 2021 to gather information, receive input from federal experts, and review relevant documents. The scientific questions informed the scope of the Committee's review of the science and its Scientific Report. The criteria HHS and USDA used to identify and prioritize the proposed scientific questions included:

- Relevance: Question is within the scope of the *Dietary Guidelines* and is focused on food-based recommendations for the general public, not clinical guidelines for medical treatment.
- Importance: Question addresses an area of substantial public health concern, uncertainty, and/or knowledge gap.
- Potential Impact to Federal Programs: A high probability exists for the question to provide the scientific foundation for guidance that would inform federal food and nutrition policies and programs.
- Avoiding Duplication: Question is not addressed through existing or planned evidence-based federal guidance (other than the *Dietary Guidelines*).

Research availability was also considered for proposed scientific questions that would be addressed by systematic reviews. Research availability considers whether sufficient evidence exists to conduct a new systematic review or update an existing systematic review. If adequate research was not available, the question was identified as an area needing more research.

HHS and USDA also considered the following items as they applied the criteria:

- Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Questions addressed by the 2020 Committee, particularly those that informed development of the current *Dietary Guidelines*; and future directions documented in the *Scientific Report of the 2020 Dietary Guidelines Advisory Committee.*[1]
- Topics of Public Health Interest: The state of current nutrition science and potential new topics of public health interest.
- Federal Review: Input from federal nutrition scientists and program experts from across the federal government, including the Interagency Committee on Human Nutrition Research (ICHNR) and other federal experts.
- Federal Resources: To avoid duplication of efforts, topics addressed by existing or planned federal resources were not included on the list of proposed scientific questions but may be included in the *Dietary Guidelines for Americans, 2025-2030.*

Two examples of topics that were proposed as scientific questions included dietary patterns with varying amounts of ultra-processed foods (UPF) and food sources of saturated fat. UPF was an area of recent nutrition research and a topic of interest among the public and federal nutrition scientists. Food sources of saturated fat was also a topic of public health interest and was recommended in the future directions of the *Scientific Report of the 2020 Dietary Guidelines Advisory Committee*. Both topics met the criteria of relevance, importance, potential impact to federal programs, and avoiding duplication of existing or planned evidence-based federal guidance.

Topics that met the criteria and that were not addressed by federal resources or through separate efforts were included in the list of proposed scientific questions. To provide transparency about existing or planned federal resources that may be used to inform the *Dietary Guidelines for Americans, 2025-2030*, the following list of topics was posted on DietaryGuidelines.gov. These topics were not reviewed by the Committee:

- Healthy food environments (e.g., Community Preventive Service Task Force findings)[2]
- Oral health (e.g., CDC Oral Health)[3]
- Food safety (e.g., FoodSafety.gov)[4]
- Specific nutrient recommendations (Dietary Reference Intakes)[5]
- Human milk, infant formula, and health outcomes (e.g., forthcoming federal systematic reviews)[6]
- Seafood (e.g., FDA/EPA Advice about Eating Fish)[7]
- Eating disorders (e.g., National Institute of Mental Health resources on eating disorder symptoms, risk factors, and treatment)[8]
- Physical activity (Physical Activity Guidelines for Americans)[9]

Additionally, HHS and USDA determined that the topic of alcoholic beverages and health requires a comprehensive review with significant, specific expertise and would be best addressed through a process separate from the Committee's work. Two separate scientific reviews on adult alcohol consumption and health are being conducted as of the time of this report's preparation, one by an interagency committee led by HHS, the Interagency Coordinating Committee on the Prevention of Underage Drinking (ICCPUD),[10] and the other by the National Academies of Sciences, Engineering, and Medicine (NASEM).[11] These reviews are independent of each other yet are working on complementary tracks. Both projects include external scientific peer review and opportunities for public participation. Each will result in a report with scientific findings—not recommendations—on alcohol consumption. These findings will be considered by HHS and USDA as the Departments develop the *Dietary Guidelines for Americans, 2025-2030.*

Public Engagement on Scientific Questions

HHS and USDA publicly issued the proposed scientific questions on April 15, 2022. In the announcement about the questions, the Departments noted that all questions would be reviewed through a health equity lens (**Box C.1**). The Departments requested public comments on the proposed scientific questions from April 15 through May 16, 2022. Approximately 1,400 public comments were received, with about half of these submissions identified as unique comments. HHS and USDA considered all comments in relation to the criteria listed above as the Departments worked with the Committee to refine and prioritize the scientific questions throughout its review of the science.

Box C.1: Health Equity Lens

When the proposed questions were shared for public comment, HHS and USDA stated that all scientific questions would be reviewed with a health equity lens to ensure that the next edition of the *Dietary Guidelines* is relevant to people with diverse racial, ethnic, socioeconomic, and cultural backgrounds. The steps the Committee took to operationalize the health equity lens are included in this chapter's sections describing each scientific approach and additional context is available in **Part B. Chapter 3: Health Equity and Nutrition.**

After the Committee was appointed (Step 2), it considered the proposed scientific questions and determined if scientific questions should be added, refined, or removed as it prioritized questions for its review. The Committee used the criteria of relevance, importance, potential impact to federal programs, avoiding duplication, and research availability (as described previously) during its prioritization process.

The complete list of scientific questions addressed by the Committee is included in **Table C.1** in this chapter's section titled "Scientific Question Prioritization." That section also provides rationale for why some questions that were originally proposed by the Departments or the Committee were later deprioritized or discontinued. The list of proposed scientific questions was available for public reference on DietaryGuidelines.gov throughout the Committee's term.

Step 2: Appoint the 2025 Dietary Guidelines Advisory Committee

After the Departments shared the proposed scientific questions for public comment and determined the expertise needed on the Committee, the next step was to form the Committee. The Committee was convened and governed under the Federal Advisory Committee Act (FACA).[12] The process to form the Committee included establishment of its charter; a public call for nominations; review of nomination packages by HHS and USDA staff, leadership, and ethics officials, including nominees' financial, ethical, legal, and/or criminal conflicts of interest; and appointment to the Committee by the Secretaries of HHS and USDA.

Charter for the 2025 Dietary Guidelines Advisory Committee

FACA requires that a charter be prepared and filed with Congress before a federal advisory committee meets or takes any action. The charter for the Committee was filed with Congress on December 9, 2022, and was posted publicly on DietaryGuidelines.gov. The charter provides the Committee's mission or charge, specific duties, and general operational characteristics. The Committee was established to use approaches including data analysis, systematic reviews, and food pattern modeling to examine evidence on the scientific questions, and then to develop a Scientific Report for submission to the Secretaries of HHS and USDA. The charter stated that the Committee's Scientific Report should describe the Committee's evidence review and conclusions and provide science-based advice and rationale to the Departments based on the preponderance of evidence reviewed. The charter also stated that HHS and USDA would use the Committee's Scientific Report as they develop the *Dietary Guidelines for Americans, 2025-2030*. More information about federal advisory committee charters and other information related to FACA is available through the U.S. General Services Administration (GSA).[12] The responsibility for chartering a committee for each new edition of the *Dietary Guidelines* rotates between HHS and USDA every 5 years. HHS was responsible for chartering the 2025 Committee and serving as the administrative lead for the *Dietary Guidelines for Americans, 2025-2030*. FACA requires that only 1 agency be responsible for support services at any 1 time, even if the advisory committee reports to more than 1 agency (5 U.S.C. § App. 2 § 12(b)). However, in accordance with the National Nutrition Monitoring and Related Research Act of 1990,[13] HHS and USDA work together to support development of the *Dietary Guidelines*, and the Committee's report is submitted to both Secretaries.

Call for Nominations

HHS and USDA announced a public request for nominations to the 2025 Committee on June 14, 2022. Nominations were accepted from June 15 to July 15, 2022. The nomination package requirements were described in the *Federal Register* notice (Docket ID: OASH-2022-12865). To help support the goal of having a balanced and diverse Committee, the Departments encouraged self-nominations and conducted outreach to make the public aware of the opportunity to provide nominations. HHS and USDA used the following criteria to review nominations:

- Professional Experience: At least 10 years of experience as an academic, researcher, practitioner, or other health professional in a field related to 1 or more of the scientific topic areas to be examined; consideration of leadership experience and participation on previous expert committees or panels.
- Educational Background: Advanced degree in nutrition or health-related field, including registered dietitians, nutrition scientists, physicians, and individuals with public health degrees.
- Demonstrated Scientific Expertise: Expertise related to 1 or more of the scientific topic areas to be examined by the Committee as demonstrated by the number and quality of peer-reviewed publications and presentations. Expertise related to health equity and the scientific approaches used to review the evidence was also desired.
- Balanced and Diverse Membership: A Committee that is reasonably balanced in terms of points of view and expertise, experience, education, and institutional affiliation, with a goal of establishing a diverse membership reflective of the racial, ethnic, gender, and geographic diversity within the United States.

Review of Nominations

All complete nomination packages were reviewed by HHS and USDA staff based on the criteria described above. Nominations were then evaluated by HHS and USDA leadership.

Each member of the Committee was vetted extensively prior to appointment. As the administrative lead for the 2025 Committee, HHS conducted background checks to determine if any candidates had financial, ethical, legal, and/or criminal conflicts of interest that would prohibit them from serving on the Committee. In addition, in compliance with federal ethics laws and regulations, each Committee member submitted a confidential financial disclosure report (known as the Office of Government Ethics, or OGE, Form 450) and continued to submit this form annually until the Committee's term concluded. HHS ethics officials reviewed the confidential financial disclosure reports and ensured each Committee member's interests and affiliations complied with federal laws and regulations. Following the review process, the individuals recommended for Committee membership were submitted to the Secretaries of HHS and USDA for approval.

Appointment to the Committee

The Secretaries of HHS and USDA reviewed the Departments' nomination recommendations for proposed Committee members, including Chair and Vice Chair, and jointly appointed individuals to serve on the Committee. On January 19, 2023, HHS and USDA announced the appointment of 20 nationally recognized nutrition and public health experts to serve on the Committee (see **Appendix F-3: Biographical Sketches of the 2025 Dietary Guidelines Advisory Committee**). The Committee included experts with experience across life stages from a variety of fields such as nutrition science, medicine, epidemiology, public health, and psychology. The majority of experts had conducted research with diverse populations, and many had expertise in health equity.

Management of Potential Conflicts of Interest

Members of the Committee were appointed as special government employees (SGEs). All SGEs have a fiduciary responsibility to the federal government while working on advisory committees and must follow comprehensive federal ethics laws and regulations, including criminal conflicts of interest, financial disclosure reporting laws, and Standards of Ethical Conduct for Employees of the Executive Branch per OGE regulations.[14] All members of the Committee complied with the federal ethics laws and regulations governing conflicts of interest, and with the reporting of necessary financial information under these laws. Committee members participated in an Ethics training upon Committee appointment and annually thereafter.

In addition to the requirements of federal ethics laws and regulations, the Committee voluntarily disclosed any relationships, activities, and interests during the prior 12 months that may potentially be related to the content of the Committee's scientific review, using a form from the International Committee of Medical Journal Editors (ICMJE).[15] As defined by ICMJE, "related" referred to any relationship with for-profit or not-for-profit third parties whose interests may affect the content of the Committee's report. These disclosures represent a commitment to transparency and do not necessarily indicate a bias. The

Committee worked collectively to review the evidence on diet and health and provide advice, minimizing any potential bias from individual members. Because its work is collective, the Committee provided its disclosures collectively rather than individually. These voluntary disclosures were posted publicly on DietaryGuidelines.gov and represented a commitment to transparency.

In addition to these measures to manage potential conflicts of interest, the approaches the Committee used to examine the evidence—data analysis, systematic reviews, and food pattern modeling—are rigorous, objective, protocol-driven, and designed to minimize bias. Protocols for each question were developed before examining any evidence and were presented for discussion during the Committee's meetings. The protocols were also posted to DietaryGuidelines.gov and NESR.usda.gov, providing transparency to the public throughout the Committee's deliberations. The review of the science was based on consensus. It was not based on any 1 member's expertise, nor were the final decisions for the scientific evaluation reached on an individual basis. The Committee's review of the science was completed in a collaborative manner, minimizing the impact of any real or perceived conflicts of interest of individual members. Further, the Committee's systematic review and food pattern modeling work underwent external peer review as described below, ensuring that this work was transparently described and the conclusions were supported by the evidence.

Step 3: Committee Reviews Scientific Evidence

The Committee used 3 approaches to examine the evidence: data analysis, systematic reviews, and food pattern modeling. The following sections describe the Committee's working structure and processes, including the Committee's process to prioritize the scientific questions proposed by HHS and USDA, the methodology specific to each of the 3 approaches, and how health equity was considered in the examination of evidence. Throughout the process of conducting and documenting its examination of evidence, the Committee sought to use inclusive language (**Box C.2**).

Box C.2: Inclusive Language

The Committee sought to use identity-affirming language that does not exclude, discriminate, or perpetuate stereotypes of groups of people based on factors such as sex, social gender or gender identity, disability, and health status to the extent possible, while accurately reflecting what was reported in data sources and the scientific literature. For instance, the Committee identified "toddler" as an imprecise and ableist descriptor of development that does not include the necessary specificity of the age group and moved to define life stage during early childhood based solely on age. The Committee also used person-first language to avoid stigmatizing and instead center the person above a condition. For recommendations to enhance the design and reporting of surveys and scientific studies to allow for further inclusivity, see **Part E. Chapter 2: Future Directions**.

Committee Working Structure and Processes

Committee Meetings

The Committee met 7 times to provide updates on its review of the science, deliberate on its findings, and plan for future work. In accordance with FACA regulations, all meetings of the Committee were held publicly. The Committee's work began at its first meeting and concluded upon submission of this report to the Departments. All meetings were held in person in Rockville, MD, except for Meetings 4 and 7, which were held virtually. The public was invited to attend all meetings virtually via livestream, and video recordings of each meeting were posted to DietaryGuidelines.gov.

At its first meeting, federal staff provided the Committee with an overview of the proposed scientific questions identified by HHS and USDA. Following this meeting, members divided into Working Groups to refine and prioritize the proposed scientific questions. The Committee discussed the results of this process at its second meeting. After the Committee's second meeting, the Committee established its Subcommittee structure, which it used to conduct its review of the science on its prioritized scientific questions. At Meetings 3 through 6, the Committee heard updates from each Subcommittee and discussed progress made on its review of the science. Topics included protocol and plan development, evidence reviewed and analyses conducted, draft conclusion statements, and plans for future Committee work. Federal staff from HHS and USDA supported the Committee throughout its work. The Committee's seventh and final meeting focused on its Scientific Report. This meeting provided an opportunity for Committee discussion and deliberation before it submitted its report to the Departments. Meeting materials including agendas, videocast recordings, presentation slides, and summaries, were posted to DietaryGuidelines.gov following each meeting.

The Committee also participated in 4 administrative trainings, which were solely administrative and did not include discussion or deliberations about the Committee's review of the science. All administrative trainings were held virtually via webinar. The first administrative training was held on January 30, 2023, prior to the Committee's first meeting, to prepare the Committee for its work of examining the evidence. It included an overview of the Committee's charter, operations, and timeline; an introduction to DietaryGuidelines.gov; a public affairs briefing; and an introduction to FACA. A second administrative training on May 26, 2023, oriented the Committee to the Nutrition Evidence Systematic Review (NESR) methodology. A third administrative training on October 30, 2023, oriented the Committee to the organization of its Scientific Report and the writing responsibilities of members. A final administrative training was held virtually on December 4, 2024, to share information on the posting of the Committee's Scientific Report, including plans for the Scientific Report release. Ethics trainings were also conducted upon Committee appointment and annually thereafter.

Scientific Question Prioritization

As described earlier in this chapter, the Committee formed Working Groups to refine and prioritize the proposed scientific questions. The Working Groups used in their prioritization the same criteria that HHS and USDA used to identify the scientific questions in Step 1, and also considered public comments.

For questions answered using data analysis, federal staff from the HHS Office of Disease Prevention and Health Promotion (ODPHP) and the USDA Center for Nutrition Policy and Promotion (CNPP) worked with the Committee to prioritize data analyses that described and considered factors such as socioeconomic position, food security, and race and/or ethnicity. All 4 data analysis questions identified by HHS and USDA were completed.

For questions answered using systematic review methodology, staff from USDA's NESR Branch provided preliminary research availability estimates for proposed systematic review questions. The Committee decided to adjust the wording of some questions, added questions, and deprioritized some questions, and ultimately completed 28 systematic reviews. The Committee also opted to conduct 1 evidence scan. An evidence scan is an exploratory evidence description project in which systematic methods are used to search for and describe the volume and characteristics of evidence available on a nutrition question or topic of public health importance. As described later in this report, this evidence scan provides a basis for a future expert committee to develop systematic review protocols.

For questions answered using food pattern modeling methodology, federal staff from ODPHP and CNPP supported the Committee in planning and prioritizing a series of analyses that would provide evidence for the Committee to answer the overarching food pattern modeling question. These analyses were outlined by the Committee in 9 food pattern modeling protocols and 2 additional protocols that were exploratory analyses. The results of these food pattern modeling analyses were synthesized with results from systematic review and data analysis to answer the overarching question.

As was the case with previous Committees, prioritization continued throughout the Committee's review of the science to ensure the highest priority questions could be completed within the Committee's term. Decisions to discontinue systematic review questions were discussed publicly at the Committee's meetings and were documented on DietaryGuidelines.gov with the rationale explaining why the questions were discontinued. The list of scientific questions the Committee ultimately addressed in its review of the science was available on DietaryGuidelines.gov throughout the process and is presented in **Table C.1**.

TABLE C.1
SCIENTIFIC QUESTIONS ADDRESSED BY THE COMMITTEE'S REVIEW OF THE SCIENCE

Question	Approach
What are the current patterns of food and beverage intake?	Data Analysis
What are the current intakes of food groups, nutrients, and dietary components?	Data Analysis
What is the current prevalence of nutrition-related chronic health conditions?	Data Analysis

Question	Approach
Which nutrients and/or dietary components present a substantial public health concern because of underconsumption or overconsumption?	Data Analysis
What is the relationship between dietary patterns consumed and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between dietary patterns consumed and risk of cardiovascular disease?	Systematic Review
What is the relationship between dietary patterns consumed and risk of type 2 diabetes?	Systematic Review
What is the relationship between consumption of dietary patterns with varying amounts of ultra-processed foods and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between dietary patterns consumed and risk of breast cancer?	Systematic Review
What is the relationship between dietary patterns consumed and risk of colorectal cancer?	Systematic Review
What is the relationship between dietary patterns consumed and risk of cognitive decline, dementia, and Alzheimer's disease?	Systematic Review
What is the relationship between beverage patterns consumed and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between dairy milk and milk alternative consumption and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between 100% juice consumption and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between sugar-sweetened beverage consumption and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between low- and no-calorie sweetened beverage consumption and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between sugar-sweetened beverage consumption and risk of type 2 diabetes?	Systematic Review
What is the relationship between low- and no-calorie sweetened beverage consumption and risk of type 2 diabetes?	Systematic Review
What is the relationship between food sources of saturated fat consumed and risk of cardiovascular disease?	Systematic Review
What is the relationship between dietary patterns consumed during pregnancy and risk of hypertensive disorders of pregnancy?	Systematic Review
What is the relationship between dietary patterns consumed during pregnancy and risk of gestational diabetes mellitus?	Systematic Review
What is the relationship between repeated exposure to foods and food acceptance?	Systematic Review
What is the relationship between complementary feeding and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between parental and caregiver feeding styles and practices during childhood and growth, body composition, and risk of obesity?	Systematic Review

Question	Approach
What is the relationship between parental and caregiver feeding styles and practices during childhood and consuming a dietary pattern that is aligned with the *Dietary Guidelines for Americans*?	Systematic Review
What is the relationship between dietary patterns consumed during pregnancy and gestational age at birth?	Systematic Review
What is the relationship between dietary patterns consumed during pregnancy and birth weight?	Systematic Review
What is the relationship between frequency of meals and/or snacks and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between frequency of meals and/or snacks and energy intake?	Systematic Review
What is the relationship between frequency of meals and/or snacks and consuming a dietary pattern that is aligned with the *Dietary Guidelines for Americans*?	Systematic Review
What is the relationship between portion size and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between portion size and energy intake?	Systematic Review
What evidence has been published on the relationship between culturally tailored dietary interventions and diet-related psychosocial factors, dietary intake, diet quality, and health outcomes?	Evidence Scan
Should foods and beverages with lower nutrient density (i.e., those with added sugars, saturated fat, and sodium) contribute to item clusters, representative foods, and therefore the nutrient profiles for each food group and subgroup used in modeling the USDA Dietary Patterns?	Food Pattern Modeling
What are the differences between nutrient profiles calculated using the dietary intakes of the total U.S. population and population groups?	Food Pattern Modeling
What are the implications for nutrient intakes when modifying the Dairy and Fortified Soy Alternatives food group quantities within the Healthy U.S.-Style Dietary Pattern? What are the implications for nutrient intakes when dairy food and beverage sources are replaced with non-dairy alternatives?	Food Pattern Modeling
What are the implications for nutrient intakes when modifying the Fruits food group quantities within the Healthy U.S.-Style Dietary Pattern?	Food Pattern Modeling
What are the implications for nutrient intakes when modifying the Vegetables food group and subgroup quantities within the Healthy U.S.-Style Dietary Pattern?	Food Pattern Modeling
What are the implications for nutrient intakes when modifying the quantities of the Grains group within the Healthy U.S.-Style Dietary Pattern? What are the implications for nutrient intakes when specific individual staple grains are emphasized; or when the Grains group is replaced with other staple carbohydrate foods (i.e., Starchy Vegetables; Beans, Peas, and Lentils; starchy Red and Orange vegetables)?	Food Pattern Modeling
What are the implications for nutrient intakes when modifying the Protein Foods group and subgroup quantities within the Healthy U.S.-Style Dietary Pattern or Healthy Vegetarian Dietary Pattern? What are the implications for nutrient intakes when proportions of animal-	Food Pattern Modeling

Question	Approach
based Protein Foods subgroups are reduced and proportions of plant-based Protein Foods subgroups are increased?	
What quantities of foods and beverages lower in nutrient density can be accommodated in the USDA Dietary Patterns while meeting nutritional goals within calorie levels?	Food Pattern Modeling
Can nutrient goals be met when animal sources of foods and beverages are removed from the Healthy Vegetarian Dietary Pattern for ages 2 years and older?	Food Pattern Modeling – Exploratory Analysis
Can nutrient goals be met when carbohydrate-containing foods and beverages are reduced in the Healthy U.S-Style Dietary Pattern for ages 2 years and older?	Food Pattern Modeling – Exploratory Analysis
Do simulated diets that meet the updated USDA Dietary Patterns and reflect variation in dietary intakes achieve nutrient adequacy?	Food Pattern Modeling – Diet Simulation
Considering each life stage, should changes be made to the USDA Dietary Patterns (Healthy U.S.-Style, Healthy Mediterranean-Style, and/or Healthy Vegetarian), and should additional Dietary Patterns be developed/proposed based on: • Findings from systematic reviews, data analysis, and/or food pattern modeling analyses; and/or • Population norms, preferences, or needs of the diverse communities and cultural foodways within the U.S. population?	Overarching Question

Proposed systematic review and evidence scan questions that the Committee decided to deprioritize, along with rationale and the meeting at which the Committee discussed the decision to deprioritize, are listed in **Table C.2**.

TABLE C.2
DEPRIORITIZED SYSTEMATIC REVIEW AND EVIDENCE SCAN QUESTIONS

Question	Rationale	Timing of Decision
What is the relationship between dietary patterns consumed and risk of sarcopenia?	The Committee determined that a lack of research was available to update the existing NESR systematic review.	Meeting 2
What is the relationship between dietary patterns consumed and all-cause mortality?	The recent existing NESR systematic review had a conclusion statement graded as “strong” and the Committee chose to prioritize other outcomes in relation to dietary patterns.	Meeting 2
What is the relationship between dietary patterns consumed before and during pregnancy and lactation and developmental milestones, including neurocognitive development, in the child?	The Committee determined that a lack of research was available to update the existing NESR systematic review.	Meeting 2
What is the relationship between dietary patterns consumed and risk of lung cancer?	The Committee determined that a lack of research was available to update the existing NESR	Meeting 2

Question	Rationale	Timing of Decision
	systematic review and also identified challenges with smoking as a confounder.	
What is the relationship between food sources of added sugars consumed and: growth, body composition, and risk of obesity; risk of type 2 diabetes?	The Committee determined that a lack of research was available on food sources other than sugar-sweetened beverages (SSB), and SSB intake was addressed in other prioritized questions on beverages and complementary feeding.	Meeting 2
What is the relationship between water consumption and: growth, body composition and risk of obesity; risk of type 2 diabetes?	The Committee determined that a lack of research was available and had concerns about challenges with assessing water as an exposure. Additionally, water was included as a comparator across other beverage types examined.	Meeting 2
What is the relationship between beverage patterns consumed and risk of type 2 diabetes?	The Committee determined that a lack of research was available.	Meeting 2
What is the relationship between 1) timing of introduction, and 2) types and amounts of complementary foods and beverages and iron and zinc status?	The Committee determined that a lack of research was available to update the existing NESR systematic review.	Meeting 2
What is the relationship between dietary patterns consumed and risk of depression?	The Committee consulted federal subject matter experts on this topic and based on concerns from those experts about reverse causality and/or the plausibility of the relationship between dietary patterns and risk of depression, the Committee decided to discontinue this systematic review.	Meeting 3
What evidence has been published on the relationship between home food availability in adults and diet-related psychosocial factors, dietary intake, diet quality, and health outcomes?	The Committee determined that the planned evidence scan on culturally tailored dietary interventions was higher priority. In addition, home food availability in infants, young children, children, and adolescents was examined in other systematic reviews being conducted on caregiver feeding practices.	Meeting 4
What is the relationship between dietary patterns consumed and risk of prostate cancer?	In consideration of project workload and timelines, the Committee discontinued this systematic review after determining it was lower priority because fewer new studies had been published on this topic since it was previously reviewed, compared to dietary patterns and breast cancer or colorectal cancer.	Meeting 4
What is the relationship between coffee and/or tea consumption and: growth, body composition, and risk of obesity; risk of type 2 diabetes?	In consideration of project workload and timelines, the Committee discontinued this systematic review after determining that assessing the overall dietary pattern in relation to growth, body composition, risk	Meeting 4

Question	Rationale	Timing of Decision
	of obesity, and risk of type of 2 diabetes is higher priority than examining coffee and tea independently. In addition, the nutritional implications of consuming this beverage type are being examined in other systematic reviews and food pattern modeling analyses.	
What is the relationship between dairy milk and milk alternative consumption and risk of type 2 diabetes?	In consideration of project workload and timelines, the Committee discontinued this systematic review after determining that assessing the overall dietary pattern in relation to risk of type of 2 diabetes is higher priority than examining dairy milk and milk alternatives independently. In addition, the nutritional implications of consuming this beverage type are being examined in other systematic reviews and food pattern modeling analyses.	Meeting 4
What is the relationship between 100% juice consumption and risk of type 2 diabetes?	In consideration of project workload and timelines, the Committee discontinued this systematic review after determining that assessing the overall dietary pattern in relation to risk of type of 2 diabetes is higher priority than examining 100% juice independently. In addition, the nutritional implications of consuming this beverage type are being examined in other systematic reviews and food pattern modeling analyses.	Meeting 4
What is the relationship between dietary patterns consumed and bone health?	In consideration of project workload and timelines, the Committee discontinued this systematic review after determining that a lack of research was available to update the existing NESR systematic review and that other remaining questions were higher priority.	Meeting 5

Subcommittee Structure

Following Meeting 2, the Committee formed 4 Subcommittees focused on defined topic areas to address the prioritized scientific questions:

- Dietary Patterns and Specific Dietary Components Across Life Stages
- Diet in Pregnancy and Birth Through Adolescence
- Food Pattern Modeling and Data Analysis
- Strategies for Individuals and Families Related to Diet Quality and Weight Management

Additionally, 2 cross-cutting Working Groups—Health Equity and Meta-Analysis — addressed topics that were relevant either across the Committee or to multiple Subcommittees.

Each Subcommittee and Working Group was comprised of 6-12 Committee members, with 1 member serving as chair of each Subcommittee or Working Group. The Chair and Vice Chair of the Committee each served on 2 Subcommittees and both served on the Health Equity Working Group. The membership of each Subcommittee and Working Group is listed in **Appendix F-4: Membership of Dietary Guidelines Advisory Committee Subcommittees and Working Groups**.

The Subcommittees and Working Groups conducted their work between Committee meetings, meeting regularly via videoconference and communicating through e-mail. Subcommittees also met in person prior to Committee meetings. During Committee meetings, each Subcommittee presented its protocols and findings from its review of the science, explained the rationale for draft conclusion statements and recommendations, and answered questions from the Committee. All content presented at Committee meetings was considered draft, allowing for changes to be considered based on Committee discussions, as well as on public comments.

Public Comments During Committee Review of Scientific Evidence

The public was encouraged to submit comments to the Committee throughout its review of the science. The written public comment period opened on January 19, 2023, and remained open through October 7, 2024, several weeks following the Committee's sixth meeting, to allow for public comment throughout the entire process. The public also had the opportunity to provide oral comments to the Committee at Meeting 3 via video conference or by recording and submitting comments to be presented for the Committee at the meeting. The Committee had access to all written comments via Regulations.gov. A document summarizing comments received and linking to the full text of written comments was provided to Committee members throughout the process. Committee members considered all comments received. More information on these public comments, including a general description of the types of comments received and the process used for collecting public comments, is available in **Appendix F-2: Public Comments**.

Federal Staff Support

Federal staff from HHS and USDA worked in partnership to support the Committee throughout their process. As administrative lead, the Designated Federal Officer (DFO) was from the HHS ODPHP and led the administrative effort for the Committee's work. Additionally, staff from HHS and USDA helped manage Committee operations and contributed scientific support to the Committee's review of the science. The roles of staff and Committee members were clearly delineated to ensure that the Committee made all substantive decisions. The Committee developed and refined its protocols, synthesized evidence to develop conclusion statements, and graded the strength of the evidence for its systematic review conclusions. Staff supported the Committee by executing protocols; for example, by searching for and screening studies, extracting data, and conducting risk of bias assessments for systematic reviews; by conducting food pattern modeling analyses in accordance with the Committee's protocols; and by analyzing data based on Committee requests. The Committee was responsible for integrating evidence across all its conclusions to develop the overarching advice included in this report. Staff from HHS ODPHP, USDA CNPP, and the Federal Data Analysis Team provided invaluable support and are including in the listing of **Dietary Guidelines Advisory Committee Membership and Federal Support Staff**.

Box C.3: Interpretation of Variables Related to Health Equity and Social Determinants of Health

The Committee recognized the impact of social determinants of health (SDOH) on diet-health relationships and the importance of considering SDOH when interpreting nutrition research. However, the availability of relevant SDOH data in nutrition research is limited. The Committee considered race, ethnicity, and socioeconomic position (SEP) across its review of the science given clear evidence of health disparities in nutritional status and diet-related chronic diseases based on economic, social and/or environmental disadvantage. The Committee recognized, however, that these variables serve as indirect proxies for a host of social, economic, and structural factors that underlie health disparities. Consequently, race, ethnicity, and SEP were identified as key confounders for all systematic reviews, prioritized as variables for data analysis stratifications, and used to examine nutrient profile differences in food pattern modeling protocols. More detail is provided in this chapter’s sections describing methodology specific to each scientific approach.

The Committee framed race as a social construct that may serve as a proxy for other influential SDOH, including exposure to racial discrimination and structural racism. The attribution of race to biology was viewed as erroneous and contributing to inaccuracies in the understanding of population differences in health. The Committee also acknowledged that current conceptualizations of ethnicity may not accurately capture nuances in geography, nationality, or language that are important to identity and cultural belonging. Finally, SEP was defined to refer to social and economic factors that influence the positions individuals or groups hold in the structure of a society. SEP is broader than status and is inclusive of factors such as income, education, occupation, employment, and marital status.

The Committee identified the inclusion of direct and diverse indicators of SDOH—from broad-reaching social and economic influences such as health insurance coverage and discrimination to nutrition-specific SDOH including food security and participation in federal food and nutrition assistance programs—as a significant gap in research on diet-health relationships. Standard reporting of SDOH variables is critical for advancing health equity in populations of diverse racial, ethnic, socioeconomic, and cultural backgrounds. For more information, see **Part E. Chapter 2: Future Directions**.

Methodology Specific to the 3 Scientific Approaches

As outlined above, the Committee used 3 approaches to examine the evidence: data analysis, systematic reviews, and food pattern modeling. Each approach has its own rigorous, protocol-driven methodology, and plays a unique, complementary role in examining the science. Methodology specific to the 3 scientific approaches is provided below and described further in online resources. Across all 3 scientific approaches, the Committee carefully considered how to interpret variables related to health equity and SDOH. The Committee's approach to interpreting these variables is described in detail in **Box C.3**.

Data Analysis

Data analysis is described in **Box C.4.** A collection of nationally representative federal data sources informed the Committee's work and deliberations. Data sources included the National Health and Nutrition Examination Survey (NHANES), including its dietary component, What We Eat in America (WWEIA); National Health Interview Survey (NHIS); Surveillance, Epidemiology and End Results (SEER); National Vital Statistics System (NVSS); National Immunization Surveys (NIS); and Pregnancy Risk Assessment Monitoring System (PRAMS). **Table C.3** describes these data sources and cites their methodologies. Federal staff from ODPHP and CNPP supported the Committee in leveraging existing data briefs and publications and coordinating original analyses when existing publications were not available to answer the Committee's questions. When available, statistical testing for significance was considered when reported in data publications. The quantity of analyses examined by this Committee surpassed that of prior Committees; therefore, time limitations impacted the ability for this testing to be broadly completed across all analyses and reviewed and synthesized by the Committee.

Box C.4: Data Analysis

is the use of statistical methods to analyze national datasets to describe the current health and dietary intakes in the United States. This approach helped the Committee ensure its advice was practical, relevant, and achievable.

Analysis and review of the data was led by federal staff, informed by Committee requests. Data were shared with the Committee for synthesis, evaluation, and development of conclusion statements for each data analysis question.

Additionally, efforts were made to ensure that data analysis methodologies capture the most updated and relevant data possible. To address the disruption to federal data collection during the Coronavirus Disease 2019 (COVID-19) pandemic, an evidence scan was conducted to identify and describe data sources that captured food and beverage patterns from March 2020 to December 2022, including potential changes due to COVID-19.[16] The Committee considered and discussed the evidence scan results that are described in **Part D. Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions.** The full evidence scan can be found on DietaryGuidelines.gov.

TABLE C.3
OVERVIEW OF FEDERAL DATA SOURCES FOR DATA ANALYSIS

Data Source	Supporting Agencies	Description of Data Sources
National Health and Nutrition Examination Survey (NHANES)[17]	HHS, Centers for Disease Control and Prevention (CDC), National Center for Health Statistics USDA, Agricultural Research Service (ARS), Food Surveys Research Group (FSRG)	NHANES is a federal program of studies designed to assess the health and nutritional status of children and adults residing in the 50 U.S. states and the District of Columbia. The nationally representative survey includes interviews (e.g., 24-hour dietary recall), questionnaires (e.g., demographics, food security, income), laboratory data (e.g., folate status or other biochemical markers of public health relevance), and physical examinations (e.g., height, weight, blood pressure), that measure dietary intakes and diet-related chronic disease rates in the U.S. population.
What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES)[18]	USDA, ARS, FSRG	The dietary component of NHANES, called WWEIA, is the only nationally representative survey of total food and beverage consumption that captures intakes across life stages on a population level in the United States. The dietary data are collected using the gold standard for dietary assessment: a multiple pass, 24-hour dietary recall.
USDA Food and Nutrient Database for Dietary Studies (FNDDS)[19]	USDA, ARS, FSRG	FNDDS is a database that provides the energy and nutrient values for foods and beverages reported in WWEIA, NHANES. Data are available for energy and 64 nutrients for about 7,000 foods and beverages. The data can be used to examine nutrient intakes from foods and beverages reported by participants in WWEIA, NHANES and assess adherence to Dietary Reference Intakes.
USDA Food Pattern Equivalents Database (FPED)[20]	USDA, ARS, FSRG	FPED converts foods and beverages from FNDDS into 37 USDA Food Patterns components. It can be used to examine food group or component intakes (e.g., whole fruit, total Vegetables, added sugars) from foods and beverages reported by participants in WWEIA, NHANES and assess adherence to *Dietary Guidelines* food group recommendations.
WWEIA Food Categories[21]	USDA, ARS, FSRG	WWEIA Food Categories provide an application to analyze the foods and beverages reported by participants in WWEIA, NHANES. Each food and beverage are placed in 1 of 167 mutually exclusive food categories, where similar items are grouped together based on their typical use and nutrient content (e.g., mixed dishes – Asian, savory snacks, cooked cereals).

Data Source	Supporting Agencies	Description of Data Sources
National Health Interview Survey (NHIS)[22]	HHS, CDC, National Center for Health Statistics	NHIS is a health survey conducted using in-person, confidential household interviews. It provides data on the U.S. civilian noninstitutionalized population residing in the 50 states and District of Columbia for analyzing public health trends, assessing prevalence of health conditions, and tracking progress toward achieving national health objectives.
Surveillance, Epidemiology and End Results (SEER)[23]	HHS, National Institutes of Health (NIH), National Cancer Institute, Division of Cancer Control and Population Sciences	The SEER Program is the authoritative source for cancer statistics in the U.S. population. SEER collects and publishes cancer incidence and survival data from population-based cancer registries. The 22 geographic areas of data collection from the U.S. states and American Indian/Alaska Native communities are representative of the demographics of the U.S. population.
National Vital Statistics System (NVSS)[24]	HHS, CDC, National Center for Health Statistics	NVSS collects and disseminates the most complete data on U.S. births and deaths from vital registration systems across 50 states, 2 cities (District of Columbia and New York City), and 5 territories.
National Immunization Surveys (NIS)[25]	HHS, CDC, National Center for Immunization and Respiratory Diseases	NIS are a group of telephone surveys that provide current, population-based, state and local area estimates of vaccination coverage among children ages 19 through 35 months and adolescents 13 through 17 years. The surveys collect data through telephone interviews with parents or guardians in all 50 U.S. states, the District of Columbia, and some U.S. territories (U.S. Virgin Islands, Puerto Rico, Guam).
Pregnancy Risk Assessment Monitoring System (PRAMS)[26]	HHS, CDC, Division of Reproductive Health	PRAMS is a population-based surveillance system that collects data on maternal health and behaviors before, during, and immediately after pregnancy from 46 states, 2 cities (District of Columbia and New York City), and 2 territories (Northern Mariana Islands and Puerto Rico).

Transparency of the Data Analysis Work

Data Analysis Plan

Prior to conducting new analyses, federal staff developed a Federal Data Analysis Plan to comprehensively describe the data analysis process and strategy and specify the analyses that would be used to support the Committee in answering the data analysis questions.[27] The Committee contributed to the data analysis plan, including providing feedback on how health equity should be considered across data analyses. The plan, including updated versions, was posted on DietaryGuidelines.gov.[28] The public was encouraged to review and submit written comments to the Committee on its work, including the data analysis plan, throughout its term. The final version of the data analysis plan was posted to DietaryGuidelines.gov to accompany the Committee's Scientific Report.

Data Analysis Reports and Supplements

The evidence for each data analysis question was transparently documented in 1 or more reports, which are posted on DietaryGuidelines.gov. [28-32] Each data analysis report summarizes detailed results for each analysis examined by the Committee, as well as references to data source methodology, data publications, and data analysis supplements.[33] The data analysis supplements include data tables with results for analyses that the Committee requested from federal interagency partners (ARS, CDC, and NIH). The chapters included in Part D of this report briefly summarize findings from the Committee's data analysis work, and the full data analysis reports and supplements are posted on DietaryGuidelines.gov.

Expert Review of the Data Analysis Reports and Supplements

Data source experts from federal interagency partners who were familiar with methodologies for the data collection and analyses reviewed all federal data analysis reports and supplements to provide feedback on their accuracy, clarity, transparency, and organization. Following expert review, data analysis staff shared comments with the Committee and revised the reports and supplements as needed.

Health Equity Considerations

Health equity considerations were incorporated into each step of the data analysis process, including identification of data needs, development of the data analysis plan, and refinement of sociodemographic groups to be examined. Dietary intakes, dietary patterns, and prevalence of health conditions within the sociodemographic groups were identified, summarized, and synthesized as part of the Committee's data analyses and used to inform conclusions and future recommendations.

These efforts built on the work of the 2020 Committee, which examined data by sociodemographic groups including sex, race and/or ethnicity, socioeconomic status (e.g., family income, poverty to income ratio (PIR), education), and age/life stage. Given the 2025 Committee's focus on health equity, additional sociodemographic variables were proposed and considered, and socioeconomic status was expanded to socioeconomic position to capture the relation to poverty level. In proposing new variables to examine, the Committee emphasized the need for prioritization of variables that would be most meaningful to its work. Selection of these variables also relied on the presence of a sufficient sample size to conduct these population group analyses. In light of those considerations, the 2025 Committee prioritized the following variables that were in addition to those examined by the 2020 Committee: household food security category, current household Supplemental Nutrition Assistance Program (SNAP) participation, and current child participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) program.

Other variables that were considered by the 2025 Committee included: country of birth (i.e., U.S.-born or non-U.S.-born), health insurance coverage and type, geographic location (i.e., living in urban or rural areas), social vulnerability index, household emergency food benefits (receipt in the last 12 months), disability status (i.e., disability or no disability), language spoken at home as a proxy for acculturation (i.e., English, Spanish, or other language), and length of time in the United States. Some of these variables were included in certain analyses when available (e.g., country of birth, health insurance coverage and type, geographic location, and disability status), while others were determined to be a lower priority or unfeasible (e.g., social vulnerability index, household emergency food benefits, language spoken at home, length of time in the United States).

Data Analysis Team

The federal data analysis team and interagency partners supported the Committee's work to answer specific topics and questions. The team and partners were federal scientists with advanced degrees in nutrition, statistics, and epidemiology from the following Departments and agencies:

- HHS
  - ODPHP; Office of the Assistant Secretary for Health
  - National Cancer Institute; NIH
  - National Center for Health Statistics; CDC
- USDA
  - CNPP; Food and Nutrition Service (FNS); Food, Nutrition, and Consumer Services
  - ARS; Research, Education, and Economics

Systematic Reviews

Systematic reviews are described in **Box C.5.** The Committee, with support from USDA's NESR team, conducted original and/or updated existing systematic reviews using NESR's rigorous, transparent methodology. The Committee also used NESR methodology to conduct an evidence scan, described earlier in this chapter.

Box C.5: Systematic Reviews

are gold-standard evidence synthesis projects that answer nutrition questions of public health importance using systematic, transparent, rigorous, and protocol-driven methods to search for, evaluate, synthesize, and grade the strength of the eligible body of evidence. To find out more, go to **https://nesr.usda.gov**.

The NESR methodology used by the Committee for conducting systematic reviews includes developing a systematic review protocol, searching and screening for literature, extracting data and assessing risk of bias, synthesizing evidence, developing conclusion statements, grading the evidence, and recommending future research.

NESR evidence scans use systematic methods to search, screen, and describe the type and amount of evidence on a topic, but differ from systematic reviews in that they do not answer a research question by synthesizing results and developing graded conclusion statements. The complete NESR methodology for conducting systematic reviews and evidence scans is described in detail in a manual posted on the NESR website: **https://nesr.usda.gov**.

The NESR systematic review process is highly collaborative and designed to leverage the Committee's expertise, with clear delineations between staff and Committee roles to ensure that the Committee was responsible for all substantive decision-making. The Committee developed its protocols, synthesized the evidence, developed and graded the strength of evidence underlying conclusion statements, and made research recommendations. The NESR team supported the Committee by completing the most time- and resource-intensive steps of the process, which included executing the Committee's protocols. NESR librarians developed comprehensive literature search strategies that were externally peer-reviewed. NESR analysts screened articles, extracted data, assessed risk of bias, and prepared data for the Committee to synthesize. This collaborative approach ensured that the Committee was fully responsible for the results of its systematic reviews and had robust support from the NESR team to complete a large scope of work within established timelines.

Continuous Quality Advancement

NESR has maintained a robust continuous quality advancement (CQA) program since its inception. Through its CQA program, NESR routinely evaluates and refines its methodology and tools to ensure that NESR's process remains state-of-the-art. CQA work results in timely updates to the NESR methodology manual, procedure, and training materials. For example, CQA work to prepare for establishment of the 2025 Committee resulted in the addition of meta-analysis methodology for use by the 2025 Committee, as well as development of a continuous evidence monitoring (CEM) process that uses established systematic review protocols to periodically search for, screen, and prepare evidence for future systematic reviews. NESR used CEM prior to the establishment of the 2025 Committee to monitor the evidence on high priority questions. The results of this monitoring helped the Committee determine if sufficient new research was available to update existing NESR systematic reviews.

Transparency of the Committee's Systematic Reviews and Evidence Scan

Methodology

NESR's methodology manual provides detailed information about NESR's methodology and processes, including those for conducting and updating systematic reviews and evidence scans. NESR's methodology manual is available at the NESR website: **https://nesr.usda.gov**.

Protocols

The Committee developed protocols that included an analytic framework, inclusion and exclusion criteria, and a synthesis plan to answer each question. Literature search strategies were available upon request. All protocols and any revisions to protocols were presented by the Committee at its meetings and posted to the NESR website on a dedicated web page that will permanently house all NESR protocols, including those of the Committee (**https://nesr.usda.gov/protocols**). The public was encouraged to review and submit written comments to the Committee on its work, including on its protocols, throughout the Committee's term.

Systematic Review Reports

Each systematic review was transparently documented in a report that included a plain language summary, an abstract, and the full systematic review. The reports were posted on NESR's website at the same time that this Scientific Report was released. Each systematic review report presented comprehensive details of the systematic review, including a summary of NESR's methodology and the protocol implemented for that review, the literature search strategy and search results, the description and synthesis of the evidence reviewed, and the conclusion statements and grades along with the rationale supporting them. The evidence scan was similarly documented. The chapters in Part D of this report briefly summarize the findings from the Committee's systematic reviews and evidence scan, and the full systematic review and evidence scan reports are linked within their respective chapters and posted on NESR's website: **https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews.**

Peer Review of the Committee's Systematic Reviews

All of the Committee's systematic reviews underwent external peer review in a process coordinated by staff from the National Institutes of Health (NIH). As a research center, NIH has access to nutrition scientists and networks with professional organizations to support peer review. Additionally, while within HHS, those coordinating the peer review were separate from the staff supporting the Committee's work. NIH staff identified potential peer reviewers through outreach to a variety of professional organizations to select academic reviewers from U.S. colleges and universities across the country with a doctorate degree, including MDs, and expertise specific to the questions being reviewed. This reflects a change from the peer review process used for the 2020 Committee and is responsive to recommendations from a NASEM panel. In 2020, federal scientists who were not involved in the development of the *Dietary Guidelines* were served as peer reviewers. For the 2025 Committee's process, all peer reviewers were external to the *Dietary Guidelines* process; therefore, current Committee members and federal staff who supported the Committee, or who were involved in the development of the *Dietary Guidelines,* were not eligible to serve as peer reviewers. Federal scientists who were not involved in the development of the *Dietary Guidelines* were eligible to serve as peer reviewers. Past members of Dietary Guidelines Advisory Committees were eligible to serve, as long as they were not serving on the 2025 Committee.

NIH staff assigned each systematic review to be peer-reviewed by at least 2 reviewers. Peer reviewers are listed in **Appendix F-5: Acknowledgements**. The peer review process was anonymous and confidential in that the peer reviewers were not identified to the Committee members or NESR staff, and in turn, the reviewers were asked not to share or discuss the review with anyone. Peer reviewers were made aware that per USDA, FNS agency policy, all peer reviewer comments would be summarized public, but comments would not be attributed to a specific reviewer.

Before peer review began, NESR staff recorded a video orientation to the NESR systematic review methodology, which NIH staff shared with the peer reviewers. Peer review occurred after draft conclusion statements were discussed by the Committee at its third, fourth, fifth, and sixth meetings. Following Committee discussion at the respective meetings, NESR staff sent drafts of the Committee's systematic reviews to NIH staff, who assigned and distributed the reviews to peer reviewers. Peer reviewers were asked to complete their review within 14 days. Each peer reviewer received drafts of the full systematic review for their assigned question(s), and were provided with the following questions to guide their review and feedback:

- Description of the Evidence, Synthesis of Evidence, and Assessment of the Evidence: Are these sections clearly written and organized so that they provide transparency to the body of evidence reviewed?
- Conclusion Statement(s) and Grade(s): Are the conclusion statement(s) and grade(s) supported by the body of evidence reviewed?
- Research Recommendations: Would you suggest any additional research recommendations be made to encourage future research that can inform agency programs, guidance, and/or policy?

Following peer review, NIH staff returned anonymized peer reviewer comments to NESR staff, who shared the comments with the Committee. The Committee reviewed and discussed comments and revised the systematic reviews, as needed, based on the discussion. NESR staff then sent NIH staff the Committee's responses to each peer review, and NIH staff shared responses with the respective peer reviewers.

Health Equity Considerations

The Committee considered health equity throughout the NESR systematic review process, and these considerations align with how other organizations have integrated equity in their review processes, including the Cochrane Equity Methods for systematic reviews and the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) Equity-Extension.[34,35] These resources provide recommendations for conducting and reporting equity-focused systematic reviews. Cochrane Equity's recommendations are found in Chapter 16 of Cochrane's larger methodology handbook and discuss considerations for each step of the systematic review process.[34] PRISMA provides guidance on reporting the methods and findings of evidence synthesis projects to promote transparency and reproducibility. The PRISMA Equity-Extension, published in 2012, focuses on reporting standards for health equity.[36]

Examples of how the Committee incorporated health equity considerations into its systematic reviews and evidence scan include:

Consideration of Key Confounders

Each systematic review protocol considered health equity variables as potential key confounders of relationships between exposures and outcomes of interest. For example, race, ethnicity, and socioeconomic position were identified as key confounders for all systematic reviews, given clear evidence of health disparities in nutritional health and diet-related chronic diseases based on economic, social, and/or environmental disadvantage. Descriptive data on key confounders and other health equity-related variables were extracted, where possible, and considered when assessing risk of bias due to confounding.

The Committee then considered these data and the risk of bias assessments as it synthesized the evidence and developed and graded conclusion statements.

Generalizability

The NESR systematic review process addresses health equity by including generalizability of the evidence as 1 of 5 elements considered when grading evidence. The Health Equity Working Group provided the Committee with guidance for consistent evaluation of generalizability when grading the strength of evidence. The Committee considered the extent to which study participants, interventions and/or exposures, comparators, and outcomes were representative and inclusive of the diversity of the U.S. population. While generalizability does not equate to health equity, it is critical to the goal of representation—ensuring that the science provides the basis of fair and just opportunities for health for everyone. Because the *Dietary Guidelines* informs federal nutrition policies and programs in the United States, it is imperative to consider the generalizability of evidence included in systematic reviews to population groups served by those policies and programs.

Food Pattern Modeling

Food pattern modeling (FPM) is described in **Box C.6**. The Committee used FPM to complete analyses in 9 food pattern modeling protocols and 2 additional protocols that were exploratory analyses. The results informed the Committee's conclusions for its overarching question: Considering each life stage, should changes be made to the USDA Dietary Patterns (Healthy U.S.-Style, Healthy Mediterranean-Style, and/or Healthy Vegetarian), and should additional Dietary Patterns be developed/proposed based on:

- Findings from systematic reviews, data analysis, and/or food pattern modeling analyses; and/or
- Population norms, preferences, or needs of the diverse communities and cultural foodways within the U.S. population?

Box C.6: Food Pattern Modeling

is a methodology used to illustrate how changes to the amounts or types of foods and beverages in a dietary pattern might affect meeting nutrient needs and is used to develop quantitative dietary patterns that reflect health-promoting patterns identified in systematic reviews and meet energy and nutrient needs.

To answer the question, the Committee developed protocols that describe how FPM analyses would be used to examine the implications of changes to the types and amounts of foods and beverages in a dietary pattern on meeting nutrient requirements. The results of the individual FPM analyses were considered together along with evidence from systematic reviews and data analysis and translated into a dietary pattern(s), which reflects health-promoting patterns identified in systematic reviews, meets recommendations for nutrient intake, and considers dietary intakes of the U.S. population to ensure the Committee's advice is practical, relevant, and achievable.

The FPM process is highly collaborative and designed to leverage the Committee's expertise, with clear delineations between staff and Committee roles to ensure that the Committee was responsible for all substantive decision-making. The Committee developed its protocols, reviewed and synthesized evidence across all FPM analyses along with data analysis and systematic review evidence, developed synthesis statements and conclusion statements, and made research recommendations. The FPM team was responsible for the most resource-intensive steps of the FPM process: conducting each FPM analysis detailed in the Committee's protocols, except for the analyses identified by the Committee in the diet simulations protocol. Diet simulation analyses were conducted by a third-party contractor and were overseen by the FPM team. The FPM team was comprised of nutrition scientists from across CNPP and data analysts in the Nutrition and Economic Analysis Branch at CNPP within FNS. This collaborative approach ensured that the Committee was fully responsible for the results of its FPM analyses and had robust support from the FPM team to complete a large scope of work within established timelines.

Continuous Quality Advancement

To prepare for the establishment of the 2025 Committee, HHS and USDA collaborated on CQA efforts for FPM, focusing on methods to better reflect the complex interactions involved, variability in dietary intakes, and range of possible healthful diets. The interagency Food Pattern Modeling Interest Group (FPM IG) was formed in 2021 to increase the diversity of federal staff directly involved in the process to develop healthy dietary patterns. Federal staff evaluated the analytic methods and development of data inputs and constraints for FPM by comparing them to methods used to develop guidance in other countries and to modeling exercises described in scientific publications. The FPM IG also collaborated with other federal workgroups, such as the NIH Nutrition and Health Disparities Implementation Working Group and the Interagency Committee on Human Nutrition Research. The FPM IG prioritized 2 efforts from its work—food composition data and addition of a systems science approach (i.e., diet simulations) to complement existing FPM methods.[37]

Food Composition Data

Prior to the 2025 FPM process, the USDA nutrient composition database called Standard Reference (SR) was used for FPM analyses.[38] The SR database is still available on USDA's FoodData Central,[39] but its final release was in April 2018. The final version of SR is called SR Legacy and it contains historic data on food components including nutrients derived from analyses, calculations, and published literature. Due to retirement of the SR database, the 2025 FPM analyses switched from using SR as the sole nutrient database for its analyses to using the Food and Nutrient Database for Dietary Studies (FNDDS),[19] with few exceptions. SR Legacy is still used for certain foods that are unavailable in FNDDS and comprises just 2 out of 387 representative food-item cluster pairs. The version of FNDDS used for the 2025 FPM process was FNDDS 2017-2018. Although FNDDS 2019-2020 was released during the 2025 FPM process, its companion database that is essential to the FPM process, the Food Patterns Equivalents Database (FPED), 2019-2020 was not released due to the impacts of the COVID-19 pandemic on the WWEIA, NHANES survey. Therefore, the FNDDS 2017-2018 and corresponding FPED 2017-2018 were used for all 2025 FPM analyses.

Diet Simulations

The FPM IG conducted an evidence scan to explore methodologies used by international counterparts to understand how other research groups have considered intake variability in diverse populations. The results of that evidence scan revealed that the addition of simulated diet methodologies may provide another opportunity to consider intake variability in addition to existing rigorous FPM methods. The FPM IG prioritized diet simulation analyses as an avenue to better consider intake variability and evaluate the range of possible daily diets to meet both recommended patterns and nutritional goals by generating thousands of 7-day diets. The addition of this methodology to the FPM process further advances how dietary patterns are evaluated for their flexibility when considering variation in dietary intakes, adding to the rigor of FPM. The addition of this systems science approach allowed the Committee to examine and consider refinement of the modified 2020 HUSS Dietary Pattern to ensure the final pattern(s) proposed to the Departments were inclusive of a broader range of dietary intakes.

Transparency of the Committee's Food Pattern Modeling Analyses

Methodology

FPM analyses (with the exception of diet simulations) focused on modifying the calculation of nutrient profiles for food groups and subgroups, and subsequent analyses examined modifications to the quantities of each food group and subgroup. The USDA Dietary Patterns included in the *Dietary Guidelines for Americans, 2020-2025* provided amounts of 5 major food groups and subgroups, including:

- Fruits
- Vegetables: Dark Green; Red and Orange; Beans, Peas, and Lentils[a]; Starchy; and Other
- Dairy and Fortified Soy Alternatives
- Grains: Whole Grains and Refined Grains
- Protein Foods: Meats, Poultry, and Eggs; Seafood; Nuts, Seeds, and Soy products

Below are abbreviated summaries of the 6-step methodology applied to conduct all FPM analyses, except for diet simulations. For full details pertaining to how these methods were operationalized, see the food pattern modeling report titled, "*Should foods and beverages with lower nutrient density (i.e., those with added sugars, saturated fat, and sodium) contribute to item clusters, representative foods, and therefore the nutrient profiles for each food group and subgroup used in modeling the USDA Dietary Patterns? Food Pattern Modeling Report*."[40]

Step 1: Establish energy levels

The updated 2023 Dietary Reference Intakes (DRI) predictive equations,[41] newly available to the 2025 Committee, were used to calculate Estimated Energy Requirements (EER) for each age-sex group and for 3 age groups specific to pregnancy and lactation (14-18 years, 19-30 years, and 31-50 years). Each EER

[a]Beans, Peas, and Lentils are typically modeled as Vegetables, but can also be included and modeled in the Protein Foods group. Food pattern modeling protocols and reports noted how Beans, Peas, and Lentils were modeled.

calculation was based on sex, age, height, weight, level of physical activity, and life stage, and during pregnancy, gestational weeks. For individuals ages 19 years and older, the established energy levels for FPM analyses used the EER calculation specific to inactive individuals at the median height and a normal weight (BMI 22.5 kg/m^2 for males, BMI 21.5 kg/m^2 for females) for each age-sex group, rounded to the nearest 200 kilocalorie (kcal) level. This approach results in a more tailored EER for each age-sex group with consideration for variation in heights and weights, which differed from the approach of previous Committees, which used 1 reference weight (healthy BMI) and height (median) for all adult males (70 inches and 154 pounds) and all adult females (64 inches and 126 pounds). For children and adolescents ages 2 to 18 years, median height and the 50th percentile BMI-for-age were used, with the EER rounded to the nearest 200 kcal level. Previous Committees used median height and weight for children and adolescents. For young children ages 12 to 24 months, EERs from the DRI report using median weight and length were used and rounded to the nearest 100 kcal level.[41] The corresponding calories were then used to evaluate the patterns against nutritional goals.

Step 2: Establish nutritional goals

Specific nutritional goal quantities for a dietary pattern were set according to energy level and based on the DRI specific to the age-sex group(s) for which the pattern is designed. For individual FPM analyses, the assigned energy level for each age-sex group and life stage was tested against the established nutritional goals for that age-sex group or life stage. Dietary patterns were evaluated against goals for total energy, fat, protein, carbohydrates, 3 fatty acids, 12 vitamins, 8 minerals, added sugars, and fiber based on DRI reports released between 1997 and 2023 and on quantitative recommendations in the *Dietary Guidelines for Americans, 2020-2025*.

Step 3: Establish food groupings and amounts

Existing food groups and subgroups in the USDA Healthy U.S.-Style (HUSS) Dietary Pattern and the Healthy Vegetarian Dietary Pattern for ages 12 through 23 months and ages 2 years and older (published in the *Dietary Guidelines for Americans, 2020-2025*) were used in analyses. The existing patterns served 2 purposes in the analyses: (1) as a reference and/or (2) as the starting point in analyses that investigate implications to nutritional goals when quantities of food groups and/or subgroups are increased or reduced.

Step 4: Determine the amounts of nutrients that would be obtained by consuming various foods within each food group and subgroup

A composite system was used to calculate the anticipated energy and nutrient content, or nutrient profile, of each food group or subgroup as described below. All foods reported by individuals ages 1 year and older as part of WWEIA, NHANES 2017-2018 were disaggregated into their ingredients. Some foods and beverages that are lower in nutrient density were excluded from the set of foods used to calculate nutrient profiles. For more information on the foods and beverages excluded by the Committee, please see **Part D. Chapter 9: Nutrient Profile Development**. Similar ingredients were aggregated into food item clusters. A nutrient-dense form of the food was selected as the representative food for each item cluster.

The proportional intake of each item cluster within each food group or subgroup was calculated and used to compute a weighted average of nutrient-dense forms of foods representing each food item cluster.

Step 5: Evaluate the implications for meeting nutritional goals when modifying food group and subgroup quantities within the HUSS

Generally, food group and subgroup quantities were modified (e.g., from the quantity currently in the HUSS pattern and incrementally reduced to zero) and implications of these quantity modifications on meeting established nutritional goals were evaluated. Each protocol includes objectives that describe the analyses related to such modifications for each food group or subgroup.

Step 6: Iterate and re-evaluate the patterns to align with current or potential recommendations

The Committee used a stepwise, iterative approach to synthesize across analyses and adjust and re-evaluate the dietary patterns based on findings from systematic reviews, data analysis, or FPM analyses, and to examine flexibilities within the patterns.

The Committee interpreted results of food pattern modeling analyses under the premise of 2 key assumptions. First, modeling was based on food group and subgroup nutrient profiles of nutrient-dense foods (i.e., those with the least added sugars, saturated fat, and/or sodium) and proportions of foods and beverages reported in the U.S. population (e.g., proportion of different beans, peas, and lentils). Second, modeling assumed population-wide compliance with quantitative food and beverage recommendations of the dietary patterns under review. As with other types of modeling, food pattern modeling is hypothetical and does not predict the behaviors of individuals.

The Committee considered FPM analyses along with evidence from data analysis and systematic reviews to develop a conclusion statement that answered the overarching question:

Considering each life stage, should changes be made to the USDA Dietary Patterns (Healthy U.S.-Style, Healthy Mediterranean-Style, and/or Healthy Vegetarian)? And, should additional Dietary Patterns be developed/proposed based on:

- Findings from systematic reviews, data analysis, and/or food pattern modeling analyses; and/or
- Population norms, preferences, or needs of the diverse communities and cultural foodways within the U.S. population?

Protocols

The Committee developed 9 protocols that each included an analytic framework and analytic plan to answer the food pattern modeling question. The Committee also conducted 2 exploratory FPM analyses. The Committee presented all protocols and revisions at its meetings, and the protocols were also posted on DietaryGuidelines.gov. The public was encouraged to review and submit written comments to the Committee on its work, including protocols, throughout its term.

The analytic plans for the protocols included the element(s) to be modified and examined in the FPM analyses:

- 2 protocols detailed analyses to help the Committee develop the nutrient profiles used in subsequent analyses (Basis Nutrient Profiles Protocol and WWEIA Population Groups Protocol),
- 5 protocols detailed analyses that modified individual food groups and subgroups (Fruits Protocol, Vegetables Protocol, Grains Protocol, Protein Foods Protocol, and Dairy and Fortified Soy Alternatives Protocol),
- 1 protocol detailed analyses that evaluated the dietary pattern component called "limits on calories for other uses" and the hypothetical inclusion of foods or beverages lower in nutrient density (Ranges of Nutrient Density Protocol),
- 2 protocols detailed exploratory analyses that reduced or excluded specific food groups, subgroups, or dietary components (Removing Animal-Source Foods Protocol and Reducing Carbohydrate-Containing Foods Protocol), and
- 1 protocol detailed diet simulation analyses that evaluated the implications on nutritional goals if different combinations of individual foods and beverages were consumed to meet the recommended amounts for each food group and subgroup (Diet Simulations Protocol).

The Committee discusses results of these analyses in **Part D. Chapter 9: Nutrient Profile Development**, **Part D. Chapter 10: Food Group and Subgroup Analysis**, and **Part D. Chapter 11: Diet Simulations**.

Food Pattern Modeling Reports

The FPM reports available on DietaryGuidelines.gov provide the full analytical methods used to conduct and reproduce the modeling analyses, detailed results for each analysis, and the synthesis or summary statements for the analyses.

Peer Review of the Committee's Food Pattern Modeling Reports

Like the Committee's systematic review reports, all FPM reports underwent external peer review in a process coordinated by staff from NIH. Peer reviewers were identified using a similar process that NIH staff used to identify peer reviewers for the Committee's systematic reviews. NIH staff assigned each FPM report to be peer-reviewed by at least 2 independent reviewers. The peer review process was anonymous and confidential in that the peer reviewers were not identified to the Committee members or FPM staff, and in turn, the reviewers were asked not to share or discuss the review with anyone. Peer reviewers were made aware that per USDA, FNS agency policy, all peer reviewer names would be released, and comments would be summarized and made public, but comments would not be attributed to a specific reviewer. Peer reviewers are listed in **Appendix F-5: Acknowledgements**.

Before peer review began, FPM staff recorded a video orientation to the FPM process, which NIH staff shared with the peer reviewers. Peer review occurred after draft synthesis or summary statements were discussed by the Committee at its fifth and sixth meetings. Following Committee discussion at the respective meetings, FPM staff sent drafts of the FPM reports to NIH staff, who assigned and distributed the reviews to peer reviewers. Peer reviewers were asked to complete their review within 14 days. Each peer reviewer received drafts of the full FPM report along with Excel workbooks detailing all analysis results and a video orienting them to the Excel workbooks for their assigned topic, and were provided with the following questions to guide their review and feedback:

- Description of the Overview, Food Pattern Modeling Analytic Process – In Brief (and associated Steps), Objective Methods, and Objective Results: Are these sections clearly written and organized so that they provide transparency to the methodology, operationalization of the methods, and the results?
- Synthesis (or Summary) Statements: Are the Synthesis (or Summary) Statements supported by the findings from the analyses?
- Research Recommendations: Would you suggest any additional research recommendations be made to encourage future research that can inform agency programs, guidance, and/or policy?

Following peer review, NIH staff returned anonymized peer reviewer comments to FPM staff, who shared the comments with the Committee. The Committee reviewed and discussed comments and revised the FPM reports, as needed, based on the discussion. FPM staff then sent NIH staff the Committee's responses to each peer review, and NIH staff shared responses with the respective peer reviewers.

Health Equity Considerations

The Committee identified representation of population groups in the dietary patterns under review as a topic to be consistently prioritized and integrated into all aspects of food pattern modeling or discussed as future recommendations. Thus, health equity considerations were incorporated into each step of the food pattern modeling process, including refinement of food pattern modeling methods that considered the full population, along with specific population groups (e.g., nutrient profile development and application), the identification of analyses to support the overarching question (e.g., food group protocols), and the addition of a systems modeling approach that provided the opportunity to evaluate intake variability and flexibility of the dietary pattern(s) (e.g., diet simulations process).

Nutrient Profile Development

Each food group and subgroup within the USDA Dietary Patterns has a defined nutrient profile that is the foundation of any FPM analysis. Prior FPM analyses used nutrient profiles that considered the proportions of foods and beverage types consumed in the total population. The Committee suggested that this methodology could potentially mask differences related to factors that are clearly associated with health equity and population characteristics such as food access, food preferences and choices, and cultural foodways. To alleviate this concern, the Committee identified an additional approach to developing a nutrient profile that considered both the proportional consumption of the total population and reflected dietary intakes of populations groups represented in WWEIA, NHANES. The Committee decided that this protocol would be implemented prior to any other FPM protocols so that its findings could inform subsequent analyses if differences were meaningful. The Committee evaluated these nutrient profiles and considered the representation and variations in dietary intake when evaluating how proposed dietary patterns meet nutritional goals for each age-sex group. The Committee prioritized this step as essential to promoting a dietary pattern(s) that strives to be flexible for all and can be implemented by population groups across the United States. As part of the final synthesis analyses, proposed patterns were examined against nutritional goals using the population-level nutrient profile and the individually calculated profiles for population groups classified by race and Hispanic origin and income. For more information on the results and outcome of this protocol, see **Part D. Chapter 9: Nutrient Profile Development**. The Committee also identified recommendations around this topic for consideration during future analyses (see **Part E. Chapter 2: Future Directions**).

Food Group Protocols

Additional protocols were developed based on Committee deliberations, feedback from federal agencies, and in response to public comments that focused on quantitative guidance around specific food groups and subgroups. These protocols focused on examining flexibilities to the dietary patterns with the goal of enhancing representation. For instance, part of the rationale for evaluating hypothetical reductions and/or modifications to the Dairy and Fortified Soy Alternatives food group was the prevalence of lactose malabsorption and of cow milk allergies in the U.S. population. For each of the food group protocols the Committee established, it sought to examine the potential flexibility for a recommendation(s) that more equitably represent the range of population group norms, preferences, and needs. The Committee also identified recommendations around these topics for consideration during future analyses (see **Part E. Chapter 2: Future Directions**).

Diet Simulations Process

The diet simulations protocol was developed to evaluate how well the quantitative dietary patterns recommended by the Committee achieved nutritional goals when considering variability in consumption. Employing a systems science approach, the overall goal of the diet simulations protocol was to construct at least 500 7-day diets for each age-sex group by randomly selecting different combinations of nutrient-dense foods and beverages in the amounts recommended for each age-sex group. The final analysis constructed 2,500 7-day diets for each age-sex group. The addition of this systems science approach allowed for examination and potential refinement of the proposed dietary pattern(s), which increased the Committee's confidence that the final pattern(s) recommended to the Departments were inclusive of a broader range of dietary intakes.

As the Committee worked on the diet simulations protocol, it learned of a newly implemented project within FNS and CNPP that was contracting with food and nutrition experts with lived experiences in cultural foodways to identify relevant foods in the FNDDS database for individual population groups. The Committee inquired about the potential use of these data to conduct additional population group-specific diet simulations. After discussion, the Committee prioritized pilot diet simulations using food composition data coded as relevant to 3 American Indian populations (Navajo Nation, Blackfeet, and Cherokee) and Alaska Native populations. The Committee also identified recommendations around this topic for consideration during future analyses in **Part E. Chapter 2: Future Directions**.

Committee Report Development and Structure

The Committee began work on its Scientific Report in 2023. Staff drafted a tentative outline, which was reviewed by the Committee Chair, Vice Chair, and all Subcommittee Chairs and then presented to the full Committee. The outline provided a useful framework and context for the Committee during its review of the science and as it began writing this report. The Committee began drafting portions of its report in early spring 2024 and continued through October 2024.

The Committee integrated evidence across data analysis, systematic reviews, and food pattern modeling as it developed this report. Because each Committee member served on 2 Subcommittees, and at least 1 member from each Subcommittee was part of the Health Equity Working Group, integration of evidence across Subcommittees was discussed during Subcommittee meetings and as chapters were drafted. Additionally, staff facilitated integration between data analysis and systematic reviews by providing relevant data as members began drafting chapters focused on its systematic reviews. Further, members involved in food pattern modeling were all also involved in systematic reviews and shared relevant insights as they prioritized and interpreted food pattern modeling analyses. Finally, prior to, during, and after Meeting 6, members held a series of integration discussions that included representation from across Subcommittees and Working Groups. These included discussions focused on integration across dietary patterns systematic reviews; integration across all systematic reviews on dietary patterns and specific foods and beverages; and integration across systematic reviews, food pattern modeling, and data analysis. Ultimately, the findings and advice in this Scientific Report reflect the entire body of evidence the Committee reviewed.

A general description of writing duties and review process for each report section is described below:

- **Part A. Executive Summary** was drafted by the Science Writer following her editorial review of each chapter.
- **Part B. Chapter 1: Introduction** was drafted by the Chair and Vice Chair with support from additional Committee members and federal staff.
- **Part C. Methodology** was drafted by federal staff with support from Committee members.
- **Part D. Evidence on Diet and Health** consists of 11 science-based chapters organized by topic and scientific approach that mirror the Subcommittee structure the Committee used to conduct its review of the science: Data Analysis, Dietary Patterns and Specific Dietary Components Across Life Stages, Dietary Practices and Behaviors in Birth through Childhood, Strategies for Individuals and Families Related to Diet Quality and Weight Management, and Food Pattern Modeling. Part D chapters, along with **Part B. Chapter 2: Health Equity and Nutrition**, were drafted by Committee members with support from federal staff. Meta-Analysis Working Group members contributed to drafting the chapters that included questions answered using systematic reviews with meta-analysis. Once developed, these chapters underwent editorial review and were shared for Committee review. To ensure a focused review of each

chapter, 2 Committee members, who were not involved in drafting the chapter, conducted a cross-review of each chapter.

- **Part E. Integrating the Evidence** consists of 2 chapters, Overarching Advice to the Departments and Future Directions. **Chapter 1: Overarching Advice to the Departments** contains the Committee's overarching advice for updating the next edition of the *Dietary Guidelines* based on a synthesis of key findings and themes from the Part D chapters and provides the recommended dietary pattern to be considered by the Departments when drafting the next edition of the *Dietary Guidelines.* The chapter was led by the Chair and Vice Chair and considered iterative input and feedback from members across the Committee's Subcommittees and Working Groups and findings from all 3 approaches to examine the evidence. **Chapter 2: Future Directions** was drafted by members from each Subcommittee and Working Group to highlight research recommendations that could advance knowledge in nutrition science and inform future federal food and nutrition guidance.

The Committee's seventh meeting focused on its Scientific Report and provided an overview of the Committee's scientific findings and advice to the Departments. Committee members reviewed the draft report before Meeting 7 and made decisions for finalizing the report based on Committee member review and discussion at the meeting. This report, submitted to the Secretaries of HHS and USDA, reflects the consensus of the full Committee.

References

1. Dietary Guidelines Advisory Committee. Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services. 2020;doi:https://doi.org/10.52570/DGAC2020
2. Community Preventive Services Task Force Findings. Nutrition https://www.thecommunityguide.org/topics/nutrition.html
3. Centers for Disease Control and Prevention. About Oral Health. https://www.cdc.gov/oral-health/about/
4. U.S. Department of Health & Human Services. People at Risk of Food Poisoning. https://www.foodsafety.gov/people-at-risk
5. U.S. Department of Agriculture, U.S. Department of Health and Human Services. Related Projects. https://www.dietaryguidelines.gov/related-projects#uswds-text-687
6. Agency for Healthcare Research and Quality. Breastfeeding and Health Outcomes for Infants and Children. https://effectivehealthcare.ahrq.gov/products/breastfeeding-health-outcomes/protocol
7. U.S. Food and Drug Administration. Advice about Eating Fish. https://www.fda.gov/food/consumers/advice-about-eating-fish
8. National Institute of Mental Health. Eating Disorders. https://www.nimh.nih.gov/health/topics/eating-disorders
9. U.S. Department of Health and Human Services. Physical Activity Guidelines for Americans, 2nd edition. https://odphp.health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf
10. The Interagency Coordinating Committee on the Prevention of Underage Drinking. ICCPUD Study on Alcohol Intake and Health. https://www.stopalcoholabuse.gov/research-resources/alcohol-intake-health.aspx
11. National Academies of Sciences, Engineering, and Medicine. Review of Evidence on Alcohol and Health. https://www.nationalacademies.org/our-work/review-of-evidence-on-alcohol-and-health

12. U.S. General Services Administration. Federal Management Regulation: Federal Advisory Committee Management (GSA-FMR-2022-0015) https://www.regulations.gov/document/GSA-FMR-2022-0015-0010
13. H.R.1608 - 101st Congress (1989-1990). National Nutrition Monitoring and Related Research Act of 1990 (Public Law 101-445). https://www.congress.gov/bill/101st-congress/house-bill/1608/text
14. Part 2635—Standards Of Ethical Conduct for Employees of the Executive Branch, (1992). https://www.ecfr.gov/current/title-5/part-2635
15. International Committee of Medical Journal Editors. Disclosure of Interest. https://www.icmje.org/disclosure-of-interest/
16. Cruz CM, DeSilva DM, Beckman K, et al. Dietary Intake Datasets in the United States from March 2020 to December 2022: An Evidence Scan. 2024;doi:https://doi.org/10.52570/DA.DGAC2025.ES
17. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. National Health and Nutrition Examination Survey. https://www.cdc.gov/nchs/nhanes/index.htm
18. U.S. Department of Agriculture, Agricultural Research Service. What We Eat in America. https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-surveys-research-group/docs/wweianhanes-overview/
19. U.S. Department of Agriculture, Agricultural Research Service. Food and Nutrient Database for Dietary Studies. https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-surveys-research-group/docs/fndds/
20. U.S. Department of Agriculture, Agricultural Research Service. Food Patterns Equivalents Database. https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-surveys-research-group/docs/fped-overview/
21. U.S. Department of Agriculture, Agricultural Research Service. Dietary Methods Research: WWEIA Food Categories. https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-surveys-research-group/docs/dmr-food-categories/
22. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. National Health Interview Survey. https://www.cdc.gov/nchs/nhis/index.htm
23. U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute. Surveillance, Epidemiology, and End Results Program. https://seer.cancer.gov/
24. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. National Vital Statistics System. https://www.cdc.gov/nchs/nvss/index.htm
25. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Immunization and Respiratory Diseases. National Immunization Surveys (NIS). https://www.cdc.gov/nis/about/
26. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Division of Reproductive Health. Pregnancy Risk Assessment Monitoring System. https://www.cdc.gov/prams/index.html
27. Cruz CM, DeSilva D, Beckman K, et al. *Federal Data Analysis Plan for the 2025 Dietary Guidelines Advisory Committee*. 2023. https://www.dietaryguidelines.gov/
28. Cruz CM, DeSilva D, Beckman K, et al. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Nutrients and Dietary Components. 2024; doi:https://doi.org/10.52570/DA.DGAC2025.DA03
29. Cruz CM, DeSilva D, Beckman K, et al. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Patterns of Food and Beverage Intake. 2024; doi:https://doi.org/10.52570/DA.DGAC2025.DA01
30. Cruz CM, DeSilva D, Beckman K, et al. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Food Groups. 2024; doi:https://doi.org/10.52570/DA.DGAC2025.DA02
31. Cruz CM, DeSilva D, Beckman K, et al. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Prevalence of Nutrition-Related Chronic Health Conditions. 2024; doi:https://doi.org/10.52570/DA.DGAC2025.DA04

32. Cruz CM, DeSilva D, Beckman K, et al. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Nutritional Biomarker Outcomes. 2024; doi:https://doi.org/10.52570/DA.DGAC2025.DA05
33. U.S. Department of Agriculture, U.S. Department of Health and Human Services. Data Analysis https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
34. Welch VA, Petkovic J, Jull J, et al. Equity and Specific Populations [last updated October 2019]. *In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors) Cochrane Handbook for Systematic Reviews of Interventions*. 2019;version 6.5 Cochrane,
35. Welch V, Petticrew M, Petkovic J, et al. Extending the PRISMA statement to equity-focused systematic reviews (PRISMA-E 2012): explanation and elaboration. *International Journal for Equity in Health*. 2015/10/08 2015;14(1):92. doi:https://doi.org/10.1186/s12939-015-0219-2
36. Welch V, Petticrew M, Tugwell P, et al. PRISMA-Equity 2012 extension: reporting guidelines for systematic reviews with a focus on health equity. *PLoS Med*. 2012;9(10):e1001333. doi:https://doi.org/10.1371/journal.pmed.1001333
37. Gutuskey L, Neenan, R., Hammond, R. A., & Wagner, H,. *Applicability of Systems Science Approaches to the Dietary Guidelines for Americans*. 2023. https://www.dietaryguidelines.gov/sites/default/files/2024-02/Systems%20Science%20DGA%20Report_Final_508-compliant_rev.pdf
38. U.S. Department of Agriculture, Agricultural Research Service, Laboratory ND. Methods and Application of Food Composition Laboratory: Beltsville, MD. http://www.ars.usda.gov/nutrientdata
39. U.S. Department of Agriculture, Agricultural Research Service. FoodData Central. https://fdc.nal.usda.gov/
40. Taylor CA, Eicher-Miller HA, Abrams SA, et al. *Should foods and beverages with lower nutrient density (i.e., those with added sugars, saturated fat, and sodium) contribute to item clusters, representative foods, and therefore the nutrient profiles for each food group and subgroup used in modeling the USDA Dietary Patterns? Food Pattern Modeling Report*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Guidance and Analysis Division. 2024; doi: https://doi.org/10.52570/DGAC2025.FPM01
41. National Academies of Sciences, Engineering, and Medicine. Dietary Reference Intakes for Energy. 2023; doi:https://doi.org/10.17226/26818

Part D. Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions

Introduction

Chronic health conditions for which poor nutrition is a risk factor are prevalent in the United States. Conditions such as overweight and obesity, type 2 diabetes, heart disease, metabolic syndrome, and certain cancers present major public health challenges, but have the potential to be prevented or improved with a healthy diet as outlined by the *Dietary Guidelines for Americans, 2020-2025 (Dietary Guidelines)*. Consumption of nutrient-dense foods and beverages is critical for meeting nutrient needs that are essential for health throughout the lifespan, from growth and development during pregnancy and childhood through healthy aging during adulthood. The typical U.S. dietary pattern, however, is not aligned with the *Dietary Guidelines*, and many food groups, nutrients, and dietary components are underconsumed or overconsumed across the total population and/or specific groups by age, sex, and sociodemographic factors.

Evaluation of dietary intake data is complex, but necessary to assess the state of current U.S. diets and inform the starting point for dietary improvements. Social determinants of health, which include economic, environmental, social, educational, and structural factors, play a role in dietary intakes because they impact the ability of individuals and population groups to access healthy foods and achieve nutrition recommendations.[1] Moreover, dietary behaviors and food choices are shaped not by a single social factor, but by the complex interplay of intersecting social identities and the related systems of oppression and discrimination. These intersecting influences collectively impact access to resources, opportunities, and information, ultimately affecting individuals' ability to adopt and maintain healthy dietary patterns. Although federal data sources describe dietary intakes and patterns of defined sociodemographic groups, they do not capture the intersectionality and multidimensionality of the individuals within those groups. Nor do the group-specific intakes and patterns suggest causality (e.g., race and/or ethnicity does not cause the intake of the nutrient or dietary component examined). Additionally, because data are cross-sectional and provide information on dietary intake only at a single point in time, trends in intake over time cannot be determined.[2] Despite the cross-sectional design and complexity and intersectionality of these data, they provide valuable insights in understanding the role of social drivers that impact healthy eating. The Committee recognizes the importance of understanding and acknowledging these complex factors in the development and implementation of the *Dietary Guidelines*.

This chapter presents evidence on current dietary intakes and the prevalence of nutrition-related chronic health conditions in the United States from cross-sectional, nationally representative federal data sources. It also identifies nutrients and dietary components of public health concern, based on a framework developed specifically for that purpose, and identifies nutrients that pose special challenges (which are defined differently than nutrients of public health concern, as this chapter will discuss). The chapter also discusses and synthesizes findings from the data analyses and provides the Committee’s advice to the

Departments, based on the integration of results from the data analyses along with the Committee's systematic reviews and food pattern modeling efforts, for developing the *Dietary Guidelines for Americans, 2025-2030.*

In summary, U.S. dietary intakes of many food groups, nutrients, and dietary components continue to fall short of recommendations. As a result, dietary patterns—among the population as a whole and by each sociodemographic group examined (**Box D.1.1**)—do not align with the *Dietary Guidelines.* This overarching finding and the conclusion statements supporting it are consistent with those of the 2020 Committee.

Box D.1.1: Representation in Data Analysis

This Committee's data analysis work expanded on the life stage approach used by the 2020 Dietary Guidelines Advisory Committee by applying a health equity lens to broaden representation of sociodemographic groups—as defined and captured by the data sources—in the evidence it considered. The Committee carried forward the same variables by which the 2020 Committee evaluated population dietary intakes—age/life stage, sex, race and/or ethnicity, and poverty to income ratio—and expanded that list of variables to analyze dietary and chronic health condition data by household food security category, current household participation in the Supplemental Nutrition Assistance Program (SNAP), and current child participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Additional sociodemographic variables were examined in select published analyses when available; these variables included detailed race and/or ethnicity, education, family income, birth in or outside of the United States, health insurance status, disability status, geographic/metropolitan location, body mass index (BMI) status, and diabetes status. Health equity considerations that were applied across the Committee's work, including for data analysis, are further described in **Part C. Methodology.**

List of Questions

1. What are the current patterns of food and beverage intake?
2. What are the current intakes of food groups, nutrients, and dietary components?
3. What is the current prevalence of nutrition-related chronic health conditions?
4. Which nutrients and/or dietary components present a substantial public health concern because of underconsumption or overconsumption?

To access the data analyses examined for these questions, visit: https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis.

Methodology

This section briefly highlights key details of the methodology for the data analyses presented in this chapter. An overview of the data analysis methodology is also provided in **Part C. Methodology**, and detailed methodologies for the 4 data analysis questions are available in the Federal Data Analysis Reports.[3-7]

Food and beverage patterns are broadly described using the Healthy Eating Index (HEI), which provides a score (up to 100) indicating dietary adherence with the overall diet quality recommendations outlined by the *Dietary Guidelines*. All analyses for HEI applied the Markov Chain Monte Carlo method to What We Eat in America (WWEIA), National Health and Nutrition Examination Survey (NHANES) 2011-2018 data, with the exception of the HEI scores for individuals who are pregnant or lactating which used the population ratio method with WWEIA, NHANES 2013-2018 data. Beverage patterns are further described based on intake data for the types, amounts, and frequency of specific beverages. Detailed food pattern information includes evidence of engaging in specific eating occasions (including snacking, late evening consumption, and breakfast); this information is found in **Part D. Chapter 6: Frequency of Meals and/or Snacking** and Data Analysis Supplements.[8-10]

Intakes of food groups (e.g., Vegetables) and subgroups (e.g., Beans, Peas, and Lentils), nutrients (including macronutrients, vitamins, and minerals), and dietary components (i.e., fiber, added sugars, saturated fat) contribute to overall food and beverage patterns. Thus, these intakes are examined on their own, in comparison to recommended amounts, and by the foods and beverages from which they are obtained (e.g., vegetables as a contributor to daily dietary fiber intakes). Recommended amounts are based on the *Dietary Guidelines* and National Academies of Sciences, Engineering, and Medicine's (NASEM) Dietary Reference Intakes (DRIs), which are a set of nutrient reference values that include Estimated Average Requirements (EAR), Adequate Intakes (AI), Chronic Disease Risk Reduction Intakes (CDRR), Tolerable Upper Intake Levels (UL), Acceptable Macronutrient Distribution Ranges (AMDR), and Estimated Energy Requirements (EER).[11-18] (Note: Recommended Dietary Allowances (RDAs) for nutritional adequacy in individuals were not used, as the data analysis approach examined population-level data.)

Nutrients and dietary components of public health concern were identified using a 3-pronged framework that was developed by the 2020 Committee and is described in other publications and in the Data Analysis Reports.[4,5,7,19] The framework considers evidence on dietary intake, biological and clinical indicators, and clinical health consequences measured through validated surrogate measures. Nutrients of public health concern are those that are underconsumed or overconsumed and, if available, have 1) supporting evidence that the inadequacy or excess is directly related to a specific health condition and 2) evidence of risk supported by biological or chemical indicator. Nutrients that pose special challenges are defined as those for which it was difficult to identify at-risk groups or for which dietary guidance to meet recommended intake levels was challenging to develop. Not all nutrients that are underconsumed or overconsumed compared to recommended amounts rise to the level of public health concern or special challenges according to the framework.

Review of the Science

Question 1. What are the current patterns of food and beverage intake?

Approach to Answering Question: Data Analysis

Conclusion Statements

Dietary Patterns

Among individuals ages 1 year and older, dietary intake patterns, as assessed by the Healthy Eating Index-2020 (HEI-2020) and HEI-Toddlers-2020, fail to align with the *Dietary Guidelines for Americans, 2020-2025* in the life stages or sociodemographic groups examined. The mean HEI-2020 score for the total population ages 2 years and older is 56 out of 100. The mean HEI-Toddlers-2020 score for young children ages 12 through 23 months is 63 out of 100.

Beverage Patterns

Among adults and older adults, beverages contribute to daily energy, nutrient, and dietary component intakes, with added sugars, vitamin C, vitamin D, calcium, and magnesium being the top 5 nutrients provided by the totality of daily beverage intake.

Among individuals ages 2 years and older, water is the most consumed beverage, both in mean volume (fluid ounces) and the percent reporting intake at least once in a day. Intakes of water based on 2017-2018 data are significantly higher compared to 2007-2008 data. Older children and adolescents (ages 6 through 11 years and ages 12 through 19 years, respectively) consume a significantly higher volume of water compared to younger children (ages 2 through 5 years), and older adults (ages 60 years and older) consume a significantly lower volume compared to younger adults (ages 20 through 39 years and ages 40 through 59 years).

Based on mean volume consumed, sugar-sweetened beverages, milk, and 100% juice are other top beverages for children and adolescents (ages 2 through 19 years). Alcoholic beverages, coffee and tea, and sugar-sweetened beverages are other top beverages for adults and older adults. Compared to 2007-2008 data, during 2017-2018 a significantly lower percentage of individuals ages 2 years and older consumed sugar-sweetened beverages, milk, and 100% juice in a day. Nonetheless, sugar-sweetened beverages are the top food category contributor to added sugars intake.

Summary of the Evidence

The body of evidence for these conclusion statements includes data on patterns of food and beverage intake from What We Eat in America (WWEIA), National Health and Nutrition Examination Survey (NHANES), National Immunization Survey-Child (NIS-Child), and National Vital Statistics System (NVSS). The evidence is summarized in the following paragraphs by life stage and sociodemographic group. Meaningful differences are described when there is a 5- to 6-point variation between total HEI scores, which constitutes a meaningful difference based on the effect size and standard deviation of the usual distribution.[20] Component scores are described as being close to the maximum score when they fall within

0.1 to 0.2 points of the maximum score, and standard errors are provided in the complete data tables. Full data analysis methods, summaries, and tables are available in the Federal Data Analysis Reports and Data Analysis Supplements.[3,5,21-23]

Dietary Patterns

Infants Birth through Age 11 Months

The Healthy People 2030 target for exclusive human milk feeding through age 6 months is 42 percent and at age 12 months is 54 percent. The prevalence of human milk feeding initiation during birth hospitalization is 84 percent, according to birth certificate estimates of planned feeding by families. Among birth parent racial and/or ethnic groups, initiation of human milk feeding ranges from 75 percent among those who are Black (single-race) to 90 percent among those who are Asian (single-race). However, the overall prevalence of exclusive human milk feeding through age 6 months is 25 percent. When examining data by birth parent age, infant race and/or ethnicity, poverty income ratio, and birth parent education, no sociodemographic groups meet the Healthy People goal through 6 months.

The prevalence of infants receiving any human milk at 12 months is 38 percent, which also falls short of the Healthy People 2030 goal. Among sociodemographic groups for birth parent age, race and/or ethnicity, educational attainment, family income, geographic location, and country of birth, the Healthy People 2030 goal through 12 months is met only by birth parents who are born outside of the United States (62 percent).

Young Children Ages 12 through 23 Months

Dietary intakes among young children ages 12 through 23 months fail to align with the *Dietary Guidelines*, with a mean total HEI-Toddlers-2020 score of 63 out of 100. Of all components, no scores are close to achieving maximum component scores. However, scores for total Fruits (4.6 out of 5) and whole fruits (4.7 out of 5) are approaching that threshold as they fall within 0.5 points of their maximum component scores. When examining total HEI-Toddlers-2020 scores by sex and race and/or ethnicity, meaningful differences in total mean scores are observed between non-Hispanic Asian males (total HEI score: 66) and females (total HEI score: 65) and males of other racial and/or ethnic groups (total HEI score: 60).

Children and Adolescents Ages 2 through 18 Years

Dietary intakes among children and adolescents ages 2 through 18 years fail to align with the *Dietary Guidelines*. The mean total and component HEI-2020 scores vary by age-sex group, with total HEI scores ranging from a low of 48 among males ages 14 through 18 years to a high of 59 among females ages 2 through 4 years. The total HEI score for males ages 2 through 4 years is 58. Among children ages 5 through 8 years, the total HEI-2020 scores are 53 for males and 54 for females. These scores are meaningfully lower than those for ages 2 through 4 years.

Of particular concern are children ages 9 through 13 years and adolescents ages 14 through 18 years. The total HEI-2020 score for ages 9 through 13 years is 50 among males and 52 among females. Among adolescents ages 14 through 18 years, the total HEI-2020 score is 48 for males and 51 for females.

Among children and adolescents ages 2 through 18 years, meaningful differences exist in total mean HEI-2020 scores by race and/or ethnicity. Total scores range from 50 among males of other race and/or ethnicity groups to 57 among males who are non-Hispanic Asian. Total scores range from 51 among females who are non-Hispanic Black to 57 among females who are non-Hispanic Asian. No meaningful differences are present among children by household food security status and poverty to income ratio (PIR).

No sociodemographic groups for children and adolescents meet or are close to meeting the maximum component scores for any HEI components.

Adults and Older Adults Ages 19 Years and Older

Dietary intakes among adults and older adults ages 19 years and older fail to align with the *Dietary Guidelines*. Meaningful differences exist in total HEI-2020 scores across groups for age, race and/or ethnicity, and (for females only) household food security status, and variation is also noted among groups by sex and PIR.

When considered across age-sex groups, total HEI-2020 scores for individuals ages 19 through 30 years are 52 for males and 56 for females. In contrast, the mean total HEI-2020 scores for older adults ages 60 years and older are meaningfully higher (total HEI score: 58 among males and 61 among females). All age groups are close to meeting the maximum component score for total Protein Foods, except for females ages 19 through 30 years.

When considered across racial and/or ethnic and sex groups for adults ages 19 years and older, the mean total HEI-2020 scores are meaningfully higher among non-Hispanic Asian males (total HEI score: 64) and females (total HEI score: 64) than all other groups examined (non-Hispanic White, non-Hispanic Black, Hispanic, other races and/or ethnicities). Non-Hispanic Asian females are 0.3 to 1.0 points away from the maximum scores for whole fruits, greens and beans, and total Vegetables. Several race and/or ethnicity and sex groups have seafood and plant proteins scores within 1.0 point of the maximum component score, including both males and females who are non-Hispanic Asian or Hispanic, and females who are non-Hispanic White, non-Hispanic Black, or other races and/or ethnicities. No racial and/or ethnic groups achieve close to the maximum score for any other component except for total Protein Foods, for which all racial and/or ethnic and sex groups except for non-Hispanic White females are within 0.1 to 0.2 points of the maximum component score.

Meaningful differences in mean total HEI-2020 scores also exist between adult females who are food secure compared to those who are food insecure. Total scores are 60 for females in food secure households and 54 for females in food insecure households.

When considered across PIR and sex groups, mean total HEI-2020 scores ranged from 53 among adult males with a PIR ≤1.85, to 60 among adult females with a PIR >1.85. Males with a PIR >1.85 meet the maximum component score for total Protein Foods, while all other PIR-sex groups are close to achieving the maximum component score. Seafood and plant proteins scores among males and females with PIR >1.85 are also within 1 point of the maximum component score.

Individuals Ages 20 through 44 Years who are Pregnant and Lactating

Dietary intakes for individuals ages 20 through 44 years who are pregnant or lactating fail to align with the *Dietary Guidelines*. The mean total HEI-2020 score is 63 among individuals who are pregnant and 62 among individuals who are lactating, which is meaningfully different than the mean total HEI-2020 score of 53 for females ages 20 through 44 years who are not pregnant, or lactating. Individuals who are pregnant and individuals who are lactating achieve the maximum component score for total Protein Foods, while only individuals who are pregnant achieve the maximum score for whole fruits. They also are within 0.2 to 0.6 points of the maximum scores for seafood and plant proteins and for greens and beans.

Beverage Patterns

Infants Ages 6 through 11 Months

For infants ages 6 through 11 months, mean daily energy intake from beverages is 504 kcal. Most daily energy intake from beverages is contributed by infant formula (375 kcal) and human milk (103 kcal). The contribution from beverages other than human milk or infant formula is small (25 kcal, or 8 percent of total daily energy), and top sources include whole milk, 100% juice, reduced-fat, low-fat, or non-fat milk, and/or sugar-sweetened beverages. Beverage intakes, mostly in the form of sugar-sweetened beverages, contribute 19 percent, or 0.2 teaspoons, of mean daily added sugars for this age group.

Young Children Ages 12 through 23 Months

Beverages contribute 30 percent of mean daily energy intake among young children ages 12 through 23 months, along with certain nutrients and dietary components. Sugar-sweetened beverages provide 3 percent of mean daily energy intake and 24 percent of mean added sugars intake, but do not contribute to nutrient intakes. Whole milk contributes largely to mean daily intakes of energy (17 percent), protein (22 percent), total fat (24 percent), vitamin D (55 percent), calcium (38 percent), and potassium (24 percent). Of all energy contributed from intakes of beverages other than human milk or infant formula, the top sources are whole milk; 100% juice; reduced-fat, low-fat, or non-fat milk; and sugar-sweetened beverages. The Committee notes that infant formula is designed to meet nutritional needs from birth through age 11 months and is not recommended for young children ages 12 through 23 months.[24]

Children and Adolescents Ages 2 through 19 Years

Among children and adolescents, water is the most consumed beverage, based on both the mean volume and the percent reporting consumption at least once in a day. Milk, sugar-sweetened beverages, and 100% juice are top beverage sources of energy intake and beverages contribute 14 percent of mean daily energy intake and 43 percent of mean daily added sugars intake.

The percent contribution from each beverage source shifts across age groups. Milk provides significantly different contributions to daily energy intake from beverages between ages 2 through 5 years (56 percent), ages 6 through 11 years (42 percent), and ages 12 through 19 years (25 percent). Sugar-sweetened beverages have significantly different contributions to daily energy intake from beverages between ages 2 through 5 years (18 percent), ages 6 through 11 years (37 percent), and ages 12 through 19 years (46 percent). Finally, 100% juice contributes 22 percent of energy intake from beverages among ages 2 through 5 years, 14 percent among ages 6 through 11 years, and 9 percent among ages 12 through 19 years.

Compared to 10 years ago (2017-2018 vs. 2007-2008), a significantly higher percentage consume water (84 percent vs. 74 percent), and a significantly lower percentage consume sweetened beverages (54 percent vs. 66 percent), milk (44 percent vs. 53 percent), and 100% fruit and vegetable juices (26 percent vs. 33 percent) in a day. Additionally, the contribution of beverage intakes to mean daily intakes is significantly lower (in 2017-2018 vs. 2007-2008) for energy (14 percent vs. 19 percent), carbohydrates (21 percent vs. 28 percent), added sugars (43 percent vs. 51 percent), vitamin C (43 percent vs 58 percent), vitamin D (40 percent vs. 53 percent), and calcium (31 percent vs. 37 percent).

Adults and Older Adults Ages 20 Years and Older

Among adults and older adults, water is the most consumed beverage based on both the mean volume and the percent reporting at least once in a day. The daily volume of water consumed is significantly different between ages 20 through 39 years (59 fluid ounces), ages 40 through 59 years (51 fluid ounces), and ages 60 years and older (42 fluid ounces). Beverages other than water contribute 17 percent of mean daily energy intake and 54 percent of mean daily added sugars intake. Sugar-sweetened beverages account for one-third of daily energy from beverages among both males and females. Among adults ages 19 years and older, sugar-sweetened beverages and coffee and tea are two of the top food category sources of added sugars in males (contributing 26.0 percent and 12.7 percent, respectively) and females (contributing 20.6 percent and 14.1 percent, respectively). Females (27 percent) consume a significantly higher amount of beverage energy from coffee and tea compared to males (18 percent). Males consume a significantly higher percent of beverage energy from alcoholic beverages (31 percent) compared to females (22 percent).

Among adults and older adults, compared to 10 years ago (2017-2018 vs. 2007-2008), a significantly higher percentage consume coffee and tea (72 percent vs. 66 percent), and a significantly lower percentage consume diet beverages (11 percent vs. 20 percent), sweetened beverages (42 percent vs. 48 percent), milk (16 percent vs. 23 percent), and 100% fruit and vegetable juices (13 percent vs. 21 percent) in a day. Additionally, the contribution of beverage intakes to mean daily intakes is significantly lower for vitamin C (34 percent vs 44 percent), vitamin D (28 percent vs. 35 percent), and calcium (28 percent vs. 31 percent). No significant difference exists during that time period in contributions to daily intake of added sugars.

Individuals Ages 20 through 44 Years who are Pregnant or Lactating

Shifts occur in the beverage types consumed in a day among individuals ages 20 through 44 years who are pregnant or lactating, compared to females of the same ages who are not pregnant or lactating. For example, during pregnancy, 56 percent consume sugar-sweetened beverages at least once per day, compared to 43 percent during lactation and 46 percent among females who are not pregnant or lactating. During pregnancy, 41 percent of individuals consume coffee or tea at least once per day, compared to 57 percent of individuals during lactation and 63 percent among females who are not pregnant or lactating. Beverages contribute 48 percent of mean daily added sugars intake during pregnancy and 44 percent of daily added sugars intake during lactation. Many estimates of other beverages consumed by individuals who are pregnant or lactating are less reliable than estimates for other life stages and are not reported here.

Question 2. What are the current intakes of food groups, nutrients, and dietary components?

Approach to Answering Question: Data Analysis

Conclusion Statements

Food Group and Subgroup Intakes

In general, food group and subgroup intakes for individuals ages 1 year and older do not align with *Dietary Guidelines for Americans, 2020-2025* recommendations.

For the majority of individuals ages 1 year and older, intakes of the following food groups and subgroups are generally below *Dietary Guidelines* recommendations (Healthy U.S.-Style Dietary Pattern): total Vegetables (including all subgroups, i.e., Dark-Green Vegetables; Red and Orange Vegetables; Beans, Peas, and Lentils; Starchy Vegetables; Other Vegetables); Fruits; Dairy and Fortified Soy Alternatives; Seafood; Nuts, Seeds, and Soy Products; and Whole Grains.

For the majority of individuals ages 1 year and older, intakes of the following food groups and subgroups are generally at or above *Dietary Guidelines* recommendations (Healthy U.S. Style Dietary Pattern): total Grains; Refined Grains; total Protein Foods; and (for ages 2 years and older) Meat, Poultry, and Eggs.

Many of the top sources of food groups are consumed in forms that are high in nutrients to limit: added sugars, saturated fat, and sodium.

Nutrient and Dietary Component Intakes

Nutrient intakes do not align with recommendations for nutrients and dietary components.

For individuals ages 1 year and older, many nutrients are underconsumed. Many individuals consume below the nutrient intake requirements for dietary protein, dietary fiber, calcium, potassium, magnesium, iron, zinc, copper, phosphorus, vitamin A, thiamin, vitamin B6, folate (dietary folate equivalent [DFE]), vitamin B12, vitamin C, vitamin D, vitamin E, and vitamin K.

Many individuals consume above the nutrient intake recommendations for added sugars, saturated fat, and sodium.

The proportion of individuals who meet or exceed nutrient intake recommendations varies within population groups by age, sex, race and/or ethnicity, and socioeconomic position.

Many of the top food sources of nutrients are consumed in forms with lower nutrient density.

Summary of the Evidence

The body of evidence for these conclusion statements includes data from WWEIA, NHANES. The evidence is summarized in the following paragraphs by life stage and sociodemographic group. Full data analysis methods, summaries, and tables are available in the Federal Data Analysis Reports and Data Analysis Supplements.[5,6,22,25-58]

Food Group and Subgroup Intakes

Vegetables

The Healthy U.S.-Style Dietary Pattern (HUSS) recommendations for total Vegetables intake (including Beans, Peas, and Lentils) are 1 to 4 cup equivalents (cup eq) per day for individuals ages 2 years and older, depending on energy intake level. Among all individuals ages 1 year and older, mean intake is 1.5 cup eq per day, with 22 percent at or above the recommendations. Most individuals also consume below the recommended amounts for the Vegetables Subgroups: 79 percent are below recommended intakes for Dark-Green Vegetables, 93 percent for Red and Orange Vegetables, 83 percent for Beans, Peas, and Lentils, 86 percent for Starchy Vegetables, and 65 percent for Other Vegetables.

Vegetables intake varies across age-sex and sociodemographic groups. For example, adolescents ages 14 through 18 years have low intake of Vegetables, with 1 to 2 percent at or above the recommendations. Across race and/or ethnicity, 21 percent of non-Hispanic Asian individuals are at or above recommendations for total Vegetables and Dark-Green Vegetables compared to 12 percent of the total population ages 1 year and older. Similarly, 45 percent of Hispanic and/or Latino individuals are at or above the recommendations for Beans, Peas, and Lentils, whereas 17 percent of the total population ages 1 year and older are at or above the recommendations.

Among individuals ages 2 years and older, the top 3 food sources of Vegetables are vegetables (including beans, peas and lentils, excluding starchy vegetables), starchy vegetables, and burgers and sandwiches (including tacos and burritos). Rice, pasta, and other grain-based mixed dishes, and meat, poultry, and seafood mixed dishes also contribute to Vegetable intakes for some groups.

The HUSS recommendations for Vegetables intake (including Beans, Peas, and Lentils) are ⅔ to 1 cup eq per day for young children ages 12 through 23 months. Mean intake is 0.6 cup eq per day, with 38 percent of males and females at or above the recommendations.

Quantitative recommendations for Vegetables do not exist among infants ages 6 through 11 months, and mean intake is 0.4 cup eq per day. Most infants (79 percent) consume Vegetables from complementary foods and beverages daily, including 65 percent consuming Red and Orange Vegetables daily, 41 percent consuming Starchy Vegetables, and 28 percent consuming Other Vegetables. The top food sources of Vegetables among infants are baby food, vegetables, and starchy vegetables.

Vegetable intake is significantly different for 1 age group since 2003-2004. Among adolescents ages 12 through 19 years, mean intake in 2017-2018 is significantly lower (1.0 cup eq per day) compared to 2003-2004 (1.3 cup eq per day).

Fruits

The HUSS recommendations for total Fruits intake are 1.0 to 2.5 cup equivalents (cup eq) per day for individuals ages 2 years and older, depending on energy intake level. Twenty percent of individuals ages 1 year and older are at or above the recommended daily Fruits intake, and the mean intake is 1.0 cup eq per day. Among individuals ages 2 years and older, approximately half of Fruits intake is from fruit not including 100% juices, followed by top contributions from 100% fruit juice and sugar-sweetened and diet beverages.

Fruits intake varies by age-sex groups, with 50 to 90 percent of individuals ages 1 through 8 years at or above recommendations, compared to 11 to 23 percent of individuals ages 9 years and older.

Fruit juice intake is significantly different in 2017-2018 compared to 2005-2006. Mean intake of 100% fruit juice is significantly lower among children (ages 6 through 11 years), adolescents, and adults compared to intake of fruit juice in 2005-2006.

The HUSS recommendations for Fruits intake are 0.5 to 1.0 cup eq per day for ages 12 through 23 months, and mean Fruits intake is 1.3 cup eq per day for both males and females, with approximately 90 percent at or above the recommendations.

Quantitative recommendations for daily Fruits intake do not exist for infants ages 6 through 11 months, and mean intake is 0.7 cup eq per day. Most infants (84 percent) consume Fruits from complementary foods and beverages daily, including 35 percent consuming 100% fruit juice daily.

Grains

The HUSS recommendations for total Grains intake are 3 to 10 ounce equivalents (oz eq) per day for individuals ages 2 years and older, depending on energy intake level. The mean intake is 6.6 oz eq per day among individuals ages 1 year and older, and 60 percent are at or above the recommendations.

However, the HUSS also recommends that at least 50 percent of Grains be consumed as Whole Grains, and 2 percent of individuals ages 1 year and older are at or above this recommendation. On average, Whole Grains contribute 0.9 oz eq per day to total Grain intake, while 5.7 oz eq of Grains per day are in the form of Refined Grains. Ninety-three percent of individuals ages 1 year and older are at or above the recommendations for Refined Grains.

Among individuals ages 2 years and older, burgers and sandwiches are the top food subcategory contributor of Refined Grains (26 percent for females, 30 percent for males) and the second top contributor of whole grains (21 percent for females and males). The top contributor of Whole Grains is breakfast cereals and bars (37 percent for females, 36 percent for males). Other top contributors of Refined Grains are rice, pasta, and other grain-based mixed dishes, and desserts and sweet snacks.

Among young children ages 12 through 23 months, the HUSS recommendations for total Grains intake are 3 to 4 oz eq per day. Most young children ages 12 through 23 months surpass the recommended intake of Refined Grains, with mean intakes of 2.9 oz eq per day for females and 3.3 oz eq per day for males.

Quantitative recommendations for Grains do not exist for infants ages 6 through 11 months, and mean intake is 0.3 oz eq per day. Most infants (79 percent) report consumption of Refined Grains and 60 percent report consumption of Whole Grains daily from complementary foods and beverages.

Whole Grains intake is significantly different for 2 age groups in 2017-2018 compared to 2003-2004. For adolescents ages 12 through 19 years, Whole Grain intake is significantly higher (0.8 oz eq per day) compared to 2003-2004 (0.4 oz eq per day). For adults ages 20 years and older, Whole Grain intake is also significantly higher (0.8 oz eq per day) compared to 2003-2004 (0.6 oz eq per day). Both age groups have significantly lower intakes of Refined Grains compared to 2003-2004.

Dairy and Fortified Soy Alternatives

The HUSS recommendations for Dairy and Fortified Soy Alternatives intake are 2 to 3 cup eq per day for individuals ages 2 years and older, depending on energy intake level. Among all individuals ages 1 year and older, mean intake of Dairy and Fortified Soy Alternatives is 1.7 cup eq per day, with 12 percent at or above the recommendations. Mean intake of milk is 0.8 cup eq per day, of cheese is 0.8 cup eq per day, and of yogurt is 0.1 cup eq per day.

Intake of Dairy and Fortified Soy Alternatives varies across age-sex and sociodemographic groups. For example, 6 percent of adolescent females ages 14 through 18 years have intakes at or above recommendations, while 24 percent of males ages 14 through 18 years are at or above recommendations. Data also show that at least 21 percent of individuals ages 1 through 13 years are at or above recommendations, and 15 percent or less of individuals ages 19 and older are at or above recommendations. Across race and/or ethnicity, 4 percent of non-Hispanic Black individuals and 6 percent of non-Hispanic Asian individuals are at or above the recommendations for Dairy and Fortified Soy Alternatives.

Among individuals ages 2 years and older the top food subcategories contributing to Dairy and Fortified Soy Alternatives include burgers and sandwiches (16 percent for females, 22 percent for males), higher-fat milk/yogurt (12 percent for females, 13 percent for males), and breakfast cereals and bars (12 percent for females, 11 percent for males). Cheese and lower-fat milk/yogurt each contribute to approximately 5 percent of Dairy and Fortified Soy Alternatives intake.

The HUSS recommendations for Dairy and Fortified Soy Alternatives intake for young children ages 12 through 23 months are ⅔ to 2 cup eq per day. The mean intake for young children is 2.2 cup eq per day for males and 2.0 cup eq per day for females, with 70 percent and 62 percent at or above recommendations, respectively. Nearly all young children ages 12 through 23 months (98 percent) consume Dairy and Fortified Soy Alternatives at least daily, with 96 percent consuming daily fluid milk and fortified soymilk, 68 percent consuming cheese, and 24 percent consuming yogurt.

Quantitative recommendations for Dairy and Fortified Soy Alternatives do not exist for infants ages 6 through 11 months and mean intake is 0.4 cup eq per day for males and 0.3 cup eq per day for females. About half (46 percent) of infants consume Dairy and Fortified Soy Alternatives daily from complementary foods and beverages.

Dairy and Fortified Soy Alternatives intake is significantly different for 2 age groups in 2017-2018 compared to 2003-2004. Mean intake in 2017-2018 is significantly lower compared to 2003-2004 among adolescents ages 12 through 19 years (1.7 cup eq per day vs. 2.2 cup eq per day) and adults ages 20 years and older (1.5 cup eq per day vs. 1.6 cup eq per day).

Protein Foods

The HUSS recommendations for Protein Foods intake are 2 to 7 oz eq per day for individuals ages 2 years and older, depending on energy intake level. Among all individuals ages 1 year and older, mean intake of Protein Foods is 5.7 oz eq per day, with 57 percent at or above the recommended level. Across age-sex groups, however, the proportion of individuals meeting recommended intakes varies. For example, 78 percent of females ages 14 through 18 years do not meet recommended daily protein intakes, while more than half of adult males consume at or above the recommended intakes.

Intake of Protein Foods varies by subgroups. For individuals ages 1 year and older, mean intake of Meat, Poultry and Eggs is 4.4 oz eq per day and 70 percent of individuals ages 2 years and older have intake at or above the weekly recommendations. Across all age groups starting at age 2 years, the percentage of females who have intakes of Meat, Poultry, and Eggs at or above the recommendations ranges from 46 percent to 77 percent, and for males, intakes range from 62 percent to 86 percent at or above the recommendations. Among non-Hispanic Asian individuals, 56 percent are at or above the recommendations for Meat, Poultry, and Eggs, while at least 68 percent of other race and/or ethnicity groups are at or above the recommendations.

Mean intake of Seafood is 0.5 oz eq per day for individuals ages 1 year and older and 89 percent have intakes below the weekly recommendations. Ten percent to 21 percent of adults ages 31 years and older have intakes at or above the recommendations while 10 percent or less of individuals ages 1 through 30 years have intakes at or above the recommendations. Additionally, 34 percent of non-Hispanic Asian individuals are at or above the recommendations for Seafood compared to 11 percent of the total population ages 1 year and older.

Mean intake of Nuts, Seeds, and Soy Products is 0.8 oz eq per day for individuals ages 1 year and older, and 60 percent have intakes below the weekly recommendations. Intake varies across sociodemographic groups. For example, 49 percent of individuals with a PIR >1.85 are at or above recommendations for Nuts, Seeds, and Soy Products compared to 28 percent of those with a PIR ≤1.85.

Among individuals ages 2 years and older, the top 3 food subcategory sources of Protein Foods for most sociodemographic groups are burgers and sandwiches (including tacos and burritos) (27 percent for females, 32 percent for males); meat, poultry, and seafood mixed dishes (15 percent for females, 13 percent for males); and poultry (not including deli and mixed dishes) (12 percent for females and males). Nuts, seeds, and soy contribute 4 to 5 percent of Protein Foods intakes, and deli/cured products contribute to approximately 4 percent.

The HUSS recommendations for Protein Foods are 2 oz eq per day for young children ages 12 through 23 months, and mean intake is 2.5 oz eq per day for males and 2.3 oz eq per day for females. Sixty-four percent of males and 53 percent of females are at or above the recommendations. Almost all young children in this age group consume Protein Foods daily.

Quantitative recommendations for Protein Foods do not exist for infants ages 6 through 11 months, and mean intakes are 0.6 oz eq per day for males and 0.5 oz eq per day for females. About half (48 percent) of infants consume Protein Foods daily.

Oils

The HUSS recommendations for Oils are 15 to 51 g per day of Oils for individuals ages 2 years and older, and mean intake is 26.5 g per day, with 54 percent of individuals at or above the recommendations.

Among ages 2 years and older, the top 3 food subcategory sources of Oils for most sociodemographic groups are burgers and sandwiches (including tacos and burritos); chips, crackers, and savory snacks; and vegetables (both starchy and non-starchy).

The HUSS recommendations for Oils are 9 to 13 g per day for young children ages 12 through 23 months, and mean intakes are 12.2 g per day for males and 11.7 g per day for females, with 71 percent and 67 percent at or above the recommendations, respectively.

Quantitative recommendations for Oils do not exist for infants ages 6 through 11 months, and mean intakes are 2.3 g per day for males and 2.2 g per day for females. About half of infants (56 percent) consume Oils from complementary foods and beverages daily.

Nutrient and Dietary Component Intakes

Based on dietary intake data, the following nutrients are *underconsumed* (5 percent or more below the EAR or 5 percent or less above the AI) by individuals ages 1 year and older and/or by some age-sex groups, but do not rise to the level of a nutrient of public health concern or special challenge:

- Dietary protein, vitamin A, thiamin (vitamin B1), riboflavin (vitamin B2),[a] niacin (vitamin B3),[b] vitamin B6, folate,[c] vitamin B12, vitamin C, vitamin E, copper, iron, magnesium, phosphorous, zinc, vitamin K, iodine

The following nutrients are *overconsumed* (i.e., intakes that exceed the UL) by some age-sex groups ages 1 year and older, but do not rise to the level of a nutrient of public health concern or special challenge:

- Children ages 1 through 3 years (compared to the UL): copper,[d] retinol, zinc, selenium
- Males ages 4 through 8 years (compared to the UL): zinc

Intakes of nutrients and dietary components from foods and beverages and comparisons to DRI recommendations are summarized in the following paragraphs.[11-13,15-18,59] Data on the designation of nutrients of public health concern are found with the evidence for Question 4 in this chapter.

For infants ages 6 through 11 months, most nutrients rely on an AI to determine adequacy, which is largely based on human milk composition. Due to the lack of current and accurate data on human milk volume and composition, this Committee assessed adequacy by comparing data on mean intakes from

---

[a]Riboflavin is underconsumed by males and females ages 14 through 30 years, males ages 51 years and older, and females ages 71 years and older.
[b]Niacin is underconsumed by females ages 14 through 18 years.
[c]Folate rises to the level of a nutrient of public health concern for individuals who are pregnant during the first trimester.
[d]Copper is overconsumed by males, according to available data. Estimates are unreliable for females.

complementary foods and beverages (CFB) (not intakes from milk) compared to the proportion of the AI contribution from CFB (not the total AI). In many cases, the value for the AI contribution from CFB is set by extrapolating up from the AI for infants ages 0 through 6 months, extrapolating down from adult requirements, or a combination of both. For example, mean intakes of calcium from CFB (234 mg per day) were compared to the proportion of the AI contribution from CFB (140 mg per day), which was calculated by using the estimated content of 0.6 L of human milk and adding the amount provided by solid foods. When nutrients have an EAR for infants, data on the percent consuming below the EAR are reported.

For individuals ages 1 year and older, nutrient intake is reported by comparing intakes to DRI recommendations. Data on top food subcategory sources of nutrient and dietary component intake across sociodemographic groups are also summarized. Some of the food category sources are not notable contributors to the nutrients themselves, but the preparation and/or production method of these foods allows them to be top contributors. Notably, baby food is the top contributor to all nutrients for infants ages 6 through 11 months and is not included in the top food category source data below.

Calcium

Dietary intakes of calcium are described in **Table D.1.1** for infants ages 6 through 11 months and **Table D.1.2** for individuals ages 1 year and older.

TABLE D.1.1
MEAN INTAKES OF CALCIUM FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Adequate Intake (AI)		Mean Intakes		
AI for Calcium, Ages 7-12 Months (mg/day)[a]	**AI Contribution from CFB, Ages 7-12 Months (mg/day)**	**All Infants (mg/day)**	**Infants Exclusively Human Milk-Fed (mg/day)**	**Infants Fed Any Volume of Formula (mg/day)**
260	140	234	152	254

[a]The AI for infants ages 0 through 6 months is 200 milligrams per day.

mg/day = milligrams per day

TABLE D.1.2
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER BELOW THE ESTIMATED AVERAGE REQUIREMENT (EAR) FOR CALCIUM BY AGE-SEX GROUP

	Percent Below the EAR	
Age (Years)	**All**	
1+	46	
	Males	**Females**
1-3	<3	*
4-8	22	37

	Percent Below the EAR	
Age (Years)	**Males**	**Females**
9-13	62	68
14-18	56	86
19-30	29	46
31-50	23	42
51-70	27	76
71+	58	82

*Estimate may be less reliable due to small sample size and/or large relative standard error.

Food Subcategory Sources of Calcium

Among infants ages 6 through 11 months of age, across the sociodemographic groups examined, top food subcategory contributors to daily calcium intake include higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); cheese; rice, pasta, and other grain-based mixed dishes; breakfast cereals and bars; and waters.

Among young children ages 12 through 23 months, across sociodemographic groups examined, top food subcategory contributors to daily calcium intake include higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); breakfast cereals and bars; lower-fat milk and yogurt (i.e., low-fat and fat-free); burgers and sandwiches (including tacos and burritos); rice, pasta, and other grain-based mixed dishes; and vegetables (including beans and peas, not starchy).

Among individuals ages 2 years and older, across the sociodemographic groups examined, the top food subcategory sources of calcium include burgers and sandwiches (including tacos and burritos); waters; higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); and breakfast cereals and bars.

Vitamin D

Dietary intakes of vitamin D are described in **Table D.1.3** for infants ages 6 through 11 months and **Table D.1.4** for individuals ages 1 year and older.

TABLE D.1.3
MEAN INTAKES OF VITAMIN D FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Adequate Intake (AI)		Mean Intakes		
AI for Vitamin D, Ages 0-12 Months (IU)	**AI Contribution from CFB, Ages 7-12 Months (IU)**	**All Infants (IU)**	**Infants Exclusively Human Milk-Fed (IU)**	**Infants Fed Any Volume of Formula (IU)**
400	400	46	24.4	51.2

IU = international units

TABLE D.1.4
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER BELOW THE ESTIMATED AVERAGE REQUIREMENT (EAR) FOR VITAMIN D BY AGE-SEX GROUP

	Percent Below the EAR	
Age (Years)	**All**	
1+	96	
	Males	**Females**
1-3	95	*
4-8	*	>97
9-13	92	95
14-18	95	>97
19-30	97	>97
31-50	95	>97
51-70	93	>97
71+	89	>97

*Estimate may be less reliable due to small sample size and/or large relative standard error.

Food Subcategory Sources of Vitamin D

Among infants ages 6 through 11 months, across the sociodemographic groups examined, the top food subcategory sources of vitamin D include higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); breakfast cereals and bars; and eggs.

Among young children ages 12 through 23 months, across sociodemographic groups examined, the top food subcategory sources of vitamin D include higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); breakfast cereals and bars; lower-fat milk and yogurt (i.e., fat-free and low-fat); and eggs.

Among individuals ages 2 years and older, across sociodemographic groups examined, the top food subcategory sources of vitamin D include burgers and sandwiches (including tacos and burritos); breakfast cereals and bars, higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); coffee and tea; and eggs.

Potassium

Dietary intakes of potassium are described in **Table D.1.5** for infants ages 6 through 11 months and **Table D.1.6** for individuals ages 1 year and older.

TABLE D.1.5
MEAN INTAKES OF POTASSIUM FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Adequate Intake (AI)		Mean Intakes		
AI for Potassium, Ages 7-12 Months (mg/day)[a]	AI Contribution from CFB, Ages 7-12 Months (mg/day)	All Infants (mg/day)	Infants Exclusively Human Milk-Fed (mg/day)	Infants Fed Any Volume of Formula (mg/day)
860	600	565	430	598

[a]The AI for infants ages 0 through 6 months is 400 milligrams per day.

mg/day = milligrams per day

TABLE D.1.6
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER ABOVE THE ADEQUATE INTAKE (AI) FOR POTASSIUM BY AGE-SEX GROUP

	Percent Above the AI	
Age (Years)	All	
1+	28	
	Males	Females
1-3	43	38
4-8	31	20
9-13	25	36
14-18	16	17
19-30	14	23
31-50	29	29
51-70	32	35
71+	31	31

Food Subcategory Sources of Potassium

Among infants ages 6 through 11 months, across sociodemographic groups examined, the top food subcategory sources of potassium include fruit (non-juice); vegetables (including beans and peas, not starchy); starchy vegetables; 100% fruit juice; soups; and higher-fat milk and yogurt (i.e., whole-fat and reduced-fat).

Among young children ages 12 through 23 months, across sociodemographic groups examined, the top food subcategory sources of potassium include higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); fruit (non-juice); 100% juice; breakfast cereals and bars; and baby food.

Among individuals ages 2 years and older, across sociodemographic groups examined, the top food subcategory sources of potassium include burgers and sandwiches; coffee and tea; vegetables (including beans and peas, not starchy); meat, poultry, and seafood mixed dishes; starchy vegetables; and rice, pasta, and other grain-based mixed dishes.

Dietary Fiber

Dietary intakes of dietary fiber are described in **Table D.1.7** for infants ages 6 through 11 months and **Table D.1.8** for individuals ages 1 year and older.

TABLE D.1.7
MEAN INTAKES OF DIETARY FIBER FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Mean Intake		
All Infants (mg/day)	**Infants Exclusively Human Milk-Fed (mg/day)**	**Infants Fed Any Volume of Formula (mg/day)**
4.6	4.0	4.7

mg/day = milligrams per day

TABLE D.1.8
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER ABOVE THE ADEQUATE INTAKE (AI) FOR DIETARY FIBER BY AGE-SEX GROUP

	Percent Above the AI	
Age (Years)	**All**	
1+	6	
	Males	**Females**
1-3	*	*
4-8	<3	<3
9-13	<3	*
14-18	<3	<3
19-30	<3	5
31-50	<3	6

	Percent Above the AI	
Age (Years)	**Males**	**Females**
51-70	7	17
71+	8	16

*Estimate may be less reliable due to small sample size and/or large relative standard error.

Food Subcategory Sources of Dietary Fiber

Among infants ages 6 through 11 months, across sociodemographic groups examined, top food subcategory contributors to daily dietary fiber intake include fruit (non-juice); vegetables (including beans and peas, not starchy); and rice, pasta, and other grain-based mixed dishes.

Among young children ages 12 through 23 months, across sociodemographic categories examined, top food subcategory contributors to daily dietary fiber intake include fruit (non-juice); breakfast cereals and bars; burgers and sandwiches (including tacos and burritos); rice, pasta, and other grain-based mixed dishes; and vegetables (including beans and peas, not starchy).

Among individuals ages 2 years and older, across all sociodemographic groups examined, top food subcategory sources of dietary fiber are burgers and sandwiches (including tacos and burritos); vegetables (including beans and peas, not starchy); fruit (non-juice); rice, pasta, and other grain-based mixed dishes; and breakfast cereals and bars.

Sodium

Dietary intakes of sodium are described in **Table D.1.9** for infants ages 6 through 11 months and **Table D.1.10** for individuals ages 1 year and older.

TABLE D.1.9
MEAN INTAKES OF SODIUM FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Adequate Intake (AI)		Mean Intakes		
AI for Sodium, Ages 7-12 Months (mg/day)[a]	**AI Contribution from CFB, Ages 7-12 Months (mg/day)**	**All Infants (mg/day)**	**Infants Exclusively Human Milk-Fed (mg/day)**	**Infants Fed Any Volume of Formula (mg/day)**
370	300	320	230	341

[a]The AI for infants ages 0 through 6 months is 110 milligrams per day.

mg/day = milligrams per day

TABLE D.1.10
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER ABOVE THE CHRONIC DISEASE RISK REDUCTION INTAKE (CDRR) FOR SODIUM BY AGE-SEX GROUP

	Percent Above the CDRR	
Age (Years)	**All**	
1+	89	
	Males	**Females**
1-3	*	92
4-8	>97	96
9-13	>97	*
14-18	*	72
19-30	>97	86
31-50	>97	81
51-70	97	77
71+	92	69

*Estimate may be less reliable due to small sample size and/or large relative standard error.

Food Subcategory Sources of Sodium

Among infants ages 6 through 11 months, across sociodemographic groups examined, top food subcategory contributors to daily sodium intake include vegetables (including beans and peas, not starchy); rice, pasta, and other grain-based mixed dishes; soups; starchy vegetables; chips, crackers, and savory snacks; and higher-fat milk/yogurt.

Among young children ages 12 through 23 months, across sociodemographic groups examined, top food subcategory sources of sodium include burgers and sandwiches (including tacos and burritos); rice, pasta, and other grain-based mixed dishes; higher-fat milk/yogurt; poultry (not including deli and mixed dishes); and chips, crackers, and savory snacks.

Among individuals ages 2 years and older, across sociodemographic groups examined, top food subcategory sources of sodium include burgers and sandwiches; rice, pasta, and other grain-based mixed dishes; and meat, poultry, and seafood mixed dishes.

Saturated Fat

Dietary intakes of saturated fat are described in **Table D.1.11** for infants ages 6 through 11 months and **Table D.1.12** for individuals ages 1 year and older.

TABLE D.1.11
MEAN INTAKES OF SATURATED FAT FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Mean Intake		
All Infants (g/day)	**Infants Exclusively Human Milk-Fed (g/day)**	**Infants Fed Any Volume of Formula (g/day)**
2.6	1.6	2.9

g/day = grams per day

TABLE D.1.12
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER EXCEEDING LIMITS FOR SATURATED FAT INTAKE BY AGE-SEX GROUP

	Percent Exceeding Limits[a]	
Age (Years)	**All**	
1+	82	
	Males	**Females**
1-3	87	87
4-8	88	84
9-13	89	91
14-18	90	88
19-30	73	83
31-50	77	81
51-70	76	85
71+	82	86

[a]Less than or equal to 10% of daily energy intake, as recommended in the *Dietary Guidelines for Americans, 2020-2025.*

Food Subcategory Sources of Saturated Fat

No data on food category sources of saturated fat for infants ages 6 through 11 months or young children ages 12 through 23 months were available to the Committee.

Among individuals ages 2 years and older, across the sociodemographic groups examined, the top food subcategory sources of saturated fat include burgers and sandwiches; desserts and sweet snacks; rice, pasta, and other grain-based mixed dishes; and meat, poultry, and seafood mixed dishes.

Added Sugars

Dietary intakes of added sugars are described in **Table D.1.13** for infants ages 6 through 11 months and **Table D.1.14** for individuals ages 1 year and older.

TABLE D.1.13
MEAN INTAKES OF ADDED SUGARS FROM COMPLEMENTARY FOODS AND BEVERAGES AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Mean Intakes		
All Infants (tsp eq/day)	**Infants Exclusively Human Milk-Fed (tsp eq/day)**	**Infants Fed Any Volume of Formula (tsp eq/day)**
1.0	0.8	1.0

tsp eq/day = teaspoon equivalents per day

TABLE D.1.14
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER EXCEEDING LIMITS FOR ADDED SUGARS INTAKE BY AGE-SEX GROUP

	Percent Exceeding Limits[a]	
Age (Years)	**All**	
2+	66	
	Males	**Females**
2-4	66	62
5-8	85	81
9-13	82	82
14-18	74	77
19-30	64	66
31-50	63	66
51-59	60	62
60+	57	58
71+	57	59

[a]Less than or equal to 10% of daily energy intake, as recommended in the *Dietary Guidelines for Americans, 2020-2025.*

Food Subcategory Sources of Added Sugars

Among infants ages 6 through 11 months, across sociodemographic groups examined, top food subcategory sources of added sugars are baby food; desserts and sweet snacks; breakfast cereals and bars; and sugar-sweetened and diet beverages.

Among young children ages 12 through 23 months, across sociodemographic groups examined, top food subcategory sources of added sugars are desserts and sweet snacks; breakfast cereals and bars; sugar-sweetened and diet beverages; and higher-fat milk/yogurt.

Among individuals ages 1 year and older, across sociodemographic groups examined, top food subcategory sources of added sugars are sugar-sweetened and diet beverages; desserts and sweet snacks; and coffee and tea.

Folate (as Dietary Folate Equivalents [DFE])

Dietary intakes of folate as DFE are described in **Table D.1.15** for infants ages 6 through 11 months and **Table D.1.16** for individuals ages 1 year and older.

TABLE D.1.15
MEAN INTAKES OF FOLATE AS DIETARY FOLATE EQUIVALENTS (DFE) FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Adequate Intake (AI)		Mean Intakes		
AI for Folate as DFE, Ages 7-12 Months (µg/day)[a]	AI Contribution from CFB, Ages 7-12 Months (µg/day)	All Infants (µg/day)	Infants Exclusively Human Milk-Fed (µg/day)	Infants Fed Any Volume of Formula (µg/day)
80	29	90	66	96

[a]The AI for infants ages 0 through 6 months is 65 micrograms per day.

µg/day = micrograms per day

TABLE D.1.16
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER BELOW THE ESTIMATED AVERAGE REQUIREMENT (EAR) FOR FOLATE AS DIETARY FOLATE EQUIVALENTS (DFE) BY AGE-SEX GROUP

	Percent Below the EAR	
Age (Years)	All	
1+	16	
	Males	Females
1-3	<3	<3
4-8	<3	<3

	Percent Below the EAR	
Age (Years)	**Males**	**Females**
9-13	*	5
14-18	11	34
19-30	8	23
31-50	9	24
51-70	9	31
71+	13	29

*Estimate may be less reliable due to small sample size and/or large relative standard error.

Food Subcategory Sources of Folate (DFE)

No data on food category sources of folate (as DFE) for infants ages 6 through 11 months or young children ages 12 through 23 months were available to the Committee.

Among individuals ages 2 years and older, across sociodemographic groups examined, top food subcategory sources of folate (as DFE) are burgers and sandwiches (including tacos and burritos); breakfast cereals and bars; and rice, pasta, and other grain-based mixed dishes.

Iron

Dietary intakes of iron are described in **Table D.1.17** for infants ages 6 through 11 months and **Table D.1.18** for individuals ages 1 year and older.

TABLE D.1.17
PERCENT BELOW THE ESTIMATED AVERAGE REQUIREMENT (EAR) FOR IRON AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Percent Below the EAR		
All Infants	**Infants Exclusively Human Milk-Fed**	**Infants Fed Any Volume of Formula**
20	74	7

TABLE D.1.18
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER BELOW THE ESTIMATED AVERAGE REQUIREMENT (EAR) FOR IRON BY AGE-SEX GROUP

	Percent Below the EAR	
Age (Years)	**All**	
1+	6	
	Males	**Females**
1-3	<3	<3
4-8	<3	<3
9-13	<3	<3
14-18	4	23
19-30	<3	22
31-50	<3	20
51-70	<3	<3
71+	<3	<3

Food Subcategory Sources of Iron

Among infants ages 6 through 11 months, across sociodemographic groups examined, top food subcategory contributors to daily iron intake include breakfast cereals and bars; vegetables (including beans and peas, not starchy); desserts and sweet snacks; soups; meat, poultry, and seafood mixed dishes; rice, pasta, and other grain-based mixed dishes; and fruit (non-juice).

Among young children ages 12 through 23 months, across sociodemographic groups examined, top food subcategory contributors to daily iron intake include breakfast cereals and bars; burgers and sandwiches (including tacos and burritos); chips, crackers, and other savory snacks; baby food; and rice, pasta, and other grain-based mixed dishes.

No data on food category sources of iron for individuals ages 1 year and older were available to the Committee.

Energy

Dietary intakes of energy are described in **Table D.1.19** for infants ages 6 through 11 months.

TABLE D.1.19
MEAN INTAKES OF ENERGY FROM COMPLEMENTARY FOODS AND BEVERAGES AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Mean Intakes		
All Infants (kcal/day)	**Infants Exclusively Human Milk-Fed (kcal/day)**	**Infants Fed Any Volume of Formula (kcal/day)**
317	223	340

kcal/day = kilocalories per day

Food Subcategory Sources of Energy

No data on food category sources of energy for infants ages 6 through 11 months or young children ages 12 through 23 months were available to the Committee.

Data for individuals ages 2 years and older show the top food subcategory contributors to daily energy intake across sociodemographic groups (including race and/or ethnicity, family income as a percent of the poverty level, and household food security) as burgers and sandwiches (including tacos and burritos); desserts and sweet snacks; rice, pasta, and other grain-based mixed dishes; and meat, poultry, and seafood mixed dishes.

Dietary Protein

Dietary intakes of dietary protein are described in **Table D.1.20** for infants ages 6 through 11 months and **Table D.1.21** for individuals ages 1 year and older.

TABLE D.1.20
PERCENT BELOW THE ESTIMATED AVERAGE REQUIREMENT (EAR) FOR DIETARY PROTEIN AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Percent Below the EAR		
Infants Fed Exclusively Human Milk	**Infants Exclusively Human Milk-Fed**	**Infants Fed Any Volume of Formula**
7	22	3

TABLE D.1.21
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER BELOW THE ESTIMATED AVERAGE REQUIREMENT (EAR) FOR DIETARY PROTEIN BY AGE-SEX GROUP

	Percent Below the EAR
Age (Years)	**All**
1+	7

	Percent Below the EAR	
Age (Years)	**Males**	**Females**
1-3	<3	<3
4-8	<3	<3
9-13	<3	<3
14-18	8	23
19-30	4	7
31-50	4	9
51-70	5	8
71+	9	14

Food Subcategory Sources of Dietary Protein

Among infants ages 6 through 11 months, across sociodemographic groups examined, top food subcategory contributors to daily dietary protein intake include higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); rice, pasta, and other grain-based mixed dishes; vegetables (including beans and peas, not starchy); and poultry (not including deli and mixed dishes).

Among young children ages 12 through 23 months, across sociodemographic groups examined, top food subcategory contributors to daily dietary protein intake include higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); burgers and sandwiches (including tacos and burritos); poultry (not including deli and mixed dishes); rice, pasta, and other grain-based mixed dishes; eggs; and meat, poultry, and seafood mixed dishes.

Among individuals ages 1 year and older, the top three food subcategory sources of dietary protein are burgers and sandwiches (including tacos and burritos); meat, poultry, and seafood mixed dishes; and rice, pasta, and other grain-based mixed dishes.

Vitamin B12

Dietary intakes of vitamin B12 are described in **Table D.1.22** for infants ages 6 through 11 months and **Table D.1.23** for individuals ages 1 year and older.

TABLE D.1.22
MEAN INTAKES OF VITAMIN B12 FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Adequate Intake (AI)		Mean Intakes		
AI for Vitamin B12, Ages 7-12 Months (µg/day)[a]	**AI Contribution from CFB, Ages 7-12 Months (µg/day)**	**All Infants (µg/day)**	**Infants Exclusively Human Milk-Fed (µg/day)**	**Infants Fed Any Volume of Formula (µg/day)**
0.5	0.25	0.76	0.48	0.83

[a]The AI for infants ages 0 through 6 months is 0.4 micrograms per day (µg/day).

µg/day = micrograms per day

TABLE D.1.23
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER BELOW THE ESTIMATED AVERAGE REQUIREMENT (EAR) FOR VITAMIN B12 BY AGE-SEX GROUP

	Percent Below the EAR	
Age (Years)	**All**	
1+	7	
	Males	**Females**
1-3	<3	<3
4-8	<3	<3
9-13	<3	<3
14-18	<3	20
19-30	6	10
31-50	3	11
51-70	6	11
71+	7	10

Food Subcategory Sources of Vitamin B12

No data on food category sources of vitamin B12 for infants ages 6 through 11 months or 12 through 23 months were available to the Committee.

Among individuals ages 2 years and older, across the sociodemographic groups examined, the top food subcategory sources of vitamin B12 are burgers and sandwiches (including tacos and burritos);

breakfast cereals and bars; meat, poultry, and seafood mixed dishes; and higher-fat milk and yogurt (i.e., whole-fat and reduced-fat).

Vitamin E

Dietary intakes of vitamin E are described in **Table D.1.24** for infants ages 6 through 11 months and **Table D.1.25** for individuals ages 1 year and older.

TABLE D.1.24
MEAN INTAKES OF VITAMIN E FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Adequate Intake (AI)		Mean Intakes		
AI for Vitamin E, Ages 7-12 Months (mg/day)[a]	**AI Contribution from CFB, Ages 7-12 Months (mg/day)**	**All Infants (mg/day)**	**Infants Exclusively Human Milk-Fed (mg/day)**	**Infants Fed Any Volume of Formula (mg/day)**
5	2.06	2.08	1.66	2.18

[a]The AI for infants ages 0 through 6 months is 4 milligrams per day.

mg/day = milligrams per day

TABLE D.1.25
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER BELOW THE ESTIMATED AVERAGE REQUIREMENT (EAR) FOR VITAMIN E BY AGE-SEX GROUP

	Percent Below the EAR	
Age (Years)	**All**	
1+	74	
	Males	**Females**
1-3	41	45
4-8	33	51
9-13	61	60
14-18	83	94
19-30	79	84
31-50	67	84
51-70	68	86
71+	72	87

Food Subcategory Sources of Vitamin E

The primary components of many of the top food subcategories described here are not notable contributors of vitamin E alone, but rather their preparation with oils makes them a carrier of vitamin E. Among infants ages 6 through 11 months, across sociodemographic groups examined, top food subcategory contributors to daily vitamin E intake include fruit (non-juice); vegetables (including beans and peas, not starchy); starchy vegetables; soups; rice, pasta, and other grain-based dishes; and chips, crackers, and savory snacks.

Among young children ages 12 through 23 months, across sociodemographic groups examined, top food subcategory contributors to daily vitamin E intake include burgers and sandwiches (including tacos and burritos); rice, pasta, and other grain-based dishes; chips, crackers, and savory snacks; baby food; poultry (not including deli and mixed dishes); eggs; and higher-fat milk and yogurt (i.e., whole-fat and reduced-fat).

Across sociodemographic groups examined, the top food subcategory source of vitamin E is burgers and sandwiches. The second and third food subcategory sources that contribute to vitamin E intake vary across socioeconomic groups, but include some combination of chips, crackers, and savory snacks; vegetables (including beans and peas, not starchy), rice, pasta, and other grain-based mixed dishes; or meat, poultry, and seafood mixed dishes. Among ages 1 year and older, 74 percent have vitamin E intakes below the EAR.

Choline

Dietary intakes of choline are described in **Table D.1.26** for infants ages 6 through 11 months and **Table D.1.27** for individuals ages 1 year and older.

TABLE D.1.26
MEAN INTAKES OF CHOLINE FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Adequate Intake (AI)		Mean Intakes		
AI for Choline, Ages 7-12 Months (mg/day)[a]	AI Contribution from CFB, Ages 7-12 Months (mg/day)	All Infants (mg/day)	Infants Exclusively Human Milk-Fed (mg/day)	Infants Fed Any Volume of Formula (mg/day)
150	54	47	36	50

[a]The AI for infants ages 0 through 6 months is 125 milligrams per day.

mg/day = milligrams per day

TABLE D.1.27
PERCENT OF THE POPULATION AGES 1 YEAR AND OLDER ABOVE THE ADEQUATE INTAKE (AI) FOR CHOLINE BY AGE-SEX GROUP

	Percent Above the AI	
Age (Years)	**All**	
1+	12	
	Males	**Females**
1-3	59	52
4-8	40	30
9-13	8	7
14-18	<3	<3
19-30	8	6
31-50	12	7
51-70	13	8
71+	10	6

Food Subcategory Sources of Choline

Among infants ages 6 through 11 months, across sociodemographic groups examined, top food subcategory sources of choline include vegetables (including beans and peas, not starchy); eggs; rice, pasta, and other grain-based mixed dishes; starchy vegetables; soups; higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); and fruit (non-juice).

Among young children ages 12 through 23 months, across the sociodemographic groups examined, the top food subcategory sources of choline include higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); eggs; burgers and sandwiches (including tacos and burritos); poultry (not including deli and mixed dishes); rice, pasta, and other grain-based mixed dishes; meat, poultry, and seafood mixed dishes; and lower-fat milk and yogurt (i.e., non-fat and low-fat).

No data on food category sources of choline for individuals ages 1 year and older were available to the Committee.

Zinc

Dietary intakes of zinc are described in **Table D.1.28** for infants ages 6 through 11 months.

TABLE D.1.28
PERCENT BELOW THE ESTIMATED AVERAGE REQUIREMENT (EAR) FOR ZINC AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Percent Below the EAR		
All Infants	**Infants Exclusively Human Milk-Fed**	**Infants Fed Any Volume of Formula**
10	47	<3

Food Subcategory Sources of Zinc

Among infants ages 6 through 11 months, across sociodemographic groups examined, top food subcategory sources of zinc include breakfast cereals and bars; higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); rice, pasta, and grain-based mixed dishes; fruit (non-juice); soups; meat, poultry, and seafood mixed dishes; and eggs.

Young children ages 12 through 23 months consume an average of 6.8 mg of zinc from infant milk, foods, and beverages. Across the sociodemographic groups examined, the top food subcategory sources of zinc include breakfast cereals and bars; burgers and sandwiches (including tacos and burritos); higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); rice, pasta, and other grain-based mixed dishes; and breakfast cereals and bars.

Total Fat

Dietary intakes of total fat are described in **Table D.1.29** for infants ages 6 through 11 months.

TABLE D.1.29
MEAN INTAKES OF TOTAL FAT FROM COMPLEMENTARY FOODS AND BEVERAGES (CFB) AMONG INFANTS AGES 6 THROUGH 11 MONTHS BY INFANT MILK REPORTING STATUS

Adequate Intake (AI)		Mean Intake		
AI for Total Fat, Ages 7-12 Months (g/day)[a]	**AI Contribution from CFB, Ages 7-12 Months (g/day)**	**All Infants (g/day)**	**Infants Exclusively Human Milk-Fed (g/day)**	**Infants Fed Any Volume of Formula (g/day)**
30	5.7	7.9	5.6	8.5

[a]The AI for infants ages 0 through 6 months is 31 grams per day.

g/day = grams per day

Food Subcategory Sources of Total Fat

Among infants ages 6 through 11 months, across sociodemographic groups examined, top food subcategory sources of total fat include vegetables (including beans and peas, not starchy); higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); starchy vegetables; poultry (not including deli and mixed dishes); soups; eggs; meat, poultry, and seafood mixed dishes; rice, pasta, and other mixed dishes; chips, crackers, and savory snacks; and desserts and sweet snacks.

Among young children ages 12 through 23 months, across the sociodemographic groups examined, the top food subcategory sources of total fat include higher-fat milk and yogurt (i.e., whole-fat and reduced-fat); burgers and sandwiches (including tacos and burritos); chips, crackers, and savory snacks; poultry (not including deli and mixed dishes); rice, pasta, and other grain-based mixed dishes; and desserts and sweet snacks.

Question 3. What is the current prevalence of nutrition-related chronic health conditions?

Approach to Answering Question: Data Analysis

Conclusion Statement(s)

The widespread prevalence of nutrition-related chronic health conditions continues to be a major public health issue in the United States. The high prevalence of risk factors among adolescents, such as the 38 percent of individuals ages 12 through 19 years with prediabetes, is particularly concerning as it may contribute to an increased risk of developing chronic diseases later in life. Chronic disease rates are especially high among adults and older adults.

Variation in prevalence, incidence, and mortality rates indicate health disparities for some chronic health conditions, such as higher prevalence of obesity and diabetes among individuals of lower socioeconomic position.

Some chronic health conditions—including obesity, diabetes, and (for females only) osteoporosis—have become more prevalent compared to 10 to 20 years ago.

Summary of the Evidence

The body of evidence for these conclusion statements includes data from NHANES, NHIS, SEER, and NVSS. The evidence is summarized in the following paragraphs by life stage and sociodemographic group. Full data analysis methods, summaries, and tables are available in the Federal Data Analysis Reports and Data Analysis Supplements.[4,60]

Growth, Size, Body Composition, Overweight and Obesity

Infants

Low Birthweight

Prevalence of low birthweight among infants born in the United States is 9 percent and varies by birth parent age and race and/or ethnicity. When prevalence is examined by birth parent race and/or ethnicity, it ranges from 7 percent among those who are non-Hispanic White to 15 percent among those who are non-Hispanic Black. By birth parent age, prevalence of low birthweight ranges from 8 percent among those ages 30 through 34 years to 14 percent among those younger than age 15 years.

Individuals Ages 2 Years and Older

Weight status for children and adolescents ages 2 through 19 years and for adults and older adults ages 20 years and older is classified using the BMI measure.

Underweight

The prevalence of underweight is low among children and adolescents ages 2 through 19 years (4 percent) and adults and older adults ages 20 years and older (2 percent).

Overweight

The prevalence of overweight among children and adolescents ages 2 through 19 years is 17 percent. Among adults and older adults ages 20 years and older, the prevalence of overweight is high at 32 percent.

Children and Adolescents Ages 2 through 19 Years

Obesity

The prevalence of obesity among children and adolescents ages 2 through 19 years is 19 percent, and the prevalence of severe obesity is 6 percent. For comparison, during 2009-2010, the prevalence of obesity in this age group was 17 percent, and the prevalence of severe obesity was 6 percent.

Significant differences in the prevalence of obesity (including severe obesity) are observed across sociodemographic groups, such that:

- Prevalence of obesity is significantly lower among non-Hispanic Asian children and adolescents (9 percent) compared to all other racial and/or ethnic groups examined. Prevalence is also lower in non-Hispanic White children and adolescents (17 percent) than among those who are non-Hispanic Black (25 percent) and Hispanic and/or Latino (26 percent).
- Prevalence of obesity is significantly higher in children and adolescents ages 12 through 19 years (22 percent) and ages 6 through 11 years (21 percent) compared to children ages 2 through 5 years (13 percent).
- Among children ages 6 through 11 years, prevalence of obesity is significantly higher in males (23 percent) than females (19 percent).
- Prevalence of obesity by family income as a percent of the federal poverty level is significantly lower among children and adolescents ages 2 through 19 years with family income >350 percent of the federal poverty level (12 percent) compared to those with family income ≤130 percent of the federal poverty level (26 percent).

Although statistical testing is not available, prevalence of obesity by household food security category also varies, ranging from 16 percent among children from households with full food security to 27 percent among children from households with very low food security.

Adults and Older Adults Ages 20 Years and Older

Prevalence of obesity and severe obesity among adults and older adults ages 20 years and older are 41 percent and 9 percent, respectively. Across sociodemographic groups examined, significant differences are present in prevalence of obesity among this age group, such that:

- Compared to other racial and/or ethnic groups, prevalence of obesity is significantly lower in non-Hispanic Asian adults (16 percent) and significantly higher in non-Hispanic Black adults (50 percent).
- Prevalence of obesity is significantly higher among adults and older adults ages 20 years and older with family income of 130 to 350 percent of the federal poverty level (47 percent) than among those with family income >350 percent of the federal poverty level (39 percent).
- Prevalence of obesity is significantly lower among adults and older adults ages 20 years and older with a college degree or above (34 percent) than among those with less than a high school diploma (40 percent) and those with a high school diploma or some college (46 percent).

Variation also exists in prevalence of obesity across household food security categories. Among adults and older adults ages 20 years and older with full household food security, prevalence of obesity is 39 percent. Among adults with marginal, low, and very low household food security, prevalence of obesity (including severe obesity) ranges from 46 to 47 percent.

Cardiovascular Health

Children and Adolescents Ages 8 through 19 Years

Cholesterol

The total prevalence of high low-density lipoprotein (LDL) cholesterol among children and adolescents ages 12 through 19 years is 5 percent. Prevalence is 11 percent among children and adolescents in households with very low food security and 3 percent among those in households with full food security.

Prevalence of low high-density lipoprotein (HDL) cholesterol among children and adolescents ages 12 through 19 years is 14 percent. By sex, prevalence is 19 percent among males and 9 percent among females. By race and/or ethnicity, prevalence is 16 percent for non-Hispanic White children, 15 percent for Hispanic and/or Latino children, 10 percent for non-Hispanic Asian children, and 7 percent for non-Hispanic Black children.

Hypertension

Prevalence of hypertension among children and adolescents ages 8 through 17 years is 5.1 percent.

Adults and Older Adults Ages 18 Years and Older

Cholesterol and Triglycerides

The total prevalence of high LDL cholesterol among adults and older adults ages 20 years and older is 59 percent, with variation by age. Among females, prevalence ranges from 47 percent among individuals ages 20 through 39 years to 72 percent among individuals ages 40 through 59 years. Among males, prevalence ranges from 55 percent among individuals ages 20 through 39 years to 73 percent among individuals ages 40 through 59 years.

Prevalence of high LDL cholesterol also varies by race and/or ethnicity. Among males, prevalence by race and/or ethnicity ranges from 57 percent among non-Hispanic White males to 63 percent among Hispanic and/or Latino males. Among females, prevalence by race and/or ethnicity ranges from 50 percent among non-Hispanic Black females to 62 percent among Hispanic and/or Latino females.

The total age-adjusted prevalence of low HDL cholesterol among adults and older adults ages 20 and older is 16 percent, which is significantly lower compared to 2007-2008 (22 percent). Age-adjusted prevalence is significantly higher among males (27 percent) compared to females (8 percent) and ranges from 12 percent among non-Hispanic Black adults to 22 percent among Hispanic and/or Latino adults. Prevalence of low HDL cholesterol also varies by household food security, ranging from 15 percent among adults in households with full food security to 25 percent among adults in households with very low food security.

The total prevalence of high triglycerides among adults and older adults ages 20 years and older is 21 percent. Prevalence by household food security category ranges from 19 percent among adults in households with full food security to 27 percent among adults in households with low food security.

Hypertension

The total prevalence of hypertension among adults and older adults ages 18 years and older is 48 percent. Differences in age-adjusted prevalence exist by age, race and/or ethnicity, education, and family income relative to the federal poverty level. By age, prevalence is significantly lower among adults ages 18 through 39 years (23 percent) compared to adults ages 40 through 59 years (52 percent) and older adults ages 60 years and older (74 percent). By race and/or ethnicity, prevalence is significantly higher among adults who are non-Hispanic Black (57 percent) than among adults who are non-Hispanic White (44 percent), non-Hispanic Asian (45 percent), and Hispanic and/or Latino (43 percent). By educational attainment, prevalence is significantly lower among adults with a college degree or above (39 percent) than among adults with less than a high school diploma (47 percent) and adults with a high school diploma or some college (50 percent). By family income, prevalence is significantly lower among adults with family income >350 percent of the federal poverty level (43 percent) compared to adults with family income >130 through 350 percent of the federal poverty level (47 percent).

Among males, age-adjusted prevalence of hypertension was higher in 1999-2000 (52 percent), lower in 2013-2014 (45 percent), and higher again in 2017-2018 (51 percent). Among females, no significant difference in age-adjusted prevalence of hypertension was observed in 2017-2018 compared to 1999-2000.

Stroke

Prevalence of stroke among adults and older adults ages 18 years and older is 3 percent and varies by age, race and/or ethnicity, and educational attainment. By age, prevalence ranges from 1 percent among adults ages 18 through 44 years to 12 percent among older adults ages 75 years and older. By race and/or ethnicity, prevalence of stroke ranges from 2 percent among adults who are Mexican or Mexican American (single race or multiracial) to 8 percent among adults who are American Indian or Alaska Native and White (multiracial). Among adults ages 25 years and older, the prevalence of stroke by educational attainment is 6 percent among adults without a high school diploma, 4 percent among adults with a high school diploma or General Educational Development (GED) and no college, 4 percent among adults with some college, and 2 percent among adults with a college degree or higher.

Coronary Heart Disease

The total prevalence of coronary heart disease (CHD) among adults and older adults ages 18 years and older is 5 percent and varies by sex, age, and educational attainment. The prevalence of CHD is 4 percent in adult females and 6 percent in adult males. By age, prevalence of CHD ranges from 1 percent among adults ages 18 through 44 years to 20 percent among older adults ages 75 years and older. Among adults ages 25 years and older, prevalence of CHD ranges from 4 percent among individuals with a college degree or higher to 8 percent among individuals with less than a high school diploma.

Prediabetes and Diabetes

Children and Adolescents Ages 12 through 19 Years

Prediabetes

The prevalence of prediabetes in children and adolescents ages 12 through 19 years is high (38 percent) and ranges from 33 percent among females to 43 percent among males. As described below, prediabetes prevalence is also 38 percent among adults and older adults.

Diabetes

The prevalence of diagnosed diabetes (proxy or self-reported) among children and adolescents ages 19 years and younger is 352,000 cases, or about 35 per 10,000. Additional estimates of diabetes in children and adolescents are not available due to the limited federal, nationally representative data on diabetes for this age group.

Adults and Older Adults Ages 18 Years and Older

Prediabetes

The total prevalence of prediabetes among adults and older adults ages 18 years and older is 38 percent. Examining data by age, prevalence is 28 percent among adults ages 18 through 44 years, 45 percent among adults ages 45 through 64 years, and 49 percent among older adults ages 65 years and older. Prevalence by sex is 42 percent among males and 34 percent among females.

Diabetes

The prevalence of diabetes, including diagnosed and undiagnosed diabetes, among adults and older adults ages 20 years and older is 16 percent. Age-adjusted prevalence, however, is significantly different among sociodemographic groups for age, race and/or ethnicity, family income relative to the federal poverty level, education, and BMI status.

Age-adjusted diabetes prevalence is significantly different between age groups and is lowest among adults ages 20 through 39 years (4 percent), higher among adults ages 40 to 59 years (16 percent), and highest among older adults ages 60 years and older (30 percent). By race and/or ethnicity, age-adjusted prevalence is significantly lower among non-Hispanic White adults (12 percent) compared to Hispanic and/or Latino adults (21 percent), non-Hispanic Asian adults (18 percent), and non-Hispanic Black adults (19 percent). By sex, age-adjusted prevalence is significantly higher among males (16 percent) than females (13 percent).

Age-adjusted diabetes prevalence is also significantly different between family income groups, relative to the federal poverty level. It is highest among adults with family income ≤130 percent of the federal poverty level (20 percent), followed by adults with family income >130 through 350 percent of the federal poverty level (16 percent), and lowest among adults with family income >350 percent of the federal poverty level (11 percent).

Finally, significant differences exist in age-adjusted diabetes prevalence between BMI levels. Prevalence is highest among adults with a BMI ≥30.0 (23 percent), followed by adults with a BMI of 25.0 to 29.9 (10 percent), and lowest among adults with a BMI of 18.5 to 24.9 (7 percent).

Metabolic Syndrome

Adults and Older Adults Ages 20 Years and Older

The total prevalence of metabolic syndrome among adults and older adults ages 20 years and older is 40 percent. Prevalence varies by age, sex, race and/or ethnicity, and household food security category. Prevalence of metabolic syndrome is 24 percent among adults ages 20 through 39 years, 43 percent among adults ages 40 through 59 years, and 55 percent among older adults ages 60 years and older. By sex, prevalence is 41 percent among females and 38 percent among males. By racial and/or ethnic groups, prevalence of metabolic syndrome ranges from 31 percent among non-Hispanic Asian individuals to 40 percent among non-Hispanic White individuals. Finally, across household food security categories, prevalence of metabolic syndrome ranges from 38 percent among individuals with full household food security to 47 percent among individuals with very low household food security.

Gestational Conditions

Gestational Diabetes

The rate of gestational diabetes is 8 per 100 live births, or about 8 percent. This rate (2020 data) is significantly higher compared to the 2016 rate (6 per 100 live births, or 6 percent). The rate of gestational diabetes is significantly different across sociodemographic groups for pre-pregnancy BMI, birth parent race and/or ethnicity, and birth parent age. By pre-pregnancy BMI group, the lowest rate is among individuals with an underweight BMI (4 percent), and the highest rate is among individuals with obesity (13 percent). By racial and/or ethnic group, the lowest rate is among birth parents who are non-Hispanic Black (7 percent), and the highest rate is among birth parents who are non-Hispanic Asian (15 percent). By age group, the lowest rate is among birth parents younger than age 20 years (3 percent), and the highest rate is among birth parents ages 40 years and older (15 percent).

Gestational Hypertension

The rate of gestational hypertension is 84 per 1,000 live births. The prevalence of gestational hypertension varies by age and race and/or ethnicity, ranging from 70 per 1,000 live births among birth parents who are Hispanic and/or Latino to 105 per 1,000 live births among birth parents who are 40 years and older.

Osteoporosis & Low Bone Mass

Adults and Older Adults Ages 50 Years and Older

The total age-adjusted prevalence of osteoporosis among adults and older adults ages 50 years and older is 13 percent and varies by sex and race and/or ethnicity. Age-adjusted prevalence is significantly higher in females (20 percent) compared to males (4 percent). The percentage (age-adjusted) of non-Hispanic Black adults with osteoporosis is 7 percent, while the prevalence for non-Hispanic White adults is 13 percent, non-Hispanic Asian adults is 18 percent, and Hispanic and/or Latino adults is 15 percent. The age-adjusted prevalence of osteoporosis in females ages 50 years and older was significantly higher in 2017-2018 (20 percent) compared to 2007-2008 (14 percent), while the prevalence in males of the same age was not significantly different.

The total age-adjusted prevalence of low bone mass (osteopenia) in adults and older adults ages 50 years and older is 43 percent. Age-adjusted prevalence is significantly higher in females (52 percent) than in males (34 percent). No significant difference was observed in the age-adjusted prevalence in 2017-2018 compared to 2007-2008.

Breast and Colorectal Cancer

Breast Cancer

The total age-adjusted incidence rate of female breast cancer is 137 per 100,000, and the total age-adjusted female breast cancer mortality rate is 19 per 100,000. Incidence and mortality rates of female breast cancer per 100,000 vary by age and race and/or ethnicity.

By age, age-adjusted incidence of breast cancer is 50 per 100,000 among females under age 50 years, 291 among females ages 50 through 64 years, and 455 among females ages 65 years and older. Mortality rates of female breast cancer are 4 among females under 50 years, 32 among females ages 50 through 64 years, and 88 among females ages 65 years and older.

By race and/or ethnicity, breast cancer incidence is 147 per 100,000 among non-Hispanic White females; 136 among non-Hispanic Black females, 131 among non-Hispanic American Indian and Alaska Native females, 126 among non-Hispanic Asian or Pacific Islander females, and 111 among Hispanic and/or Latino females. Breast cancer mortality rates are 12 among non-Hispanic Asian or Pacific Islander females, 14 among Hispanic and/or Latino females, 17 among non-Hispanic American Indian and Alaska Native females, 19 among non-Hispanic White females, and 26 among non-Hispanic Black females.

Colorectal Cancer

The total age-adjusted incidence rate for colorectal cancer is 38 per 100,000, and the total age-adjusted mortality rate is 13 per 100,000. For colorectal cancer, age-adjusted incidence and mortality rates per 100,000 vary across sex, age, and racial and/or ethnic groups as follows. By sex, incidence is 43 among males and 33 among females. The mortality rate is 15 among males and 11 among females.

By age, incidence rates for colorectal cancer are 10 per 100,000 among individuals younger than age 50 years, 74 among individuals ages 50 through 64 years, and 155 among individuals ages 65 years and older. The mortality rate is 2 among individuals less than age 50 years, 20 among individuals ages 50 through 64 years, and 65 among individuals ages 65 years and older. For comparison, the 2016 incidence rates were 8 for individuals younger than age 50 years, 72 among adults ages 50 through 64 years, and 173 among older adults ages 65 years and older.

By race and/or ethnicity, colorectal cancer incidence rates are 31 per 100,000 among non-Hispanic Asian or Pacific Islander individuals, 35 among Hispanic and/or Latino individuals, 38 among non-Hispanic White individuals, 44 among non-Hispanic Black individuals, and 59 among non-Hispanic American Indian or Alaska Native individuals. Mortality rates are 9 among individuals who are non-Hispanic Asian or Pacific Islander, 11 among Hispanic and/or Latino individuals, 13 among non-Hispanic White individuals, 16 among non-Hispanic Black individuals, and 18 among non-Hispanic American Indian or Alaska Native individuals.

Dental Health

Oral health and nutrition have a bidirectional relationship. Dietary behaviors that may contribute to dental health include consuming foods and beverages that are low in sugar or acid, meeting calcium recommendations, drinking fluoridated water, and limiting alcohol intake.[61] However, dental disease may also impact dietary intakes, particularly among older adults with teeth that are lost or compromised.

Children and Adolescents Ages 2 through 19 Years

The prevalence of untreated or restored dental caries in children and adolescents ages 2 through 19 years is 46 percent, with significant differences by age, family income as a percent of the federal poverty level, and race and/or ethnicity. Prevalence is significantly different between all child and adolescent age groups and is highest among adolescents ages 12 through 19 years (56 percent) compared to children ages 6 through 11 years (48 percent) and children ages 2 through 5 years (22 percent).

The prevalence of dental caries is also significantly different between all groups for family income as a percent of the federal poverty level. The prevalence is highest in children and adolescents with family income ≤130 percent (54 percent) compared to those with family income >130 through 350 percent (47 percent) and with family income >350 percent (36 percent). Among the racial and/or ethnic groups examined, Hispanic and/or Latino children and adolescents have a significantly higher prevalence of dental caries (55 percent) compared to those who are non-Hispanic White (43 percent), non-Hispanic Black (42 percent), and non-Hispanic Asian (47 percent).

Adults and Older Adults Ages 20 Years and Older

The prevalence of untreated dental caries is 26 percent among adults ages 20 through 44 years, 25 percent among adults ages 45 through 64 years, and 20 percent among older adults ages 65 years and older. Among older adults ages 65 years and older, the age-adjusted prevalence of complete tooth loss was 13 percent in 2017-2018, which was significantly lower compared to 1999-2000 (30 percent). The prevalence was significantly lower between these time periods for both males (14 vs. 26 percent) and females (13 vs. 33 percent).

The prevalence of complete tooth loss in older adults differs by age, family income as a percent of the federal poverty level, and education level. Prevalence is significantly different between age groups and is highest in individuals ages 75 years and older (17 percent) compared to individuals ages 70 through 74 years (11 percent) and individuals ages 65 through 69 years (11 percent). Prevalence is significantly higher among older adults with family income ≤130 percent of the federal poverty level (28 percent) compared to older adults with family income >130 through 350 percent of the federal poverty level (17 percent). The prevalence of complete tooth loss is also significantly different between education levels. The prevalence is lowest among older adults with a college degree or above (3 percent) compared to those with less than high school diploma (32 percent) and with a high school diploma or some college (15 percent).

Food Allergies

Children and Adolescents Ages 17 Years and Younger

The prevalence of food allergies (proxy- or self-reported) among children and adolescents ages 17 years and younger is 7 percent. For children ages 0 through 4 years and children 5 through 11 years, prevalence is 6 percent, and for adolescents ages 12 through 17 years, prevalence is 8 percent. The prevalence is 13 percent among children and adolescents of two or more racial and/or ethnic groups.

Question 4. Which nutrients and/or dietary components present a substantial public health concern because of underconsumption or overconsumption?

Approach to Answering Question: Data Analysis

Conclusion Statements

Individuals Ages 1 Year and Older

Based on dietary intake, biomarker data, and relevance to health, for individuals ages 1 year and older, vitamin D, calcium, potassium, and dietary fiber are nutrients of public health concern due to underconsumption and added sugars, (for ages 2 years and older) saturated fat, and sodium are nutrients of public health concern due to overconsumption.

Infants Ages 6 through 11 Months

Based on dietary intake data and relevance to health, iron is a nutrient of public health concern for infants ages 6 through 11 months who are human milk-fed.

Adolescent Females

Based on dietary intake data for females ages 14 through 18 years and biomarker data for females ages 12 through 19 years, iron is of public health concern for adolescent females.

Females Ages 20 through 49 Years

Based on dietary intake and biomarker data, iron is of public health concern for females ages 20 through 49 years.

Individuals who are Pregnant

Based on dietary intake data in females ages 20 through 44 years and biomarker data in pregnant females, iron is of public health concern among females who are pregnant.

Based on dietary intake data and relevance to health, folate is of public health concern for females during the preconception period and during the first trimester of pregnancy.

Based on biomarker data and relevance to health in females who are pregnant, iodine is of public health concern for females who are pregnant.

Summary of the Evidence

The body of evidence for these conclusion statements includes data from NHANES for biochemical indicators and chronic disease prevalence, and WWEIA, NHANES for usual nutrient intakes, including the prevalence of how the group meets the markers of adequacy (EAR and AI) or those of overconsumption (CDRR, UL, and *Dietary Guidelines* limits). The evidence is summarized in the following paragraphs by life stage and includes sociodemographic group data. Full data analysis methods, summaries, and tables are available in the Federal Data Analysis Reports and Data Analysis Supplements.[4,5,7,26,57,58,60]

Individuals Ages 1 Year and Older

Nutrients of Public Health Concern

Vitamin D

Relevance: Vitamin D is required for bone growth and remodeling and may have physiological roles outside of bone health.[16]

Dietary Intake Data: 96 percent of individuals ages 1 year and older have intakes of vitamin D below the EAR.

Biomarker Data: The prevalence of vitamin D concentrations at risk of deficiency (serum 25-hydroxyvitamin D <30 nmol/L) in the United States indicates that many individuals are at risk for inadequacy at 1.3 percent for ages 1 through 5 years, 1.2 percent for ages 6 through 11 years, 6.8 percent for ages 12 through 19 years, 7.3 percent for ages 20 through 39 years, 5.1 percent for ages 40 through 59 years, and 2.4 percent for ages 60 years and older.

Health Outcome(s): The age-adjusted prevalence of osteoporosis in adults and older adults ages 50 years and older is 12.6 percent.

Sociodemographic Data: Regardless of race and/or ethnicity, poverty level, and food security level, vitamin D intakes are 95 percent or more below the EAR.

Calcium

Relevance: Calcium is a mineral associated with the formation and metabolism of bone and is located primarily in the bones and teeth. Bone is constantly being remodeled and is especially important when peak bone mass is achieved, in particular during adolescence with growth and early adulthood, and during periods of rapid bone remodeling among post-menopausal females. Calcium is also involved in vascular contraction and vasodilation, muscle function, nerve transmission, intracellular signaling, and hormonal secretion.[16]

Dietary Intake Data: 46 percent of individuals ages 1 year and older have intakes of calcium below the EAR.

Biomarker Data: No NHANES data are available for calcium concentrations. Serum calcium levels are tightly regulated and do not closely reflect nutritional status.

Health Outcome(s): The age-adjusted prevalence of osteoporosis among adults and older adults ages 50 years and older is 12.6 percent.

Sociodemographic Data: Certain sociodemographic groups may be at elevated risk for having low calcium intakes, such as non-Hispanic Black and non-Hispanic Asian adults, with 62 percent and 59 percent, respectively, below the EAR. A lower percentage of non-Hispanic Black adults have osteoporosis compared to other racial and/or ethnic groups. Additionally, females ages 14 through 18 years during the stage of peak bone accumulation, and females ages 71 years and older during the stage when more bone loss occurs, may also be at elevated risk of low intakes of calcium with 86 percent and 82 percent, respectively, below the EAR.

Potassium

Relevance: Potassium is a mineral that is critical for maintaining intracellular fluid volume and transmembrane electrochemical gradients, which is required for nerve transmission, muscle contraction, and kidney function.

Dietary Intake Data: 28 percent of individuals ages 1 year and older have intakes of potassium above the AI.

Biomarker Data: No NHANES data are available for potassium concentrations. Serum potassium levels are tightly regulated in individuals without kidney disease and do not reflect nutritional status.

Health Outcome(s): Hypertension is prevalent among the U.S. population (48 percent of individuals ages 18 years and older). Per the review of the potassium DRI by NASEM, moderate strength of evidence exists between potassium intake and blood pressure, based on potassium supplementation trials.[17]

Sociodemographic Data: Non-Hispanic Black individuals may be at elevated risk for low potassium intakes, with 16 percent above the AI.

Sodium

Relevance: Sodium has an important role in maintaining extracellular volume, plasma osmolality, and transporting molecules across cell membranes. High intakes of sodium increase risk of high blood pressure, which increases risk of cardiovascular disease and stroke.[17]

Dietary Intake Data: 89 percent of individuals ages 1 year and older have intakes of sodium above the CDRR.

Biomarker Data: No current NHANES data are available for sodium concentrations.

Health Outcome(s): Cardiovascular disease is prevalent in the United States. The prevalence of hypertension for U.S. adults ages 18 years and older is 48 percent. The prevalence of coronary heart disease is 5 percent among adults ages 18 and older. The prevalence of stroke is 3 percent among adults ages 18 years and older, 7 percent among older adults ages 65 through 74 years, and 12 percent among older adults ages 75 years and older.

Sociodemographic Data: Sodium intakes above the CDRR are 88 to 90 percent regardless of race and/or ethnicity. Prevalence of hypertension, however, is significantly higher among non-Hispanic Black adults than among non-Hispanic White and Hispanic adults.

Dietary Fiber

Relevance: Dietary fiber consists of nondigestible carbohydrates and lignin that are intrinsic and intact in plants. Higher intakes of dietary fiber are associated with a reduced risk of coronary heart disease.

Dietary Intake Data: 6 percent of individuals ages 1 year and older have intakes of dietary fiber above the AI.

Biomarker Data: No biomarker data exists to confirm low intakes of dietary fiber.

Health Outcome(s): The prevalence of coronary heart disease is 5 percent among adults ages 18 and older, 12 percent among older adults ages 65 through 74 years, and 20 percent among older adults ages 75 years and above.

Sociodemographic Data: Certain sociodemographic groups may be at elevated risk for having low dietary fiber intake, such as non-Hispanic Black individuals and individuals with a very low household food security level, with less than 3 percent above the AI. Regardless of race and/or ethnicity, the prevalence of coronary heart disease ranges from 3 to 5 percent. Children and adolescents ages 4 through 18 years may also be at elevated risk for having low dietary fiber intakes with less than 3 percent above the AI.

Added Sugars

Relevance: Added sugars contribute to energy intake without providing additional nutrient content. High intakes of added sugars may lead to excess weight gain, which increases risk for obesity and obesity-related diseases. The *Dietary Guidelines* recommendation for individuals ages 2 years and older is to limit added sugars to less than 10 percent of calories per day. Young children from birth through 23 months should avoid added sugars.

Dietary Intake Data: 65 percent of individuals ages 1 year and older have intakes of added sugars above the *Dietary Guidelines* recommended limit of less than 10 percent of calories per day starting at age 2. The recommendation for infants and young children from birth through 23 months is to avoid added sugars.

Biomarker Data: No biomarker exists to measure added sugars concentrations.

Health Outcome(s): Given that the top food source of added sugars in the United States is sugar-sweetened beverages, the 2025 Committee examined the relationship between sugar-sweetened beverages and health outcomes (see **Part D. Chapter 3: Beverages**) and drew the following conclusion statements, which were based on evidence graded as moderate, from systematic reviews:

- Sugar-sweetened beverage consumption by infants, children, and adolescents is associated with unfavorable growth patterns and body composition, and higher risk of obesity in childhood up to early adulthood. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)
- Sugar-sweetened beverage consumption by adults and older adults is associated with unfavorable body composition. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)
- Sugar-sweetened beverage consumption by adults and older adults is associated with higher risk of obesity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)
- Sugar-sweetened beverage consumption by adults and older adults may be associated with higher risk of type 2 diabetes. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

The total prevalence of overweight and obesity among children and adolescents ages 2 through 19 years is 36 percent. Among adults ages 20 years and older, the prevalence of overweight and obesity is 73 percent.

Sociodemographic Data: Certain life stages may be at elevated risk of high added sugars intake, with 74 to 85 percent of children and adolescents ages 5 through 8 years exceeding the recommended limits for added sugars. Other sociodemographic groups may also be at elevated risk of high added sugars intakes, as more than 70 percent of the following groups exceed limits for added sugars: individuals who are non-Hispanic Black, individuals classified as food insecure, and individuals with a PIR ≤1.85.

Saturated Fat (Ages 2 Years and Older)

Relevance: There is no biological requirement for intake of saturated fat, and the relationship between consumption of saturated fat and cardiovascular disease has long been understood. The 2020 Committee concluded that strong evidence demonstrates that replacing saturated fatty acids with polyunsaturated fatty acids in adults reduces the risk of coronary heart disease events and cardiovascular disease mortality. It also concluded that strong evidence demonstrates that diets lower in saturated fatty acids and cholesterol during childhood results in lower levels of total blood and low-density lipoprotein (LDL) cholesterol throughout childhood, particularly in male children.[62] The *Dietary Guidelines* recommendation for individuals ages 2 years and older is to limit saturated fat to less than 10 percent of calories per day. There is no limit on saturated fat intake from birth through 23 months, although the development of the HEI-Toddlers-2020 showed that saturated fat cannot be unlimited without displacing the energy available to achieve other food group and subgroup goals. Therefore, the standard maximum score for the HEI-Toddlers-2020 is based on approximately 12 percent of energy from saturated fats.[63]

Dietary Intake Data: 82 percent of individuals ages 1 year and older have intakes of saturated fat above the *Dietary Guidelines for Americans, 2020-2025* recommended limit of less than 10 percent of calories per day starting at age 2 years.

Biomarker Data: No biomarker exists to directly measure saturated fat concentrations.

Health Outcome(s): The prevalence of high LDL cholesterol among children and adolescents ages 12 through 19 years is 5 percent, and among adults and older adults ages 20 years and older is 59 percent. Among adults ages 18 years and older, prevalence of coronary heart disease is 5 percent.

Sociodemographic Data: Certain life stages and sociodemographic groups may be at elevated risk of high saturated fat intakes, with 88 to 91 percent of children and adolescents ages 9 through 18 years exceeding limits for saturated fat. Eighty-eight percent of non-Hispanic White adults, 76 percent of non-Hispanic Black adults, 54 percent of non-Hispanic Asian adults, and 74 percent of Hispanic adults exceed the limit for saturated fat.

Nutrients or Dietary Components that Pose Special Challenges

Choline

Choline is an essential nutrient for methyl metabolism, cholinergic neurotransmission (which is involved in memory and muscle control), cell membrane signaling, and lipid and cholesterol transport and metabolism.[14] Dietary intake data show that 12 percent of individuals ages 1 year and older have intakes of choline above the AI and certain life stages may be at elevated risk for low intakes, as less than 3 percent of adolescents ages 14 through 18 years have intakes of choline above the AI. It is also understood that choline intakes may be challenging to achieve for those who consume a vegan diet or avoid eggs. Although choline is an essential nutrient, few data exist on the impact of inadequate dietary intake in healthy individuals, and no biomarker data are available. Therefore, due to underconsumption but lack of adverse clinical and health outcome data, choline poses special challenges for individuals ages 1 year and older.

Infants Younger Than Age 6 Months

Notwithstanding that dietary intakes among infants younger than age 6 months are important due to the specific dietary requirements necessary to support proper growth and development, the Committee did not evaluate data on nutrient intakes during this life stage. Identifying nutrients of potential concern among infants is challenging due to minimal research on nutrient requirements, absence of biomarker data, and challenges with assessing dietary intakes during the life stage. Moreover, the AI values for nutrients during this life stage reflect usual human milk content, therefore it is not appropriate to use the 3-pronged framework to determine nutrients of public health concern for infants younger than age 6 months whose only source of nutrition is human milk and/or infant formula. Nonetheless, the Committee notes the importance of supplemental vitamin D during this life stage for infants who are exclusively fed human milk or for those who receive both human milk and infant formula.

Infants Ages 6 through 11 Months

Nutrients of Public Health Concern

Iron (Human Milk-Fed)

Relevance: Iron is a mineral and critical component of hemoglobin, a protein that transports oxygen throughout the body.[14] Iron is particularly important during some life stages, such as infancy, to support neurological development and immune function where critical windows for iron exist and once closed, recovery may not be possible.

Dietary Intake Data: 74 percent of infants fed human milk have intakes of iron below the EAR.

Biomarker Data: No nationally representative biomarker data are available for iron status in infants ages 6 through 11 months.

Health Outcome(s): Infants fed human milk are more likely to have inadequate intakes of iron, which increases the risk of iron-deficiency anemia.

Nutrients or Dietary Components that Pose Special Challenges

Zinc (Human Milk-Fed)

Zinc is an essential nutrient for proper growth and development.[14] Dietary intake data show that 47 percent of infants ages 6 through 11 months fed human milk have zinc intakes below the EAR. However, no biomarker data or clinical health outcome data related to low dietary intakes of zinc among infants ages 6 through 11 months were available to the Committee. Therefore, zinc poses a special challenge based on the percent of human milk-fed infants below the EAR.

Zinc (Infant Formula-Fed)

Dietary intake data show that 78 percent of infants ages 6 through 11 months fed infant formula have intakes of zinc above the Tolerable Upper Intake Level (UL). No biomarker data or clinical health outcome data related to high dietary intakes of zinc among infants ages 6 through 11 months were available to the Committee. Additionally, concerns exist that this UL is not reflective of true biological concerns.[64] Therefore, zinc poses a special challenge based on the percent of infants fed infant formula with intakes above the UL.

Protein (Human Milk-Fed)

Protein during infancy is critically important for muscle and tissue development.[15] Dietary intake data show that 22 percent of infants ages 6 through 11 months fed human milk have intakes of protein below the EAR. No biomarker or clinical health outcome data related to low dietary intakes of protein among infants ages 6 through 11 months were available to the Committee. Therefore, protein poses a special challenge based on the percent of human milk-fed infants with intakes below the EAR.

Retinol (Infant Formula-Fed)

Retinol, or vitamin A, is a nutrient that is especially important for normal vision.[14] Excess intake of vitamin A can lead to acute vitamin A toxicity. Dietary intake data show that 24 percent of infants ages 6 through 11 months fed infant formula have intakes of retinol above the UL. However, no biomarker data or clinical health outcome data related to high dietary intakes of retinol among infants ages 6 through 11 months were available to the Committee, nor is there evidence of harm from vitamin A levels in formula. Therefore, retinol poses a special challenge based on the percentage of infants fed infant formula with intakes above the UL, and intakes of retinol among this group should continue to be monitored.

Potassium

Dietary intake data show that mean nutrient intakes of potassium from complementary foods and beverages for infants ages 6 through 11 months fall below the AI contribution from complementary foods and beverages. No biomarker or clinical health outcome data related to low dietary intakes of potassium among infants ages 6 through 11 months were available to the Committee. Therefore, potassium poses a special challenge based on low mean intakes from complementary food and beverages.

Vitamin D

Dietary intake data show that mean nutrient intakes of vitamin D from complementary foods and beverages for infants ages 6 through 11 months fall below the AI contribution from complementary foods and beverages. No biomarker or clinical health outcome data related to low dietary intakes of vitamin D among infants ages 6 through 11 months were available to the Committee. Therefore, vitamin D poses a special challenge based on low mean intakes from complementary food and beverages.

Choline

Dietary intake data show that mean nutrient intakes of choline from complementary foods and beverages for infants ages 6 through 11 months fall below the AI contribution from complementary foods and beverages. No biomarker or clinical health outcome data related to low dietary intakes of choline among infants ages 6 through 11 months were available to the Committee. Therefore, choline poses a special challenge based on low mean intakes from complementary food and beverages.

Adolescents Ages 14 through 18 Years

Nutrients or Dietary Components that Pose Special Challenges

Adolescents ages 14 through 18 years, especially adolescent females, are at a greater risk of inadequate nutrient intake than other age groups. Poor nutrient intakes during this life stage are particularly concerning, as it is a time of growth and development, puberty, hormonal changes, and the onset of menstruation for females. Related to growth and muscle development, 8 percent of males and 23 percent of females have intakes of protein below the EAR. Nutrients important for bone health (vitamin D, calcium, phosphorus, magnesium, and zinc) are also underconsumed by a high percentage of adolescents, especially adolescent females. For example, 86 percent of females ages 14 through 18 years have intakes of calcium below the EAR, compared to 46 percent of individuals ages 1 year and older. Similarly, 53 percent of females ages 14 through 18 years have intakes of phosphorus below the EAR, compared to 5 percent of individuals ages 1 year and older. Other nutrients where high percentages of adolescents are below the EAR (in addition to the nutrients of public health concern) include vitamin A, vitamin B6, folate, vitamin B12, vitamin C, vitamin E, and copper. Additionally, adolescents are at high risk of overconsumption of added sugars and saturated fat compared to the general population ages 1 year and older.

Adolescent Females

Nutrients of Public Health Concern

Iron

Relevance: Iron needs increase for females around the age of 12.5 years when menstruation begins.[14,65] Accordingly, the RDA for iron increases from 8 mg per day to 15 mg per day. For females who have reached age 14 years but are not yet menstruating, the requirement is 10.5 mg per day.

Dietary Intake Data: Among females ages 14 through 18 years, 23 percent have intakes of iron below the EAR. Although data show that less than 3 percent of females ages 9 through 13 years have intakes of iron below the EAR, the EAR for this age-sex group may not account for females who have begun menstruation and have increased iron requirements.

Biomarker Data: The prevalence of inflammation-adjusted serum ferritin deficiency (<15 μg/L) is 24 percent for females ages 12 through 19 years.

Health Outcome(s): Adolescent females have increased iron requirements and are more likely to have inadequate intakes of iron, which increases the risk of iron deficiency.

Females Ages 20 through 49 Years

Nutrients of Public Health Concern

Iron

Relevance: Iron requirements are higher for females ages 20 through 49 years than males ages 20 through 49 years to account for loses with menstruation.[14]

Dietary Intake Data: 22 percent of females ages 19 through 30 years and 20 percent of females ages 31 through 50 years have dietary intakes of iron below the EAR.

Biomarker Data: The prevalence of inflammation-adjusted serum ferritin deficiency (<15 μg/L) is 23 percent for females ages 20 through 49 years.

Health Outcome(s): Females ages 20 through 49 years have higher iron requirements than their male counterparts and are more likely to have inadequate intakes of iron, which increases the risk of iron-deficiency anemia.

Individuals who are Pregnant or Lactating

Nutrients of Public Health Concern

Iron (Pregnancy)

Relevance: Iron requirements increase during pregnancy to support fetal development.[14]

Dietary Intake Data: Although the sample size was too small to determine a reliable estimate of dietary intakes of iron among females who are pregnant ages 20 through 44 years, 22 percent of non-pregnant females ages 19 through 30 years and 20 percent of females ages 31 through 50 years who are not pregnant have dietary intakes of iron below the EAR. These data suggest that iron remains of concern during pregnancy.

Biomarker Data: Among females who are pregnant or who are lactating, the prevalence of high serum soluble transferrin receptor concentration is 13 percent. Although these data include females who are lactating, the prevalence is likely driven by those who are pregnant as iron requirements during lactation fall and then return to pre-pregnancy levels when menstruation resumes.

Health Outcome(s): Females who are pregnant have increased iron requirements and are more likely to have inadequate intakes of iron, which increases the risk of iron-deficiency anemia.

Folate (Pregnancy - 1st trimester)

Relevance: Folate is a water-soluble B vitamin that functions as a coenzyme in the metabolism of nucleic and amino acids.[14] Folate requirements increase during pregnancy to support neural tube development.

Dietary Intake Data: 52 percent of pregnant females ages 20 through 44 years have intakes of folate below the EAR.

Biomarker Data: The prevalence of low folate (red blood cell) concentration is 0 percent among pregnant or lactating females ages 20 through 44 years.

Health Outcome(s): Adequate folate intake is critical to prevent neural tube defects in the developing fetus, such as spina bifida.

Iodine (Pregnancy)

Relevance: Iodine is an essential component of thyroid hormones that regulate many key biochemical reactions, including protein synthesis.[14] Iodine requirements increase by more than 50 percent during pregnancy to support neurological development and fetal growth. Most prenatal products do not contain iodine.[66]

Dietary Intake Data: Dietary intake data are not available for iodine.

Biomarker Data: Although no recent biomarker data related to iodine intakes among females who are pregnant were available to the Committee, data from NHANES 2007-2014 show that median urinary iodine concentration among females who are pregnant was 144 µg/L, which is below the WHO cut-off for 'insufficiency' (less than 150 µg/L).[67]

Health Outcome(s): Inadequate iodine intake during pregnancy can lead to severe adverse fetal health effects such as neurological damage and growth and developmental abnormalities.

Nutrients or Dietary Components that Pose Special Challenges

Folic Acid

Dietary intake data show that 21 percent of females who are pregnant and who use dietary supplements have folic acid intakes above the UL. Previous dietary intake data show that 24 percent of females who are lactating and who use dietary supplements have folic acid intakes above the UL.[68] Folic acid supplementation is recommended at least 1 month before conception and through the first 2 to 3 months of pregnancy. No clinical health outcome data related to high dietary intakes of folic acid during pregnancy or lactation were available to the Committee. Therefore, folic acid poses a special challenge for females who are pregnant or lactating and who use dietary supplements.

Iron

Previous dietary intake data show that 29 percent of females who are lactating and who use dietary supplements have intakes of iron above the UL.[68] No clinical health outcome data related to high dietary intakes of iron during lactation were available to the Committee. Although no current reliable estimates exist for the percentage of females who are pregnant and who use dietary supplements and have intakes above the UL, the concern for exceeding the UL also exists for this population. Therefore, iron poses a special challenge for females who are pregnant or lactating and who use dietary supplements.

Older Adults

Nutrients or Dietary Components that Pose Special Challenges

Protein

Protein consumption is important to help prevent loss of lean muscle mass that occurs with age (i.e., sarcopenia). While <1 percent of older adults are categorized as underweight and 42 percent are categorized as having obesity, sarcopenia impacts all older adults regardless of weight status. Fourteen percent of females ages 71 years and older and 9 percent of males 71 years and older have intakes of protein below the EAR. Eight percent of females ages 51 through 70 years and 5 percent of males ages 51 through 71 years have intakes of protein below the EAR. No biomarker data related to protein status or clinical health outcome data on the prevalence of sarcopenia or reduced muscle strength were available to the Committee. Therefore, protein poses a special challenge based on the percentage of older adults with protein intakes below the EAR.

Vitamin B12

Vitamin B12 status tends to decline with age because the ability to absorb B12 may decrease, and certain medications may also decrease absorption. Among individuals ages 71 years and older, 10 percent of females and 7 percent of males have intakes of vitamin B12 below the EAR. Eleven percent of females ages 51 through 70 years and 6 percent of males ages 51 through 71 years have intakes of vitamin B12 below the EAR. No biomarker data or clinical health outcome data related to B12 status were available to the Committee. Therefore, vitamin B12 poses a special challenge for older adults based on their reduced ability to absorb this nutrient.

Discussion

In general, U.S. dietary intakes do not align with recommendations in the *Dietary Guidelines for Americans*. Dietary patterns, as assessed by the HEI-2020 and HEI-Toddlers-2020, indicate that intakes of food groups and nutrients do not meet recommendations for all life stages and sociodemographic groups examined. Data show that dietary intakes of food groups, nutrients, and dietary components associated favorably with health outcomes (total Vegetables; Fruits; Dairy and Fortified Soy Alternatives; Seafood; Nuts, Seeds, and Soy Products; and Whole Grains; dietary protein; dietary fiber; calcium; potassium; magnesium; iron; zinc; copper; phosphorus; vitamin A; thiamin; vitamin B6; folate (DFE); vitamin B12; vitamin C; vitamin D; vitamin E; and vitamin K) are underconsumed by much of the population, while intakes of food groups, nutrients, and dietary components associated unfavorably with health outcomes (added sugars, saturated fat, and sodium) are overconsumed. Systematic reviews that support dietary patterns characterized by higher intakes of vegetables, fruits, legumes, whole grains, fish/seafood, nuts, and unsaturated vegetable oils and lower intakes of red and processed meats, sugar-sweetened foods and beverages, refined grains, and saturated fats were associated favorably with health outcomes, such as lower risks of cardiovascular disease, type 2 diabetes, obesity, age-related cognitive decline, and colorectal and breast cancer.[69-74] Furthermore, evidence from food pattern modeling shows that consuming a diet aligned with the HUSS Dietary Pattern allows achievement of nutrient recommendations with few exceptions. (See **Part D. Chapter 9: Nutrient Profile Development** and **Part D. Chapter 10: Food Group and Subgroup Analyses**.) The Dietary Reference Intakes, many of which are based on prevention of poor health outcomes, serve as the foundation for established nutritional goals used in food pattern modeling.[11-18] Although no major differences in dietary intake were noted since the 2020 Committee's review, a few differences in intake have occurred over time, such as a positive shift in beverage patterns to more water and less sugar-sweetened beverages. For adolescents, Vegetables intake is higher, but Dairy and Fortified Soy Alternatives intake is lower. Dairy and Fortified Soy Alternatives intake is also lower for adults now than in the past.

Nutrition-related chronic health conditions and their precursors pose a major threat to health throughout the lifespan, even starting during childhood and adolescence, which does not bode well for the future of health in the United States. Based on its review of data on dietary intakes, biomarkers, and disease prevalence, the 2025 Committee identified the same nutrients of public health concern for individuals ages 1 year and older as the 2020 Committee: vitamin D, calcium, potassium, and dietary fiber due to underconsumption; and added sugars, (for ages 2 years and older) saturated fat, and sodium due to overconsumption. Many of the food groups and subgroups that are noted as underconsumed (Vegetables; Fruits; Whole Grains; Seafood; Nuts, Seeds, and Soy Products; and Dairy and Fortified Soy Alternatives) are major contributors of these nutrients (e.g., Dairy and Fortified Soy Alternatives to vitamin D and calcium, Vegetables to dietary fiber). Similarly, many top sources of food groups are consumed in forms that are high in nutrients to limit: added sugars, saturated fat, and sodium.

Understanding the current U.S. health status and dietary intakes helped the 2025 Committee provide practical recommendations and advice to the Departments, along with evidence from systematic reviews and food pattern modeling, regarding what to include in the *Dietary Guidelines for Americans, 2025-2030*. The Committee used dietary intake data to help put into perspective the conclusions drawn from the systematic review and food pattern modeling evidence. For example, systematic review evidence suggested that a dietary pattern that includes legumes is associated with favorable health outcomes.[69,70,74] Therefore, the Committee used the usual intake distribution data to understand the range of intakes of Beans, Peas, and Lentils (i.e., legumes) in the United States to develop quantitative recommendations that are achievable.[58] Another example was the Committee's decision to remove some foods lower in nutrient density from the nutrient profiles used in food pattern modeling based on dietary intake data indicating that many top sources of food groups are consumed in forms that are high in nutrients to limit: added sugars, saturated fat, and sodium (see **Part D. Chapter 9: Nutrient Profile Development**).

Several key themes emerged throughout the Committee's review of the data analysis evidence, including the importance of consuming a healthy dietary pattern throughout the lifespan, the impact of environmental influences on dietary intakes, the value of applying a health equity lens, and the importance of recognizing the impacts of COVID-19. These topics are discussed in the following sections, along with a discussion of the strengths and limitations of the nationally representative data used in the data analysis approach.

Importance of a Healthy Dietary Pattern Throughout the Lifespan

The lifespan approach was an important concept for the development of the *Dietary Guidelines for Americans, 2020-2025* and continued to influence the work of the 2025 Committee because age and life stage characterize nutritional needs and dietary behaviors. The rates of nutrition-related outcomes and indicators were considered along with dietary intakes and patterns to gain insights on life stages by sex, another important differentiator of intakes.

It is estimated that more than $700 billion is spent each year in healthcare costs related to nutrition-related chronic diseases, including $173 billion on obesity, $240 billion on heart disease, and $307 billion on diabetes.[75,76] Financial burden aside, these chronic health conditions threaten the population's ability to lead long, healthy lives. Obesity is a major public health issue, impacting 36 percent of children ages 2 through 19 years and 41 percent of adults ages 20 years and older. Further, the prevalence of prediabetes among children and adolescents ages 12 through 19 years is 38 percent. Obesity, prediabetes, hypertension, unfavorable blood lipid profile, and metabolic syndrome are also risk factors for other chronic diseases such as cardiovascular disease and diabetes.

Although non-dietary factors contribute to risk of developing a chronic health condition, the importance of consuming a healthy dietary pattern throughout the lifespan cannot be overstated and starts early in life. Yet, dietary intakes are not aligned with dietary guidance at any age. HEI score data show that dietary patterns tend to be healthier at the earlier stages of life (ages 12 months through 4 years) and the later stages of life (ages 71 years and older), with the poorest intakes among adolescents ages 14 through 18 years. Dietary patterns also tend to be somewhat healthier during pregnancy and lactation. These HEI scores align with data on food group and nutrient intakes. For food groups and subgroups, average intake data across age-sex groups show low intakes of Vegetables; Fruits; Whole Grains; Seafood; Nuts, Seeds, and Soy Products; and Dairy and Fortified Soy Alternatives and high intakes of Refined Grains. Many health-promoting nutrients and dietary components with intake requirements are underconsumed, while those with recommendations to limit (i.e., added sugars, saturated fat, and sodium) are overconsumed.

Using this lifespan approach, infancy, adolescence, pregnancy, and lactation were determined to be life stages during which the impact of nutritional inadequacies is substantial due to the occurrence of development and growth, the high risk of poor immediate or long-term outcomes, and poor dietary and nutrient intakes, especially among adolescent females. Considerations for these life stages are discussed in the following sections.

Infants

Iron is notable as a nutrient of public health concern for infants ages 6 through 11 months who are fed human milk, as the health risks of underconsumption are particularly high due to the role of iron in cognition and brain development. The Committee recognizes the American Academy of Pediatrics (AAP) recommendations for iron supplementation starting at age 4 months for infants fed exclusively human milk or infants partially fed human milk if no iron-containing complementary foods are consumed.[77]

Adolescents

Throughout the lifespan, dietary intake is poorest in adolescence despite this period being essential for heightened linear growth. Adolescent females and males have poor dietary intakes, but females experience a constellation of nutrient shortfalls and high needs for nutrients related to growth, development, and menstruation losses. For nearly all nutrients with an EAR, a high percentage of adolescents ages 14 through 18 years—and especially females—have intakes below the EAR. Notably, nutrient intake data indicate that 56 percent of males and 68 percent of females ages 14 through 18 years have intakes below the EAR for calcium, 95 percent of males and >97 percent of females have intakes below the EAR for vitamin D, 81 percent of males and 89 percent of females have intakes below the EAR for magnesium, 13 percent of males and 53 percent of females have intakes below the EAR for phosphorous, and in particular, 23 percent of females ages 14 through 18 years have intakes of protein below the EAR. The nutrients contributing to bone health—including calcium, vitamin D, protein, magnesium, and phosphorous—are critical during this life stage where linear and skeletal growth is rapid and the accretion of bone mineral density is maximized throughout the lifespan. For this reason, osteoporosis, which affects 20 percent of females ages 50 years and older, is often referred to as a disease rooted in childhood. Among individuals ages 50 years and older, approximately 1 in 2 females and up to 1 in 4 males will have a broken bone resulting from osteoporosis in their lifetime, according to the Bone Health and Osteoporosis Foundation.[78]

Nationally representative biomarker data indicate that 24 percent of adolescent females have iron deficiency. However, some studies show that iron deficiency among adolescent females may be up to 40 percent, which indicates that increasing iron intake in late prepubertal females may be beneficial.[79] Iron is important for growth, development, and brain function, due to its incorporation into red blood cells that deliver oxygen, energy, and nutrients to body cells. Yet, iron losses may be high with the initiation and continuation of menstruation in females throughout adolescence and into adulthood. Changes occur in eating habits and behaviors during this life stage as adolescents consume more food independently and outside of the household. Disordered eating such as anorexia nervosa and bulimia nervosa is common among adolescent and young adult females and may contribute to poor dietary practices, and the food environments that adolescents navigate may also not support healthful choices.[80]

Pregnancy and Lactation

Pregnancy and lactation are other life stages that the Committee is highlighting due to the need for heightened attention to food and nutrient intakes, shortfalls, and risk of health outcomes. The nutrient and dietary shortfalls that most adolescent females experience can persist into young adulthood, the most common life stage during which pregnancy and lactation occur. Dietary intakes during pregnancy can impact the birthing parent's immediate and long-term health, and the developing embryo and fetus may be influenced by the nutritional status and environment of the birthing parent. Gestational diabetes was estimated at 8 percent, significantly higher than the 6 percent noted for 2016, and gestational hypertension was 84.3 per 1,000 live births. These outcomes threaten the health and wellbeing of individuals who are pregnant or lactating, and the lives of their children.

Although dietary quality, as measured by HEI scores, is higher among individuals who are pregnant or lactating (total HEI scores: 63 and 62, respectively) compared to their female counterparts who are not pregnant or lactating (total HEI score: 53), several nutrient shortfalls are still present among this group. Iron is a nutrient of public health concern during pregnancy and for females ages 20 through 49 years. Although no reliable estimates were available to evaluate iron intake among individuals who are lactating, dietary intake and biomarker data for females ages 20 through 49 years indicate that iron is assumed to be of public health concern for this life stage. Folate is essential early in pregnancy for the prevention of neural tube defects, when many individuals are unaware that they are pregnant. Folate-rich foods such as vegetables, however, are not consumed at recommended levels. Therefore, folate is considered as a nutrient of public health concern for females during the preconception period and the first trimester of pregnancy. Iodine is an important regulator of metabolism, growth, and development during pregnancy and is also identified as a nutrient of public health concern based on biomarker data. Several other nutrients are noted as posing special challenges, including iodine, which is not available in the current nutrient databases, therefore future consideration of iodine intake is needed.

Environmental Influences

Although individual behavior and personal choices contribute to dietary intake, the food environment and other environmental factors strongly influence the ability of individuals to consume healthy dietary patterns. The types and amounts of foods that individuals consume are influenced by a variety of well-recognized personal, physical, economic, and sociocultural factors that include taste, culture, convenience, access, availability, cost, education, time, skills, and social systems. Many of these factors are shaped by the food environment. For example, children and adolescents attending public schools select from the choices that are offered to them in the school cafeteria, which are regulated through the National School Lunch Program. Therefore, such programs are key mediators of healthy dietary patterns among children.

Adults are also influenced by the food available in the places they live, work, and visit as part of their routines.

Dietary intakes may reflect the food environment, which is represented in the foods included in the national food composition database (FNDDS) for this data analysis work. **Part D. Chapter 11: Diet Simulations** describes how analyses were conducted to evaluate the proposed modifications to the HUSS Dietary Patterns, considering a wide variability in the selection of foods and beverages and varying amounts of lower nutrient-dense foods and beverages. Results showed that CDRR criteria were not met for most age-sex groups even when lower-nutrient-dense foods that exceeded the sodium limit criteria were excluded from simulation. These results help make salient the potential for healthier diets by shifting industry practices toward reformulating food products with less sodium. Industry's shifting the nutrient profiles of its food products could help individuals stay within recommendations for nutrients to limit, such as added sugars and saturated fat. Creating a healthier food environment may lead to better dietary intakes and nutrition-related health outcomes.

Healthy dietary patterns play an important role in promoting health and preventing disease but are not the only determinant of health. The onset and progression of chronic disease is impacted by behavioral aspects such as physical activity and social determinants—many of which are environment-related—such as safe housing, transportation, neighborhood contexts, access to health care, and education.[1] Cross-sector collaboration is needed to improve U.S. health because social and environmental determinants of health play out in complex systems that span across sectors.

Health Equity/Sociodemographic Data

This Committee intentionally emphasized and incorporated health equity throughout its work. For the data analysis approach, such efforts included ensuring that the data reviewed for each scientific question considered the variety of sociodemographic variables (described in the Introduction of this chapter) to provide a more granular look at how dietary intakes and chronic disease prevalence may vary in the population and allow for insights into the choices and environments supporting these intakes (see **Box D.1.2**). Statistical testing was not completed for many analyses, and differences between groups could not be determined. Nonetheless, several valuable insights were gleaned from these data that provide a more nuanced look at population dietary patterns, intakes, and health outcomes.

Box D.1.2: Data Analysis Variables

This Committee prioritized health equity throughout the data analysis approach by examining data for sociodemographic variables including age, sex, race and/or ethnicity, and poverty to income ratio. This Committee was the first to evaluate several sociodemographic characteristics and factors, such as food security status and participation in the SNAP and WIC programs, in its data analysis efforts.

Few individuals consume a dietary pattern that aligns with *Dietary Guidelines* recommendations, regardless of race, ethnic, or sociodemographic group examined. All U.S. individuals can benefit from shifting to healthier dietary patterns. A few meaningful differences exist in HEI scores across race, ethnic, and sociodemographic groups. For individuals ages 2 years and older, non-Hispanic Asian individuals have a higher HEI score (63) than all other racial and/or ethnic groups. Among children and adolescents ages 2 through 18 years, non-Hispanic Asian children have a higher total HEI-2020 score (57 for males and females) compared to non-Hispanic White children (males: 50, females: 52), non-Hispanic Black children (males: 52, females: 51), and children of other race and/or ethnicity groups (males: 50, females: 52). Among adults ages 19 years and older, total HEI-scores are higher among non-Hispanic Asian adults (64) than adults of all other racial and/or ethnic groups examined. Mean total HEI-2020 scores are also higher among adult females from food secure households (60) than adult females from food insecure households (54).

Data on the percentage of individuals below, or at or above, recommended intakes of food groups and subgroups are relatively consistent across sociodemographic groups and largely mirror findings from the HEI-2020 data. Most individuals could benefit from shifting intakes to better align with recommendations, but a few sociodemographic groups have intakes that stand out. For example, among ages 1 year and older, a noticeable percentage of non-Hispanic Asian individuals have intakes at or above the recommendations for Vegetables, Dark-Green Vegetables, Other Vegetables, Fruits, Whole Grains, Seafood, and Nuts, Seeds, and Soy Products, compared to the percentages for the other racial and/or ethnic groups examined.

As described earlier in this chapter, certain sociodemographic groups may be at elevated risk for inadequate nutrient intakes. Across race and/or ethnicity, data on the percentage of individuals below the EAR show that non-Hispanic Black individuals may be at a greater risk for inadequate nutrient intakes. These data also show that individuals with household income below 131 percent of the poverty level and individuals with very low food security may be at a higher risk for inadequate nutrient intakes. Findings by race and/or ethnicity highlight the importance of representing the population using a specific and detailed approach to such characteristics of diversity.

U.S. rates of nutrition-related chronic health conditions are high, and data show significant differences in prevalence across sociodemographic groups. For example, the prevalence of obesity is lower among non-Hispanic Asian children compared to all other race and/or ethnicity groups examined, and the prevalence is lower in non-Hispanic White children compared to non-Hispanic Black and Hispanic and/or Latino children. Obesity is significantly lower among children with higher family income compared to those with lower family income. Among adults, the prevalence of obesity is lower among non-Hispanic Asian adults and higher in non-Hispanic Black adults. Prevalence of hypertension is higher in non-Hispanic Black adults than adults of all other race and/or ethnicity groups examined. Diabetes is lower in non-Hispanic White adults compared to all other race and/or ethnicity groups examined, while gestational diabetes is highest among non-Hispanic Asian adults and lowest among non-Hispanic Black adults. Income data show that among adults, the prevalence of obesity, of hypertension, and of diabetes are higher among families with lower incomes compared to higher incomes. Education data show that prevalence of obesity and of hypertension among adults are lower among those with higher educational attainment (college degree or above) than those with lower educational attainment. Although statistical testing was not completed, another interesting finding is that the mortality rate of breast cancer is highest (by absolute differences) among non-Hispanic Black females, although the incidence rate is highest among non-Hispanic White females. Taken together, these data indicate presence of health disparities across some of the sociodemographic groups examined.

The Committee examined intakes and nutrition-related chronic disease by SNAP and WIC program participation status for some of the analyses. Data on intakes of food groups and nutrients revealed that regardless of program participation status, intakes do not align with recommendations. SNAP and WIC play an important role in promoting food and nutrition security, serving a combined 47.5 million individuals per month.[81,82] SNAP provides food benefits to low-income families, which helps them afford nutritious food essential to health and wellbeing.[83] SNAP-Ed, a federally funded grant program, offers nutrition education to eligible individuals to empower them with knowledge to maximize nutrition in their food choices, along with practical information for comparing prices and nutrition labels and planning and cooking healthy meals.[84] Similarly, WIC benefits help provide low-income women, infants, and children younger than age 5 years with nutritious foods, nutrition education, health referrals, and other social services. WIC serves about 40 percent of all infants in the United States.[85] The circumstances in which individuals are eligible for and participate in these programs are complex, and some income-eligible households may not participate in the programs. For example, most SNAP households live at or below the poverty level, and most include either a child, an older adult, or an individual with a disability.[82] These complexities represent the intersectionality that exists among individuals who are characterized as a SNAP participant. These characteristics also impact dietary intakes and the prevalence of chronic disease but are not captured in the data. Further, the completed analyses were not designed to assess the impact of the SNAP or WIC programs, control for confounding, or describe statistical differences between participants compared to nonparticipants (income-eligible and higher income). Prior research on dietary intakes among program participants, which includes statistical testing and elaborates on these analytic challenges, is available elsewhere.[86-88]

Impact of COVID-19

During the NHANES 2019-2020 cycle, the COVID-19 pandemic disrupted data collection. Although the partial 2019-2020 data were combined with data from the previous cycle (2017-2018) to create a nationally representative 2017-March 2020 sample, NHANES did not collect data during the height of COVID-19.[89] This is an important consideration when describing current dietary intakes because COVID-19 brought attention to food insecurity and diet-related diseases and affected the way individuals purchased food. A publication by the Economic Research Service (ERS) showed that U.S. households shifted away from full-service restaurant meals and purchased more foods and beverages at grocery stores and other food-at-home establishments.[90]

The lack of federal data collection during this time and the need for understanding what, if any, impact COVID-19 had on dietary intakes led federal staff to conduct an evidence scan exploring published evidence on dietary patterns during COVID-19 (March 2020-December 2022).[91] The evidence scan revealed insufficient research, including no nationally representative studies, to warrant further investigation of food and beverage intakes during COVID-19. Although too few research studies were identified to elucidate associations between COVID-19 and changes in dietary intakes, the Committee recognizes that dietary patterns could have been affected. However, any potential changes in intakes are not represented in this report.

The COVID-19 pandemic also impacted the use of health care services and reporting for the prevalence of chronic conditions. According to the Centers for Disease Control and Prevention (CDC), the use of health care services declined for preventive, routine, and emergency care.[92] This presents a challenge as preventive care can help improve chronic disease prevalence; and some conditions, like obesity, had significantly higher rates during the first year of the COVID-19 pandemic compared to pre-pandemic.[93] Additionally, fewer people received recommended cancer screenings during the pandemic. According to the Surveillance, Epidemiology, and End Results Program (SEER), due to delays in cancer screening and diagnosis, cancer incidence rates for all cancers combined fell 10 percent in 2020 compared to 2019.[94] This decline impacted SEER's modeling for cancer trends. Therefore, no 2020 cancer data were considered by the Committee, and instead, 2021 incidence and 2022 mortality data were included.

Data Strengths

The Committee's data analysis work relied on nationally representative data, collected primarily from the NHANES survey and its WWEIA component, which has a primary purpose of assessing the health and nutritional status of U.S. adults and children. The importance of NHANES and the valuable data it collects cannot be overstated, especially as it related to this Committee's work. These data were used to describe the current health and dietary intakes in the United States to inform practical, relevant, and achievable recommendations. As a key advantage, NHANES relies on laboratory data to determine the prevalence of nutritional biomarkers and physical examination data for health condition prevalence, rather than self-reported information. In addition, NHANES collects dietary intake information using a rigorous 5-step multiple pass method, which enhances the reliability of the dietary recall. To determine mean and usual dietary intake distributions of food groups, food subgroups, and nutrients, as well as the percent of the population at/above or below recommendations, the Committee relied on the National Cancer Institute method, which helps to mitigate some of the measurement error that is inherent to dietary assessment.[95]

To ensure the data were comprehensive and allow for application of a health equity lens, the Committee requested and analyzed data that considers the sociodemographic variables described previously. More than 4,700 pages of new data tables are included in the federal data analysis supplements, and 45 existing data publications were considered in the development of this report and the Committee's recommendations. The 2025 Committee examined an amount of data that surpassed that which was reviewed by all prior Committees.

Data Limitations

The data analysis approach used the most recent, nationally representative data possible and provided a basic understanding of dietary intakes and the prevalence of nutrition-related chronic health conditions in the United States but was not without methodological limitations in the data collection, analysis, and interpretation. The Committee considered several such limitations as data were synthesized, conclusions were developed, and advice to the Departments was proposed.

First, dietary intake data are subject to measurement error such as by self-reported intake, proxy interviews, or variation in the FNDDS food composition data. In addition to the standard concerns regarding measurement error when assessing diet (e.g., underreporting), little is known about measurement error due to proxy interviews, which were the source of dietary recall data for infants and young children. Proxy interviews were typically provided by a parent; however, this may not be the person most familiar with the infant's dietary intake, particularly if the infant was in childcare for the recalled day. Furthermore, little is known regarding potential differences in the measurement error of groups by food security or income status where misreporting may potentially vary from food secure or higher income groups.

Second, due to sample sizes and data availability, variation exists across analyses such as data sources used, data years analyzed, sociodemographic groups examined, and definitions applied for categories within certain sociodemographic groups. When stratifying data by sociodemographic groups, sample size is often small due to NHANES' current structure for sampling population groups of interest, and some estimates may be less reliable due to large standard error. To obtain reliable estimates, multiple cycles of data over longer time frames were combined for many population estimates, including infants, young children, pregnancy, and lactation. Despite this approach, many estimates remain less reliable, such as beverage patterns during pregnancy and lactation. The use of multiple data cycles is potentially problematic due to the dynamic nature of the food supply, changes in the food environment, trends in intake, and potential lags in the FNDDS to reflect the food supply in a timely manner. In addition, non-NHANES, self-reported data sources may have been used for certain sociodemographic groups to obtain chronic disease estimates that were not available in NHANES laboratory or physical examination data. For the purposes of the Committee's data analysis work, data that were less reliable—such as when the sample was small, confidence interval was wide, and/or relative standard error was large—were not included in this report or considered in conclusion statements for the data analysis questions.

Third, for most analyses, statistical testing for significance was not completed. Although variation between groups may exist, data were not available to determine if differences are statistically meaningful. Data points that did not have statistical testing were not described with any statements of directionality (e.g., higher or lower) or importance (e.g., significant). Data points with statistical testing are described with directionality when the p-value is below the threshold for statistical significance included in that analysis.

Fourth, with regard to the process of identifying nutrients and dietary components of public health concern, the framework uses a 5 percent cut-off for the assessment of risk of dietary inadequacy or excess in the population. Although this cut-off provides a threshold that is sufficiently low, it is an arbitrary value that does not capture the full spectrum of dietary intakes among sociodemographic groups for some nutrients, such as protein. Data show that 7 percent of individuals ages 1 year and older are below the EAR for dietary protein, thus the Committee has identified this nutrient as underconsumed. However, this is close to the threshold of 5 percent. When further stratifying the data, it becomes apparent that this percentage is driven by certain age-sex groups, including females ages 14 through 18 years (23 percent below the EAR) and females ages 71 years and older (14 percent below the EAR). All other age-sex groups have intakes 9 percent or less below the EAR. Intakes of dietary protein as a nutrient are distinct from intakes of Protein Foods as a food group. Although multiple food groups contribute dietary protein as a nutrient, data on Protein Foods Group and Subgroup intakes provide complementary insight into common sources of dietary protein. At least half of individuals in most age-sex groups have Protein Food intakes at or above recommendations, except for individuals ages 9 through 13 years, females ages 14 through 30 years, and females ages 60 years and older.

Lastly, data limitations related to interpretation were considered. The Committee recognizes the complexity of the data for average intakes of food groups and subgroups. Although the average intake data help describe, in general, how intakes compare to recommendations, these data fail to capture the range of usual intake distributions within the population. For example, data show that for most age-sex groups, the average intake of Nuts, Seeds, and Soy Products (5.6 oz eq per week) are at or above recommendations. However, usual intake distribution data show that half of individuals ages 1 year and older consume only 2.8 oz eq of Nuts, Seeds, and Soy Products per week, although for most calorie levels in the *Dietary Guidelines* Dietary Patterns, the recommendation is at least 5 oz eq per week. In this case, a small percentage of the population (95th percentile) is consuming a relatively high amounts of Nuts, Seeds, and Soy Products (19.6 oz eq per week). This skews the average intake data, so it appears that most individuals are meeting the recommendation when they are not. Intakes of Nuts, Seeds, and Soy Products may be more complex due to the prevalence of food allergies. Data on the percentage at, above, and below recommendations help provide clarity on the intakes of food groups in the population. These interpretation challenges were taken into the consideration as the Committee developed its conclusion statements and recommendations. Additionally, complex factors that were not captured in the data contributed to the results. For example, these data did not capture that members of one sociodemographic group also have other identities and characteristics and are shaped by social systems (i.e., intersectionality). Also, the data were cross-sectional and cannot be used to determine trends over time or cause-and-effect relationships. Research and other recommendations related to these limitations are described in **Part E. Chapter 2: Future Directions**.

Committee's Advice to the Departments

The data analyses described in this chapter include the prevalence of diet-related chronic health outcomes, indicators, and other diet-related conditions; dietary patterns and beverage patterns; food group, food subgroup, nutrient, and dietary component intakes; and the classification of nutrients of public health concern and nutrients posing special challenges in the U.S. population and among certain life stage and sex groups. These data do not show causality, and therefore the Committee integrated the findings with the systematic review and food pattern modeling results presented in Part D: Evidence on Diet and Health to consider implications for public health programs and interventions. Nonetheless, the cross-sectional data analysis results herein are useful for informing practical, relevant recommendations for the diverse U.S. population to achieve dietary recommendations and thereby improve their health. The Committee provides the following recommendations to the Departments as they develop the *Dietary Guidelines for Americans, 2025-2030*:

- Although most individuals in the United States have poor diet quality, the Committee recommends recognizing differences by sociodemographic groups including age, sex, race and/or ethnicity, and food security status. Mean HEI-2020 scores range from 48 to 64 (out of 100) among age-sex and sociodemographic groups, illustrating that meaningful differences exist in the alignment of dietary patterns with the *Dietary Guidelines*. The *Dietary Guidelines for Americans, 2025-2030* should continue to report current dietary intakes by age and life stage—as done in the lifespan approach of the *Dietary Guidelines for Americans, 2020-2025*—while also expanding to consider other sociodemographic groups where variation in dietary intakes was noted in this report.
- Recommendations should continue to consider the poor health and high prevalence of nutrition-related chronic diseases among older adults, as well as the high prevalence of indicators of poor health among children, adolescents, and younger adults. The Committee found that prediabetes affected nearly 40 percent of children and adolescents ages 12 through 19 years, obesity impacted nearly 20 percent of children and adolescents ages 2 through 19 years, and obesity impacted around 40 percent of adults ages 20 years and older. These estimates, along with the other chronic disease data examined by the Committee, indicate the importance of elevating diet and nutrition as national public health priorities. The recommendations of the *Dietary Guidelines for Americans, 2025-2030* should continue to promote health and reduce chronic disease risk, with the aim to prevent new disease incidence.
- The Committee supports the existing special considerations in the *Dietary Guidelines for Americans, 2020-2025* based on the nutrients and dietary components of public health concern and posing special challenges, as these have remained consistent with the 2020 Committee's work. Continued emphasis should be placed on life stages that are particularly vulnerable due to increased nutrient needs or substantial health risks associated with underconsumption. Several nutritional concerns exist for infants, adolescents (especially females), and individuals who are pregnant or lactating, who are all experiencing rapid growth and development. Left unaddressed, nutrient shortfalls during these life stages have the potential to impact health in the short-term, throughout the lifespan, and for future generations. Thus, dietary recommendations to support these groups in meeting their nutritional needs should continue to be prioritized.

References

1. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion. Social Determinants of Health. Accessed September 12, 2024. https://health.gov/healthypeople/priority-areas/social-determinants-health
2. Flowers H. Intersectionality Part One: Intersectionality Defined. U.S. Department of Health and Human Services, National Institutes of Health, Office of Equity, Diversity, and Inclusion. Accessed September 12, 2024. https://www.edi.nih.gov/blog/communities/intersectionality-part-one-intersectionality-defined
3. Cruz CM, DeSilva D, Beckman K, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Patterns of Food and Beverage Intake*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://doi.org/10.52570/DA.DGAC2025.DA01
4. Cruz CM, DeSilva D, Beckman K, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Prevalence of Nutrition-Related Chronic Health Conditions*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://doi.org/10.52570/DA.DGAC2025.DA04
5. DeSilva D, Cruz CM, Beckman K, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Nutrients and Dietary Components*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://doi.org/10.52570/DA.DGAC2025.DA03
6. DeSilva D, Cruz CM, Beckman K, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Food Groups*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://doi.org/10.52570/DA.DGAC2025.DA02
7. DeSilva D, Cruz CM, Beckman K, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Nutritional Biomarker Outcomes*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://doi.org/10.52570/DA.DGAC2025.DA05
8. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Late Evening Eating Occasions: Children and Adolescents Ages 12-19 Years: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
9. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Late Evening Eating Occasions: Adults and Older Adults Ages 20 Years and Older: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
10. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Snacking Occasions: Adults and Older Adults Ages 20 Years and Older: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis

11. Institute of Medicine. *Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline*. Washington, DC: The National Academies Press; 1998. https://doi.org/10.17226/6015
12. Institute of Medicine. *Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids*. Washington, DC: The National Academies Press; 2000. https://doi.org/10.17226/9810
13. Institute of Medicine. *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*. Washington, DC: The National Academies Press; 2001. https://doi.org/10.17226/10026
14. Institute of Medicine. *Dietary Reference Intakes: The Essential Guide to Nutrient Requirements*. Washington, DC: The National Academies Press; 2006. https://doi.org/10.17226/11537
15. Institute of Medicine. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids*. Washington, DC: The National Academies Press; 2005. https://doi.org/10.17226/10490
16. Institute of Medicine. *Dietary Reference Intakes for Calcium and Vitamin D*. Washington, DC: The National Academies Press; 2011. https://doi.org/10.17226/13050
17. National Academies of Sciences, Engineering, and Medicine. *Dietary Reference Intakes for Sodium and Potassium*. Washington, DC: The National Academies Press; 2019. https://doi.org/10.17226/25353
18. National Academies of Sciences, Engineering, and Medicine. *Dietary Reference Intakes for Energy*. Washington, DC: The National Academies Press; 2023. https://doi.org/10.17226/26818
19. Bailey RL, Ard JD, Davis TA, et al. A Proposed Framework for Identifying Nutrients and Food Components of Public Health Relevance in the Dietary Guidelines for Americans. *The Journal of Nutrition*. 2021;151(5):1197-1204. doi:https://doi.org/10.1093/jn/nxaa459
20. Kirkpatrick SI, Reedy J, Krebs-Smith SM, et al. Applications of the Healthy Eating Index for Surveillance, Epidemiology, and Intervention Research: Considerations and Caveats. *Journal of the Academy of Nutrition and Dietetics*. 2018;118(9):1603-1621. doi:https://doi.org/10.1016/j.jand.2018.05.020
21. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Patterns of Beverage Intake: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
22. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Food Category Sources of Added Sugars: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
23. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *HEI-2020 and HEI-Toddlers-2020 Scores by Sociodemographic Groups: Individuals Ages 1 Year and Older: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
24. U.S. Department of Health and Human Services, Food and Drug Administration. Infant Formula. Updated August 14, 2024. Accessed October 25, 2024. https://www.fda.gov/food/resources-you-food/infant-formula
25. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Mean Intakes of Food Groups and Components by Sociodemographic Groups: Individuals Ages 2 Years and Older: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition

Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis

26. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Usual Intakes of Nutrients and Dietary Components and Comparison to Recommendations by Sociodemographic Groups: Individuals Ages 1 Year and Older: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
27. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Food Category Sources of Total Vegetables: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
28. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Oils: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
29. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources Analysis Methodology: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
30. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Total Protein Foods: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
31. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Cured Meats: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
32. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Red Meats: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
33. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Total Dairy and Fortified Soy Alternatives: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
34. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Milk and Fortified Soy Milk: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of

the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis

35. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Cheese: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
36. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Total Grains: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
37. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Whole Grains: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
38. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Refined Grains: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
39. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Total Fruits: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
40. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Mean Intakes of Food Groups and Nutrients: Infants and Young Children Ages 6 through 23 Months: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
41. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Energy: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
42. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Sodium: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
43. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Dietary Protein: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the

Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis

44. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Saturated Fat: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
45. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Dietary Fiber: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
46. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Calcium: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
47. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Potassium: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
48. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Vitamin D: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
49. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Vitamin E: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
50. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Folate as DFE: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
51. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Vitamin B12: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
52. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Mean Intakes of Food Groups and Components: Pregnancy and Lactation: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion

and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis

53. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Iron: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
54. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Total Choline: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
55. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Zinc: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
56. Federal Data Analysis Team, 2025 Dietary Guidelines Advisory Committee, and Mathematica. *Food Category Sources of Total Fat: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
57. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Usual Intakes of Nutrients and Dietary Components and Comparison to Recommendations: Infants and Young Children Ages 6 through 23 Months: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
58. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Usual Intakes of Food Groups and Components and Comparison to Recommendations by Sociodemographic Groups: All Ages: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
59. Institute of Medicine. *Dietary Reference Intakes: Applications in Dietary Assessment*. Washington, DC: The National Academies Press; 2000:305. https://doi.org/10.17226/9956
60. Federal Data Analysis Team and 2025 Dietary Guidelines Advisory Committee. *Prevalence of Nutrition-Related Chronic Conditions and Nutritional Biomarkers: Supplementary Data Analysis for the 2025 Dietary Guidelines Advisory Committee*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
61. U.S. Department of Health and Human Services, Health Resources and Services Administration. Oral Health and Nutrition. Updated July 2024. Accessed October 23, 2024. https://www.hrsa.gov/oral-health/nutrition
62. Dietary Guidelines Advisory Committee. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. Washington, DC: U.S. Department of Agriculture, Agricultural Research Service; 2020. https://doi.org/10.52570/DGAC2020

63. Pannucci TE, Lerman JL, Herrick KA, et al. Development of the Healthy Eating Index-Toddlers-2020. *Journal of the Academy of Nutrition and Dietetics*. 2023;123(9):1289-1297. doi:https://doi.org/10.1016/j.jand.2023.05.013
64. Wuehler S, Lopez de Romaña D, Haile D, McDonald CM, Brown KH. Reconsidering the Tolerable Upper Levels of Zinc Intake among Infants and Young Children: A Systematic Review of the Available Evidence. *Nutrients*. May 5 2022;14(9) doi:https://doi.org/10.3390/nu14091938
65. Wang Z, Asokan G, Onnela J-P, et al. Menarche and Time to Cycle Regularity Among Individuals Born Between 1950 and 2005 in the US. *JAMA Network Open*. 2024;7(5):e2412854-e2412854. doi:https://doi.org/10.1001/jamanetworkopen.2024.12854
66. Gahche JJ, Bailey RL, Mirel LB, Dwyer JT. The Prevalence of Using Iodine-Containing Supplements Is Low among Reproductive-Age Women, NHANES 1999–2006. *The Journal of Nutrition*. 2013;143(6):872-877. doi:https://doi.org/10.3945/jn.112.169326
67. Perrine CG, Herrick KA, Gupta PM, Caldwell KL. Iodine Status of Pregnant Women and Women of Reproductive Age in the United States. *Thyroid*. Jan 2019;29(1):153-154. doi:https://doi.org/10.1089/thy.2018.0345
68. U.S. Department of Agriculture, Agricultural Research Service. *Total Usual Nutrient Intake from Food, Beverages, and Dietary Supplements, by Pregnancy/Lactation Status, What We Eat in America, NHANES 2013-2016*. 2020. https://www.ars.usda.gov/nea/bhnrc/fsrg
69. Anderson CAM, Gardner C, Talegawkar SA, et al. *Dietary Patterns and Risk of Cardiovascular Disease: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR13
70. Booth SL, Talegawkar SA, Fung TT, et al. *Dietary Patterns and Risk of Cognitive Decline, Dementia, Alzheimer's Disease, and Mild Cognitive Impairment: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR20
71. Fung TT, Giovannucci E, Anderson CAM, et al. *Dietary Patterns and Risk of Breast Cancer: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR21
72. Giovannucci E, Fung TT, Anderson CAM, et al. *Dietary Patterns and Risk of Colorectal Cancer: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR22
73. Hoelscher DM, Tobias D, Deierlein AL, et al. *Dietary Patterns and Growth, Body Composition, and Risk of Obesity: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR01
74. Talegawkar SA, Tobias D, Fung TT, et al. *Dietary Patterns and Risk of Type 2 Diabetes: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR12
75. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Heart Disease Facts. Updated May 15, 2024. Accessed September 24, 2024. https://www.cdc.gov/heart-disease/data-research/facts-stats/
76. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Fast Facts: Health and Economic Costs of Chronic Conditions. Updated July 12, 2024. Accessed September 24, 2024. https://www.cdc.gov/chronic-disease/data-research/facts-stats/
77. Baker RD, Greer FR, The Committee on Nutrition. Diagnosis and Prevention of Iron Deficiency and Iron-Deficiency Anemia in Infants and Young Children (0–3 Years of Age). *Pediatrics*. 2010;126(5):1040–1050. doi:https://doi.org/10.1542/peds.2010-2576
78. Bone Health and Osteoporosis Foundation. What is Osteoporosis and What Causes It? Accessed October 14, 2024. https://www.bonehealthandosteoporosis.org/patients/what-is-osteoporosis/

79. Weyand AC, Chaitoff A, Freed GL, Sholzberg M, Choi SW, McGann PT. Prevalence of Iron Deficiency and Iron-Deficiency Anemia in US Females Aged 12-21 Years, 2003-2020. *Jama*. Jun 27 2023;329(24):2191-2193. doi:https://doi.org/10.1001/jama.2023.8020
80. U.S. Department of Health and Human Services, National Institute of Mental Health. Statistics: Eating Disorders. Accessed October 11, 2024. https://www.nimh.nih.gov/health/statistics/eating-disorders
81. Kessler C, Bryant A, Munkacsy K, Gray KF. *National- and State-Level Estimates of WIC Eligibility and Program Reach in 2022*. U.S Department of Agriculture, Food and Nutrition Service; 2024. https://www.fns.usda.gov/research/wic/eer-2022
82. Monkovic M. *Characteristics of Supplemental Nutrition Assistance Program Households: Fiscal Year 2022*. U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support; 2024. Report No. SNAP-22-CHAR. https://www.fns.usda.gov/research/snap/characteristics-fy22
83. U.S Department of Agriculture, Food and Nutrition Service. Supplemental Nutrition Assistance Program (SNAP). Updated July 1, 2024. Accessed October 10, 2024. https://www.fns.usda.gov/snap/supplemental-nutrition-assistance-program
84. U.S. Department of Agriculture, Food and Nutrition Service. Supplemental Nutrition Assistance Program Education (SNAP-Ed) Connection. Accessed September 24, 2024. https://snaped.fns.usda.gov/
85. U.S. Department of Agriculture, Food and Nutrition Service. Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Updated September 26, 2024. Accessed October 10, 2024. https://www.fns.usda.gov/wic
86. Caulfield LE, Bennett WL, Gross SM, et al. *Maternal and Child Outcomes Associated With the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Comparative Effectiveness Review No. 253. (Prepared by the Johns Hopkins University Evidence-based Practice Center under Contract No. 75Q80120D00003.)*. U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality; 2022. AHRQ Publication No. 22-EHC019. https://doi.org/10.23970/AHRQEPCCER253
87. Gregory CA, Ver Ploeg M, Andrews M, Coleman-Jensen A. *Supplemental Nutrition Assistance Program (SNAP) Participation Leads to Modest Changes in Diet Quality*. U.S Department of Agriculture, Economic Research Service; 2013. Economic Research Report No. 147. https://www.ers.usda.gov/publications/pub-details/?pubid=45062
88. Gleason S, Hansen D, Wakar B. *Indicators of Diet Quality, Nutrition, and Health for Americans by Program Participation Status, 2011–2016: The SNAP Report*. U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support; 2021. Prepared by Insight Policy Research, Contract No. AG-GS-10F-0136X. https://www.fns.usda.gov/research/snap-indicators-diet-quality-nutrition-and-health-americans-program-participation-status-2011
89. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. Questionnaires, Datasets, and Related Documentation: NHANES 2017-March 2020 Pre-pandemic. Accessed October 10, 2024. https://wwwn.cdc.gov/nchs/nhanes/continuousnhanes/default.aspx?cycle=2017-2020
90. Okrent A, Zeballos E. *COVID-19 Working Paper: Consumer Food Spending Changes During the COVID-19 Pandemic*. U.S. Department of Agriculture, Economic Research Service; 2022. https://www.ers.usda.gov/publications/pub-details/?pubid=105532
91. Cruz CM, DeSilva DM, Beckman K, et al. *Dietary Intake Datasets in the United States from March 2020 to December 2022: An Evidence Scan*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Guidance and Analysis Division and U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion; 2024. https://doi.org/10.52570/DA.DGAC2025.ES
92. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion. COVID-19 and Chronic Disease Prevention and Interventions. Updated July 11, 2024. Accessed September 24, 2024. https://www.cdc.gov/nccdphp/priorities/covid-19.html
93. Restrepo BJ. Obesity Prevalence Among U.S. Adults During the COVID-19 Pandemic. *American Journal of Preventive Medicine*. 2022;63(1):102-106. doi:https://doi.org/10.1016/j.amepre.2022.01.012

94. U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute. Impact of COVID on the April 2024 SEER Data Release. Accessed September 24, 2024. https://seer.cancer.gov/data/covid-impact.html
95. U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute. Usual Dietary Intakes: The NCI Method. Updated August 19, 2024. Accessed September 24, 2024. https://epi.grants.cancer.gov/diet/usualintakes/method.html

Part D. Chapter 2: Dietary Patterns

Introduction

Nutritional science investigates dietary exposures as the consumption of individual foods, nutrients, and distinct patterns of food combinations. Dietary patterns can be described by the foods that comprise them or their relative distribution of macro- and micronutrients, and the nutrient profile for any given dietary pattern can vary significantly.[1] For example, both plant-based and animal-based foods contribute to protein intake, but the nutrient profiles for each can differ substantially. Dietary or food patterns reflect cultural and population norms and preferences and are influenced by many factors including food availability, cooking methods and food processing techniques, climate and agricultural production, socioeconomic factors, advertising and marketing, and religious beliefs.[2]

Dietary patterns comprise usual quantities and frequencies of foods and beverages that are consumed during a given time frame or life stage (e.g., past year, during pregnancy), and can also be specific to eating occasions (e.g., breakfast or snacks).[3] Research that evaluates exposure to the consumption of a dietary pattern can capture individuals' collinear eating behaviors, as well as any additive, synergistic, or antagonistic effects between foods and nutrients in the overall diet matrix. Further, because people consume foods rather than individual nutrients, reviewing the evidence for consumption of habitual diet as an overall eating pattern can translate into practical dietary guidance that may be readily incorporated into daily living.

This chapter provides key background information about dietary patterns and presents evidence from systematic reviews on the relationships between dietary patterns and the following health outcomes: growth, body composition, and risk of obesity; cardiovascular disease; type 2 diabetes; breast cancer; colorectal cancer; and cognitive decline, dementia, Alzheimer's disease, and mild cognitive impairment. In addition, this chapter provides evidence on the relationships between dietary patterns consumed during pregnancy and outcomes in the pregnant individual or infant, including risk of hypertensive disorders of pregnancy, risk of gestational diabetes mellitus, gestational age at birth, and birth weight. The chapter also integrates and discusses the results of those systematic reviews and provides the Dietary Guidelines Advisory Committee's (Committee) advice to the Departments, based on these systematic reviews, for developing the *Dietary Guidelines for Americans, 2025-2030.*

Box D.2.1: Data Analysis Highlight

U.S. dietary intake patterns, as assessed by the Healthy Eating Index-2020 (HEI-2020) and HEI-Toddlers-2020, generally fail to align with the *Dietary Guidelines for Americans, 2020-2025*. The mean HEI-2020 score for the total population ages 2 years and older is 56 out of 100, and the mean HEI-Toddlers score for young children ages 12 through 23 months is 63 out of 100. **Part D, Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions** provides additional details on data analysis findings for dietary intake patterns.

Why the *Dietary Guidelines for Americans* Recommend Dietary Patterns

The 2010 Dietary Guidelines Advisory Committee was the first Committee to recommend as a future direction that systematic reviews be conducted to examine the association of dietary patterns with health outcomes.[4] Following that recommendation, USDA's Nutrition Evidence Systematic Review (NESR) team (formerly Nutrition Evidence Library) collaborated with a technical expert collaborative to conduct a series of systematic reviews on dietary patterns and health.[5] This foundational work has been built upon and expanded by subsequent Committees. The 2015 Dietary Guidelines Advisory Committee conducted several systematic reviews for dietary patterns and health outcomes.[6] Dietary patterns that were associated with better health outcomes included higher intakes of vegetables, fruits, whole grains, low- or non-fat dairy, seafood, legumes, and nuts; moderate intake of alcohol (in adults only); and lower intakes of red and processed meat, refined grains, and sugar-sweetened foods and drinks. After examining the evidence, and considering the results of systematic reviews along with the results from food pattern modeling, the 2015 Committee proposed 3 dietary patterns that illustrated various flexibilities for a healthy diet: the Healthy U.S.-Style Dietary Pattern, the Healthy Mediterranean-style Dietary Pattern, and the Healthy Vegetarian Dietary Pattern.[6] The focus on dietary patterns has continued and a paper detailing the history and evolution of dietary patterns systematic reviews conducted to inform the *Dietary Guidelines for Americans* has been published.[4]

An approach focused on dietary patterns allows examination of the totality of the diet and facilitates the comparison of various patterns of eating for their relationship(s) with beneficial or adverse health outcomes, while also capturing cultural norms and food preferences.[2] Previous Committees have drawn conclusion statements for dietary patterns that have generally been consistent over time, across health outcomes and populations.[4] Further, the ability to harmonize the dietary pattern systematic review findings with food pattern modeling and data analysis strengthens the evidence base of the Committee's recommendations.

The *Dietary Guidelines* are also used as the basis for federal food assistance programs; thus, defining overall healthy dietary patterns is useful to guide development and implementation of federal programs such as the National School Lunch Program (NSLP), the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and the Child and Adult Care Food Program (CACFP). These programs include menu planning approaches, which can benefit from determination of healthy food patterns, as well as setting norms for the populations who participate.

Key Concepts and Methodological Approaches

Dietary patterns in the research setting are derived using selected foods, beverages, and nutrients defined *a priori* by investigators, whereas data-driven *a posteriori* patterns identify correlated patterns of foods, beverages, and nutrients that exist within the specific study population through various methods.[4] *A priori* dietary patterns are hypothesis-driven and include pre-determined indices, such as the Healthy Eating Index (HEI), to quantify an individual's adherence to a set of dietary guidelines or cultural eating patterns, metric(s) of high or low dietary quality, or collective intake of a set of foods, beverages, or nutrients prioritized for their hypothesized relationship with a health outcome.[7] Standardized scores are assigned to foods or nutrients consumed, with an overall score providing a quantitative rating of adherence to the overall dietary pattern that can then be used for descriptively characterizing a population's diet or evaluating pattern-outcome relationships. In contrast, *a posteriori* approaches use statistical methods such as principal component analysis (PCA), exploratory factor analysis (EFA), and cluster analysis to determine dietary patterns based on empirical data within a given study population,[7] from various sources of dietary data, including food frequency questionnaires (FFQs). Because data are obtained from existing dietary intakes, the patterns represented may not always reflect current dietary guidance,[8] are not always generalizable, and may be arbitrary depending on how the foods or food groups were measured and analyzed.[4] This methodology can be hypothesis-generating and highlight latent food and beverage correlations and trends. Hybrid approaches include a combination of methods, such as reduced-rank regression and treelet transformation.[4] The term hybrid is applied because these methods are based on prior knowledge of a mechanism or pathway associated with disease (e.g., inflammation, hyperinsulinemia) and the diet is formed *a posteriori* on the basis of optimally predicting level of a biomarker (e.g., C-reactive protein for inflammation, C-peptide or insulin for hyperinsulinemia).[4,7]

A recent systematic review examined methods to derive and report dietary patterns. Of the 410 studies identified, 62.7 percent used *a priori* index methods and 30.5 percent used PCA or EFA *a posteriori* approaches. Less than 10 percent of the studies used reduced rank regression (6.3 percent), cluster analysis (5.6 percent), or combination methods (4.6 percent).[9] A challenge of synthesizing evidence among dietary pattern analyses is harmonizing the similarities and differences in the foods and nutrients (de)emphasized, which are often highly variable. The NESR review methodology used for the 2025 Committee's report incorporated detailed synthesis of dietary pattern food and nutrient composition from studies using both *a priori* and *a posteriori* methods. Identifying major foods or food groups classified in these studies allowed the Committee to compare dietary patterns derived using different methodology and population-specific diets.

Prioritizing the Systematic Reviews

The Committee prioritized the systematic reviews by listing the questions that were recommended for this review and using an iterative prioritization and refinement process. Questions for the systematic reviews were initially evaluated by Committee members based on relative importance to the field, past systematic reviews and grades, and feasibility based on time and magnitude of the available literature. During subsequent meetings, several additional questions were de-prioritized based on workload and other factors identified during the review, such as the number of new studies identified since the last question update. Table D.2.1 provides a more detailed overview of the rationale for each deprioritized review. The full process yielded 11 questions for dietary patterns systematic reviews that included several life stages.

TABLE D.2.1
DEPRIORITIZED DIETARY PATTERNS SYSTEMATIC REVIEWS

Deprioritized Systematic Review	Rationale for Deprioritization
Dietary patterns and risk of sarcopenia	The Committee determined that a lack of research was available to update the existing NESR systematic review.
Dietary patterns and all-cause mortality	The recent existing NESR systematic review had a conclusion statement graded as "strong" and the Committee chose to prioritize other outcomes in relation to dietary patterns.
Dietary patterns before/during pregnancy and lactation and developmental milestones	The Committee determined that a lack of research was available to update the existing NESR systematic review.
Dietary patterns and risk of lung cancer	The Committee determined that a lack of research was available to update the existing NESR systematic review and also identified challenges with smoking as a confounder.
Dietary patterns and risk of depression	The Committee consulted federal subject matter experts on this topic and based on concerns from those experts about reverse causality and/or the plausibility of the relationship between dietary patterns and risk of depression, the Committee decided to discontinue this systematic review.

Expansion of Previous Reviews

Most of the systematic review questions on dietary patterns and health outcomes for this report were reviewed by previous Committees, except for 1 new systematic review of dietary patterns with varying levels of ultra-processed foods and growth, body composition, and risk of obesity. That new systematic review included the following life stages: infants and young children up to age 24 months, children and adolescents, adults and older adults, and individuals during pregnancy and postpartum. This report includes updated health outcomes evaluated in 2020, as well as updated systematic reviews of diet during pregnancy. Other features of the current Committee's dietary pattern systematic reviews include the focus on different age and developmental stages from early childhood to older adulthood.

Where possible, conclusion statements were developed separately for different life stages. In particular, the relationships between dietary patterns consumed during pregnancy and risk of hypertensive disorder during pregnancy, risk of gestational diabetes mellitus, infant gestational age at birth, and infant birth weight were also examined. Further, throughout this chapter, the term "adults" refers to individuals ages 19 years and older, including older adults. This is because the bodies of evidence for adults included studies that enrolled participants across the adult age span, including older adults, but did not allow for drawing separate conclusions for older adults in any of the questions reviewed. One of the challenges in systematic reviews of chronic diseases that manifest primarily, but not exclusively, in older adults is the lack of data that indicates when during the lifespan does diet impact health as we age. Until the role of diet across the lifespan is better understood, it can be assumed that the healthy diet pattern in younger adulthood will have similar positive influences on health in older adulthood for the questions examined. However, that is an assumption not based on empirical evidence.

The Committee applied a health equity lens to all its systematic reviews and identified an opportunity to consider health equity to an even greater extent in its review on dietary patterns consumed by adults and older adults and risk of cardiovascular disease (**Box D.2.2**). Several advantages to using that systematic review for this purpose were present, including the well-established and extensive body of literature on the topic, the existing strong conclusion for the relationship, and the number of studies that included outcomes for diverse populations. To further examine the systematic review question, the evidence was limited to studies conducted in the United States. Because most studies did not include comparable measures of socioeconomic position, criteria for diversity included race and/or ethnicity, as well as other socioeconomic measures, where applicable. The Committee considered studies with participants of ≤40 percent Non-Hispanic White as having population diversity.

Box D.2.2: Dietary Patterns and Risk of Cardiovascular Disease

The 2020 Dietary Guidelines Advisory Committee's Scientific Report carried forward the conclusion about dietary patterns consumed by adults and older adults and cardiovascular disease from the 2015 Report, with a suggestion that the evidence be systematically reviewed in 2025. The 2025 Committee's review confirmed the strong association between a healthy dietary pattern among adults and older adults and lower risk of cardiovascular disease. It also afforded the opportunity to examine health equity in the research on dietary patterns and cardiovascular disease among adults and older adults. Equity considerations are important because the impacts of dietary patterns are mediated by the conditions under which people live and implement recommendations. Although the *Dietary Guidelines for Americans, 2020-2025* include consideration for budget, food preferences, and culture, they stop short of examining systems and structures that impact food intake and adherence to guidelines—as evidenced by Americans' persistently low Healthy Eating Index scores.

List of Questions

1. What is the relationship between dietary patterns consumed and growth, body composition, and risk of obesity?[10]
2. What is the relationship between dietary patterns consumed and risk of cardiovascular disease?[11]
3. What is the relationship between dietary patterns consumed and risk of type 2 diabetes?[12]
4. What is the relationship between consumption of dietary patterns with varying amounts of ultra-processed foods and growth, body composition, and risk of obesity?[13]
5. What is the relationship between dietary patterns consumed and risk of breast cancer?[14]
6. What is the relationship between dietary patterns consumed and risk of colorectal cancer?[15]
7. What is the relationship between dietary patterns consumed and risk of cognitive decline, dementia, Alzheimer's disease, and mild cognitive impairment?[16]
8. What is the relationship between dietary patterns consumed during pregnancy and risk of hypertensive disorders of pregnancy?[17]
9. What is the relationship between dietary patterns consumed during pregnancy and risk of gestational diabetes mellitus?[18]
10. What is the relationship between dietary patterns consumed during pregnancy and gestational age at birth?[19]
11. What is the relationship between dietary patterns consumed during pregnancy and birth weight?[20]

Conclusion Statements

Question 1. What is the relationship between dietary patterns consumed and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review

Infants and Young Children Up to Age 24 Months

A conclusion statement cannot be drawn about the relationship between dietary patterns consumed by infants and young children up to age 24 months and growth, body composition, and risk of obesity because of substantial concerns with consistency. (Grade: Grade Not Assignable)

Children and Adolescents

Dietary patterns consumed by children and adolescents that are characterized by higher intakes of vegetables, fruit, legumes, nuts, whole grains, fish/seafood, and dairy (low-fat, unsweetened) and lower intakes of red and processed meats, sugar-sweetened beverages, and sugar-sweetened or savory/salty snack foods are associated with favorable growth patterns, lower adiposity, and lower risk of obesity later in childhood and early adulthood. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Dietary patterns consumed by children and adolescents that are characterized by higher intakes of red and processed meats, refined grains, sugar-sweetened beverages, sugar-sweetened or savory/salty snack foods, and fried potatoes and lower intakes of vegetables, fruit, and whole grains are associated with unfavorable growth patterns, higher adiposity, and higher risk of obesity later in childhood and early adulthood. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Adults and Older Adults

Dietary patterns consumed by adults and older adults that are characterized by higher intakes of vegetables, fruits, legumes, nuts, whole grains, and fish/seafood and lower intakes of meats (including red and processed meats), refined grains and sugar-sweetened foods and beverages are associated with lower adiposity (body fat, body weight, BMI, and/or waist circumference) and lower risk of obesity. These dietary patterns also included higher intakes of unsaturated fats and lower intakes of saturated fats and sodium. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Individuals During Pregnancy

Dietary patterns consumed during pregnancy may be associated with a lower risk of excessive gestational weight gain. These patterns tend to emphasize higher intakes of vegetables, fruits, legumes, nuts, whole grains, fish, and dairy and lower intakes of added sugars. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between dietary patterns consumed during pregnancy and risk of inadequate gestational weight gain because there are substantial concerns with consistency in the body of evidence. (Grade: Grade Not Assignable)

Individuals During Postpartum

A conclusion statement cannot be drawn about the relationship between dietary patterns consumed during postpartum and postpartum weight change because there are substantial concerns with consistency, precision, risk of bias and generalizability in the body of evidence. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns_growth-obesity

Question 2. What is the relationship between dietary patterns consumed and risk of cardiovascular disease?

Approach to Answering Question: Systematic Review

Children and Adolescents

Dietary patterns consumed by children and adolescents that are characterized by higher intakes of vegetables, fruits, legumes, nuts, whole grains, fish and/or seafood, and unsaturated fats and oils and lower intakes of red and processed meats and sugar-sweetened foods and beverages are associated with lower systolic and diastolic blood pressure and triglycerides later in life. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Adults and Older Adults

Dietary patterns consumed by adults and older adults that are characterized by higher intakes of vegetables, fruits, legumes, nuts, whole grains, unsaturated relative to saturated fats and lower sodium, and lower intakes of red and processed meat, refined grains, and sugar-sweetened foods and beverages are associated with lower risk of cardiovascular disease, including clinically meaningful improvements in blood lipids and blood pressure. Some of these dietary patterns also included low-fat dairy and seafood. These findings were consistent across diverse racial/ethnic groups and socioeconomic positions. This conclusion statement is based on evidence graded as strong. (Grade: Strong)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns_cardiovascular-disease

Question 3. What is the relationship between dietary patterns consumed and risk of type 2 diabetes?

Approach to Answering Question: Systematic Review

Children and Adolescents

A conclusion statement cannot be drawn about the relationship between dietary patterns consumed by children and adolescents and risk of type 2 diabetes because of substantial concerns with directness. (Grade: Grade Not Assignable)

Adults and Older Adults

Dietary patterns consumed by adults and older adults that are characterized by higher intakes of vegetables, fruits, legumes, nuts, whole grains, and fish/seafood and lower intakes of red and processed meats, high-fat dairy products, refined grains, and sugar-sweetened foods and beverages are associated with lower risk of type 2 diabetes. This conclusion statement is based on evidence graded as strong. (Grade: Strong)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns_type-2-diabetes

Question 4. What is the relationship between consumption of dietary patterns with varying amounts of ultra-processed foods and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review

Infants and Young Children up to 24 Months

A conclusion statement cannot be drawn about the relationship between dietary patterns consumed by infants and young children up to age 24 months with varying amounts of ultra-processed food and growth, body composition, and risk of obesity because of substantial concerns with consistency and directness in the body of evidence. (Grade: Grade Not Assignable)

Children and Adolescents

Dietary patterns consumed by children and adolescents with higher amounts of food classified as ultra-processed food are associated with greater adiposity (fat mass, waist circumference, BMI) and greater risk of overweight. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Adults and Older Adults

Dietary patterns consumed by adults and older adults with higher amounts of food classified as ultra-processed food are associated with greater adiposity (fat mass, waist circumference, BMI) and greater risk of obesity and/or overweight. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Individuals During Pregnancy

A conclusion statement cannot be drawn about the relationship between dietary patterns consumed during pregnancy with varying amounts of ultra-processed food and gestational weight gain because there is not enough evidence available. (Grade: Grade Not Assignable)

Individuals During Postpartum

A conclusion statement cannot be drawn about the relationship between dietary patterns consumed during postpartum with varying amounts of ultra-processed food and postpartum weight change because there is not enough evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns-ultraprocessed_growth-obesity

Question 5. What is the relationship between dietary patterns consumed and risk of breast cancer?

Approach to Answering Question: Systematic Review

Adults and Older Adults

Dietary patterns consumed by adults and older adults that are characterized by higher intakes of vegetables, fruits, legumes and nuts, and whole grains and lower intakes of red and processed meats, refined grains, and sugar-sweetened foods and beverages are associated with lower risk of postmenopausal breast cancer relative to other dietary patterns. The data regarding dietary patterns and risk of premenopausal breast cancer point in the same direction, but the evidence is less consistent. This conclusion statement is based on evidence for postmenopausal breast cancer graded as moderate. (Grade: Moderate)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns_breast-cancer

Question 6. What is the relationship between dietary patterns consumed and risk of colorectal cancer?

Approach to Answering Question: Systematic Review

Adults and Older Adults

Dietary patterns consumed by adults and older adults that are characterized by higher intakes of vegetables, fruits, legumes and nuts, and whole grains and lower intakes of red and processed meats, refined grains, fried potatoes, saturated fat, and sugar-sweetened foods and beverages are associated with lower risk of colon and rectal cancer. Some of these dietary patterns also included fish, low-fat dairy, tea and coffee. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns_colorectal-cancer

Question 7. What is the relationship between dietary patterns consumed and risk of cognitive decline, dementia, Alzheimer’s disease, and mild cognitive impairment?

Approach to Answering Question: Systematic Review

Adults and Older Adults

Dietary patterns consumed by adults and older adults that are characterized by higher intakes of vegetables, fruits, legumes or beans, nuts, fish and/or seafood, and unsaturated vegetable oils/fats and lower in red and processed meats and sugar-sweetened beverages, are associated with lower risk of age-related cognitive decline, mild cognitive impairment, dementia and/or Alzheimer's disease. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns_neurocognitive-health

Question 8. What is the relationship between dietary patterns consumed during pregnancy and risk of hypertensive disorders of pregnancy?

Approach to Answering Question: Systematic Review

Individuals During Pregnancy

A conclusion statement cannot be drawn about the relationship between dietary patterns consumed during pregnancy and risk of hypertensive disorders of pregnancy because of substantial concerns with consistency, directness, and precision in the body of evidence. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns_hypertensive-disorders-pregnancy

Question 9. What is the relationship between dietary patterns consumed during pregnancy and risk of gestational diabetes mellitus?

Approach to Answering Question: Systematic Review

Individuals During Pregnancy

Dietary patterns consumed during pregnancy that are characterized by higher intakes of vegetables, fruits, legumes, nuts and seeds, whole grains, fish/seafood, and unsaturated fats, and lower intakes of red and processed meat, added sugars, and saturated fats are associated with lower risk of gestational diabetes mellitus. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns_gestational-diabetes

Question 10. What is the relationship between dietary patterns consumed during pregnancy and gestational age at birth?

Approach to Answering Question: Systematic Review

Individuals During Pregnancy

Dietary patterns consumed during pregnancy may not be associated with risk of preterm birth. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns_gestational-age

Question 11. What is the relationship between dietary patterns consumed during pregnancy and birth weight?

Approach to Answering Question: Systematic Review

Individuals During Pregnancy

Dietary patterns consumed during pregnancy that are characterized by higher intakes of vegetables, fruits, legumes, nuts and seeds, grains, fish/seafood, dairy, and unsaturated fats, and lower intakes of red and processed meat, added sugars, and saturated fats may be associated with lower risk of small-for-gestational age in infants. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between dietary patterns consumed during pregnancy and risk of large-for-gestational age, low birth weight, and macrosomia in infants because of substantial concerns with consistency, risk of bias, and generalizability in the body of evidence. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/dietary-patterns_birthweight

Integration

In this section the Committee integrates evidence across this chapter's systematic review conclusion statements by organizing its findings on relationships between dietary patterns and health outcomes: associations with favorable health outcomes, associations with unfavorable health outcomes, no relationship with health outcomes, and relationships for which a conclusion statement could not be drawn. The studies reviewed included a variety of dietary patterns from multiple countries, which is consistent with the aim of the *Dietary Guidelines* to provide nutrition advice that represents a variety of cultural foodways. Because the systematic reviews included several distinct dietary patterns, it was necessary to describe a composite dietary pattern representing conclusion statements collectively. Dietary patterns are represented by specific foods and beverages, food groups, and nutrients, so the Committee examined dietary patterns for these commonalities.

Dietary Patterns Associated with Favorable Health Outcomes

Eleven conclusion statements were drawn that associated dietary patterns with favorable health outcomes: 2 in children and adolescents, 6 in adults and older adults, and 3 in pregnant individuals. Two were based on evidence graded as strong, 5 were based on evidence graded as moderate, and 4 were based on evidence graded as limited. All these dietary patterns included higher intakes of vegetables, fruits, legumes, and nuts; most had higher intakes of whole grains and fish or seafood; and some had higher intakes of low-fat dairy or unsaturated fats (**Table D.2.2**). In contrast, these dietary patterns were lower in intakes of refined grains, red and processed meats, sugar-sweetened foods and beverages, and saturated fat.

Associations graded as strong included adult health outcomes for cardiovascular disease and type 2 diabetes, chronic diseases that have repeatedly been shown to be associated with dietary consumption.[6,21-23] The association between dietary patterns and cardiovascular disease has remained robust, with strong grades and a large body of evidence for the 2015 and 2020 Dietary Guidelines Advisory Committee Scientific Reports. The conclusion statement for cardiovascular disease specifically focused on health equity, as discussed later in this chapter (**Box D.2.3**), and the evidence remained graded as strong.

Associations graded as moderate included the conclusion statements for dietary patterns in children and cardiovascular disease, and dietary patterns in adults and adiposity and risk of obesity; colorectal cancer; breast cancer; and cognitive decline, dementia, Alzheimer's disease, and mild cognitive impairment. The conclusion statement for dietary patterns and cardiovascular disease in children and adolescents was the only conclusion statement graded as moderate in that age group.

Conclusion statements graded as limited included dietary patterns in children and adolescents and growth, adiposity, and risk of obesity, and all 3 of the conclusion statements examining associations in individuals who are pregnant for dietary patterns and lower risk of excessive gestational weight gain, lower risk of gestational diabetes mellitus, and lower risk of small-for-gestational age in infants.

Dietary Patterns Associated with Unfavorable Health Outcomes

Three conclusion statements were associated with unfavorable health outcomes, all of which were related to growth, body composition, and risk of obesity. Two of these conclusion statements included dietary patterns associated with higher amounts of foods classified as ultra-processed foods in children and adolescents, and adults and older adults. The third conclusion statement examined the relationship between a dietary pattern higher in red and processed meats, refined grains, fried potatoes, sugar-sweetened beverages, and sugar-sweetened or savory/salty snack foods, and unfavorable growth patterns and higher adiposity and risk of obesity in children and adolescents (**Table D.2.2**). Many of the foods identified in the latter dietary pattern overlap with the foods classified as ultra-processed.

The conclusion statements for dietary patterns with ultra-processed foods and growth, body composition, and risk of obesity was based on evidence graded as limited for children and adolescents and for adults. This body of evidence was difficult to assess, largely because of the lack of clear definition of ultra-processed foods.

No Associations Between Dietary Patterns and Health Outcomes

One conclusion statement found no association between a dietary pattern and a health outcome. This conclusion statement was related to dietary patterns consumed during pregnancy and the risk of preterm birth, which was based on evidence graded as limited.

Dietary Patterns and Health Outcomes for Which a Conclusion Statement Could Not Be Drawn

Conclusion statements could not be drawn for some life stages within the prioritized questions: 2 were for infants and young children up to age 24 months, 1 was for children and adolescents, 4 were for individuals who are pregnant, and 2 were for individuals who are postpartum. Together, the lack of evidence in these populations reflects the paucity of research examining dietary patterns and health outcomes at different developmental stages. For some of these questions, it can be challenging to study dietary patterns and health outcomes in these populations because of difficulty with data collection, participant recruitment, or ethical considerations. In addition, definitions of dietary patterns can be difficult to discern in infants who predominantly consume human milk or infant formula.

Summary

As the Committee considered collectively the systematic reviews, which encompassed multiple life stages, a dietary pattern emerged that was consistently related to beneficial health. This healthy dietary pattern for individuals ages 2 years and older is higher in vegetables, fruits, legumes, nuts, whole grains, fish/seafood, and vegetable oils higher in unsaturated fat, and lower in red and processed meats, sugar-sweetened foods and beverages, refined grains, and saturated fat. Some of these healthy dietary patterns also include consumption of low- or non-fat dairy and foods lower in sodium, as noted in specific systematic review conclusion statements. **Tables D.2.2** and **D.2.3** provide an overview of the dietary patterns systematic review topics and foods or food groups identified in each conclusion statement.

TABLE D.2.2
SUMMARY OF SYSTEMATIC REVIEW CONCLUSION STATEMENTS THAT DESCRIBE DIETARY PATTERNS ASSOCIATED WITH FAVORABLE HEALTH OUTCOMES BY LIFE STAGE

Life Stage	**Adults and Older Adults**						**Children and Adolescents**		**Pregnancy**		
Outcome	**Lower risk of cardiovascular disease (CVD)**	**Lower risk of type 2 diabetes**	**Lower risk of age-related cognitive decline, dementia, Alzheimer's disease**	**Lower risk of colorectal cancer**	**Lower risk of breast cancer**	**Lower adiposity and risk of obesity**	**Lower CVD risk factors**	**Favorable growth patterns, lower body composition, and lower risk of obesity**	**Lower risk of gestational diabetes**	**Lower risk of excess gestational weight gain**	**Lower risk of small-for-gestational-age**
Grade	**Strong**	**Strong**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Limited**	**Limited**	**Limited**	**Limited**
Vegetables	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Fruit	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Legumes	▲	▲	▲ or Beans	▲	▲	▲	▲	▲	▲	▲	▲
Nuts	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Whole Grains	▲	▲		▲	▲	▲	▲	▲	▲	▲	▲ 'Grains'
Fish or Seafood	▲	▲	▲	▲		▲	▲	▲	▲	▲	▲
Unsaturated Fats	▲		▲			▲	▲		▲		▲
Tea, Coffee				▲							
Dairy	▲ Low-fat, Non-fat	▼ Whole fat		▲ Low-fat, Non-fat				▲ Unsweetened, Low-fat, Non-fat		▲	▲
Meats	▼ Red and Processed	▼ Red and Processed	▼ Red and Processed	▼ Red and Processed	▼ Red and Processed	▼	▼ Red and Processed	▼ Red and Processed	▼ Red and Processed		▼ Red and Processed
Refined Grains	▼	▼		▼	▼	▼					▲ 'Grains'
Sugar-Sweetened Foods	▼	▼		▼	▼	▼	▼	▼	▼ Added Sugars	▼ Added Sugars	▼ Added Sugars
Sugar-Sweetened Beverages	▼	▼	▼	▼	▼	▼	▼	▼	▼ Added Sugars	▼ Added Sugars	▼ Added Sugars
Saturated Fats	▼			▼		▼			▼		▼
Sodium	▼					▼					
Sweetened and Savory/Salty Snack Foods								▼			
Fried Potatoes				▼							

No entry in a cell means that the foods, food group, or component was not included in the conclusion statement for that health outcome.

▲ Higher intake of this component as part of the pattern are related to health **favorably**

▼ Lower intake of this component as part of the pattern are related to health **favorably**

TABLE D.2.3
SUMMARY OF SYSTEMATIC REVIEW CONCLUSION STATEMENTS THAT DESCRIBE DIETARY PATTERNS ASSOCIATED WITH UNFAVORABLE HEALTH OUTCOMES BY LIFE STAGE

Life Stage	**Children, adolescents**		**Adults, older adults**
Outcome	**Unfavorable growth and higher adiposity and risk of obesity**	**Unfavorable growth and higher adiposity and risk of obesity**	**Higher adiposity and risk of obesity**
Grade	**Limited**	**Limited**	**Limited**
Dietary pattern components			
Vegetables	▼		
Fruit	▼		
Whole Grains	▼		
Refined Grains	▲		
Meats	▲ Red and Processed		
Sugar-Sweetened Foods	▲		
Sugar-Sweetened Beverages	▲		
Fried Potatoes	▲		
Sweetened and Savory/salty Snack Foods	▲		
Ultra-Processed Food		▲	▲

No entry in a cell means that the foods, food group, or component was not included in the conclusion statement for that health outcome.

▲ Higher intakes of this component as part of the pattern are related to health **unfavorably**

▼ Lower intakes of this component as part of the pattern are related to health **unfavorably**

Discussion

Conclusion statements were developed for the systematic reviews on dietary patterns and various health outcomes across multiple life stage groups as follows.

- Fifteen of the conclusion statements were graded: 7 for adults, 4 for children and adolescents, and 4 for individuals who are pregnant.
    - For adults and older adults, 2 of the conclusion statements were graded as strong, 4 were moderate, and 1 was limited.
    - For children and adolescents, the only conclusion statement graded as moderate was for the systematic review of dietary patterns and risk factors for cardiovascular disease. Three additional conclusion statements were graded as limited.
    - For individuals who are pregnant, 4 conclusion statements were graded as limited.
- Nine conclusion statements did not receive a grade due to lack of evidence or heterogeneity of results: 2 in infants and young children, 1 in children and adolescents, 4 in individuals who are pregnant, and 2 in individuals who are postpartum.
- No conclusion statements specific to only older adults were developed due to discrepancies in classifying ages in this group based on the evidence pooling adults and older adults together, not conducting stratification by age, and/or a lack of evidence examining only older adults.

The conclusion statements illustrate the relatively robust body of evidence for adults and older adults compared to other life stages. Some conclusion statements graded the evidence as limited or could not assign a grade; the majority of these were in infants and young children, children and adolescents, individuals who are pregnant, and individuals who are postpartum.

Box D.2.3: Health Equity-Based Synthesis of Evidence

The Committee conducted a systematic review to examine the relationship between dietary patterns consumed by adults and older adults and risk of cardiovascular disease, updating conclusions from the 2015 Committee's report. The Committee identified this review as an opportunity to consider health equity in its synthesis of evidence given the extensive literature on the topic supporting existing strong conclusions for the relationship. The Committee included only studies conducted in the U.S. to prioritize evidence most applicable to the U.S. population in terms of dietary intake, risk of cardiovascular disease, and other factors (e.g., race and/or ethnicity, socioeconomic position) that may impact the relationship examined in the review. The Committee used the NESR methodology to synthesize the entire body of evidence (n=110) and confirmed the strong association between a healthy dietary pattern consumed by adults and older adults and lower risk of cardiovascular disease. Next, per the Committee's protocol, health equity was considered to understand whether the findings applied to participants from diverse racial or ethnic groups or of varied socioeconomic positions by considering the results from a subset of the articles; these articles included a majority of non-White participants (n=43). It was noted that beneficial dietary patterns were similar across these studies, which included diverse population groups. The Committee determined that the findings reported in this subset of articles were also consistent with findings from the overall body of evidence, especially for race and/or ethnicity. Findings were generally consistent across different socioeconomic positions based on various indicators, such as levels of educational attainment or household income, although these data were not available for all studies. The conclusion statement acknowledged the health equity-based synthesis and noted the consistency in outcomes among population groups.

Overall, the Committee's findings reaffirm the healthy dietary patterns presented in the 2015 and 2020 Committee reports, with a few minor changes or updates. Although the systematic reviews included a significant number of studies, many studies were conducted in other countries or in majority white populations, which limited the generalizability of the findings and contributed to several of the moderate or limited grades for the conclusion statements. Several of the studies identified in the systematic reviews also focused on plant-based dietary patterns or on new dietary indices.

The systematic review for ultra-processed foods was a new question for the Committee. Because several methods have been developed to characterize ultra-processed foods, the foods and dietary patterns included in the articles were not consistent. The definition of ultra-processed foods was determined by the authors of the articles included in the review, leading to differences in the dietary patterns, especially in non-U.S. populations with different food supplies. Many foods designated as ultra-processed were higher in saturated fat, sodium, and added sugars, especially in contrast to foods identified as part of the comparator pattern, and food composition—specifically, food additives, emulsifiers, and colorants—was not specified. Dietary tools such as FFQs do not adequately distinguish between processing levels, i.e., a homemade meal versus a frozen dinner. Because of these inconsistencies, conclusion statements were developed with a grade of limited.

Despite an increase during the past 5 years in the number of studies that addressed specific outcomes—and that were, for the most part, consistent in findings with the studies included in the 2020 Committee's report—this Committee's conclusion statements upgraded the strength of evidence in only 3 cases, 2 in adults and 1 in children and adolescents. This is because most of the new research included prospective cohort studies that were similar in the procedures used to assess diets, the frequency of dietary assessment, and the measurement of other study variables; therefore, their limitations were largely the same. Such limitations are further described in the following paragraphs and include measurement error, residual confounding, and reverse causation.

For some life stages, such as pregnancy, dietary intake data can be difficult to collect for a variety of reasons. These include timing of the measurement (e.g., pre-conception, month of pregnancy), difficulty in the representativeness of the diet unless measured at multiple time points during pregnancy, and reverse causation if dietary intake is collected concurrently or post-diagnosis for conditions such as gestational diabetes mellitus. Postpartum measurements of dietary intake can have similar concerns. For infants and young children, measurements are conducted by parents or other caregivers, and amounts of foods and beverages consumed, especially human milk, may be difficult to assess. It can also be difficult to measure school-aged children's dietary intake, especially foods that are consumed at schools or after-school programs.

Most studies relied on FFQs, which are based on self-report of diet and are prone to measurement error. Furthermore, most studies collected a single dietary assessment during the lifespan, even though most chronic diseases may have a long development period and specific periods of susceptibility or sensitivity to diet. A single measure would incur substantial error in capturing the etiologic relevant time of exposure. Nonetheless, because the questionnaires were completed before overt disease, such misclassification is typically random or non-directional in regard to the outcome, so this type of measurement error should typically attenuate any true association instead of inflating or creating false associations. However, for some outcomes such as cognitive decline, subtle cognitive changes may occur before diagnosis of the outcome, which could theoretically be differential in the direction of the outcome. In this case, the rate of type 1 errors, or a false positive, may increase, or associations could be exaggerated.

Potential for residual confounding is the primary limitation of prospective cohort dietary studies. Although studies statistically adjusted for various factors deemed to be important confounders (such as tobacco use and physical activity), it is possible that those factors had substantial measurement error—which would make complete statistical adjustment infeasible—and/or that there were factors unaccounted for entirely. For example, assessments of physical activity were typically self-reported, which has measurement error, and may not capture subtle features such as sedentary behavior. For cancer outcomes, screening (typically mammography for breast cancer and colonoscopy for colorectal cancer) was accounted for in many but not all studies. Consistency of an association observed across many studies in diverse settings would generally be important in supporting a true association, because it might be less likely for the same confounding structure to be consistent across all settings, so the potential for residual confounding should differ across studies. Thus, consistency across populations was an important factor to consider in addressing the potential for residual confounding, but it was difficult to assess, because heterogeneity in study population was generally limited.

Reverse causation can result when the disease itself or a strong susceptibility to develop the disease in the future causes a change in the dietary pattern, which can produce a spurious association or accentuate or attenuate the association between the dietary pattern and the disease. For example, a diagnosis of pre-diabetes might prompt an individual to adopt a better diet. Although the individual may now be classified as having a healthy diet, he or she may be at higher-than-average risk for diabetes because a diagnosis of pre-diabetes is a strong risk factor for diabetes. In this scenario, there will tend to be a bias toward making a healthy diet appear to increase risk of diabetes. Statistical adjustment is possible if information about pre-diabetes is available, but such information is not often available.

Comparison to Prior Dietary Guidelines Advisory Committee Findings

The 2025 Committee continued to build on the body of evidence produced by previous Committees. For example, the Committee introduced a new question about the relationship between consumption of different amounts of ultra-processed foods and growth, body composition, and risk of obesity. Also new was the application of a health equity lens to the systematic review on dietary patterns and cardiovascular disease, as discussed earlier in this chapter. In addition, this Committee updated several systematic reviews conducted by prior (2015 and/or 2020) Committees and was able to modify those reviews' conclusion statements based on availability of new or more consistent findings in the body of evidence. For some conclusion statements, the evidence grade was also strengthened. The following paragraphs describe how these systematic review conclusion statements have evolved (or in some cases, stayed the same) since publication of the 2015 Committee's report.

For the relationship between dietary patterns and cardiovascular risk factors among children and adolescents, the 2020 Committee was the first Committee to have evidence on this topic and graded it as limited. This Committee was able to update this systematic review with new evidence, now graded as moderate, and modified the conclusion statement by adding higher intakes of nuts, seafood, and unsaturated fats and oils, adding lower intakes of red meats, and removing low-fat dairy. Many of the studies were conducted in non-U.S. settings, and data regarding dairy products did not consistently indicate the type or fat content of dairy consumed. Other systematic reviews specifically examining the consumption of dairy can be found in **Part D. Chapter 3: Beverages**.

For the relationship between dietary patterns and type 2 diabetes outcomes in adults and older adults, the 2015 Committee graded the evidence as moderate. The 2020 Committee completed an evidence scan and determined that the conclusion drawn by the 2015 Committee generally reflected the current state of the science at the time, reaffirming the grade of moderate. The 2025 Committee updated the 2015 systematic review and updated the grade from moderate to strong, as the new evidence encompassed studies with more consistent outcomes conducted in more diverse populations. Based on the dietary patterns examined, the conclusion statement was modified to reflect higher consumption of legumes, nuts, and fish/seafood, and lower consumption of sugar-sweetened foods and sugar-sweetened beverages. For the association between dietary patterns and type 2 diabetes in children, a grade could not be assigned, which is consistent with the 2020 Committee's determination. Although an expanded set of outcomes was available compared to the 2020 Committee's review, significant concerns with directness of the studies were present. Longer-term prospective cohort studies beginning in youth with type 2 diabetes-related outcomes would be helpful in establishing a more robust body of evidence, as well as incorporation of other intermediate diabetes outcomes, such as hemoglobin A1c.

For the relationship between dietary patterns and colorectal cancer, the 2020 Committee graded the evidence as moderate, and this Committee maintained that grade. The 2020 Committee's conclusion statement, however, described a dietary pattern associated with higher risk for colorectal cancer as well as dietary components that associated with lower risk. This Committee combined the findings into a single conclusion statement that is in the direction of lower risk only, to simplify the dietary guidance and avoid confusion. Several of the newer studies in this Committee's systematic review included newer indices that represented particular foods and food groups that were not explicitly examined compared to previous reviews. For example, the empirical dietary index for hyperinsulinemia (EDIH) or the empirical dietary index for inflammation insulin (ELIP), which are based on foods that predict insulin and inflammatory responses and may not reflect an intuitive dietary pattern, included fried potatoes as part of the index. This contributed to the Committee including lower intakes of fried potatoes in the conclusion statement, acknowledging that given the dietary index, it is difficult to determine if the food (e.g., the potato) or its method of preparation drives the association. Additionally, this Committee's systematic review included many plant-based indices, all of which rated animal-based products negatively regardless of whether the other foods and food components in the indices were indicative of lower risk of colorectal cancer.

For the relationship between dietary patterns and breast cancer, the 2015 and 2020 Committees developed conclusion statements that referred to both pre- and postmenopausal breast cancer and graded evidence for premenopausal breast cancer (limited in both 2015 and 2020) separately from evidence for postmenopausal breast cancer (moderate for both 2015 and 2020). This Committee also developed a single conclusion statement and retained the moderate grade of the evidence for postmenopausal breast cancer but did not assign a specific grade to the evidence for premenopausal breast cancer, and instead shifted the rationale for the conclusion statement from a general lack of evidence to concerns with consistency in the body of evidence available.

For the relationship between dietary patterns and cognitive decline, dementia, Alzheimer's disease, and mild cognitive impairment in adults and older adults, this Committee graded the evidence as moderate, which strengthens the grade of limited assigned by the 2020 Committee. The dietary pattern described in the 2020 Committee's conclusion statement was updated with the following additional components: higher intakes from legumes or beans and lower intakes from red/processed meats and sugar-sweetened beverages. Most studies did not have a consistent age cut point to define older adulthood; therefore, the conclusion statement encompasses both adults and older adults.

For the relationship between dietary patterns during pregnancy and gestational weight gain (which was examined by this Committee as part of the systematic review on dietary patterns and growth, body composition, and risk of obesity), the 2020 Committee and this Committee examined evidence on dietary patterns consumed during pregnancy. When examining the relationship between dietary patterns in individuals who are pregnant and growth, body composition, and risk of obesity health outcomes, gestational weight gain (both excessive weight gain and inadequate weight gain) was used as the primary health outcome. Appropriate gestational weight gain is associated with better maternal and infant outcomes.[24] The Committee maintained a grade of limited for dietary patterns and lower risk of excessive gestational weight gain; the identified dietary patterns were similar, supporting higher intakes of vegetables, fruits, legumes, nuts, and fish, and lower intakes of added sugars. This Committee's conclusion statement added higher intakes of whole grains and dairy and removed lower intakes of red and processed meat. The Committee also examined the relationship between dietary patterns and inadequate gestational weight gain, but a grade was not assigned because of lack of evidence. The outcome of inadequate gestational weight gain was not examined by the 2020 Committee.

For the remaining 4 pregnancy outcomes of hypertensive disorders of pregnancy, gestational diabetes mellitus (GDM), gestational age at birth, and birth weight, this Committee updated prior systematic reviews that were conducted by NESR in collaboration with groups of external experts as part of the Pregnancy and Birth to 24 months Project (P/B-24 Project).[25] The 2020 Committee used these prior systematic reviews to address the scientific questions in its report.

For the relationship between dietary patterns and hypertensive disorders of pregnancy, the conclusion from the prior P/B-24 systematic review was limited for dietary patterns consumed before and during pregnancy and reduced risk of hypertensive disorders of pregnancy among healthy Caucasian women with access to healthcare; and a grade was not assigned for dietary patterns before and during pregnancy and hypertensive disorders of pregnancy among minority women and those of lower socioeconomic status. This Committee examined evidence only for dietary patterns during pregnancy but was not able to assign a grade for this conclusion statement because of concerns of heterogeneity, risk of bias, and lack of generalizability.

For the relationship between dietary patterns and risk of GDM, the conclusion from the prior P/B-24 systematic review was limited for dietary patterns consumed before pregnancy and lower risk of GDM, and grade not assignable for dietary patterns during pregnancy. This Committee examined evidence only for dietary patterns during pregnancy and graded its conclusion statement as limited for dietary patterns during pregnancy and lower risk of GDM.

For the relationship between dietary patterns and gestational age at birth, the conclusion from the prior P/B-24 systematic review was limited for dietary patterns consumed during pregnancy and reduced risk of preterm birth, and grade not assignable for dietary patterns consumed before pregnancy and gestational age at birth and risk of preterm birth. This Committee examined evidence only for dietary patterns during pregnancy and graded its conclusion statement as limited for no association between dietary patterns during pregnancy and preterm birth.

For the relationship between dietary patterns and birth weight outcomes, a conclusion statement could not be drawn in the prior P/B-24 systematic review for dietary patterns consumed either before or during pregnancy and the outcomes examined. This Committee examined evidence only for dietary patterns during pregnancy, and graded the evidence as limited for its conclusion statement on lower risk of small-for-gestational age. This Committee was not able to assign a grade for dietary patterns consumed during pregnancy and the outcomes of large-for-gestational age, macrosomia, or low birth weight.

Both the 2020 and this Committee examined the relationship between dietary patterns and postpartum weight change (the 2020 Committee considered dietary patterns among lactating persons only), and neither Committee was able to assign a grade because of the dearth of available evidence.

Comparison to Other Systematic Reviews

Several other published systematic reviews have assessed relationships between dietary patterns and health outcomes.[1,16,26-30] Many such reviews have focused on specific dietary patterns, such as Mediterranean, vegan or vegetarian, or other patterns. Several of the reviews did not clearly define the dietary pattern they set out to investigate, which made it difficult for the Committee to identify the dietary pattern being examined. Most reviews focused on a specific health outcome, although several focused on multiple outcomes, especially related to cardiometabolic and type 2 diabetes outcomes. The most robust body of published evidence on dietary patterns and health outcomes is the literature that evaluates associations between dietary patterns and cardiovascular disease or diabetes.

A comprehensive 2023 review of popular dietary patterns assessed their relative alignment with the American Heart Association's (AHA) dietary guidance based on 10 features of evidence-based dietary guidance to promote cardiovascular health. The popular dietary patterns examined included Dietary Approaches to Stop Hypertension (DASH)-style, Mediterranean style, vegetarian style (pescetarian, lacto-/ovo-, and vegan), low fat, very low fat, low carbohydrate, very low carbohydrate, and paleolithic.[1] A scoring process was developed to evaluate whether dietary pattern components met 9 of the 10 features of AHA dietary guidelines (excluding energy balance, given that many of the diet types do not prescribe an energy level). The DASH-style, Mediterranean, and vegetarian patterns more closely met the dietary guidelines, while dietary patterns that emphasized high consumption of meats and animal products scored lower.[1] The components of the AHA dietary guidelines are consistent with many of the findings of the Committee's systematic reviews, which include emphasis on consuming vegetables, fruits, whole grains, legumes, fish or seafood, use of oils with higher levels of unsaturated fatty acids, and low-fat dairy.

A 2023 umbrella review of systematic reviews and meta-analyses examining DASH dietary patterns and cardiometabolic outcomes found that consumption of a DASH diet was associated with several outcomes. Among prospective cohort studies, these results included decreased incident cardiovascular disease (relative risk [RR]=0.80, 95% CI: 0.76, 0.85), and among trials, these results included lower low-density lipoprotein cholesterol and decreased body weight. One 2023 systematic review evaluated the effects of the Mediterranean diet on primary and secondary prevention of cardiovascular disease.[28] Higher adherence to the Mediterranean diet was associated with decreased overall mortality, as well as decreased risk for heart attacks, stroke, and cardiovascular mortality. Many of the components assessed for adherence to a Mediterranean diet were similar to the Committee's overall findings—fruits, vegetables, legumes, fish, olive oil, and nuts. Another systematic review and meta-analysis of controlled trials to examine the effect of the Mediterranean diet on metabolic health found that, compared to other diets, it resulted in lower risk of incidence of cardiovascular disease (RR=0.61, 95% CI: 0.42, 0.80). These studies confirm this Committee's findings, which graded the evidence on dietary patterns and cardiovascular disease as strong in adults and older adults using a health equity focus. The 2015 and 2020 Committees also graded the evidence on dietary patterns and cardiovascular disease as strong.

Several dietary patterns were found to improve metabolic outcomes in type 2 diabetes mellitus in a systematic review of randomized clinical trials.[31] In particular, the Mediterranean dietary pattern showed improved body weight and hemoglobin A1c levels, the vegan diet showed improved glycemic control, and the vegetarian diet was related to greater body weight loss.[31] That study confirms the findings of a previous systematic review with meta-analyses that examined the association of the Mediterranean diet with better glycemic control.[27] The Committee graded the current evidence on dietary patterns and type 2 diabetes as strong in adults and older adults, corroborating these reviews demonstrating an effect of dietary patterns higher in fruits, vegetables, legumes, fish, and nuts.

Two systematic reviews evaluated the association between consumption of dietary patterns that included ultra-processed foods and childhood obesity, while another review examined the role of ultra-processed food consumption on children's health.[32-34] Both of those systematic reviews included cross-sectional studies, which were not included in the Committee's methodology.[32,33] One of the reviews found an obesogenic dietary pattern that included cheeses, sugary drinks, processed foods, fast food, candies, snacks, cakes, animal products, whole milk, and refined grains. In contrast, the foods associated with lowest risk of obesity included fruits, vegetables, whole grains, fish, nuts, legumes, and yogurt.[33] The other review found a positive association between ultra-processed foods (as defined by the Nova food processing classification) and adiposity in children and adolescents, but only in longitudinal studies.[32]

A systematic review conducted with adults found that higher intakes of ultra-processed foods (as defined by Nova) were associated with risk of obesity and increased risk of non-communicable diseases.[29] Another comprehensive review reported associations between consumption of ultra-processed foods and health outcomes such as risk of overweight and obesity and body composition in both adults and children.[35]

A 2021 umbrella review of meta-analyses of studies of dietary patterns and colorectal cancer concluded suggestive evidence for the association of dietary patterns with reduced risk for colorectal cancer including adherence to the Mediterranean diet, adherence to a healthy diet, adherence to a pesco-vegetarian diet, and adherence to a semi-vegetarian diet.[36]

The association between dietary patterns and breast cancer risk was examined among Asian populations in a systematic review and meta-analysis.[37] Healthy dietary patterns, as defined by vegetables and 'prudent' dietary patterns compared to meat and animal food dietary patterns, and higher scores on Healthy Eating Index, were associated with lower risk of breast cancer.[36,37]

An umbrella review examined associations between dietary patterns, foods, and supplements and cognitive outcomes in mild cognitive impairment.[16] Although most of the reviews were of low quality and the trials tended to have small sample sizes, the Mediterranean diet was found to be the most promising for addressing cognitive decline. Several of the foods identified in the Committee's conclusion statement are consistent with a Mediterranean diet: higher in vegetables, fruits, legumes or beans, nuts, fish or seafood, and unsaturated vegetable oils, and lower in processed or red meat and sugar-sweetened beverages.[32-34]

A prior systematic review and meta-analysis of maternal dietary patterns and birth outcomes included both *a posteriori* and index-based dietary patterns.[35,38] Healthier dietary patterns during pregnancy, which included higher intakes of vegetables, fruits, whole grains, low-fat dairy, and lean protein foods (seafood, lean meat/poultry, eggs, legumes, nuts/seeds, and soy), were associated with a lower risk of preterm birth. This finding is different than the Committee's conclusion, which found that dietary patterns may not be associated with preterm birth; however, the conclusion was based on evidence graded as limited. Notably, healthy *a posteriori* dietary patterns were associated with higher birth weight, but *a priori* healthy dietary patterns were not.[38] No associations were seen between dietary patterns during pregnancy and small-for-gestational age or large-for-gestational age, although the number of studies for these analyses was small.

Overall, the Committee's conclusions are generally consistent with the findings of prior systematic reviews that examined relationships between dietary patterns and various health outcomes, especially for adults. Differences in inclusion and exclusion criteria and definition of outcomes of interest, for example, help explain some of the nuances that may exist between prior reviews and the Committee's findings. Data examining associations between dietary patterns and health outcomes continue to evolve but are still relatively limited for other life stages and the diversity of the U.S. population.

Committee's Advice to the Departments

The systematic reviews covered in this chapter largely confirm the findings of previous Committees. At the same time, the current systematic reviews included new evidence and conclusion statements that could be translated for incorporation into the *Dietary Guidelines for Americans, 2025-2030*. Concepts that the Committee recommends the Departments include are as follows:

- Emphasize consumption of vegetables, fruits, legumes (beans, peas, lentils), whole grains, nuts, and fish/seafood, which were common components found in dietary patterns that were associated with more desirable health outcomes.
- Continue to emphasize consumption of low-fat or non-fat dairy and unsaturated fats, which were frequently found in dietary patterns that were associated with more desirable health outcomes. This advice is consistent with the findings discussed in **Part D. Chapter 3: Beverages**.

- Limit consumption of red and processed meats, foods high in saturated fat, and salty/savory snacks. When consuming grains, encourage mostly whole grains and lower refined grains.
- Continue to limit foods high in added sugars, including sweetened beverages and foods. This advice is consistent with the findings discussed in **Part D. Chapter 3 Beverages**.
- Include more nutrient-dense plant-based meal and dietary recommendation options. Many of the articles reviewed include plant-based dietary patterns, with fish and seafood or low-fat dairy. These findings are consistent with the findings discussed in **Part D. Chapter 4: Food Sources of Saturated Fat**, and **Part D. Chapter 10: Food Group and Subgroup Analyses**.
- Recommend that future Committees consider examining the association of ultra-processed foods with growth, body composition, and risk of obesity. In the Committee's review, ultra-processed foods were defined by the authors of the articles included in the review, which led to inconsistency among definitions. Despite this inconsistency, most of the foods categorized as ultra-processed were higher in saturated fat, sodium, and added sugars, as well as other food additives and preservatives. The current conclusion statements for both adults and older adults and children and adolescents were based on evidence graded as limited but might change if a more rigorous definition of ultra-processed foods is developed and further studies are conducted. In addition, it would be relevant to examine the consumption of dietary patterns higher in ultra-processed foods and other health outcomes, such as type 2 diabetes mellitus, cardiovascular disease, cancer, and cognitive decline.
- Encourage consumption of healthy dietary patterns at all stages of life and for diverse populations.
- Encourage consumption of healthy dietary patterns and maintain existing guidance that emphasizes intakes of iron, folate/folic acid, iodine, and choline among individuals who are pregnant and postpartum. These dietary patterns were associated with lower risk of excessive gestational weight gain, gestational diabetes mellitus, and small-for-gestational age in infants.
- Consider recognizing that although a healthy dietary pattern is proposed as part of the systematic review process, the nutrition research studies that support this evidence comprise a variety of countries and cultures. Thus, the dietary pattern proposed in this chapter should serve as a core for cultural adaptations (**Part D. Chapter 8: Culturally Responsive Interventions to Improve Diet**) and flexibilities in food choices (**Part E. Chapter 1: Overarching Advice to the Departments**).
- Consider conducting more implementation science research to increase consumption of dietary patterns associated with decreased cardiovascular disease and type 2 diabetes, given the strength of the evidence. Despite the strong conclusion statements, adherence to these dietary patterns is still low in the U.S. population.

References

1. Gardner CD, Vadiveloo MK, Petersen KS, et al. Popular Dietary Patterns: Alignment With American Heart Association 2021 Dietary Guidance: A Scientific Statement From the American Heart Association. *Circulation*. May 30 2023;147(22):1715-1730. doi:https://doi.org/10.1161/CIR.0000000000001146
2. Monterrosa EC, Frongillo EA, Drewnowski A, de Pee S, Vandevijvere S. Sociocultural Influences on Food Choices and Implications for Sustainable Healthy Diets. *Food Nutr Bull*. Dec 2020;41(2_suppl):59S-73S. doi:https://doi.org/10.1177/0379572120975874
3. Tapsell LC, Neale EP, Satija A, Hu FB. Foods, Nutrients, and Dietary Patterns: Interconnections and Implications for Dietary Guidelines. *Adv Nutr*. May 2016;7(3):445-54. doi:https://doi.org/10.3945/an.115.011718
4. English LK, Raghavan R, Obbagy JE, et al. Dietary Patterns and Health: Insights From NESR Systematic Reviews to Inform the Dietary Guidelines for Americans. *J Nutr Educ Behav*. Jan 2024;56(1):75-87. doi:https://doi.org/10.1016/j.jneb.2023.10.001
5. Dietary Patterns Technical Expert Collaborative and NESR Staff. *A Series of Systematic Reviews on the Relationship Between Dietary Patterns and Health Outcomes*. 2014. https://nesr.usda.gov/sites/default/files/2019-06/DietaryPatternsReport-FullFinal2.pdf
6. Dietary Guidelines Advisory Committee. *Scientific Report of the 2015 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Health and Human Services and Secretary of Agriculture*. 2015. https://odphp.health.gov/sites/default/files/2019-09/Scientific-Report-of-the-2015-Dietary-Guidelines-Advisory-Committee.pdf
7. Madadizadeh F, Bahariniya S. Tutorial on statistical data reduction methods for exploring dietary patterns. *Clin Nutr ESPEN*. Dec 2023;58:228-234. doi:https://doi.org/10.1016/j.clnesp.2023.09.916
8. Hu FB. Dietary pattern analysis: a new direction in nutritional epidemiology. *Curr Opin Lipidol*. Feb 2002;13(1):3-9. doi:https://doi.org/10.1097/00041433-200202000-00002
9. Wingrove K, Lawrence MA, McNaughton SA. A Systematic Review of the Methods Used to Assess and Report Dietary Patterns. *Front Nutr*. 2022;9:892351. doi:https://doi.org/10.3389/fnut.2022.892351
10. Hoelscher DM, Tobias D, Deierlein AL, et al. *Dietary Patterns and Growth, Body Composition, and Risk of Obesity: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR01
11. Anderson CAM, Gardner C, Talegawkar SA, et al. *Dietary Patterns and Risk of Cardiovascular Disease: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR13
12. Talegawkar SA, Tobias D, Fung TT, et al. *Dietary Patterns and Risk of Type 2 Diabetes: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR12
13. Stanford FC, Taylor C, Booth S, et al. *Dietary Patterns with Ultra-Processed Food and Growth, Body Composition, and Risk of Obesity: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR11
14. Fung TT, Giovannucci E, Anderson CAM, et al. *Dietary Patterns and Risk of Breast Cancer: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR21
15. Giovannucci E, Fung TT, Anderson CAM, et al. *Dietary Patterns and Risk of Colorectal Cancer: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR22

16. Andrews V, Zammit G, O'Leary F. Dietary pattern, food, and nutritional supplement effects on cognitive outcomes in mild cognitive impairment: a systematic review of previous reviews. *Nutr Rev*. Oct 10 2023;81(11):1462-1489. doi:https://doi.org/10.1093/nutrit/nuad013
17. Byrd-Bredbenner C, Abrams SA, Andres A, et al. *Dietary Patterns Consumed During Pregnancy and Risk of Hypertensive Disorders of Pregnancy: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR08
18. Andres A, Abrams SA, Byrd-Bredbenner C, et al. *Dietary Patterns Consumed During Pregnancy and Risk of Gestational Diabetes Mellitus: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR07
19. Abrams SA, Andres A, Byrd-Bredbenner C, et al. *Dietary Patterns Consumed During Pregnancy and Gestational Age at Birth: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR26
20. Abrams SA, Andres A, Byrd-Bredbenner C, et al. *Dietary Patterns Consumed During Pregnancy and Birth Weight: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR27
21. Dietary Guidelines Advisory Committee. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. 2020. https://doi.org/10.52570/DGAC2020
22. Lichtenstein AH, Appel LJ, Vadiveloo M, et al. 2021 Dietary Guidance to Improve Cardiovascular Health: A Scientific Statement From the American Heart Association. *Circulation*. Dec 7 2021;144(23):e472-e487. doi:https://doi.org/10.1161/CIR.0000000000001031
23. Jannasch F, Kröger J, Schulze MB. Dietary Patterns and Type 2 Diabetes: A Systematic Literature Review and Meta-Analysis of Prospective Studies12. *The Journal of Nutrition*. 2017/06/01/ 2017;147(6):1174-1182. doi:https://doi.org/10.3945/jn.116.242552
24. Institute of Medicine (US) and National Research Council (US) Committee to Reexamine IOM Pregnancy Weight Guidelines. In: Rasmussen KM, Yaktine AL, eds. *Weight Gain During Pregnancy: Reexamining the Guidelines*. 2009. *The National Academies Collection: Reports funded by National Institutes of Health*.
25. Stoody EE, Spahn JM, Casavale KO. The Pregnancy and Birth to 24 Months Project: a series of systematic reviews on diet and health. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):685S-697S. doi:https://doi.org/10.1093/ajcn/nqy372
26. Chiavaroli L, Viguiliouk E, Nishi SK, et al. DASH Dietary Pattern and Cardiometabolic Outcomes: An Umbrella Review of Systematic Reviews and Meta-Analyses. *Nutrients*. Feb 5 2019;11(2)doi:https://doi.org/10.3390/nu11020338
27. Esposito K, Maiorino MI, Bellastella G, Chiodini P, Panagiotakos D, Giugliano D. A journey into a Mediterranean diet and type 2 diabetes: a systematic review with meta-analyses. *BMJ Open*. Aug 10 2015;5(8):e008222. doi:https://doi.org/10.1136/bmjopen-2015-008222
28. Laffond A, Rivera-Picon C, Rodriguez-Munoz PM, et al. Mediterranean Diet for Primary and Secondary Prevention of Cardiovascular Disease and Mortality: An Updated Systematic Review. *Nutrients*. Jul 28 2023;15(15)doi:https://doi.org/10.3390/nu15153356
29. Jardim MZ, Costa BVL, Pessoa MC, Duarte CK. Ultra-processed foods increase noncommunicable chronic disease risk. *Nutr Res*. Nov 2021;95:19-34. doi:https://doi.org/10.1016/j.nutres.2021.08.006
30. Papadaki A, Nolen-Doerr E, Mantzoros CS. The Effect of the Mediterranean Diet on Metabolic Health: A Systematic Review and Meta-Analysis of Controlled Trials in Adults. *Nutrients*. Oct 30 2020;12(11)doi:https://doi.org/10.3390/nu12113342
31. Papamichou D, Panagiotakos DB, Itsiopoulos C. Dietary patterns and management of type 2 diabetes: A systematic review of randomised clinical trials. *Nutr Metab Cardiovasc Dis*. Jun 2019;29(6):531-543. doi:https://doi.org/10.1016/j.numecd.2019.02.004
32. De Amicis R, Mambrini SP, Pellizzari M, et al. Ultra-processed foods and obesity and adiposity parameters among children and adolescents: a systematic review. *Eur J Nutr*. Aug 2022;61(5):2297-2311. doi:https://doi.org/10.1007/s00394-022-02873-4

33. Liberali R, Kupek E, Assis MAA. Dietary Patterns and Childhood Obesity Risk: A Systematic Review. *Child Obes*. Mar 2020;16(2):70-85. doi:https://doi.org/10.1089/chi.2019.0059
34. Mescoloto SB, Pongiluppi G, Domene SMA. Ultra-processed food consumption and children and adolescents' health. *J Pediatr (Rio J)*. Mar-Apr 2024;100 Suppl 1(Suppl 1):S18-S30. doi:https://doi.org/10.1016/j.jped.2023.09.006
35. Zhang Y, Giovannucci EL. Ultra-processed foods and health: a comprehensive review. *Crit Rev Food Sci Nutr*. 2023;63(31):10836-10848. doi:https://doi.org/10.1080/10408398.2022.2084359
36. Veettil SK, Wong TY, Loo YS, et al. Role of Diet in Colorectal Cancer Incidence: Umbrella Review of Meta-analyses of Prospective Observational Studies. *JAMA Netw Open*. Feb 1 2021;4(2):e2037341. doi:https://doi.org/10.1001/jamanetworkopen.2020.37341
37. Shin S, Fu J, Shin WK, Huang D, Min S, Kang D. Association of food groups and dietary pattern with breast cancer risk: A systematic review and meta-analysis. *Clin Nutr*. Mar 2023;42(3):282-297. doi:https://doi.org/10.1016/j.clnu.2023.01.003
38. Chia AR, Chen LW, Lai JS, et al. Maternal Dietary Patterns and Birth Outcomes: A Systematic Review and Meta-Analysis. *Adv Nutr*. Jul 1 2019;10(4):685-695. doi:https://doi.org/10.1093/advances/nmy123

Part D. Chapter 3: Beverages

Introduction

Beverages such as water, milk, sugar-sweetened beverages (SSB), or juice may be consumed as part of meals or snacks, as a meal or snack, or sipped throughout the day and therefore not defined as a discrete ingestive event. Beverages are key contributors to hydration and to energy and nutrient intakes in U.S. dietary patterns. For example, among children and adolescents ages 2 through 19 years, beverages contribute 14 percent of mean daily energy intake, up to 42 percent of daily calcium intake, and up to 56 percent of daily vitamin D intake. Among adults ages 20 years and older, beverages contribute 17 percent of mean daily energy intake and approximately 25 percent of both daily vitamin D and calcium intakes.[1]

Box D.3.1: Data on U.S. Beverage Consumption

Part D. Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions provides a summary of data analysis findings for beverage consumption in the United States and the Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Patterns of Food and Beverage Intake provides complete details.[1]

The substantive contribution of beverages to dietary patterns emphasizes the importance of understanding their impacts on health and including recommendations for beverage consumption within comprehensive dietary guidance. Although some beverages provide dietary and health benefits, consumption of higher quantities of certain beverages can contribute to excess intake of energy as well as certain nutrients that should be limited. Overall, total beverages contribute 43 percent and 54 percent of daily added sugars intake for children and adolescents ages 2 through 19 years and adults ages 20 years and older, respectively.[1] **Box D.3.1** provides information about where to learn more about this Committee's data analysis findings for beverage consumption in the United States.

The 2025 Committee's scientific questions about beverages were developed to focus on 1) common beverages that provide dietary benefit via their delivery of certain nutrients, such as vitamin C, vitamin D, and calcium (i.e., 100% juice and milk), and 2) beverages that do not provide dietary benefit but contribute added sugars and excess energy (i.e., SSB). Whereas low- and no-calorie sweetened beverages (LNCSB) are not generally considered to provide energy or essential nutrients in the diet, they were included because approximately 1 in 10 adults ages 20 years and older consume LNCSB at least once daily,[1] and uncertainty exists regarding their impact on growth, body composition, risk of obesity, and risk of type 2 diabetes.

This chapter provides key background information about the Committee's review of science related to beverages; presents evidence on the relationships between beverage consumption and growth, body composition, risk of obesity, and risk of type 2 diabetes across the lifespan resulting from this Committee's systematic reviews; and provides the Committee's advice to the Departments for developing the *Dietary Guidelines for Americans, 2025-2030.*

Throughout this chapter, the term adults refers to individuals ages 19 years and older, including older adults. This is because the evidence for adults included studies that enrolled participants across the adult age span, including older adults, but did not allow for drawing separate conclusions for older adults in any of the questions reviewed. In addition to the 4 beverage questions in this chapter that included the populations of infants and young children through age 24 months, **Part D. Chapter 5: Complementary Feeding and Feeding Styles and Practices During Childhood** also addresses consumption of certain beverage types during complementary feeding.

Prioritizing the Systematic Reviews

Published systematic reviews and meta-analyses involving prospective cohort studies (PCS) and/or randomized controlled trials (RCT) have examined relationships between intakes of several types of beverages and chronic diseases. Within this literature base, however, bodies of evidence for PCS and RCT are often not integrated, the influence of differing types of the same beverage (e.g., milks of differing fat content) on health outcomes is often not examined, and outcomes are often not examined across the lifespan, particularly during pregnancy and the postpartum period. For example:

- PCS included in systematic reviews and meta-analyses have found relationships between consumption of SSB and LNCSB, when considered separately and together, and increased risk of outcomes including obesity, type 2 diabetes, cardiovascular disease, and all-cause mortality in adults.[2-4] However, when only RCT are examined and when LNCSB are used as a substitute for SSB, small improvements have been found in weight and cardiometabolic risk factors in adults.[5]
- An umbrella review of systematic reviews and meta-analyses of milk consumption in children and adults, which contained cross-sectional studies, PCS, and RCT, found beneficial associations between milk consumption and risk of cardiovascular disease, type 2 diabetes, and obesity.[6] However, the review did not examine the influence of the type of milk consumed, such as milk differing in fat content or sweet flavoring, on health outcomes.
- In a systematic review and meta-analysis of 100% fruit juice, when PCS were conducted with children, greater consumption of 100% fruit juice was associated with increases in body mass index (BMI), while RCTs in adults did not find a relationship between 100% fruit juice intake and body weight.[7]

Thus, given that beverages vary in energy content and nutrient composition—differences that may be associated with beverages' different impacts on health outcomes—various types of beverages were examined in separate questions. These beverages included dairy milk and milk alternatives, 100% juice, SSB, and LNCSB. The Committee also prioritized a question on beverage patterns, which had not been examined by prior Committees. Beverage patterns were defined as the quantities, proportions, variety, or combination of different beverages in diets, and the frequency of their habitual consumption. The

Committee considered it an important question because more than 1 beverage is consumed in the typical diet, so examining a single type of beverage in isolation to determine impacts on health does not represent how beverages are typically consumed. Beverages should instead be examined within a pattern of intake as is done for foods, an approach that was recommended by the 2020 Committee because it enables examination of relationships between overall beverage intake and health outcomes.[8] Finally, during the evidence synthesis, dairy milk and milk alternatives were organized into the categories of total milk, milk by fat content, sweetened milk, and non-dairy milk alternatives.

Setting the Review Criteria

The Committee distinguished favorable growth and body composition outcomes from unfavorable growth and body composition outcomes. Favorable growth and body composition outcomes were increases in or greater height (children and adolescents only) or lean body mass, and reductions in or lower weight-for-age, BMI-for-age, fat mass, or waist circumference. Unfavorable growth and body composition outcomes were increases in or greater weight-for-age, BMI-for-age, fat mass, or waist circumference, and lower height (for children and adolescents only) or reductions in lean body mass. Risk of obesity included changes in incidence of overweight and obesity or increases in weight or BMI. Weight loss in adults was considered a favorable outcome when studies used a reduced-energy diet, included only participants with overweight or obesity, or were designed to reduce weight. Sarcopenia was not included in this review as it was not considered within scope. For pregnancy and postpartum, adequacy of total gestational weight gain and postpartum weight change, respectively, were examined.

Several key covariates or confounders were examined when interpreting results from studies of beverage consumption. Total energy intake was not examined as a key confounder; however, the Committee considered whether study results accounted for total energy intake when synthesizing the evidence. This allowed the Committee to assess the effects of beverage consumption on health outcomes both dependent and independent of the energy provided by beverages to the total diet.

Expansion of Previous Reviews

The 2020 Dietary Guidelines Advisory Committee also conducted systematic reviews on consumption of milk, 100% juice, SSB, and LNCSB in relation to growth, size, body composition, and risk of overweight and obesity.[9] The 2025 Committee updated those reviews and expanded on the work by also examining overall beverage patterns in relation to growth, body composition, and risk of obesity. Additionally, type 2 diabetes was included as a health outcome when examining SSB and LNCSB consumption. For type 2 diabetes, the Committee considered both long-term observational studies with type 2 diabetes as the outcome and short-term interventions on surrogate/intermediate outcomes such as hemoglobin A1c. While randomized interventions can provide more direct evidence of a causal association, their generally short durations may miss mechanisms relevant to type 2 diabetes, a disease that develops over the course of years or decades.

The Committee also expanded on the previous work by conducting meta-analyses as part of their systematic reviews on SSB and growth, body composition, and risk of obesity from infancy through adulthood, and on 100% juice and growth, body composition, and risk of obesity from infancy through adolescence (through age 19 years). The latter meta-analyses focused on infancy through adolescence due to the heightened interest in this population for guidance on 100% juice intake with regard to growth, body composition, and risk of obesity, as well as the significant differences in prevalence of 100% fruit juice consumption across age groups (i.e., 42 percent of children ages 2 through 5 years old, 28 percent of children ages 6 through 11 years old, and 16 percent of children and adolescents ages 12 through 19 years old consume 100% fruit juice daily).[1]

List of Questions

1. What is the relationship between beverage patterns consumed and growth, body composition, and risk of obesity?[10]
2. What is the relationship between dairy milk and milk alternative consumption and growth, body composition, and risk of obesity?[11]
3. What is the relationship between 100% juice consumption and growth, body composition, and risk of obesity?[12]
4. What is the relationship between sugar-sweetened beverage consumption and growth, body composition, and risk of obesity?[13]
5. What is the relationship between low- and no-calorie sweetened beverage consumption and growth, body composition, and risk of obesity?[14]
6. What is the relationship between sugar-sweetened beverage consumption and risk of type 2 diabetes?[15]
7. What is the relationship between low- and no-calorie sweetened beverage consumption and risk of type 2 diabetes?[16]

Conclusion Statements

Question 1. What is the relationship between beverage patterns consumed and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review

A conclusion statement cannot be drawn about the relationship between beverage pattern consumption and growth, body composition, and risk of obesity because there is not enough evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/beverage-patterns_growth-obesity

Question 2. What is the relationship between dairy milk and milk alternative consumption and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review

Children and Adolescents

Total Milk

Total milk consumption by younger children may be associated with favorable growth and body composition, and lower risk of obesity during childhood. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between total milk consumption by older children and adolescents and growth, body composition, and risk of obesity because of substantial concerns with directness, consistency, and risk of bias in the body of evidence. (Grade: Grade Not Assignable)

Milk Fat Content

Consumption of higher-fat dairy milk compared to lower-fat dairy milk by younger children may be associated with favorable growth and body composition, and lower risk of obesity during childhood. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between consumption of milk with different fat content by older children and adolescents and growth, body composition, and risk of obesity because of substantial concerns with consistency, quantity, and risk of bias in the body of evidence. (Grade: Grade Not Assignable)

Milk Alternatives

A conclusion statement cannot be drawn about the relationship between consumption of milk alternatives by children and adolescents and growth, body composition, and risk of obesity because there is not enough evidence available. (Grade: Grade Not Assignable)

Sweetened Milk

A conclusion statement cannot be drawn about the relationship between consumption of sweetened milk by younger children and growth, body composition, and risk of obesity because there is no evidence available. (Grade: Grade Not Assignable)

There may not be a relationship between consumption of sweetened milk by older children and adolescents and growth, body composition, and risk of obesity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Adults and Older Adults

Total Milk

Total milk consumption by adults and older adults is not associated with measures of body composition or risk of obesity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Milk Fat Content

A conclusion statement cannot be drawn about the relationship between consumption of milk with different fat content by adults and older adults and body composition and risk of obesity because of substantial concerns with directness, consistency, and an absence of trial data in the body of evidence. (Grade: Grade Not Assignable)

Milk Alternatives

A conclusion statement cannot be drawn about the relationship between consumption of milk alternatives by adults and older adults and body composition and risk of obesity because there is not enough evidence available. (Grade: Grade Not Assignable)

Sweetened Milk

A conclusion statement cannot be drawn about the relationship between consumption of sweetened milk by adults and older adults and body composition and risk of obesity because there is no evidence available. (Grade: Grade Not Assignable)

Pregnancy

A conclusion statement cannot be drawn about the relationship between milk consumption during pregnancy and adequacy of gestational weight gain because there is not enough evidence available. (Grade: Grade Not Assignable)

Postpartum

A conclusion statement cannot be drawn about the relationship between milk consumption during postpartum and postpartum weight change because there is no evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/milk_growth-obesity

Question 3. What is the relationship between 100% juice consumption and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review with Meta-Analysis

Infants, Children, and Adolescents

A conclusion statement cannot be drawn about the relationship between 100% juice consumption by infants and young children, up to age 24 months, and outcomes related to growth patterns, body composition, and risk of obesity during childhood because there are substantial concerns with consistency, precision, risk of bias, and generalizability in the body of evidence. (Grade: Grade Not Assignable)[a]

100% juice consumption by children and adolescents is not associated with growth, body composition, and risk of obesity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Adults and Older Adults

100% juice consumption by adults and older adults is not associated with body composition. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

100% juice consumption by adults and older adults may not be associated with weight gain. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Pregnancy

A conclusion statement cannot be drawn about the relationship between 100% juice consumption during pregnancy and adequacy of gestational weight gain because there is not enough evidence available. (Grade: Grade Not Assignable)

Postpartum

A conclusion statement cannot be drawn about the relationship between 100% juice consumption during postpartum and postpartum weight change because there is not enough evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/juice_growth-obesity

[a]This conclusion statement was developed as part of the systematic review on complementary feeding and growth, body composition, and risk of obesity. The conclusion statement relevant to infants and young children is presented here for reference. For more detail, see **Part D. Chapter 5: Complementary Feeding and Feeding Styles and Practices During Childhood**.

Question 4. What is the relationship between sugar-sweetened beverage consumption and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review with Meta-Analysis

Infants, Children, and Adolescents

Sugar-sweetened beverage consumption by infants, children, and adolescents is associated with unfavorable growth patterns and body composition, and higher risk of obesity in childhood up to early adulthood. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Adults and Older Adults

Sugar-sweetened beverage consumption by adults and older adults is associated with unfavorable body composition. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Sugar-sweetened beverage consumption by adults and older adults is associated with higher risk of obesity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Pregnancy

A conclusion statement cannot be drawn about the relationship between sugar-sweetened beverage consumption during pregnancy and adequacy of gestational weight gain because there is not enough evidence available, and there are substantial concerns with consistency, precision, risk of bias, directness, and generalizability in the available body of evidence. (Grade: Grade Not Assignable)

Postpartum

A conclusion statement cannot be drawn about the relationship between sugar-sweetened beverage consumption during postpartum and postpartum weight change because there is not enough evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/sugar-sweetened-beverages_growth-obesity

Question 5. What is the relationship between low- and no-calorie sweetened beverage consumption and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review

Children and Adolescents

Low- and no-calorie sweetened beverage consumption by children and adolescents may not be associated with growth, body composition, and risk of obesity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Adults and Older Adults

Low- and no-calorie sweetened beverage consumption by adults and older adults, compared with water or lower amounts of low- and no-calorie sweetened beverages, is not associated with a change in body composition and risk of obesity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Pregnancy

A conclusion statement cannot be drawn about the relationship between low- and no-calorie sweetened beverage consumption during pregnancy and adequacy of gestational weight gain because there is no evidence available. (Grade: Grade Not Assignable)

Postpartum

A conclusion statement cannot be drawn about the relationship between low- and no-calorie sweetened beverage consumption during postpartum and postpartum weight change because there is not enough evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/low-no-calorie-beverages_growth-obesity

Question 6. What is the relationship between sugar-sweetened beverage consumption and risk of type 2 diabetes?

Approach to Answering Question: Systematic Review

Infants and Young Children Up to Age 24 Months

A conclusion statement cannot be drawn about the relationship between sugar-sweetened beverage consumption by infants and young children up to age 24 months and risk of type 2 diabetes because there is no evidence available. (Grade: Grade Not Assignable)

Children and Adolescents

A conclusion statement cannot be drawn about the relationship between sugar-sweetened beverage consumption by children and adolescents and risk of type 2 diabetes because of substantial concerns with directness in the body of evidence. (Grade: Grade Not Assignable)

Adults and Older Adults

Sugar-sweetened beverage consumption by adults and older adults may be associated with higher risk of type 2 diabetes. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

> **View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at** https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/sugar-sweetened-beverages_type-2-diabetes

Question 7. What is the relationship between low- and no-calorie sweetened beverage consumption and risk of type 2 diabetes?

Approach to Answering Question: Systematic Review

Infants, Children, and Adolescents

A conclusion statement cannot be drawn about the relationship between low- and no-calorie sweetened beverage consumption by infants, children, and adolescents and risk of type 2 diabetes because there is not enough evidence available. (Grade: Grade Not Assignable)

Adults and Older Adults

Low- and no-calorie sweetened beverage consumption by adults and older adults may not be associated with risk of type 2 diabetes. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

> **View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at** https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/low-no-calorie-beverages_type-2-diabetes

Integration

In this section the Committee integrates evidence across conclusion statements by organizing its findings by direction of association identified in its systematic reviews: favorable associations found between beverages and health outcomes, unfavorable associations found between beverages and health outcomes, no association found between beverages and health outcomes, and beverage-health outcome relationships for which a conclusion statement could not be drawn.

Favorable Associations Found Between Beverages and Health Outcomes

Two conclusion statements, both of which examined milk, identified associations between beverages and favorable health outcomes. These statements focused on 1) total milk and 2) higher-fat dairy milk in comparison to lower-fat dairy milk and the health outcomes of growth and body composition and lower risk of obesity during childhood. Both statements were for young children (ages 2 through 5 years) and were based on evidence graded as limited. These conclusion statements suggest that total milk, and higher-fat dairy milk compared to lower-fat dairy milk, may not provide excess energy for children ages 2 through 5 years. Both lower-fat and higher-fat dairy milk provide important nutrients such as protein, vitamin D, calcium, potassium, phosphorus, and magnesium.[1]

Unfavorable Associations Found Between Beverages and Health Outcomes

Four conclusion statements identified unfavorable associations between beverages and health outcomes, all of which examined SSB consumption. These conclusion statements included meta-analysis and were based on evidence graded as moderate. One statement focused on the life stages of infancy through adolescence and the association with unfavorable growth patterns and body composition and higher risk of obesity. Two conclusion statements in adults documented associations between SSB consumption and unfavorable body composition and higher risk of obesity, respectively. The fourth conclusion statement was for adults and the association of SSB consumption with higher risk of type 2 diabetes. All life stages except pregnancy and postpartum were represented in these 4 conclusion statements, which suggest that in general, SSB intake contributes to excess energy intake, which may contribute to unfavorable health outcomes. SSB also contribute to excess added sugars intake without providing beneficial nutrients. Among individuals ages 2 years and older, SSB and LNCSB contribute an average of 22 percent of daily added sugars intake for females and 27 percent for males.[17]

No Association Found Between Beverages and Health Outcomes

Eight conclusion statements identified no relationship between the beverages and health outcomes examined. Four of those statements were based on evidence graded as moderate and 4 were based on evidence graded as limited.

The statements supported by evidence graded as moderate examined relationships between 100% juice, total milk, or LNCSB with growth, body composition, and risk of obesity. Children and adolescents (100% juice) and adults (100% juice, total milk, and LCNSB) were represented in the statements based on evidence graded as moderate.

One of the conclusion statements based on evidence graded as moderate, which focused on 100% juice and growth, body composition, and risk of obesity in children and adolescents, reflected the overall evidence from this Committee's systematic review and meta-analysis of studies with populations ranging from ages 0 to 19 years. However, only 4 studies (1 included in the meta-analysis) included children from birth to 24 months, limiting applicability of this statement for young children. Furthermore, another conclusion statement developed as part of the systematic review on complementary feeding and growth, body composition, and risk of obesity determined that a conclusion could not be drawn about the relationship between 100% juice consumption by infants and young children, up to age 24 months, and outcomes related to growth patterns, body composition, and risk of obesity during childhood because there were substantial concerns with consistency, precision, risk of bias, and generalizability in the body of evidence. Current guidance in the *Dietary Guidelines for Americans, 2020-2025* states that 100% juice should not be given to children younger than 12 months and that nutrient-dense whole fruits and vegetables should be prioritized over 100% juice when feeding young children ages 12 to 24 months.

Besides this caveat, the evidence underlying these conclusion statements graded as moderate had consistent findings across the life stages examined, indicating that no association exists between consumption of these beverages (100% juice for children and adolescents; 100% juice, total milk, and

LNCSB for adults) and growth, body composition, and risk of obesity. Research that addresses methodological limitations and allows greater ability to generalize findings to the overall U.S. population would help strengthen the evidence underlying these conclusions.

The statements based on evidence graded as limited focused on 100% juice, sweetened milk, and LNCSB, and included the health outcomes of weight gain (100% juice); growth, body composition, risk of obesity (sweetened milk, LNCSB); and risk of type 2 diabetes (LNCSB). The life stages were children and adolescents (LNCSB: growth, body composition, and risk of obesity), older children and adolescents (sweetened milk: growth, body composition, and risk of obesity), and adults (100% juice: weight gain; LNCSB: risk of type 2 diabetes). The beverages included in these conclusion statements, except for sweetened milk, are generally seen as providing important nutrients or not contributing to excess added sugars or energy to the diet. As for life stage, only infants, young children ages 12 to 24 months, pregnancy, and postpartum life stages were not included in any of these statements. Given the lack of consistency in findings, small number of RCTs, and poor generalizability, more research is needed in this area.

Beverage-Health Outcome Relationships for Which a Conclusion Could Not Be Drawn

A conclusion could not be drawn for 19 of the beverage-health outcome relationships examined. All beverage types, life stages, and health outcomes examined had at least 1 conclusion statement that could not be drawn. Moreover, a conclusion statement could not be drawn regarding beverage patterns. Five of the conclusion statements indicated that no evidence was available, 9 indicated that not enough evidence was available, and 5 indicated concerns with the available evidence (e.g., quantity, directness, consistency, risk of bias). Pregnancy and postpartum were the life stages that were most represented in the conclusion statements that indicated no or not enough evidence was available.

Summary

When examined together, the conclusion statements indicate that total milk and higher-fat dairy milk may be associated with favorable health benefits for growth, body composition, and risk of obesity in children ages 2 through 5 years based on evidence graded as limited, and that SSB are associated with unfavorable health outcomes in infants, children, adolescents, and adults based on evidence graded as moderate. Despite concerns about consuming 100% juice and LNCSB and potential adverse health consequences such as excess weight gain and obesity, this Committee's systematic reviews suggest that a relationship does not exist (i.e., neither a beneficial nor an adverse relationship exists) between these beverages and growth, body composition, or risk of obesity in children, adolescents, or adults. Finally, no conclusion statements about beverages could be drawn for the life stages of pregnancy and postpartum, indicating that this area should be a research priority so that comprehensive guidance on beverage intake can be developed.

Discussion

Comparison to 2020 Dietary Guidelines Advisory Committee Findings

This Committee noted several differences when comparing its beverages conclusion statements with the 2020 Committee's beverage conclusion statements.[9] This Committee had a greater number of conclusion statements because conclusion statements were developed for additional life stages including infants and young children, pregnancy, and postpartum (the 2020 Committee was able to develop conclusion statements only for children and adults). In addition, differences in conclusion statements were found for each beverage type examined (for example, the evidence grades changed in some cases), and the Committee was also able to draw separate conclusion statements for types of milk (total milk, higher- vs. lower-fat content milk, and sweetened milk).

Milk was the beverage with the greatest change in conclusion statements. The ability to draw additional and different conclusion statements was most likely due to a larger body of evidence that enabled this Committee to more finely organize the evidence by life stage, as well as to separate the evidence for the different types of milk. For children, there was a change in directionality of associations with growth, body composition, and risk of obesity. This Committee found favorable growth and body composition and lower risk of obesity in younger children ages 2 through 5 years for total milk and higher-fat vs. lower-fat dairy milk, whereas the 2020 Committee found no relationship between total milk and adiposity in children and was unable to draw a conclusion for type of milk, including milk fat content, and adiposity in children. This Committee was also able to develop a conclusion statement for sweetened milk in older children and adolescents, which found no association with growth, body composition, or risk of obesity during childhood and was based on evidence graded as limited. The 2020 Committee determined that evidence was insufficient to draw a conclusion about the relationship between type of milk, including flavored milk, and adiposity in children. For adults, there was an increase in the strength of the evidence (from limited to moderate) for the conclusion statement of no association between total milk and growth, body composition, and risk of obesity. Finally, the life stages of pregnancy and postpartum were included in this Committee's conclusion statements, but not in the 2020 Committee's conclusion statements.

For 100% juice, the strength of the evidence underlying conclusion statements of no association with growth, body composition, and risk of obesity in children and adolescents and no association with body composition in adults increased from limited to moderate. The life stages of pregnancy and postpartum were included in this Committee's 100% juice conclusion statements, but not in the 2020 Committee's conclusion statements.

For SSB, the strength of the evidence underlying the conclusion statement for body composition and risk of obesity in adults increased from limited to moderate. Additionally, some of the observational evidence for SSB consumption by children and adolescents included longer follow-up periods (e.g., into participants' twenties or early thirties), which allowed this Committee's conclusion statement for growth, body composition, and risk of obesity to extend into outcomes measured through early adulthood. This Committee also developed a conclusion statement on SSB consumption and risk of type 2 diabetes. Unlike the 2020 Committee, this Committee did not include a separate conclusion statement on the relationship of SSB compared with LNCSB on growth, body composition, and risk of obesity. This Committee noted that results were similar between studies comparing higher amounts of SSB consumption to lower amounts of SSB consumption, consumption of SSB to water, and consumption of SSB to LNCSB, on growth, body composition, and risk of obesity. Additionally, in PCS comparing differing levels of SSB consumption, it is not clear what other beverage(s) are consumed when SSB intake is lower. Thus, this Committee decided to integrate this evidence together in drawing a conclusion statement.

Finally, for LNCSB, there was both an increase in the strength of the evidence and a change in directionality for the conclusion statement for growth, body composition, and risk of obesity in adults: from limited evidence for an association with reduced adiposity to no association, based on evidence graded as moderate. In addition, this Committee included conclusion statements for the life stages of pregnancy and postpartum, and for risk of type 2 diabetes.

Comparisons to Other Systematic Reviews and Meta-Analyses

The relationship between SSB and risk of obesity has been examined in several published systematic reviews that include both PCS and RCT. Overall, results from these systematic reviews and meta-analyses support this Committee's findings that excess calories from SSB increase risk of obesity in both adults and children. In a systematic review and meta-analysis of controlled trials that lasted 2 or more weeks and were published through April 2022, excess energy from sugars (particularly when SSB contributed 20 percent or more of total energy intake or 100 g/d of sugars from SSB) increased adiposity, whereas removal of SSB decreased adiposity. A significant increase in body weight was observed when SSB were consumed as excess calories but not in substitution trials (energy-matched replacement of sugars).[18] In another systematic review and meta-analysis, each serving/day increase in SSB intake was associated with a 0.07-kg/m^2 higher BMI in children and a 0.42-kg higher body weight in adults. In addition, RCT in children indicated less BMI gain in the presence of SSB reduction interventions compared with control groups. In adults, randomization to addition of SSB to the diet led to greater body weight gain, and removal of SSB led to weight loss, compared with control groups. A positive linear dose-response association between SSB consumption and weight gain was found.[19] In a pooled analysis of 1.5 million adults, SSB intake was associated with an increased risk of obesity.[20] In another meta-analysis of PCS, SSB intake was associated with a higher risk of obesity in adults.[2] In a separate meta-analysis, substituting water for SSB did not result in a decrease in body weight, but this result was based on only 3 trials.[5] Overall, these findings were consistent with this Committee's conclusions that an association exists between SSB consumption and unfavorable growth patterns and body composition and increased risk of obesity across most life stages.

The association of SSB with type 2 diabetes risk has been examined in several systematic reviews of PCS. In 1 meta-analysis of PCS, each additional serving/day of SSB was associated with a 27 percent higher risk of type 2 diabetes.[3] Similar findings were observed in a pooled analysis of 1.5 million adults, in which higher SSB intake was associated with a 20 percent higher risk of type 2 diabetes.[20] In another meta-analysis, each 250-mL/day increase in SSB was associated with a 19 percent increase in risk of type

2 diabetes.[2] Collectively, these findings are consistent with this Committee's findings for adults, which indicated SSB consumption may be associated with higher risk of type 2 diabetes, based on evidence graded as moderate.

The relationship between LNCSB and risk of obesity has also been examined in several systematic reviews including PCS and RCT. In 1 meta-analysis of PCS, each 250-mL/day increase in LNCSB was associated with a 21 percent higher risk of obesity.[2] In another meta-analysis of RCT, substitution of LNCSB for SSB was associated with reduced body weight (-1.06 kg), body mass index (-0.32 kg/m^2), and percentage of body fat (-0.60 percent). Substituting LNCSB for water showed no effect on body weight, body mass index, or percentage of body fat.[5] In a systematic review and meta-analysis of PCS, an increase in LNCSB intake was associated with slightly lower weight, and substitution of LNCSB for SSB was associated with lower weight and lower incidence of obesity. Substitution of LNCSB in place of water showed no adverse associations.[21] In summary, although published meta-analyses of PCS examining LNCSB and risk of obesity indicated an increased risk, another meta-analysis based on substitution of LNCSB in place of SSB showed a decreased risk. The meta-analysis of RCT also showed a reduction in risk of obesity when SSB were substituted with LNCSB. Studies based on PCS could be prone to biases, which are difficult to rule out given that effect estimates were small and people consuming LNCSB may have experienced recent weight gain, leading to reverse causation. Overall, this Committee concluded that no association exists between LNCSB and growth, body composition, and risk of obesity across most life stages, which is compatible with the published findings from both PCS and RCT indicating that LNCSB might reduce weight compared to SSB.

With regard to risk of type 2 diabetes, meta-analysis of PCS showed that for each 250-mL/day increase in LNCSB intake, risk of type 2 diabetes was 15 percent higher.[2] Another meta-analysis of PCS indicated that each additional LNCSB serving per day was associated with a 13 percent increased risk of type 2 diabetes.[3] While these meta-analyses suggested that LNCSB might increase risk of type 2 diabetes, the magnitude of the effect was small, and this finding was based solely on PCS, which are prone to biases such as residual confounding by body mass and the inability of studies to determine if individuals diagnosed with pre-diabetes begin consuming LNCSB instead of SSB, leading to reverse causation. When developing its conclusion statements on LNCSB and risk of type 2 diabetes, the Committee noted similar limitations in the evidence, and ultimately developed a conclusion statement of no association between LNCSB and risk of type 2 diabetes in adults, based on evidence graded as limited.

Notable differences exist between this Committee's findings on milk consumption and growth, body composition, and risk of obesity when compared to other systematic reviews and meta-analyses. An umbrella review of systematic reviews and meta-analyses of milk consumption in children and adults containing cross-sectional studies, PCS, and RCT found beneficial associations between milk consumption and risk of cardiovascular disease, type 2 diabetes, and obesity. However, this review did not examine the influence of the types of milk consumed and included studies published only up to April 2019. In a linear dose-response meta-analysis of PCS published up to April 2021, the risk of overweight/obesity in adults decreased 12 percent per 200-g/day increase in total milk.[22] In a meta-analysis of PCS of children and adolescents that included studies published up to October 2021, total milk consumption was marginally associated with increased prevalence and incidence of overweight. The number of studies were limited, however, especially for low- and high-fat milk.[23] In contrast, when considering types of dairy products by fat content, this Committee's conclusion statements suggest that total milk and higher-fat dairy milk compared to lower-fat dairy milk may not contribute excessive energy for younger children ages 2 through 5 years.

In a systematic review and meta-analysis of PCS examining 100% fruit juice intake by children, greater consumption of 100% fruit juice was associated with increases in body mass index.[7] In comparison, this Committee found no association between 100% juice consumption and risk of obesity in children and adolescents, supported by evidence graded as moderate. These differences could be explained by this Committee examining outcomes in addition to BMI, and differences in the inclusion criteria between the 2 reviews. Further, the other systematic review with meta-analysis found that the increase in BMI was small, only 5 of 23 studies reported a significant positive association, and heterogeneity was high. No RCT evidence in children was reported. Additionally, authors reported that RCT in adults did not find a relationship between 100% fruit juice intake and body weight. Yet, PCS in adults found a significant association among studies unadjusted for total energy, suggesting potential mediation by calories. The results were highly heterogenous; of 8 studies, 4 reported a significant positive association, 2 reported a significant inverse association, and 2 reported a non-significant association.[7] In comparison, largely because of the inconsistency in the direction of the results from the PCS and a null RCT, this Committee concluded there was no association between 100% juice consumption and body composition and weight gain in adults and graded the evidence for weight gain as limited.

Committee's Advice to the Departments

Findings from the systematic reviews support existing general recommendations for beverage consumption provided in the *Dietary Guidelines for Americans, 2020-2025*, emphasizing water and beverages that contribute beneficial nutrients, such as fat-free and low-fat milk and 100% juices; and that intake of beverages (e.g., SSB) that contain calories while contributing limited or no beneficial nutrients, or that contribute to intakes of added sugars and saturated fat, should be reduced.

While this Committee did not specifically examine coffee and tea in its systematic reviews, data from the Committee's data analyses support existing recommendations that coffee, tea, and flavored waters are also options, but that the most nutrient-dense options include little, if any, sweeteners or cream. Coffee and tea without sweeteners or cream contain relatively few calories and contribute to nutrient intakes. For example, coffee and tea contribute 9 to 11 percent of potassium intakes for adults ages 19 years and older. However, coffee and tea also contribute 13 to 14 percent of added sugars intakes for adults ages 19 years and older,[17] reinforcing the importance of consuming coffee and tea with minimal or no sweeteners.

It is also important to note that coffee and tea often contain caffeine. The *Dietary Guidelines for Americans, 2020-2025* provides information about safe levels of caffeine consumption and this Committee recommends carrying that information forward in the next edition of the *Dietary Guidelines for Americans*.

The Committee suggests enhancements to these existing recommendations for the *Dietary Guidelines for Americans, 2025-2030*:

- The *Dietary Guidelines for Americans, 2020-2025* states that the primary beverages consumed should be calorie-free beverages (especially water) and beverages that contribute beneficial nutrients; however, it is unclear what is meant by “calorie-free beverages.” The Committee suggests that the 2025-2030 edition specifically recommend plain drinking water as the primary beverage for people to consume. Water beverages flavored with a small amount of 100% fruit juice may also be suggested as a healthy option.
- Recommended milk consumption should be specified as unsweetened fat-free and low-fat dairy milk and unsweetened fortified soy beverages. For younger children ages 2 through 5 years, the Committee found that higher-fat dairy milk (in comparison to lower-fat dairy milk) may be associated with favorable growth and body composition, and lower risk of obesity during childhood, based on evidence graded as limited. The Committee could not draw a conclusion about the relationship between consumption of milk with different fat content by older children, adolescents, adults, or older adults and growth, body composition, or risk of obesity because of substantial concerns with the body of evidence. Additionally, for older children and adolescents, the Committee found that there may not be a relationship between consumption of sweetened milk and growth, body composition, and risk of obesity, based on evidence graded as limited. The Committee was not able to draw a conclusion for the relationship between consumption of sweetened milk by younger children, adults, or older adults and growth, body composition, or risk of obesity because there was no evidence available. Sweetened dairy milk and fortified soy beverages contain beneficial nutrients, and they also contain added sugars, which should be limited as illustrated in **Part D. Chapter 10: Food Group and Subgroup Analyses**. The Committee decided that evidence is not sufficient to advise changing the *Dietary Guidelines for Americans, 2020-2025* recommendations for primary consumption of unsweetened fat-free and low-fat milk across the lifespan.
- The *Dietary Guidelines for Americans, 2020-2025* does not recommend consumption of cow milk or fortified soy beverages in place of human milk or infant formula before age 12 months. This Committee concurs with this guidance. Whole-fat unsweetened dairy milk or fortified unsweetened soy beverages can be offered to children ages 12 through 23 months, with transition to fat-free and low-fat unsweetened dairy milks starting at age 24 months. This is consistent with a consensus statement from the Academy of Nutrition and Dietetics (AND), the American Academy of Pediatric Dentistry (AAPD), the American Academy of Pediatrics (AAP), and the American Heart Association (AHA) on healthy beverage consumption in early childhood.[24]
- With regard to products that are added to beverages, this Committee recommends that products containing high amounts of calories and saturated fat and/or added sugars (such as half & half, cream, non-dairy creamers, and flavorings with added sugars such as syrups) should be replaced with versions lower in saturated fat and added sugars.

- For SSB and other beverages that contain added sugars with minimal or no beneficial nutrients, recommendations should state to limit intakes rather than to reduce/decrease them. The conclusion statements that found an association between SSB and unfavorable growth patterns and body composition, and higher risk of obesity, in childhood through early adulthood; and with unfavorable body composition, higher risk of obesity, and increased risk of type 2 diabetes in adults were based on evidence graded as moderate. The *Dietary Guidelines for Americans, 2020-2025* states that these beverages are not necessary in the diets of children and adolescents and recommends decreasing consumption. These recommendations should be strengthened to state that children and adolescents should limit SSB. Similarly, an AHA scientific statement recommends that children and adolescents limit intake of SSB to 1 or fewer 8-oz beverages per week,[25] and a consensus statement from AND, AAPD, AAP, and AHA recommends SSB and flavored milk not be consumed by children younger than age 5 years.[24] Similarly for adults, recommendations should continue to emphasize limiting consumption of beverages that contain added sugars.

The Committee also highlights other considerations for beverage consumption guidance:

- The *Dietary Guidelines for Americans, 2020-2025* states that replacement of added sugars with low- and no-calorie sweeteners in beverages may aid in short-term weight management, but questions remain about their long-term effectiveness. The Committee found that LNCSB may not be associated with growth, body composition, and risk of obesity in children and adolescents (supported by evidence graded as limited), and that they may not be associated with change in body composition and risk of obesity (supported by evidence graded as moderate) and risk of type 2 diabetes (supported by evidence graded as limited) in adults. Given continuing questions and uncertainty about the long-term effectiveness of LNCSB for weight management, emphasis should be on consumption of water and nutrient-dense beverages. This is particularly important for children; a consensus statement from AND, AAPD, AAP, and AHA recommends that children younger than 5 years not consume LNCSB.[24]
- Though the Committee found insufficient evidence to generate conclusion statements for associations of beverage consumption with gestational weight gain and postpartum weight change, general beverage recommendations still apply to pregnant and postpartum populations. The *Dietary Guidelines for Americans, 2020-2025* only mentions moderation of caffeine intakes during pregnancy and lactation; however, increased hydration and nutrient intakes are critical during these time periods.[26] The next edition of the *Dietary Guidelines for Americans* should clearly state that water and nutrient-dense beverages should be the primary beverages consumed during pregnancy and lactation.

References

1. Cruz CM, DeSilva D, Beckman K, et al. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Patterns of Food and Beverage Intake. 2024;doi:https://doi.org/10.52570/DA.DGAC2025.DA01
2. Qin P, Li Q, Zhao Y, et al. Sugar and artificially sweetened beverages and risk of obesity, type 2 diabetes mellitus, hypertension, and all-cause mortality: a dose-response meta-analysis of prospective cohort studies. *Eur J Epidemiol*. Jul 2020;35(7):655-671. doi:https://doi.org/10.1007/s10654-020-00655-y
3. Meng Y, Li S, Khan J, et al. Sugar- and Artificially Sweetened Beverages Consumption Linked to Type 2 Diabetes, Cardiovascular Diseases, and All-Cause Mortality: A Systematic Review and Dose-Response Meta-Analysis of Prospective Cohort Studies. *Nutrients*. Jul 30 2021;13(8)doi:https://doi.org/10.3390/nu13082636
4. Pan B, Ge L, Lai H, et al. Association of soft drink and 100% fruit juice consumption with all-cause mortality, cardiovascular diseases mortality, and cancer mortality: A systematic review and dose-response meta-analysis of prospective cohort studies. *Crit Rev Food Sci Nutr*. 2022;62(32):8908-8919. doi:https://doi.org/10.1080/10408398.2021.1937040
5. McGlynn ND, Khan TA, Wang L, et al. Association of Low- and No-Calorie Sweetened Beverages as a Replacement for Sugar-Sweetened Beverages With Body Weight and Cardiometabolic Risk: A Systematic Review and Meta-analysis. *JAMA Netw Open*. Mar 1 2022;5(3):e222092. doi:https://doi.org/10.1001/jamanetworkopen.2022.2092
6. Zhang X, Chen X, Xu Y, et al. Milk consumption and multiple health outcomes: umbrella review of systematic reviews and meta-analyses in humans. *Nutr Metab (Lond)*. Jan 7 2021;18(1):7. doi:https://doi.org/10.1186/s12986-020-00527-y
7. Nguyen M, Jarvis SE, Chiavaroli L, et al. Consumption of 100% Fruit Juice and Body Weight in Children and Adults: A Systematic Review and Meta-Analysis. *JAMA Pediatr*. Mar 1 2024;178(3):237-246. doi:https://doi.org/10.1001/jamapediatrics.2023.6124
8. Dietary Guidelines Advisory Committee. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. 2020. https://doi.org/10.52570/DGAC2020
9. Mayer-Davis E, Leidy H, Mattes R, et al. Beverage Consumption and Growth, Size, Body Composition, and Risk of Overweight and Obesity: A Systematic Review. 2020;USDA Nutrition Evidence Systematic Reviews. doi:https://doi.org/10.52570/nesr.dgac2020.sr0401
10. Raynor HA, Deierlein AL, Gardner CD, et al. *Beverage Patterns and Growth, Body Composition, and Risk of Obesity: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR02
11. Raynor HA, Deierlein AL, Gardner CD, et al. *Dairy Milk and Milk Alternatives and Growth, Body Composition, and Risk of Obesity: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR03
12. Deierlein AL, Raynor HA, Andres A, et al. *100% Juice and Growth, Body Composition, and Risk of Obesity: A Systematic Review with Meta-Analysis*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR05
13. Deierlein AL, Raynor HA, Andres A, et al. *Sugar-Sweetened Beverages and Growth, Body Composition, and Risk of Obesity: A Systematic Review with Meta-Analysis*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR23
14. Raynor HA, Deierlein AL, Gardner CD, et al. *Low- and No-Calorie Sweetened Beverages and Growth, Body Composition, and Risk of Obesity: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR04
15. Giovannucci E, Taylor C, Deierlein A, et al. *Sugar-Sweetened Beverages and Risk of Type 2 Diabetes: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service,

Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR14

16. Giovannucci E, Taylor C, Deierlein A, et al. *Low- and No-Calorie Sweetened Beverages and Risk of Type 2 Diabetes: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR15
17. Cruz CM, DeSilva D, Beckman K, et al. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Nutrients and Dietary Components. 2024;doi:https://doi.org/10.52570/DA.DGAC2025.DA03
18. Chiavaroli L, Cheung A, Ayoub-Charette S, et al. Important food sources of fructose-containing sugars and adiposity: A systematic review and meta-analysis of controlled feeding trials. *Am J Clin Nutr*. Apr 2023;117(4):741-765. doi:https://doi.org/10.1016/j.ajcnut.2023.01.023
19. Nguyen M, Jarvis SE, Tinajero MG, et al. Sugar-sweetened beverage consumption and weight gain in children and adults: a systematic review and meta-analysis of prospective cohort studies and randomized controlled trials. *Am J Clin Nutr*. Jan 2023;117(1):160-174. doi:https://doi.org/10.1016/j.ajcnut.2022.11.008
20. Santos LP, Gigante DP, Delpino FM, Maciel AP, Bielemann RM. Sugar sweetened beverages intake and risk of obesity and cardiometabolic diseases in longitudinal studies: A systematic review and meta-analysis with 1.5 million individuals. *Clin Nutr ESPEN*. Oct 2022;51:128-142. doi:https://doi.org/10.1016/j.clnesp.2022.08.021
21. Lee JJ, Khan TA, McGlynn N, et al. Relation of Change or Substitution of Low- and No-Calorie Sweetened Beverages With Cardiometabolic Outcomes: A Systematic Review and Meta-analysis of Prospective Cohort Studies. *Diabetes Care*. Aug 1 2022;45(8):1917-1930. doi:https://doi.org/10.2337/dc21-2130
22. Feng Y, Zhao Y, Liu J, et al. Consumption of Dairy Products and the Risk of Overweight or Obesity, Hypertension, and Type 2 Diabetes Mellitus: A Dose-Response Meta-Analysis and Systematic Review of Cohort Studies. *Adv Nutr*. Dec 22 2022;13(6):2165-2179. doi:https://doi.org/10.1093/advances/nmac096
23. Babio N, Becerra-Tomas N, Nishi SK, et al. Total dairy consumption in relation to overweight and obesity in children and adolescents: A systematic review and meta-analysis. *Obes Rev*. Jan 2022;23 Suppl 1:e13400. doi:https://doi.org/10.1111/obr.13400
24. Lott M CE, Welker Duffy E, Story M, Daniels S. *Healthy Beverage Consumption in Early Childhood: Recommendations from Key National Health and Nutrition Organizations.* 2019. https://healthyeatingresearch.org/wp-content/uploads/2019/09/HER-HealthyBeverageTechnicalReport.pdf.
25. Vos MB, Kaar JL, Welsh JA, et al. Added Sugars and Cardiovascular Disease Risk in Children: A Scientific Statement From the American Heart Association. *Circulation*. May 9 2017;135(19):e1017-e1034. doi:https://doi.org/10.1161/cir.0000000000000439
26. Bardosono S, Morin C, Guelinckx I, Pohan R. Pregnant and Breastfeeding Women: Drinking for Two? *Ann Nutr Metab*. 2017;70 Suppl 1:13-17. doi:https://doi.org/10.1159/000462998

Part D. Chapter 4: Food Sources of Saturated Fat

Introduction

The recommendation to limit consumption of saturated fat has been one of the most consistent recommendations in the *Dietary Guidelines for Americans (Dietary Guidelines)* since the first edition was published in 1980. Guidance has been informed by a large body of consistent, high-quality evidence on the role of saturated fat in the development and progression of cardiovascular disease. The *Dietary Guidelines* recommendation for reducing saturated fat intake has been affirmed by several Dietary Guidelines Advisory Committees, each of which reviewed evidence on saturated fat intake and health that was current at the time.

The *Dietary Guidelines for Americans, 2020-2025* contains a key recommendation to limit saturated fat intake to less than 10 percent of calories per day starting at age 2 years.[1] The 2005 edition of the *Dietary Guidelines* was the first to include this quantitative limit for saturated fat intake and stated that most fats should come from monounsaturated (MUFA) and polyunsaturated fatty acids (PUFA).[2] The 2010 edition was the first to specify that saturated fatty acids should be replaced with MUFA and PUFA based on systematic reviews conducted by the 2010 Dietary Guidelines Advisory Committee.[3,4] The 2015–2020 edition of the *Dietary Guidelines* reiterated this recommendation,[5] based on evidence reviewed by the 2015 Committee that found that replacing saturated fats with unsaturated fats is associated with reduced risk of cardiovascular disease.[6] The *Dietary Guidelines for Americans, 2020–2025* carried forward previous quantitative recommendations for limiting saturated fat and replacing it with unsaturated fats, particularly PUFA, and highlighted the importance of consuming a healthy dietary pattern. Because the 2020–2025 edition included infants and young children from birth to 24 months, it also clarified that the quantitative saturated fat recommendation applies starting at age 2. Despite the consistency of the saturated fat recommendation over time, less than 20 percent of U.S. individuals ages 1 year and older[a] currently meet it.[7]

This chapter provides key background information about food sources of saturated fat and cardiovascular disease, including the evolution of the evidence base that led to current recommendations for a quantitative intake limit on saturated fat. This Committee is the first to formally evaluate food-based comparisons of saturated fat to inform guidance. This chapter presents the results of a systematic review examining the potential impacts on cardiovascular disease-related endpoints (i.e., cardiovascular disease morbidity and mortality) and intermediate outcomes (i.e., cardiovascular disease risk factors, including blood lipids and blood pressure) when food sources of saturated fat are substituted or replaced with a range of comparator food sources. The chapter also integrates and discusses the results of this systematic review and provides the Committee's advice to the Departments for developing the *Dietary Guidelines for Americans, 2025-2030.*

---

[a]No quantitative limit on saturated fat exists for individuals younger than age 2 years, but data were analyzed for the population ages 1+ years. For more information on data analysis, see **Part D. Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions**.

Evolving Evidence on Saturated Fat and Health

Evidence for the deleterious effects of saturated fat on total blood cholesterol and low-density lipoprotein cholesterol (LDL-C) is well-established.[8-10] This evidence is supported by randomized controlled trials (RCT), many of which used crossover designs with multiple treatment arms and involved manipulating saturated fat vs. unsaturated fat intake while holding other dietary parameters as constant as possible between arms (e.g., calories, amount of total dietary fat, fiber).[11] This reductionist approach typically used a food vehicle such as muffins and allowed for a direct assessment of the impact of type of fat (e.g., saturated), controlling for other potential confounders. Collectively, these studies and others provided evidence to support recommendations to lower saturated fat intake and to keep total saturated fat intake in the diet below 10 percent of energy intake.

Reducing intake of saturated fat often involves substituting or replacing food sources of saturated fat with other foods. When a food source of saturated fat is substituted or replaced with another food, the impact can be complex—i.e., it can involve more than simply reducing saturated fat intake—depending on the replacement food and the nutrients and dietary components it contains. For example, relative to red meat and dairy, beans, peas, and lentils are not only lower in saturated fat, but also contain fiber. Higher fiber intake is associated with cardiovascular disease benefits.[12,13] As another example, relative to red meat and dairy, seafood and fish are not only lower in saturated fat, but also higher in omega-3 fats. Higher omega-3 fat intake from seafood/fish is associated with cardiovascular disease benefits.[14,15] As a third example, relative to red meat and dairy, eggs are lower in saturated fat but higher in dietary cholesterol, which has been associated (albeit inconsistently) with increased cardiovascular disease risk.[16-18]

Seminal work has been done using substitution models to examine data from observational studies on saturated fat intake compared with intake of MUFA, PUFA, *trans* fatty acids, and carbohydrates on cardiovascular disease mortality and morbidity outcomes.[19,20] These studies indicate that higher saturated fat intake is associated with higher cardiovascular disease morbidity and mortality. These studies also indicate that substituting saturated fat with an isocaloric intake of:

- *trans* fat is associated with even higher cardiovascular disease morbidity and mortality;
- carbohydrates from refined starches and added sugars is associated with similar cardiovascular disease morbidity and mortality; and
- MUFA, PUFA, or carbohydrates from whole grains is associated with lower cardiovascular disease morbidity and mortality.

A 2017 Presidential Statement from the American Heart Association on Dietary Fats and Cardiovascular Disease had similar conclusions about the associations with cardiovascular disease mortality and morbidity outcomes when saturated fat is replaced with various nutrients.[21] Thus, although current studies have isolated the effects of individual fatty acids or other nutrients on cardiovascular disease mortality and morbidity outcomes, as well as effects on blood lipids, foods contain various fatty acids and other nutrients, so a focus on food sources of saturated fat is more appropriate for dietary guidance.

A Food Sources Approach

The 2020 Committee's systematic review concluded that strong and consistent evidence from RCT demonstrates that replacing saturated fat with unsaturated fats, especially PUFA, in adults significantly reduces total and LDL-C.[22] It also concluded that strong evidence demonstrates that replacing saturated fat with PUFA in adults reduces the incidence of coronary heart disease events and cardiovascular disease mortality. However, it concluded that in adults, limited evidence was available regarding whether replacing saturated fatty acids with MUFA confers overall cardiovascular disease endpoint health benefits. The Committee noted that a major source of uncertainty was the co-occurrence of saturated fatty acids and MUFA within food sources of animal fat, obscuring the ability to infer a conclusion for saturated fat compared to MUFA.

The 2025 Committee decided to approach this topic from a food perspective, rather than from a nutrient perspective, to help a greater proportion of the U.S. population achieve the recommendation for less than 10 percent of energy from saturated fat. Public comments and recommendations from the 2020 Committee requested that this Committee examine the issue of food sources of saturated fat.[23] Further, as the current edition of the *Dietary Guidelines* notes, saturated fat is commonly found in higher amounts in high-fat meat, full-fat dairy products (e.g., whole milk, ice cream, cheese), butter, coconut oil, and palm kernel and palm oil. Such foods higher in saturated fat can be replaced or substituted in the diet with a wide range of foods and food groups. As noted earlier, the specific food consumed in place of a food source higher in saturated fat involves concomitant changes in the other nutrients found in those foods.

Specifying a comparator food is a necessary step in developing the hypothesis and design of single-food dietary intervention trials and nutrition feeding studies. In contrast, observational epidemiologic analyses examining single foods can be performed regardless of whether the comparator food is specified. However, even if the comparator food is not specified, participants who consume less of the exposure food of interest are still assumed to be consuming similar quantities of other food(s) in its place. Therefore, the estimates from analyses that do not specify the comparator food are, by default, estimating the relative risk of the exposure food of interest vs. an unspecified weighted average of "everything else in the diet" and cardiovascular disease risk.[24] This lack of specificity does not impact the internal validity of the results, but does become problematic when the findings are interpreted and synthesized with other studies that have differences in the composition of foods and beverages comprising "everything else," i.e., different background diets. Therefore, defining and modeling the comparator food that is substituted for the exposure food of interest (e.g., fish vs. red meat) serves to improve the interpretation of effect estimates generated in observational analyses and reduces heterogeneity to facilitate the synthesis of evidence across a large, global, and diverse body of evidence.[25] As such, food-level substitution analyses have continued to build on previous studies of saturated fat and saturated fat-containing foods in observational cohorts, and the epidemiologic evidence from food substitution analyses was included in this systematic review.[24]

Throughout this chapter, the term "substitute" is used when the evidence came primarily from substitution analyses of PCS. "Replace" is used when evidence came primarily from trials.

Setting the Review Criteria

The systematic review presented in this chapter directly addresses the relationship between cardiovascular disease risk when comparing the main food sources of saturated fat (i.e., dairy; meat; and plant sources higher in saturated fat, primarily palm oil, coconut oil, and cocoa butter) with other foods that include: similar foods with different amounts of saturated fat (e.g., lower-fat versions of dairy and meat), foods with primarily unsaturated fats (e.g., food sources higher in MUFA/PUFA such as nuts, fish, and oils higher in unsaturated fats), food sources of carbohydrate or protein (e.g., beans/peas/lentils, vegetables, grains), and different food sources of saturated fat (e.g., milk compared to yogurt). Because mixed dishes and other food products frequently contain food sources of saturated fat as ingredients (e.g., butter in baked goods), these foods and food groups were beyond the scope of this review.

The systematic review question addresses the outcome of cardiovascular disease risk. Per the protocol, that was defined broadly as cardiovascular disease mortality; morbidity; and cardiovascular disease intermediate outcomes, including blood lipids and blood pressure. Therefore, when conclusion statements were developed, they were written to reflect the outcomes examined in the studies reviewed. When no grade was assignable, the outcome was typically listed as “cardiovascular disease” because it was not necessary to differentiate among morbidity, mortality, or intermediate outcomes.

When dairy and meat were the intervention/exposure, many of the studies that met inclusion criteria were prospective cohort studies (PCS) that conducted substitution analyses and estimated the effects on cardiovascular disease morbidity and mortality. Among the smaller number of RCT that met inclusion criteria for this question, most examined plant sources higher in saturated fat as the intervention/exposure and the most frequently examined outcomes were cardiovascular disease intermediate outcomes, which for the purposes of this review included only blood lipids (LDL-C, HDL-C, and triglycerides), blood pressure (systolic blood pressure and diastolic blood pressure), and hypertension. Whereas there is a strong established mechanism for saturated fat influencing blood lipids, specifically LDL-C, there is no similarly strong mechanistic link with blood pressure. Therefore, the graded conclusion statements often focus only on blood lipids, and in many cases only on LDL-C. Blood pressure did not change in response to food sources of saturated fat compared to various comparators in any of the conclusions.

Summary

Since the first edition of the *Dietary Guidelines* was published in 1980, each edition has consistently recommended limiting consumption of saturated fat. More than 80 percent of the U.S. population ages 1 year and older exceeds the quantitative saturated fat limit of 10 percent of calories per day.[7] Consistent with the food focus of the *Dietary Guidelines*, this chapter takes an approach that builds on the foundation of past recommendations regarding food sources of saturated fat intake. Foods that differ in saturated fat content also often differ in other nutrients and dietary components that have important and established cardiometabolic effects. Substantial efforts will be required to shift saturated fat intakes into better alignment with recommendations, and choice of the replacement food is an important consideration.

Question

1. What is the relationship between food sources of saturated fat consumed and risk of cardiovascular disease?[26]

Conclusion Statements

What is the relationship between food sources of saturated fat consumed and risk of cardiovascular disease?

Approach to Answering Question: Systematic Review

The conclusion statements presented in this section resulted from the Committee's detailed comparison of specific foods sources of saturated fat vs. other specific food sources, as described in the "Setting the Review Criteria" section of this chapter's Introduction.

The conclusion statements are organized by directionality (i.e., whether or not there is a difference in cardiovascular disease risk), whether the conclusion statement was graded or a grade was not assignable, and by life stage. Within those categories, conclusion statements are further organized by saturated fat exposure (i.e., dairy, meat, or plant sources higher in saturated fat).

During synthesis, comparators were grouped based on the following:

- Similar foods with different amounts of saturated fat: Examples include lower-fat versions of milk, meat, and cheese.
- Food sources of carbohydrate and/or protein: Examples include beans, peas, and lentils; vegetables; and grains; considered broadly as plant-based foods (that included predominantly whole plant foods) or parsed into plant sources of protein, vegetables, or whole grains, as evidence permitted.
- Food sources of unsaturated fatty acids: Examples include plant-based oils and spreads (such as olive oil and olive-oil based spreads), vegetable oils higher in unsaturated fat (such as olive oil, soybean oil, corn oil, safflower oil, sunflower oil), nuts, fish, and avocado.
- Different food sources of saturated fat: Examples include milk compared to yogurt and cocoa butter compared to palm olein.

Conclusion Statements that Identified Decreased Cardiovascular Disease Risk When Food Sources of Saturated Fat are Substituted or Replaced: Adults and Older Adults

Butter and Dairy Products Compared to Food Sources of Unsaturated Fatty Acids

Butter Compared to Plant-Based Oils and Spreads with Predominantly Unsaturated Fatty Acids

Replacing butter with plant-based oils and spreads, with predominantly unsaturated fatty acids, by adults and older adults decreases LDL-C levels but does not affect HDL-C or triglyceride levels. This conclusion statement is based on evidence graded as strong. (Grade: Strong)

Substituting butter with plant-based oils and spreads, with predominantly unsaturated fatty acids, by adults and older adults may be associated with a decreased risk of cardiovascular disease morbidity and mortality. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Dairy Compared to Food Sources of Unsaturated Fatty Acids

Substituting dairy with food sources of unsaturated fatty acids by adults and older adults may be associated with a lower risk of cardiovascular disease. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Meat Compared to Dairy Sources of Saturated Fat

Substituting processed meat and red meat with dairy by adults and older adults is associated with a lower risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Meat Compared to Plant-Based Food Sources

Red Meat Compared to Plant Sources of Protein

Substituting processed or unprocessed red meat with plant sources of protein (such as beans, peas, lentils, nuts, seeds, or soy) by adults and older adults is associated with lower risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Red Meat Compared to Whole Grains

Substituting processed or unprocessed red meat with whole grains by adults and older adults is associated with lower risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Red Meat Compared to Vegetables

Substituting processed or unprocessed red meat with vegetables by adults and older adults is associated with lower risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Plant Sources Higher in Saturated Fat Compared to Vegetable Oils Higher in Unsaturated Fat

Replacing plant sources higher in saturated fat, including coconut oil, cocoa butter, and palm oil, with vegetable oils higher in unsaturated fat, by adults and older adults decreases LDL-C and has no effect on blood pressure. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Conclusion Statements that Identified No Difference in Cardiovascular Disease Risk: Adults and Older Adults

Dairy Sources of Saturated Fat Compared to Other Dairy Sources of Saturated Fat

Dairy with Different Amounts of Total Fat

Substituting higher-fat dairy with lower-fat dairy by adults and older adults is not associated with a difference in risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Comparing One Form of Dairy to Another Form of Dairy

Substituting or replacing one form of dairy (including milk, yogurt, cheese, butter,[b] and buttermilk) with another form of dairy by adults and older adults is not associated with a difference in risk of cardiovascular disease. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Meat Sources of Saturated Fat Compared to White Meat

Lean, Unprocessed Red Meat Compared to Lean, Unprocessed White Meat

Replacing consumption of lean, unprocessed red meat with lean, unprocessed white meat by adults and older adults may not affect blood lipids or blood pressure. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Processed or Unprocessed Red Meat Compared to White Meat

Substituting processed or unprocessed red meat with white meat by adults and older adults is not associated with risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Meat Sources of Saturated Fat Compared to Other Animal-Based Foods

Processed or Unprocessed Red Meat Compared to Fish or Seafood

Substituting processed or unprocessed red meat with fish or seafood by adults and older adults may not be associated with risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Processed or Unprocessed Red Meat Compared to Eggs

Substituting processed or unprocessed red meat with eggs by adults and older adults is not associated with risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

White Meat Compared to Fish or Seafood

Substituting white meat with fish or seafood by adults and older adults is not associated with risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

---

[b]Butter is not included within the current Dairy and Fortified Soy Alternatives Food Group but was grouped with other forms of dairy for this conclusion statement due to its common origin from cow's milk.

White Meat Compared to Plant-Based Foods

Substituting white meat with plant-based foods by adults and older adults is not associated with risk of cardiovascular disease morbidity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Palm Olein Compared to Vegetable Oils Higher in Unsaturated Fat

Replacing palm olein with vegetable oils higher in unsaturated fat by adults and older adults may not affect blood lipids. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Relationships for Which Conclusion Statements Could Not Be Drawn: Adults and Older Adults

Dairy Sources of Saturated Fat

Higher-Fat Dairy Compared to Lower-Fat Dairy

A conclusion statement cannot be drawn about the relationship between higher-fat dairy consumption, compared to their lower-fat versions, by adults and older adults and blood lipids, blood pressure, and cardiovascular disease mortality because there is not enough evidence available. (Grade: Grade Not Assignable)

Dairy Products Compared to Food Sources of Carbohydrate and Protein

A conclusion statement cannot be drawn about the relationship between consumption of dairy compared to food sources of carbohydrates and protein by adults and older adults and risk of cardiovascular disease because of substantial concerns with consistency in the body of evidence. (Grade: Grade Not Assignable)

Meat Sources of Saturated Fat Compared to Other Meat Sources

Red Meat with Different Amounts of Saturated Fat

A conclusion statement cannot be drawn about the relationship between consumption of red meat with different amounts of saturated fat by adults and older adults and risk of cardiovascular disease because there is not enough evidence available. (Grade: Grade Not Assignable)

White Meat with Different Amounts of Saturated Fat

A conclusion statement cannot be drawn about the relationship between consumption of white meat with different amounts of saturated fat by adults and older adults and risk of cardiovascular disease because there is no evidence available. (Grade: Grade Not Assignable)

Processed Red Meat Compared to Unprocessed Red Meat

A conclusion statement cannot be drawn about the relationship between consumption of processed red meat compared to unprocessed red meat by adults and older adults and risk of cardiovascular disease because there is not enough evidence available. (Grade: Grade Not Assignable)

Processed White Meat Compared to Unprocessed White Meat

A conclusion statement cannot be drawn about the relationship between consumption of processed white meat compared to unprocessed white meat by adults and older adults and risk of cardiovascular disease because there is no evidence available. (Grade: Grade Not Assignable)

Meat Sources Compared to Plant-Based Foods

Unprocessed Meat Consumption Compared to Plant-Based Foods

A conclusion statement cannot be drawn about the effects of unprocessed meat consumption compared to plant-based foods by adults and older adults on blood lipids or blood pressure because of substantial concerns with consistency of the comparator, directness, risk of bias, and precision in the body of evidence. (Grade: Grade Not Assignable)

Meat Sources of Saturated Fat Compared to Plant Sources of Saturated Fat

A conclusion statement cannot be drawn about the relationship between consumption of meat sources of saturated fat compared to plant sources of saturated fat by adults and older adults and risk of cardiovascular disease because there is no evidence available. (Grade: Grade Not Assignable)

Dairy Compared to Meat

A conclusion statement cannot be drawn about the relationship between replacing dairy with meat consumption by adults and older adults and blood lipids, blood pressure, and cardiovascular disease mortality because there is not enough evidence available. (Grade: Grade Not Assignable)

Plant Sources Higher in Saturated Fat

Plant Sources Higher in Saturated Fat Compared to Food Sources of Carbohydrate or Protein

A conclusion statement cannot be drawn about the relationship between consumption of plant sources higher in saturated fat, compared to food sources of carbohydrate or protein, by adults and older adults and risk of cardiovascular disease because there is not enough evidence available. (Grade: Grade Not Assignable)

Plant Sources Higher in Saturated Fat Compared to Different Food Sources of Saturated Fat

A conclusion statement cannot be drawn about the relationship between consumption of plant sources higher in saturated fat, compared to a different food source of saturated fat (including dairy, meat, or another plant source of saturated fat), by adults and older adults and risk of cardiovascular disease because there is not enough evidence available. (Grade: Grade Not Assignable)

Relationships for Which Conclusion Statements Could Not Be Drawn: Children and Adolescents

Dairy Sources of Saturated Fat

A conclusion statement cannot be drawn about dairy sources of saturated fat and different comparators consumed by children and adolescents and the relationship with blood lipids or blood pressure because there is not enough evidence available. Comparators considered included similar food sources with different amounts of total fat; food sources of unsaturated fat, carbohydrate, or protein; or a different food source of saturated fat. (Grade: Grade Not Assignable)

Meat Sources of Saturated Fat

A conclusion statement cannot be drawn about meat sources of saturated fat (including red meat, processed meat, and white meat) and different comparators consumed by children and adolescents and the relationship with blood lipids or blood pressure because there is no evidence available. Comparators considered included similar food sources with different amounts of total fat; food sources of unsaturated fat, carbohydrate, or protein; or a different food source of saturated fat. (Grade: Grade Not Assignable)

Plant Sources Higher in Saturated Fat

A conclusion statement cannot be drawn about plant sources higher in saturated fat (such as palm oil, coconut oil, or cocoa butter) and different comparators consumed by children and adolescents and the relationship with blood lipids or blood pressure because there is no evidence available. Comparators considered included similar food sources with different amounts of total fat; food sources of unsaturated fat, carbohydrate, or protein; or a different food source of saturated fat. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/food-sources-saturated-fat_cardiovascular-disease.

Integration

To help integrate and summarize evidence across its 31 conclusion statements, the Committee grouped conclusion statements into categories based on the direction of effects on health outcomes (i.e., interventions/exposures that have a beneficial effect on cardiovascular disease risk compared to their comparators and interventions/exposures that do not differ in their effects on cardiovascular disease outcomes compared to their comparators) and whether the conclusion statement was graded or a grade was not assignable. This organization reflects the order in which the conclusions statements were presented in the preceding section.

Despite ongoing efforts to address potential differences that may exist in findings across age groups, all conclusions that the Committee found sufficient evidence to grade focused on adults and older adults.

Favorable Differences in Cardiovascular Disease Health Outcomes Found When Substituting/Replacing Food Sources of Saturated Fat

For the 8 conclusion statements related to favorable cardiovascular disease health outcomes in adults and older adults, 1 had evidence graded as strong, 5 had evidence graded as moderate, and 2 had evidence graded as limited.

The association between the replacement of butter with other oils and spreads with predominantly unsaturated fatty acids and lower LDL-C was graded as strong, which is consistent with previous evidence.[8-10,27] The evidence for the association between substituting butter with plant-based oils and spreads with predominantly unsaturated fatty acids and lower cardiovascular disease morbidity and mortality was graded as limited, due to concerns with consistency in the findings and generalizability.

The evidence underlying the following conclusion statements was graded as moderate:

- Substituting processed meat and red meat with dairy products and lower risk of cardiovascular disease morbidity.
- Substituting processed or unprocessed red meat with any of the plant-based food groups examined (plant sources of protein, whole grains, or vegetables) and lower risk of cardiovascular disease morbidity.
- Replacing plant sources higher in saturated fat, such as coconut oil, cocoa butter, and palm oil, with vegetable oils higher in unsaturated fat and lower LDL-C.

The association between substituting dairy with food sources of unsaturated fatty acids, which included oils (e.g., olive oil) and other food sources of MUFA/PUFA, such as nuts and fish, was graded as limited.

No Differences in Cardiovascular Disease Health Outcomes Found When Substituting/Replacing Food Sources of Saturated Fat

Five conclusion statements that found no relationships between different food sources of saturated fat and differences in cardiovascular disease outcomes in adults and older adults had evidence graded as moderate, and 4 additional conclusion statements had evidence graded as limited. The evidence underlying the following conclusion statements was graded as moderate:

- No association between substituting or replacing one form of dairy with another form of dairy on risk of cardiovascular disease (this included comparisons between milk, yogurt, cheese, butter, and buttermilk).
- No association between substituting processed or unprocessed red meat with white meat or eggs on cardiovascular disease morbidity.
- No association between substituting white meat with plant-based foods or fish/seafood on cardiovascular disease morbidity.

The evidence underlying the following conclusion statements was graded as limited:

- No association between substituting higher-fat dairy with lower-fat dairy and cardiovascular disease morbidity.
- No association between substituting processed or unprocessed red meat with fish or seafood and cardiovascular disease morbidity.
- No association between substituting lean, unprocessed red meat with lean, unprocessed white meat and blood lipids and blood pressure.

- No effect of replacing palm olein with vegetable oils higher in unsaturated fatty acids such as olive oil and blood lipids.

Food Sources of Saturated Fat and Cardiovascular Disease Health Outcomes for Which a Conclusion Statement Could Not Be Drawn

Conclusion statements could not be drawn for 11 of the food sources of saturated fat comparisons in adults and older adults. These include 2 conclusion statements related to dairy consumption, 6 related to meat consumption, 2 related to consumption of plant sources higher in saturated fat, and 1 comparison between dairy and meat. Unlike the conclusion statement for the association between substituting processed meat and red meat with dairy and lower risk of cardiovascular disease morbidity, which was graded as moderate, a conclusion statement could not be drawn for the association between replacing dairy with meat and blood lipids, blood pressure, and cardiovascular disease mortality.

Relationships for which a conclusion statement could not be drawn for any cardiovascular disease outcome in adults and older adults included consumption of:

- Dairy compared to food sources of carbohydrates and protein.
- Red meat or white meat with different amounts of saturated fat.
- Processed red meat or processed white meat compared to unprocessed red meat or unprocessed white meat.
- Meat sources of saturated fat compared to plant sources of saturated fat.
- Plant sources higher in saturated fat compared to food sources of carbohydrate or protein.
- Plant sources higher in saturated fat compared to a different food source of saturated fat.

For children and adolescents, no conclusion statements could be drawn about the relationship between consumption of food sources of saturated fat and risk of cardiovascular disease because there was not enough evidence.

Discussion

The *Dietary Guidelines* recommends limiting saturated fat intake to less than 10 percent of daily calories (starting at age 2 years) and replacing saturated fat with PUFA, but prior Committees did not explicitly address whether specific foods should be consumed to replace saturated fat-containing foods. Given the diversity of foods in U.S. diets with widely variable amounts of saturated fat and other nutrients and dietary components (e.g., fiber, added sugars), and the importance of recommending replacement foods for substitution to inform dietary guidance, this Committee reviewed the implications of evidence from food-specific comparisons and cardiovascular disease risk. Evaluating food-specific comparisons with cardiovascular disease risk also facilitates investigation of the potential heterogeneity when comparing a food of interest (e.g., red meat) to potential practical or experimental replacement foods.

Food sources of saturated fat in the U.S. diet include both animal- and plant-based foods. Common animal-based food sources of saturated fat include processed and unprocessed red and white meat, milk and other dairy products, and butter. In this systematic review, dairy was often considered as a broad category that encompassed milk, yogurt, and cheese. While dairy and dairy products were often further differentiated as total, whole-fat, or lower-fat versions, the lower-fat versions were not well-defined (e.g., 2% vs. 1% vs. skim/fat-free). Plant sources higher in saturated fat include palm oil, coconut oil, and cocoa butter. Another plant source of saturated fat that was examined was palm olein, an industrial oil that is derived from palm oil with a lower melting point, higher oleic acid content, and lower saturated fat content than palm oil.[28-30] This Committee's systematic review examined substitution or replacement of these food sources of saturated fat with similar foods with different amounts of saturated fat, foods with primarily unsaturated fats, food sources of carbohydrate or protein, and different food sources of saturated fat.

Overall, the Committee's systematic review findings indicate a general lack of cardiovascular disease benefit for substitution or replacement within animal sources of saturated fat. Additionally, systematic review findings indicate a cardiovascular disease benefit when substituting or replacing butter with plant-based oils and spreads with predominantly unsaturated fatty acids, substituting dairy with food sources of unsaturated fatty acids, and substituting red meat with plant sources of protein, whole grains, or vegetables. These findings highlight the importance of evaluating dietary exposures at the food level and suggest that consuming foods lower in saturated fat may be related to decreased cardiovascular disease risk through their lower saturated fat content, as well as the other nutritional exposures within those foods, such as beneficial dietary factors (e.g., fiber, antioxidants).

One of this Committee's strongest findings was that replacing butter with plant-based oils and spreads higher in unsaturated fat improves lipid profiles for lower cardiovascular disease risk, which was based on evidence graded as strong. The evidence included 12 RCT and feeding studies comparing butter with MUFA- and PUFA-rich vegetable oils and spreads; importantly, this excludes vegetable-based spreads containing industrial artificial *trans* fats. In 2015, the U.S. Food and Drug Administration ruled that partially hydrogenated oils, the major source of artificial *trans* fat in the food supply, are no longer Generally Recognized As Safe (GRAS). Partially hydrogenated oils are no longer added to foods.[31] Additionally, this Committee concluded that LDL-C is lower when plant sources higher in saturated fat are replaced with vegetable oils higher in unsaturated fat. This conclusion was based on moderate evidence and was reached despite various plant sources higher in saturated fat and varying vegetable oils used as the comparator.

This Committee also synthesized a large body of evidence for the substitution of processed and unprocessed red meats with various individual foods and food groups. The primary plant-based food comparators for meat were plant sources of protein (i.e., beans, peas, lentils, nuts, seeds, and soy); whole grains; and vegetables. Decreasing red meat while increasing plant sources of protein, whole grains, or vegetables, were each related to lower long-term risks of cardiovascular disease. The three conclusions were all based on evidence graded as moderate. Notable in this set of comparisons was that the plant-based comparators are all sources of dietary fiber in addition to being low in saturated fat. Other factors that may differ for plant-based comparators vs. red meats include higher phytochemical and antioxidant levels. While these comparisons were made primarily in PCS, and therefore suggest association and not causation, the plausibility of greater causal inference is supported by the mechanistic evidence for cardiovascular disease benefits from the higher fiber content and possibly other components specific to plant-based foods.[13,32]

During evidence synthesis, the total, processed, and unprocessed red and white meat were considered separately against each comparator in relation to cardiovascular disease risk. In most cases, the trends for associations across all three categories were consistent, such that the Committee generally did not draw separate conclusions for processed vs. unprocessed red or white meat. Two conclusion statements do distinguish between processed vs. unprocessed red and white meat, but both were determined to be Grade Not Assignable.

Benefit was observed when processed meat and red meat were substituted with the dairy food group—another food source of saturated fat—although data were sparse to evaluate whether this relationship could be generalized across all dairy or whether it is specific to individual products such as milk, cheese, or yogurt. This was based on evidence graded as moderate.

In contrast, no benefit for cardiovascular disease risk was identified when red meat was substituted or replaced with other food sources of saturated fat, including white meat or eggs, based on evidence graded as moderate. Similarly, no cardiovascular disease risk or benefit was identified for substituting red meat with fish/seafood, which was based on evidence graded as limited. Finally, no impact on cardiovascular disease risk was identified when substituting or replacing within types of dairy foods or within types of unprocessed lean meats. These conclusions were based on evidence graded as limited (for substituting higher-fat dairy with lower-fat dairy and replacing lean, unprocessed red meat with lean, unprocessed white meat) or moderate (substituting or replacing one form of dairy with another form of dairy). Notable for this set of comparisons between one type of animal-based foods and another was that the magnitude of saturated fat differences was smaller between comparator groups than the magnitude of saturated fat differences between animal- and plant-based foods, and given that animal-based foods are not a source of certain nutrients and bioactive components (e.g., fiber, phytochemicals, antioxidants), this was not a factor in comparisons between these foods.

Evidence for the numerous other pairwise comparisons of foods with and without saturated fat was sparse. Further, few dietary interventions or PCS addressing these comparisons have been conducted in other life stages, therefore no conclusion statements were developed specifically for infants and young children, children and adolescents, or individuals during pregnancy or postpartum. Additionally, evidence for adults included studies that enrolled participants across the adult age span, including older adults, but did not allow for drawing separate conclusions for older adults in any of the questions reviewed.

The evidence that was graded as moderate or limited was subject to several limitations, which are discussed in detail in the full systematic review report.[26] Generalizability was a major issue for this body of evidence, with few studies reporting race/ethnicity and socioeconomic position or including diverse populations with regard to these variables.

In summary, these findings reinforce the recommendations of prior Committees for a quantitative limit on saturated fat intake by reducing intakes of foods higher in saturated fat. This is the first Committee to formally evaluate food-level comparisons of foods with higher or lower levels of saturated fat to inform potential guidance for which foods across the dietary pattern could be increased when saturated fat-containing foods are reduced, for cardiovascular disease risk reduction. Indeed, evidence indicates that when reducing butter, processed and unprocessed red meat, and dairy, substitution or replacement with a wide range of plant-based food sources, including plant-based protein foods, whole grains, vegetables, or MUFA- and PUFA-rich vegetable oils and spreads, is associated with cardiovascular disease risk reduction. Therefore, these findings support recommendations to replace saturated fat-containing foods specifically with plant sources rich in MUFA, PUFA, and fiber, rather than other animal sources of saturated fat, for reduction in cardiovascular disease risk.

Committee's Advice to the Departments

Based on its systematic reviews of food sources of saturated fat and risk of cardiovascular disease, the Committee has the following advice to the Departments as they develop the *Dietary Guidelines for Americans, 2025-2030*:

- This Committee reaffirms current guidance in the *Dietary Guidelines for Americans, 2020-2025* to limit foods and beverages higher in saturated fat and to limit total saturated fat intake to less than 10 percent of calories per day starting at age 2 by replacing it with unsaturated fat, particularly PUFA. This Committee recommends enhancing this guidance to indicate that replacement with MUFA and PUFA should focus on plant-based sources, because the systematic review on food sources of saturated fat and risk of cardiovascular disease found cardiovascular disease benefit when substituting or replacing food sources of saturated fat with foods that are not significant sources of saturated fat, such as plant sources of protein, whole grains, vegetables, and vegetable oils higher in unsaturated fat.
- Align with advice from **Part D. Chapter 3: Beverages** that there should be no change in recommendations for consumption of dairy. Although the conclusion statement for substituting higher-fat dairy with lower-fat dairy showed no association with cardiovascular disease morbidity, the evidence was graded as limited. Until further definitive studies are conducted, it is prudent to support the current *Dietary Guidelines* recommendation to consume fat-free or low-fat milk, yogurt, and cheese. Infants should not consume cow milk before age 12 months to replace human milk or infant formula. Plain cow milk (whole milk) can be offered beginning around age 12 months. Fat-free or low-fat milk can be offered beginning at age 2 years.
- Encourage dietary patterns that emphasize plant-based foods, such as plant-based proteins, whole grains, and vegetables. Substitution or replacement of meat with plant-based foods, such as plant-based proteins (beans, peas, lentils, nuts, seeds, soy), whole grains, or vegetables is associated with favorable cardiovascular disease outcomes.

- Reaffirm current guidance to lower consumption of butter and replace butter with vegetable oils higher in unsaturated fatty acids. As indicated by the systematic reviews, some of the strongest evidence was for replacing butter with plant-based oils and spreads with predominantly unsaturated fatty acids leading to lower LDL-C blood levels.
- Promote replacement of plant sources higher in saturated fat, such as coconut oil, cocoa butter, and palm oil, with vegetable oils higher in unsaturated fats. Palm oil and coconut oil are often used in food processing applications.[33] The Committee recommends efforts to minimize consumption of highly processed foods that contain these sources of saturated fat.

References

1. U.S. Department of Agriculture, U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2020-2025. 9th Edition.* 2020. DietaryGuidelines.gov.
2. U.S. Department of Health and Human Services, U.S. Department of Agriculture. *Dietary Guidelines for Americans, 2005. 6th Edition*. 2005. https://www.dietaryguidelines.gov/sites/default/files/2019-05/2005%20DG%20for%20Americans.pdf
3. Dietary Guidelines Advisory Committee. *Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010 to the Secretary of Agriculture and the Secretary of Health and Human Services*. 2010. https://www.dietaryguidelines.gov/sites/default/files/2019-05/2010DGACReport-camera-ready-Jan11-11.pdf
4. U.S. Department of Agriculture, U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2010. 7th Edition.* 2010. https://www.dietaryguidelines.gov/sites/default/files/2019-05/DietaryGuidelines2010.pdf
5. U.S. Department of Health and Human Services, U.S. Department of Agriculture. *2015–2020 Dietary Guidelines for Americans 8th Edition.* . 2015. http://health.gov/dietaryguidelines/2015/guidelines/.
6. Dietary Guidelines Advisory Committee. *Scientific Report of the 2015 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Health and Human Services and Secretary of Agriculture*. 2015. https://odphp.health.gov/sites/default/files/2019-09/Scientific-Report-of-the-2015-Dietary-Guidelines-Advisory-Committee.pdf
7. Cruz CM, DeSilva D, Beckman K, et al. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Nutrients and Dietary Components. 2024;doi:https://doi.org/10.52570/DA.DGAC2025.DA03
8. Hegsted DM, McGandy RB, Myers ML, Stare FJ. Quantitative effects of dietary fat on serum cholesterol in man. *Am J Clin Nutr*. Nov 1965;17(5):281-95. doi:https://doi.org/10.1093/ajcn/17.5.281
9. Keys A, Anderson JT, Grande F. Serum cholesterol response to changes in the diet: IV. Particular saturated fatty acids in the diet. *Metabolism*. Jul 1965;14(7):776-87. doi:https://doi.org/10.1016/0026-0495(65)90004-1
10. Katan MB, Zock PL, Mensink RP. Effects of fats and fatty acids on blood lipids in humans: an overview. *Am J Clin Nutr*. Dec 1994;60(6 Suppl):1017S-1022S. doi:https://doi.org/10.1093/ajcn/60.6.1017s
11. Lichtenstein AH, Appel LJ, Vadiveloo M, et al. 2021 Dietary Guidance to Improve Cardiovascular Health: A Scientific Statement From the American Heart Association. *Circulation*. Dec 7 2021;144(23):e472-e487. doi:https://doi.org/10.1161/CIR.0000000000001031
12. Threapleton DE, Greenwood DC, Evans CE, et al. Dietary fibre intake and risk of cardiovascular disease: systematic review and meta-analysis. *BMJ*. Dec 19 2013;347:f6879. doi:https://doi.org/10.1136/bmj.f6879
13. Fu L, Zhang G, Qian S, Zhang Q, Tan M. Associations between dietary fiber intake and cardiovascular risk factors: An umbrella review of meta-analyses of randomized controlled trials. *Front Nutr*. 2022;9:972399. doi:https://doi.org/10.3389/fnut.2022.972399

14. Harris WS, Tintle NL, Imamura F, et al. Blood n-3 fatty acid levels and total and cause-specific mortality from 17 prospective studies. *Nat Commun*. Apr 22 2021;12(1):2329. doi:https://doi.org/10.1038/s41467-021-22370-2
15. Bonaccio M, Ruggiero E, Di Castelnuovo A, et al. Fish intake is associated with lower cardiovascular risk in a Mediterranean population: Prospective results from the Moli-sani study. *Nutr Metab Cardiovasc Dis*. Oct 2017;27(10):865-873. doi:https://doi.org/10.1016/j.numecd.2017.08.004
16. Zhao B, Gan L, Graubard BI, Mannisto S, Albanes D, Huang J. Associations of Dietary Cholesterol, Serum Cholesterol, and Egg Consumption With Overall and Cause-Specific Mortality: Systematic Review and Updated Meta-Analysis. *Circulation*. May 17 2022;145(20):1506-1520. doi:https://doi.org/10.1161/circulationaha.121.057642
17. Zhong VW, Van Horn L, Cornelis MC, et al. Associations of Dietary Cholesterol or Egg Consumption With Incident Cardiovascular Disease and Mortality. *JAMA*. Mar 19 2019;321(11):1081-1095. doi:https://doi.org/10.1001/jama.2019.1572
18. Carson JAS, Lichtenstein AH, Anderson CAM, et al. Dietary Cholesterol and Cardiovascular Risk: A Science Advisory From the American Heart Association. *Circulation*. Jan 21 2020;141(3):e39-e53. doi:https://doi.org/10.1161/cir.0000000000000743
19. Wang DD, Li Y, Chiuve SE, et al. Association of Specific Dietary Fats With Total and Cause-Specific Mortality. *JAMA Intern Med*. Aug 1 2016;176(8):1134-45. doi:https://doi.org/10.1001/jamainternmed.2016.2417
20. Li Y, Hruby A, Bernstein AM, et al. Saturated Fats Compared With Unsaturated Fats and Sources of Carbohydrates in Relation to Risk of Coronary Heart Disease: A Prospective Cohort Study. *J Am Coll Cardiol*. Oct 6 2015;66(14):1538-1548. doi:https://doi.org/10.1016/j.jacc.2015.07.055
21. Sacks FM, Lichtenstein AH, Wu JHY, et al. Dietary Fats and Cardiovascular Disease: A Presidential Advisory From the American Heart Association. *Circulation*. Jul 18 2017;136(3):e1-e23. doi:https://doi.org/10.1161/cir.0000000000000510
22. Snetselaar L, Bailey R, Sabate J, et al. *Types of Dietary Fat and Cardiovascular Disease: A Systematic Review*. 2020. *USDA Nutrition Evidence Systematic Reviews*. https://doi.org/10.52570/NESR.DGA
23. Dietary Guidelines Advisory Committee. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. 2020. doi: https://doi.org/10.52570/DGAC2020
24. Ibsen DB, Laursen ASD, Wurtz AML, et al. Food substitution models for nutritional epidemiology. *Am J Clin Nutr*. Feb 2 2021;113(2):294-303. doi:https://doi.org/10.1093/ajcn/nqaa315
25. Stern D, Ibsen DB, MacDonald CJ, Chiu YH, Lajous M, Tobias DK. Improving nutrition science begins with asking better questions. *Am J Epidemiol*. 2024 Nov 4: 193(11):1507-1510. doi:https://doi.org/10.1093/aje/kwae110
26. Gardner C, Hoelscher DM, Tobias D, et al. *Food Sources of Saturated Fat and Cardiovascular Disease: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR24
27. Rosqvist F, Niinisto S. Fats and oils - a scoping review for Nordic Nutrition Recommendations 2023. *Food Nutr Res*. 2024;68doi:https://doi.org/10.29219/fnr.v68.10487
28. Cheng C, Wang D, Xia H, et al. A comparative study of the effects of palm olein, cocoa butter and extra virgin olive oil on lipid profile, including low-density lipoprotein subfractions in young healthy Chinese people. *Int J Food Sci Nutr*. May 2019;70(3):355-366. doi:https://doi.org/10.1080/09637486.2018.1504009
29. Lucci P, Borrero M, Ruiz A, et al. Palm oil and cardiovascular disease: a randomized trial of the effects of hybrid palm oil supplementation on human plasma lipid patterns. *Food Funct*. Jan 2016;7(1):347-54. doi:https://doi.org/10.1039/c5fo01083g
30. Sun G, Xia H, Yang Y, et al. Effects of palm olein and olive oil on serum lipids in a Chinese population: a randomized, double-blind, cross-over trial. *Asia Pac J Clin Nutr*. 2018;27(3):572-580. doi:https://doi.org/10.6133/apjcn.032017.12
31. U.S. Food and Drug Administration (FDA). Trans Fat. https://www.fda.gov/food/food-additives-petitions/trans-fat

32. Satija A, Hu FB. Plant-based diets and cardiovascular health. *Trends Cardiovasc Med*. Oct 2018;28(7):437-441. doi:https://doi.org/10.1016/j.tcm.2018.02.004
33. Hormenu T, Salifu I, Paku JE, et al. Tropical oils consumption and health: a scoping review to inform the development of guidelines in tropical regions. *BMC Public Health*. Sep 10 2024;24(1):2468. doi:https://doi.org/10.1186/s12889-024-19949-x

Part D. Chapter 5: Complementary Feeding and Feeding Styles and Practices During Childhood

Introduction

Childhood represents a critical window during which nutrition has a profound influence on cognitive and physical development, and it is also a focal period for development and socialization of eating behaviors. Complementary feeding is a period of rapid nutritional transition when children exposed to a single food since birth—human milk and/or infant formula—are introduced to a variety of foods and eating routines that reflect the diets of their family, culture, and environment. These dietary shifts are accompanied by physical, cognitive, emotional, and social development that enables children to take a more active role in feeding and communicating their needs and preferences to others. This development continues into the preschool years, when children have increasing autonomy in making choices about whether, what, and how much to eat. The family is a first and fundamental context in which the development of eating behaviors occurs. Considering the types, amounts, and timing of foods fed to children during complementary feeding along with caregiver feeding styles and practices during early childhood allows for a holistic approach to feeding future generations.

This chapter provides a brief background on complementary feeding and caregiver feeding styles and practices and summarizes findings from systematic reviews on relationships between the timing and types of foods and beverages introduced during the complementary feeding period and growth, body composition, and risk of obesity during infancy and childhood; associations of caregiver feeding styles and practices with child food acceptance, dietary intake, and outcomes related to growth; and repeated exposure and food acceptance among children. The chapter also discusses the results of the systematic reviews and provides the Dietary Guidelines Advisory Committee's (Committee) advice to the Departments, based on its review of the science, for developing the *Dietary Guidelines for Americans, 2025-2030.*

Complementary Feeding

Complementary feeding, which begins around age 6 months and extends to 24 months, is a period during which complementary foods and beverages (CFB) take on an increasingly important role in sustaining adequate growth and development.[1,2] In addition to the timing of introduction, the types and amounts of CFB are important factors that may influence dietary intake, nutritional status, growth and body composition, and future health outcomes.

Current nationally representative data indicate that for a majority of young children ages 12 to 24 months, intakes of the following food groups and subgroups are generally below *Dietary Guidelines* recommendations: Total Vegetables (including Dark-Green Vegetables; Other Vegetables; and Beans, Peas, and Lentils); Whole Grains; and Seafood. Conversely, for a majority of young children ages 12 to 24 months, intakes of the following food groups and subgroups are generally at or above recommendations: Total Fruits; Red and Orange Vegetables; Starchy Vegetables; Total Grains; Refined Grains; Total Protein Foods; Meat, Poultry, and Eggs; Nuts, Seeds, and Soy Products; Dairy and Fortified Soy Alternatives; and Oils.[3] Additionally, most young children ages 12 to 24 months exceed the recommended limits for added sugars and sodium.[4] The relationships between intake of food groups and health outcomes are important to explore because complementary feeding provides nutrients that are essential for physical and cognitive development. For example, brain development—which includes language, sensory and higher cognitive functions—peaks during the first 2 years of life, a period during which nutrient deficiencies can have long-term impact. Excessive intake of calories and other nutrients and food components such as sodium, added sugars, and saturated fat should be avoided during this critical window of development.[1,5,6] As such, introduction to CFB during this period of rapid growth and development is key to meeting energy and nutrient needs of children and to promoting an adequate rate of growth while preventing excessive weight gain.

Caregiver Feeding Styles and Practices

While orientation to basic tastes, such as preferences for sweetness and rejection of bitterness are innate, food acceptance and preferences are largely learned through experiences around eating that are inherently social in nature.[7] Similarly, children's self-regulation of appetite is believed to have biological and learned underpinnings. As such, *how* children are fed may be as important as *what* children are fed.[8] Caregivers have fundamental roles in socializing children's eating behaviors by providing foods that become familiar and accepted, by acting as role models, and by using feeding styles and practices to guide and socialize children's eating behaviors (see **Box D.5.1 and Figures D.5.1 and D.5.2** for more information about feeding styles and practices).[8,9]

Providing children with repeated exposure to new foods is a specific type of structured feeding practice that is thought to have fundamental influence on children's acceptance of healthy foods. Multiple lines of research provide evidence of prenatal and postnatal flavor learning in early development, where flavors of the maternal diet are transferred to the fetus and infant, respectively, through amniotic fluid during pregnancy and through human milk during lactation.[10] These early flavor exposures shape infant acceptance of these flavors in foods during complementary feeding and are thought to act as a "flavor bridge" to prepare children to learn to accept foods eaten within the family and local environments. In turn, providing repeated exposure to healthy foods during complementary feeding has been shown to promote children's liking and intake of those foods, collectively referred to as food acceptance.[11]

Box D.5.1: Key Terms

Caregiver: A parent or guardian who provides most of the direct care to a child in the home setting (e.g., mother, father, grandparent, guardian).

Complementary feeding: The process that starts when human milk or infant formula is complemented by other foods and beverages. The complementary feeding period typically continues to age 24 months as the young child transitions to family foods.

Complementary foods and beverages (CFB): Foods and beverages (liquids, semisolids, and solids) other than human milk or infant formula provided to an infant or young child to provide nutrients and energy.

Feeding styles: The broad or general approach that caregivers take to feeding children as well as the emotional climate in which feeding occurs. Feeding styles reflect caregiver demands on or expectations for the child's behavior during eating, as well as responsiveness to the child's individual eating needs (**Figure D.5.1**).

Feeding practices (also referred to as food parenting practices): Specific goal-oriented actions or behaviors used by caregivers to shape children's eating attitudes, beliefs, and behaviors (**Figure D.5.2**).

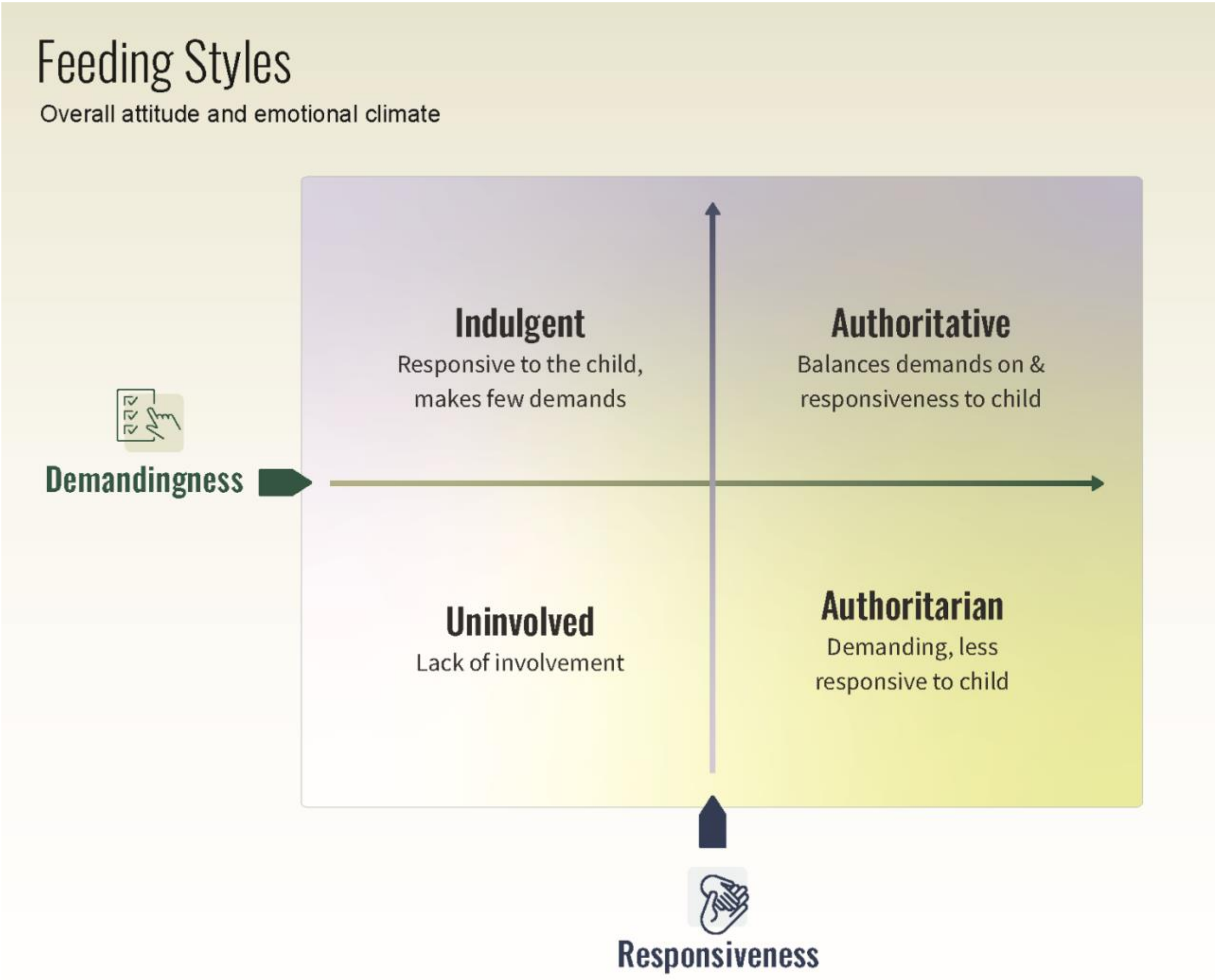
- *Structured feeding practices* organize physical and social aspects of children's eating environments to facilitate children's competence and promote positive behaviors; such practices may include the availability, accessibility, and portion sizes of foods and beverages in the home as well as role modeling, limit setting, and having routines for meals and snacks.
- *Autonomy support feeding practices* encourage developmentally appropriate independence and provide scaffolding for children's self-feeding skills, eating choices, and appetite self-regulation; such practices may include responsiveness to feeding cues, nutrition education, child involvement, encouragement, praise, reasoning, and negotiation.
- *Controlling feeding practices* reflect caregiver-centered control of and dominance over children's eating; such practices may include use of restriction, pressure to eat, threats, bribes, and using food to control negative emotions.

Food acceptance: Reflection of children's liking and intake of foods; studies of infants and young children typically measure food acceptance based on the child's willingness to try or taste the food, the child's facial responses during feeding, the caregiver's perception of the child's enjoyment, the child's verbal indication of liking the foods, the rate and duration of feeding, and the amount consumed.

Repeated exposure to foods: Providing a specific food (typically a new food) on multiple occasions during the course of food acceptance.

- *Taste exposure* occurs when a child is provided the opportunity to taste and/or consume the food.
- *Non-taste exposure* occurs when a child is provided sensory exposure to a food that does not involve tasting, such as smell, tactile, and visual exposure (e.g., looking at food or a picture of food).

FIGURE D.5.1
CAREGIVER FEEDING STYLES



Adapted from Hughes SO, Power TG, Orlet Fisher J, Mueller S, Nicklas TA. Revisiting a neglected construct: parenting styles in a child-feeding context. *Appetite*. Feb 2005;44(1):83-92. https://doi.org/10.1016/j.appet.2004.08.007[12]

Expansion of Previous Reviews

With regard to complementary feeding, prior systematic reviews were conducted as part of the Pregnancy and Birth to 24 Months Project (P/B-24 Project) by groups of external experts in collaboration with USDA's Nutrition Evidence Systematic Review (NESR) team.[13] These reviews explored the introduction of CFB (including timing of introduction and specific types of foods and beverages) in relation to growth, size, body composition, and risk of obesity; developmental milestones; micronutrient status; bone health; and food allergy, atopic dermatitis/eczema, asthma, and allergic rhinitis.[14-19] These systematic reviews were used by the 2020 Committee to address a number of scientific questions in its Scientific Report. The authors of those reviews and the 2020 Committee pointed to the need for additional research to address evidence gaps and limitations around the timing of introduction and specific types of foods and beverages introduced before age 4 months and after age 7 months for those outcomes. Therefore, this

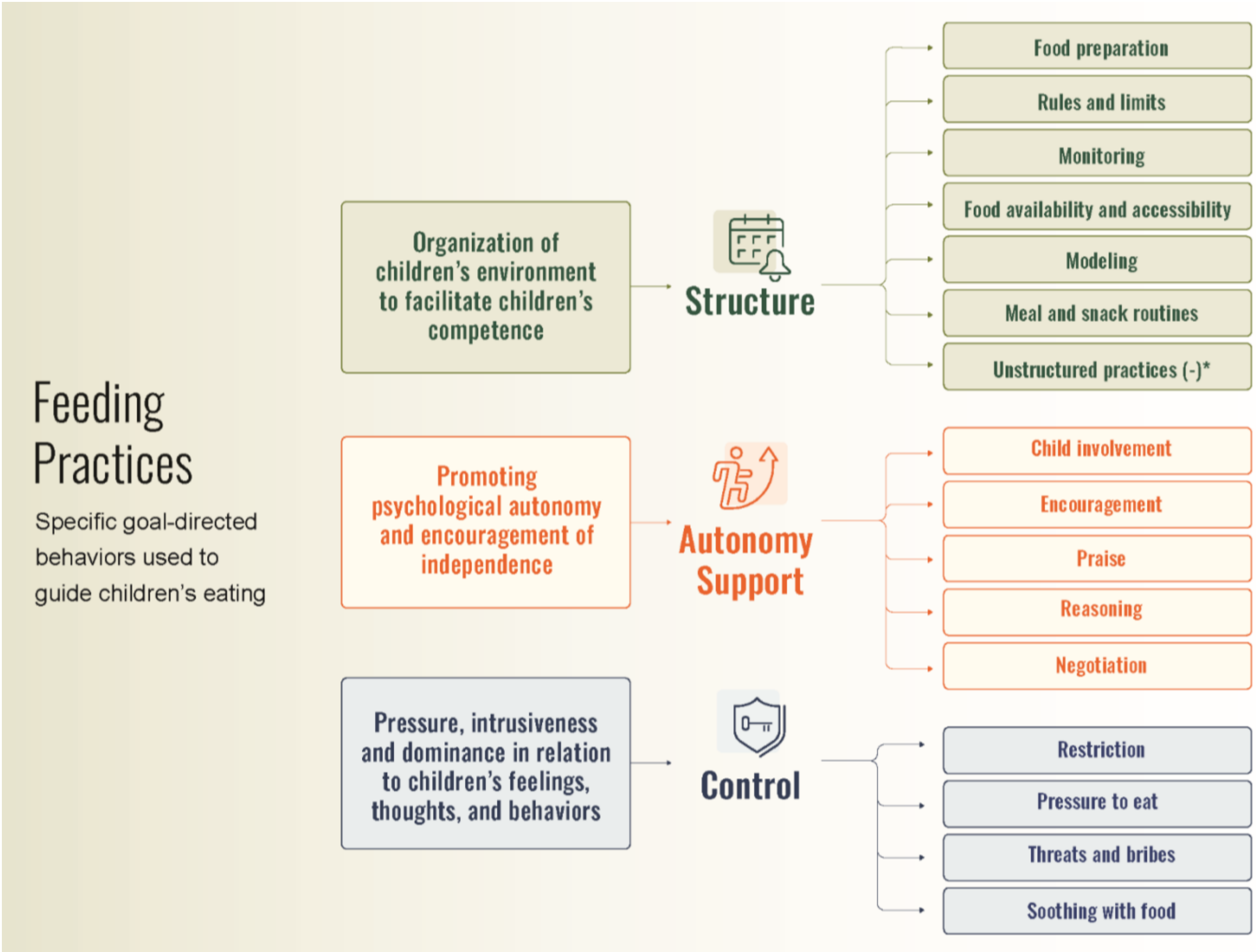
Committee updated the work of the P/B-24 Project by examining relationships between the types and the timing of introduction of specific types of CFB and growth, body composition, and risk of obesity.

With regard to repeated exposure, a systematic review conducted as part of the P/B-24 Project found moderate evidence for children ages 4 to 24 months that tasting a vegetable or fruit once per day for 8 to 10 or more days is likely to increase acceptability of the item.[20] Given evidence of fundamental effects on food acceptance during early childhood, this Committee updated the P/B-24 Project review of repeated exposure among children from birth to age 24 months and extended the review of evidence to studies of children ages 2 to 6 years. The Committee's review considered studies of taste exposure as well as evidence on other types of sensory exposure to foods. The Committee prioritized a comprehensive review of evidence on strategies for promoting food acceptance among younger children, given that this age group's current intakes of foods such as vegetables, whole grains, and seafood are below recommended amounts.

With regard to caregiver feeding practices, a systematic review on this topic was conducted as part of the P/B-24 Project, focused solely on children from birth to age 24 months.[21] Following recommendations of the 2020 Committee, the 2025 Committee comprehensively reviewed the scientific evidence on how to feed younger children. A new systematic review was conducted to evaluate associations of feeding practices used by caregivers of children ages 2 to 6 years with child dietary intakes aligned with the *Dietary Guidelines*. Dietary outcomes of interest were diet quality, and consumption of underconsumed and overconsumed food groups, specifically fruits and vegetables, whole grains, and sugar-sweetened beverages. A separate review evaluated associations of feeding practices used by caregivers of children ages 2 to 6 years with child growth, body composition, and risk of obesity outcomes, expanding the scope of the P/B-24 Project review on this topic.

These reviews of caregiver feeding practices differ from previous narrative and systematic reviews in 2 important ways. Previous reviews have tended to evaluate associations of individual feeding practices with child dietary intake and weight outcomes.[22,23] In contrast, the Committee used a conceptual framework developed by Vaughn and colleagues to organize and evaluate the evidence on individual practices within 3 higher-order dimensions of control, structure, and autonomy support (**Figure D.5.2**). This approach provided the opportunity to integrate a diverse body of literature along broad parenting dimensions that have clear public health relevance. Importantly, both reviews focused on randomized controlled trials and prospective cohort studies that provide the opportunity to evaluate directionality in the evidence, namely the extent to which associations reflect influences of the feeding practice on the child, or alternatively, reflect influences of the child on the practices used by caregivers.

FIGURE D.5.2
CAREGIVER FEEDING PRACTICES



*Note: Unstructured practices that set few boundaries, such as allowing children to graze, short-order cooking, and catering to the child's likes/dislikes, are inversely associated with structure.
Adapted from Vaughn AE, Ward DS, Fisher JO, et al. Fundamental constructs in food parenting practices: a content map to guide future research. *Nutr Rev*. Feb 2016;74(2):98-117. doi: https://doi.org/10.1093/nutrit/nuv061[24]

List of Questions

1. What is the relationship between complementary feeding and growth, body composition, and risk of obesity?[25]
2. What is the relationship between repeated exposure to foods and food acceptance?[26]
3. What is the relationship between parental and caregiver feeding styles and practices during childhood and adolescence and consuming a dietary pattern that is more aligned with the *Dietary Guidelines for Americans*?[27]
4. What is the relationship between parental and caregiver feeding styles and practices during childhood and adolescence and growth, body composition, and risk of obesity?[25]

Conclusion Statements

Question 1. What is the relationship between complementary feeding and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review

Timing of Introduction of Specific Types of Complementary Foods and Beverages

Fruit

A conclusion statement cannot be drawn about the relationship between the age when infants and young children, up to age 24 months, are introduced to fruit and outcomes related to growth patterns, body composition, and risk of obesity during childhood because there is not enough evidence available. (Grade: Grade Not Assignable)

100% Juice

A conclusion statement cannot be drawn about the relationship between the age when infants and young children, up to age 24 months, are introduced to 100% juice and outcomes related to growth patterns, body composition, and risk of obesity during childhood because there is not enough evidence available. (Grade: Grade Not Assignable)

Vegetables

A conclusion statement cannot be drawn about the relationship between the age when infants and young children, up to age 24 months, are introduced to vegetables and outcomes related to growth patterns, body composition, and risk of obesity during childhood because there is not enough evidence available. (Grade: Grade Not Assignable)

Grains

Introducing grains at or before age 4 months is associated with higher BMI z-score during childhood. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between the age when infants and young children, up to age 24 months, are introduced to grains and body composition and risk of obesity during childhood because there is not enough evidence available. (Grade: Grade Not Assignable)

Protein Foods

A conclusion statement cannot be drawn about the relationship between the age when infants and young children, up to age 24 months, are introduced to foods from the protein foods group and outcomes related to growth patterns, body composition, and risk of obesity during childhood because of substantial concerns with consistency in the body of evidence. (Grade: Grade Not Assignable)

Dairy and Fortified Soy Alternatives

A conclusion statement cannot be drawn about the relationship between the age when infants and young children, up to age 24 months, are introduced to the dairy food group and outcomes related to growth patterns, body composition, and risk of obesity during childhood because there is not enough evidence available, and the evidence that is available has substantial concerns with consistency. (Grade: Grade Not Assignable)

Sugar-Sweetened Beverages

A conclusion statement cannot be drawn about the relationship between the age when infants and young children, up to age 24 months, are introduced to sugar-sweetened beverages and outcomes related to growth patterns, body composition, and risk of obesity during childhood because of substantial concerns with consistency in the body of evidence. (Grade: Grade Not Assignable)

Food Sources of Added Sugars

A conclusion statement cannot be drawn about the relationship between the age when infants and young children, up to age 24 months, are introduced to food sources of added sugars and outcomes related to growth patterns, body composition, and risk of obesity during childhood because there is not enough evidence available. (Grade: Grade Not Assignable)

Types and Amounts of Complementary Foods and Beverages

Fruit

Fruit consumption by infants and young children, up to age 24 months, is not associated with unfavorable outcomes related to growth patterns during childhood. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between fruit consumption by infants and young children, up to age 24 months, and body composition and risk of obesity during childhood because there is not enough evidence available. (Grade: Grade Not Assignable)

100% Juice

A conclusion statement cannot be drawn about the relationship between 100% juice consumption by infants and young children, up to age 24 months, and outcomes related to growth patterns, body composition, and risk of obesity during childhood because of substantial concerns with consistency and precision in the body of evidence. (Grade: Grade Not Assignable)

Vegetables

Vegetable consumption by infants and young children, up to age 24 months, is not associated with unfavorable outcomes related to growth patterns during childhood. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between vegetable consumption by infants and young children, up to age 24 months, and body composition and risk of obesity during childhood because there is not enough evidence available. (Grade: Grade Not Assignable)

Grains

Grains consumption by infants and young children, from ages 6 months up to age 24 months, is not associated with unfavorable outcomes related to growth patterns and risk of obesity during childhood. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between grains consumption by infants and young children, from ages 6 months up to age 24 months, and outcomes related to body composition during childhood because there is not enough evidence available. (Grade: Grade Not Assignable)

Protein Foods

A conclusion statement cannot be drawn about the relationship between consumption of protein foods as a food group by infants and young children, up to age 24 months, and outcomes related to growth patterns, body composition, and risk of obesity during childhood because of substantial concerns with consistency and directness in the body of evidence. (Grade: Grade Not Assignable)

Dairy and Fortified Soy Alternatives

A conclusion statement cannot be drawn about the relationship between dairy consumption by infants and young children, up to age 24 months, and outcomes related to growth patterns, body composition, and risk of obesity during childhood because of substantial concerns with consistency in the body of evidence. (Grade: Grade Not Assignable)

Sugar-Sweetened Beverages

Sugar-sweetened beverage consumption by infants, children, and adolescents is associated with unfavorable growth patterns and body composition, and higher risk of obesity in childhood up to early adulthood. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)[a]

Food Sources of Added Sugars

A conclusion statement cannot be drawn about the relationship between consumption of food sources of added sugars by infants and young children, up to age 24 months, and outcomes related to growth patterns, body composition, and risk of obesity during childhood because there is not enough evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/complementary-foods-beverages_growth-obesity

[a]This conclusion statement was developed as part of the Committee's systematic review with meta-analysis on sugar-sweetened beverages and growth, body composition, and risk of obesity across the lifespan. The conclusion statement relevant to infants and young children is presented here for reference. For more detail, see **Part D. Chapter 3: Beverages**.

Question 2. What is the relationship between repeated exposure to foods and food acceptance?

Approach to Answering Question: Systematic Review

Infants and Young Children (Birth to 24 Months)

Taste Exposure

Repeated taste exposure to a single or multiple novel or familiar vegetable(s) is likely to increase acceptance of the target vegetable(s) by infants and young children ages 4 to 24 months. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Repeated taste exposure to a single fruit is likely to increase acceptance of the target fruit by infants and young children ages 4 to 24 months. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Repeated taste exposure to a vegetable is likely to increase acceptance of a different vegetable, but not a fruit, by infants and young children ages 4 to 24 months. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Repeated taste exposure to a fruit may increase acceptance of a different fruit, but not a vegetable, by infants and young children ages 4 to 24 months. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Non-Taste Exposure

A conclusion statement cannot be drawn about the effect of repeated non-taste exposure, either alone or together with taste exposure, on food acceptance by infants and young children ages 4 to 24 months because there are substantial concerns with consistency and directness in the body of evidence. (Grade: Grade Not Assignable)

Children Ages 2 to 6 Years

Taste Exposure

Repeated taste exposure to a single or multiple novel or familiar vegetable(s) is likely to increase acceptance of the target vegetable(s) by children ages 2 to 6 years. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

A conclusion statement cannot be drawn about the effect of repeated taste exposure to fruit(s) on acceptance of target fruit(s) by children ages 2 to 6 years because there is no evidence available. (Grade: Grade Not Assignable)

Repeated taste exposure to a target vegetable may increase acceptance of a different vegetable by children ages 2 to 6 years. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the effect of repeated taste exposure to a target fruit on acceptance of a different fruit by children ages 2 to 6 years because there is no evidence available. (Grade: Grade Not Assignable)

Non-Taste Exposure

Repeated non-taste exposure alone or together with taste exposure to a target fruit or vegetable increases acceptance, specifically willingness to try, of the target fruit or vegetable by children ages 2 to 6 years. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/repeated-exposure_acceptance

Question 3. What is the relationship between parental and caregiver feeding styles and practices during childhood and adolescence and consuming a dietary pattern that is more aligned with the *Dietary Guidelines for Americans*?

Approach to Answering Question: Systematic Review

Structured Feeding Practices

Food parenting practices by caregivers of children ages 2 to 6 years that structure children's physical and social eating environments (e.g., availability and accessibility of healthy foods, monitoring children's eating, modeling of healthy eating behaviors, meal routines such as eating together as a family) are associated with higher intake of fruits and vegetables. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Controlling Feeding Practices

A conclusion statement cannot be drawn about the relationship between controlling food parenting practices (e.g., pressure to eat, overt limits on consumption of certain foods) by caregivers of children ages 2 to 6 years and outcomes related to consuming a dietary pattern aligned with the *Dietary Guidelines for Americans* because there are substantial concerns with consistency in the body of evidence. (Grade: Grade Not Assignable)

Autonomy Supportive Feeding Practices

A conclusion statement cannot be drawn about the relationship between food parenting practices by caregivers of children ages 2 to 6 years that provide developmentally appropriate support for children's autonomy (e.g., responsive feeding, praise, child involvement in food and eating activities) and outcomes related to consuming a dietary pattern aligned with the *Dietary Guidelines for Americans* because there is not enough evidence available. (Grade: Grade Not Assignable)

Feeding Styles

A conclusion statement cannot be drawn about the relationship between feeding styles by caregivers of children ages 2 to 6 years and outcomes related to consuming a dietary pattern aligned with the *Dietary Guidelines for Americans* because there is not enough evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/caregiver-feeding-practices_diet-quality

Question 4. What is the relationship between parental and caregiver feeding styles and practices during childhood and adolescence and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review

Structured Feeding Practices

Food parenting practices involving monitoring of children's eating by caregivers of children ages 2 to 6 years is not associated with outcomes related to growth. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between food parenting practices by caregivers of children ages 2 to 6 years that structure children's physical and social eating environments (e.g., availability of healthy foods, modeling of healthy eating behaviors, meal routines such as eating together as a family), and outcomes related to growth, body composition, and risk of obesity because there was not enough evidence available. (Grade: Grade Not Assignable)

Controlling Feeding Practices

A conclusion statement cannot be drawn about the relationship between controlling feeding practices by caregivers of children ages 2 to 6 years and outcomes related to growth, body composition, and risk of obesity because there are substantial concerns with consistency in the body of evidence. (Grade: Grade Not Assignable)

Autonomy Supportive Feeding Practices

A conclusion statement cannot be drawn about the relationship between food parenting practices by caregivers of children ages 2 to 6 years that provide developmentally appropriate support for children's autonomy (e.g., responsive feeding, praise, child involvement in food and eating activities) and outcomes related to growth, body composition, and risk of obesity because there are few studies and substantial concerns with consistency in the body of evidence. (Grade: Grade Not Assignable)

Feeding Styles

A conclusion statement cannot be drawn about the relationship between feeding styles by caregivers of children ages 2 to 6 years and outcomes related to growth, body composition, and risk of obesity because there are substantial concerns with consistency in the body of evidence. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/caregiver-feeding-practices_growth-obesity

Integration

In this section the Committee integrates evidence across conclusion statements by summarizing favorable, unfavorable, and null relationships between exposures/interventions and outcomes of interest.

Favorable Relationships Between Feeding Styles and Practices and Repeated Exposures to Healthy Foods and Food Acceptance, Dietary Intake, and Growth, Body Composition, and Risk of Obesity

The Committee drew 8 conclusion statements about the influence of caregiver feeding styles and practices on child food acceptance, dietary intake, and growth, body composition, and risk of obesity outcomes. One of those conclusions outlined favorable influences of structured caregiver feeding practices on dietary intake among children ages 2 to 6 years. Based on moderate evidence from prospective cohort studies and randomized controlled trials, the Committee concluded that feeding practices that provide structure for children's eating are associated with higher intakes of fruits and vegetables among children ages 2 to 6 years. Structured feeding practices organize children's eating environments, as well as their eating behaviors, by shaping physical and social aspects of those environments. Structured practices may take many forms, including making healthy foods available in the home and accessible to the child (e.g., keeping ready-to-eat fruits in a reachable location), modeling healthy eating behaviors, setting limits and providing guided choices (e.g., offering the option of 2 different fruits as a snack choice), and following routines for snacks and meals, including eating together (i.e., family meals). Thus, the Committee's conclusion supports the use of feeding practices that structure physical and social aspects of children's eating environments to increase consumption of fruits, vegetables, and other healthy foods aligned with the *Dietary Guidelines*.

Providing children with repeated exposure to healthy foods was a feeding practice of particular interest to the Committee within the broader category of structure in feeding practices. Seven conclusion statements were developed to characterize favorable effects of repeated exposure on fruit and vegetable acceptance among children. Five of those conclusions were supported by moderate evidence, highlighting the robust nature of the evidence. Collectively, these 7 conclusions identify repeated exposure as a key strategy for promoting acceptance of healthy foods among children up to age 6 years. Four of the 7 conclusions focused on children ages 4 to 24 months and the other 3 conclusions focused on children ages 2 to 6 years.

Among children ages 4 to 24 months, repeated exposure was found to promote acceptance of the specific fruit or vegetable to which children were exposed and to increase acceptance of other nonexposed foods within the same category, such as exposure to fruits increasing acceptance of other fruits or exposure to vegetables increasing acceptance of other vegetables. The effects of repeated exposure appear to generalize to other foods in the same category, suggesting that repeated exposure may not only promote acceptance of specific foods, but also encourage children's acceptance of a variety of healthy foods during complementary feeding when children are introduced to new foods that lay the foundation of early dietary patterns.

Among children ages 2 to 6 years, favorable effects of repeated exposure on acceptance were seen for novel, familiar, and previously disliked vegetables. This conclusion suggests that repeated exposure may have favorable effects on children's acceptance of vegetables with which they may or may not be familiar as well as for vegetables that they may or may not initially like. The Committee also concluded that providing other types of sensory exposure to fruits and vegetables outside of tasting (e.g., touching and smelling foods, listening to stories about food) also benefits acceptance among children ages 2 to 6 years, specifically children's willingness to try new foods. This conclusion suggests that providing children with diverse types of positive experiences with new foods may increase the effectiveness of repeated exposure by increasing children's willingness to try (i.e., taste) those foods.

No Unfavorable Relationships Between Complementary Feeding and Growth, Body Composition, and Risk of Obesity

The Committee drew 3 conclusion statements regarding consumption of specific food groups that did not have unfavorable associations with 1 or several outcomes related to growth, body composition, and risk of obesity. The conclusion statements highlighted that fruit and vegetable consumption is not unfavorably associated with growth patterns in childhood, and that grain consumption from ages 6 to 24 months is not unfavorably associated with growth and risk of obesity in childhood. These statements support consumption of fruits, vegetables, and grains after age 6 months.

No Relationships Between Feeding Styles and Practices and Growth, Body Composition, and Risk of Obesity

One conclusion found no association of caregiver monitoring of children's eating with child growth, body composition, and risk of obesity outcomes, suggesting that monitoring children's eating does not have consequences for weight-related outcomes. The lack of association, however, between any single feeding practice and weight-related outcomes should be interpreted with caution, given evidence that from day to day, most parents use a wide range of different types of feeding practices across the broad domains considered by the Committee.

Unfavorable Relationships Between Complementary Feeding and Growth, Body Composition, and Risk of Obesity

The Committee identified that introduction of grains at or before age 4 months is associated with higher BMI z-scores in childhood. This conclusion reinforces that complementary feeding should not begin before age 4 months, which aligns with the *Dietary Guidelines for Americans, 2020-2025* recommendation to introduce complementary feeding around age 6 months. No other conclusion statements identified unfavorable associations between complementary feeding and feeding styles and practices on outcomes related to growth, body composition, and obesity.

Conclusions Could Not be Drawn about Relationships Between Complementary Feeding, Feeding Styles and Practices, and Dietary Intake, Food Acceptance, and Growth, Body Composition, and Risk of Obesity

A total of 25 conclusion statements could not be drawn about associations between complementary feeding and growth, body composition, and risk of obesity (15 conclusion statements) and feeding styles and practices and dietary intake, food acceptance, and growth, body composition, and risk of obesity (10 conclusion statements).

Complementary Feeding

The Committee was unable to draw conclusion statements for 9 areas related to complementary feeding and growth, body composition, and risk of obesity outcomes during childhood due to lack of evidence. Four conclusion statements about timing of complementary feeding indicated that conclusions could not be drawn regarding associations between age of introduction to 100% juice, fruits, vegetables, or food sources of added sugars up to age 24 months and growth, body composition, and risk of obesity outcomes during childhood due to a lack of studies. Similarly, although a conclusion statement was drawn regarding age of introduction to grains and growth outcomes, a conclusion statement could not be drawn regarding age of introduction to grains and body composition and risk of obesity during childhood due to a lack of evidence. Three conclusion statements on the types and amounts of foods and beverages during the complementary feeding period indicated that conclusions could not be drawn about the associations of fruit, vegetable, or grain consumption up to age 24 months with body composition in childhood (all) as well as risk of obesity (fruit or vegetable only) because of a lack of evidence. Additionally, a conclusion statement could not be drawn about associations between intake of added sugars from food sources up to age 24 months and growth, body composition, and risk of obesity outcomes during childhood due to a lack of evidence.

The Committee was unable to draw conclusion statements for 6 areas related to complementary feeding and growth, body composition, and risk of obesity outcomes during childhood due to concerns regarding consistency, precision, and/or directness in the bodies of evidence. Two statements indicated that conclusions could not be drawn regarding associations between the age of introduction of protein foods and sugar-sweetened beverages and growth, body composition, and risk of obesity outcomes during childhood because of concerns about consistency in the body of evidence. Further, a conclusion could not be drawn regarding associations between the age of introduction of dairy and growth, body composition, and risk of obesity outcomes during childhood due to concerns about consistency in the body of evidence, in addition to noting the minimal evidence available for certain exposures and outcomes. Concerns about consistency in the body of evidence were also noted for the association between consumption of dairy and growth, body composition, and risk of obesity outcomes during childhood. Finally, a conclusion statement could not be drawn regarding consumption of 100% juice up to age 24 months and growth, body composition, and risk of obesity during childhood because of concerns about consistency and precision, while a conclusion statement could not be drawn regarding consumption of protein foods up to age 24 months and growth, body composition, and risk of obesity outcomes during childhood because of concerns about consistency and directness.

Caregiver Feeding Styles and Practices

Five conclusion statements regarding caregiver feeding styles and practices indicated that conclusions could not be drawn due to a lack of studies. Specifically, associations could not be evaluated between caregiver feeding styles or autonomy support practices and dietary intake, or between structured feeding practices and growth, body composition, and risk of obesity outcomes among children ages 2 to 6 years. Additionally, associations could not be evaluated between repeated exposure and acceptance of a target or of different fruits among children ages 2 to 6 years.

Five conclusion statements regarding caregiver feeding styles and practices indicated that conclusions could not be drawn due to concerns about consistency and/or directness in the body of evidence. Conclusions could not be drawn for associations of controlling caregiver feeding practices with dietary intake and growth, body composition, and risk of obesity outcomes, or for autonomy support practices and feeding styles with growth, body composition, and risk of obesity outcomes among children ages 2 to 6 years, because of lack of consistency in direction of association as well as variation in the measured exposures. In addition, conclusions could not be drawn regarding the association of non-taste exposure with acceptance among children ages 4 to 24 months due to study designs that combined non-taste and taste exposure.

Summary

Taken together, the conclusion statements on timing of complementary feeding and amounts and types of CFB suggest that consumption of fruits, vegetables, and grains (around age 6 months) have no unfavorable associations with 1 or several outcomes related to growth, body composition, and risk of obesity, whereas grain consumption before age 4 months is associated with higher BMI z-score in childhood. It is notable that 15 conclusion statements about complementary feeding could not be drawn due to either lack of evidence or concerns regarding consistency, precision, and/or directness in the bodies of evidence, highlighting the need for future, rigorous research. Specifically, a need exists for prospective cohort studies and controlled trials that consider timing of introduction of different food groups and amounts of those food groups consumed during the complementary feeding period. Given these evidence gaps, conclusions for food groups beyond fruits, vegetables, and grains cannot be made at this time.

The 8 conclusion statements about feeding styles and practices, when examined collectively, highlight the potentially supportive role of structured feeding practices in promoting younger children's acceptance and consumption of healthy foods aligned with the *Dietary Guidelines*. The findings provide evidence that caregiver use of structured feeding practices may play an important role in encouraging intake of fruits and vegetables among children ages 2 to 6 years. Repeated exposure is a structured feeding practice that shows robust evidence of promoting children's acceptance of fruits and vegetables during the first 6 years of life. While health promotion efforts for healthy eating often group together fruits and vegetables, these foods are distinct in terms of taste and preference perspectives among younger children. Fruits are among the most preferred foods by younger children, due in part to their inherent sweetness, whereas vegetables are among the least preferred foods by younger children and often contain bitter flavor notes. Structured feeding practices, including repeated exposure, may support children's intakes of both fruits and vegetables by organizing children's physical and social eating environments: making readily accepted foods generally available to children (e.g., fruits) and including vegetables in eating routines (e.g., providing vegetables at snacks), providing guided choices that include vegetables, and modeling enjoyment of eating vegetables.

The lack of findings regarding other types of feeding practices as well as other aspects of dietary intake and growth, body composition, and risk of obesity outcomes among children ages 2 to 6 years highlights notable scientific gaps for promoting healthy dietary patterns aligned with the *Dietary Guidelines* and preventing diet-related chronic disease. Specifically, the inability to draw conclusions in 20 instances highlights the need for rigorous prospective and controlled trials on approaches to feeding younger children. Growth, body composition, and risk of obesity outcomes are fairly distal to the goal-oriented nature of specific child feeding practices, which are aimed at shaping children's eating behaviors and dietary intakes. As such, research evaluating outcomes related to eating behaviors and dietary intakes should be a priority for identifying approaches to feeding children that promote intakes aligned with the *Dietary Guidelines*.

Discussion

Comparison to the Pregnancy and Birth to 24 Months Project Systematic Reviews that Informed the *Dietary Guidelines for Americans, 2020-2025*

Complementary Feeding

This Committee noted several differences when comparing its conclusion statements about complementary feeding to those of the P/B-24 Project. This Committee focused solely on evaluating consumption of and timing of introduction to specific types of complementary foods and beverages—rather than the first introduction of any complementary food or beverage—in relation to growth, body composition, and risk of obesity. The Committee's updated review led to several new conclusion statements and identification of gaps in the literature.

When this Committee assessed the timing of introduction to specific complementary foods and beverages, it found that introducing grains at or before age 4 months was associated with higher BMI z-scores in childhood (supported by evidence graded as limited). However, a conclusion statement could not be drawn regarding the age at which grains were introduced (up to age 24 months) and other growth, body composition, and risk of obesity outcomes including body composition and risk of obesity in childhood because of a lack of evidence. The systematic review conducted as part of the P/B-24 Project found that first introduction of *any* complementary food or beverage before age 4 months may be associated with higher odds of overweight or obesity (supported by evidence graded as limited), whereas first introduction of *any* complementary food or beverage between ages 4 and 5 months compared to 6 months was not associated with growth, size, body composition, and risk of overweight and obesity in generally healthy, full-term infants (supported by evidence graded as moderate). This Committee had concerns about the consistency of evidence for the age of introduction of protein foods, dairy, and sugar-sweetened beverages (up to age 24 months) and growth, body composition, and risk of obesity in childhood, therefore conclusion statements could not be drawn. Similarly, not enough evidence was available to evaluate the age of introduction of 100% juice, fruit, vegetable, and food sources of added sugars in relation to growth, body composition, and risk of obesity in childhood.

When this Committee assessed consumption of specific types of complementary foods, it found no unfavorable associations between grains consumption (between ages 6 and 24 months) and growth and risk of obesity in childhood (supported by evidence graded as limited). These findings are in line with the P/B-24 Project systematic review on types and amounts of complementary foods or beverages, which identified that the type or amount of cereal did not favorably or unfavorably influence growth, size, body composition, and risk of overweight and obesity (supported by evidence graded as limited). This Committee had concerns about the consistency, directness, and precision of evidence for consumption of protein foods, dairy, and 100% juice (up to age 24 months) and growth, body composition, and risk of obesity in childhood, therefore conclusion statements could not be drawn. The P/B-24 Project systematic review identified that higher vs. lower meat intake or meat vs. iron-fortified cereal intake over a short duration (about 3 months) during the complementary feeding period does not favorably or unfavorably influence growth, size, body composition, and risk of overweight and obesity (supported by evidence graded as moderate); however evidence was insufficient to determine a relationship between meat intake and prevalence/incidence of overweight or obesity. Finally, the P/B-24 Project systematic review reported a positive association between juice intake and infant weight-for-length and child BMI z-score (supported by evidence graded as limited). An important note is that identification of 100% juice vs. "juice"—which can include sugar-sweetened beverages—was not consistent between systematic reviews. This Committee found no unfavorable association between fruits or vegetable consumption (up to age 24 months) and outcomes related to growth patterns in childhood (supported by evidence graded as limited). Not enough evidence was available, however, for outcomes related to body composition and risk of obesity. Similarly, not enough evidence was available for consumption of food sources of added sugars (up to age 24 months) and outcomes related to growth, body composition, and risk of obesity. These conclusions statements add to those of the P/B-24 Project work that identified that no conclusion could be made about the relationship between other complementary foods (vegetables, fruit, dairy products and/or cow milk, cereal-based products, milk-cereal drink, and/or categories such as "ready-made foods") and growth, size, body composition, and risk of overweight and obesity in childhood.

Details regarding consumption of sugar-sweetened beverages and 100% juice on growth, body composition, and risk of obesity are integrated in the systematic review and meta-analysis across the lifespan—which the 2020 Committee recommended conducting—and are presented in **Part D. Chapter 3. Beverages**.[28,29] The 2020 Committee also recommended that the 2025 Committee review evidence on *how* to feed infants and toddlers to complement reviews about *what* to feed infants and young children. This information is presented in the following section.

Feeding Styles and Practices

This Committee was the first to evaluate evidence examining associations of caregiver feeding styles and practices with dietary intake and growth, body composition, and risk of obesity outcomes among children ages 2 to 6 years. This work complemented and extended the P/B-24 Project work that focused more narrowly on associations of caregiver feeding practices and growth, body composition, and risk of obesity among children ages 4 to 24 months.[21] The P/B-24 Project did not review evidence on feeding styles or on influences of caregiver feeding practices on dietary outcomes.

This Committee identified favorable associations between structured feeding practices and fruit and vegetable intake among children ages 2 to 6 years. Conclusions could not be drawn, however, about the association of practices reflecting control or autonomy support with child dietary outcomes. Further, the Committee drew few conclusions regarding the influence of caregiver feeding styles and practices on child growth, body composition, and risk of obesity outcomes among children ages 2 to 6 years, largely because of a lack of rigorous studies. The exception was the conclusion that monitoring (a dimension of structure) was not associated with growth, body composition, and risk of obesity outcomes among children. In contrast, the conclusions drawn by the P/B-24 Project among children ages 4 to 24 months identified associations of feeding practices with weight-related outcomes among children.[21] A systematic review conducted as part of the P/B-24 Project found moderate evidence from randomized controlled trials to suggest that providing mothers with feeding guidance to recognize and respond appropriately to a child's hunger and satiety cues can contribute to normal weight gain and/or weight status in children ages 2 years and younger. Further, the P/B-24 review concluded that greater use of restrictive feeding practices during the period of birth to 24 months was associated with increased weight gain and higher weight status, whereas greater use of pressuring children to eat was associated with decreased weight gain and lower weight status. The P/B-24 work qualified that conclusion by noting that the direction of association between controlling feeding practices and child weight status has not been clearly established by prospective studies.

This Committee found favorable effects of repeated exposure on food acceptance, particularly vegetables, among children ages 4 to 24 months and ages 2 to 6 years. Among young children ages 4 to 24 months, the effects appeared to generalize to foods within the same category. Among children ages 2 to 6 years, increases in acceptance were observed for novel as well as previously disliked vegetables. Further, the Committee concluded that other types of sensory exposure outside of tasting may encourage children to try (i.e., taste) new foods. Collectively, these findings update and extend those of a systematic review on repeated exposure and vegetable intake among children from birth to 24 months that was conducted as part of the P/B-24 Project.[20] That review found moderate evidence that providing repeated exposure to a fruit or vegetable once a day for 8 to 10 or more days is likely to increase its acceptance and to generalize to foods in the same category. In acknowledgement of the findings of the P/B-24 reviews, the 2020 Committee subsequently recommended repeated offerings of foods such as fruits and vegetables to increase acceptance and encourage consumption of a variety of healthy foods. This Committee's findings strengthen the scientific basis for such recommendations, suggesting that repeated exposure is an effective strategy for promoting acceptance of healthy foods, particularly vegetables, during the first 6 years of life. Providing taste as well as other types of sensory exposure to healthy foods promotes their acceptance among children and has important implications for settings inside and outside the home, including federal programs that serve children and their families.

Comparisons to Other Systematic Reviews and Meta-Analyses

Complementary Feeding

Several other published systematic reviews on complementary feeding are important to highlight. For context, it is notable that Dietary Reference Intakes for specific nutrients during the complementary feeding period have not been established, which makes intake recommendations challenging. In prior systematic reviews led by the World Health Organization (WHO), several major evidence gaps were identified for ages 6 to 24 months with regard to relationships between consumption of animal food sources, or of fruits, vegetables, nuts, and pulses and dietary and health outcomes later in life.[30] These gaps have been partially addressed with this Committee's conclusion statements for the consumption of grains, fruit, and vegetables in relation to growth, body composition, and risk of obesity. Another systematic review led by the WHO suggested that early introduction of complementary foods (between 3 and 6 months) for normal-term infants might be associated with overweight, obesity, and blood pressure in observational studies (supported by limited evidence with low certainty).[31] This Committee refined the analysis to specific food groups and found that early introduction of grains was associated with higher BMI z-score in childhood (supported by evidence graded as limited).

Building on the knowledge that dietary intakes of infants are significantly associated with dietary intake of caregivers, understanding the drivers of food preferences and dietary intakes during childhood is critical.

In prior systematic reviews conducted as part of the P/B-24 Project, flavor transfer from maternal diet to the amniotic fluid and human milk was supported by evidence graded as limited and moderate, respectively.[32] Importantly, infants were found to detect diet-transmitted flavors in mother's milk (supported by evidence graded as moderate), suggesting that flavor transfer, and therefore maternal diet quality and diversity, may facilitate complementary feeding by increasing food acceptance. Such findings suggest that caregiver diet may be a promising focus for interventions aiming to shape infant food preferences and dietary intakes.

In addition, another systematic review found that socioeconomic factors, family and cultural aspects, guidance from health professionals, and factors inherent to the baby (such as the acceptance or rejection of new foods) influence caregiver selection of complementary foods.[33] More studies are needed to evaluate how food and nutrition security, individual and community resources, and cultural meaning of food choices and values may impact complementary feeding choices.[34] Parental education on readiness for complementary feeding and choice of foods should be prioritized with attention to vulnerable groups of parents such as teenagers or parents living in areas with limited access to healthcare providers.[35] Further, research is needed on the roles of fathers and other caregivers in complementary feeding.

Although other systematic reviews have focused on specific foods as this Committee did, 1 other review focused on early infancy (ages birth to 4 months),[36] and 1 focused on other outcomes (cardiometabolic risk biomarkers) not examined by this Committee.[37] Other systematic reviews focused on specific types of diets used for complementary feeding (vegetarian or vegan diets), complementary feeding approaches, and the intersection between complementary feeding and sleep. Their results suggested that: 1) vegetarian or vegan diets during the complementary feeding period have not been shown to be safe due to potential risk of micronutrient deficiencies or insufficiencies leading to growth faltering,[38] 2) complementary feeding approaches do not appear to be associated with risk of choking,[39] and 3) no association exists between timing of introduction to complementary foods and infant sleep duration during the first year of life.[40]

This Committee's findings along with findings of previous systematic reviews on complementary feeding will inform evidenced-based public health efforts to support optimal development in early life. A National Academies committee outlined possible interventions that could be scaled up or implemented at a community or state level to improve infant and young child feeding behaviors.[41] That committee's conclusions of existing ecosystems and infrastructure for complementary feeding interventions included programs in healthcare (expanding state Medicaid and Children's Health Insurance Program coverage of counseling interventions by registered dietitians, psychologists, or social workers, augmented by community health workers or peer counselors); early care and education (routinely introduce new healthy foods, fund and support early care and education providers to adopt healthy meal patterns); university cooperative extension (improve nutrition and training options for caregivers, early childhood educators, and paraprofessionals); Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (expand nutrition education and support to individuals of all income levels, and locate services in healthcare settings), and home visiting (collaboration across systems to develop, distribute, and provide training).

Feeding Styles and Practices

A number of previously published systematic reviews and meta-analyses have evaluated evidence on associations of caregiver feeding styles and practices with child outcomes. This Committee's review of the evidence, however, differs from previous systematic reviews in 2 important ways. First, most systematic reviews on this topic included cross-sectional studies, whereas the Committee considered evidence from only prospective studies and randomized controlled trials. This is important given longstanding questions regarding the direction of effects between caregiver and child, i.e., the extent to which associations reflect influences of the feeding practice on the child, or alternatively, reflect influences of the child on the feeding practices used by caregivers. Second, previous systematic reviews tended to evaluate the evidence on individual feeding practices. In contrast, the Committee organized and evaluated multiple feeding practices within broad dimensions of structure, autonomy support, and control. This approach enabled a high-level evaluation of the evidence that translates to development of population-based dietary guidance.

The Committee's findings on associations of structure-related feeding practices with child fruit and vegetable intakes are generally consistent with the only other systematic review that evaluated child dietary outcomes. A 2017 systematic review and meta-analysis of mostly cross-sectional studies evaluated associations of individual feeding practices used by caregivers of children ages 2 to 18 years (49 percent of whom were ages 2 to 6 years) with children's intake of healthy (e.g., fruits and vegetables) and unhealthy foods (e.g., SSB).[22] Results of the meta-analysis found that practices reflecting structure (specifically, parental modeling and food availability) showed the strongest positive associations with children's intake of both healthy and unhealthy foods. Other individual practices reflecting control in feeding and autonomy support showed weak associations with children's intake of healthy and unhealthy foods.[42]

Three previous systematic reviews evaluated associations of caregiver feeding styles and individual feeding practices with weight-related outcomes among children.[23,43,44] The Committee's conclusions differ from those of 2 of the systematic reviews, which included mostly cross-sectional studies. Shilom et al.[43] evaluated associations of caregiver feeding styles and practices with child body mass index (BMI) of children ages 4 to 12 years. Results showed that 2 controlling feeding practices, restriction and pressure to eat, were associated with child BMI. Restriction was positively associated with child BMI in most studies, whereas pressure to eat was negatively associated with child BMI in most studies. Moreover, indulgent feeding styles were most consistently associated with child BMI. Similarly, a 2020 systematic review and meta-analysis of mostly cross-sectional studies of children (65 percent of which involved children ages 2 to 6 years) identified associations between controlling feeding practices and child weight status (i.e., weight, BMI, BMI percentile, overweight, obesity).[44] Results showed weak positive effect sizes for associations of restriction and child weight status, and weak negative effect sizes for associations of pressure to eat and child weight status. The Committee's findings, however, are generally consistent with those of the only systematic review to date that has focused solely on prospective studies. Beckers et al. [23] evaluated associations of food parenting practices and child weight outcomes of children ages 2 to 18 years. Results indicated that restriction and pressure to eat, as well as monitoring (a dimension of structure), were generally not associated with child weight over time. Food parenting practices reflecting autonomy support and other aspects of structure were generally understudied.

The Committee's findings agree with 2 other systematic reviews on repeated exposure. A 2018 systematic review and meta-analysis found small but reliable benefits of repeated exposure to a single vegetable and to a variety of vegetables on children's acceptance of new vegetables.[45] It also found evidence that acceptance may be enhanced with the addition of small non-food rewards such as stickers or praise by incentivizing or encouraging children to try foods. Similarly, a 2017 systematic review that evaluated methods for increasing vegetable consumption among children ages 2 to 5 years concluded that repeated exposure was effective.[46] These findings collectively suggest that repeated exposure will be most effective when paired with positive social environments around eating, where children's willingness to explore and try healthy foods is reinforced and where adults consume and enjoy healthy foods with children and encourage—but do not pressure—children to try them.

In summary, the Committee's conclusions on caregiver feeding styles and practices are generally consistent with recent systematic reviews and extend that work by evaluating broad dimensions of control, structure, and autonomy support and by focusing on dietary outcomes among children. The Committee's findings on structure-related practices are also consistent with evidence-based recommendations from Healthy Eating Research (HER) on promoting healthy eating behaviors among children ages 2 to 8 years.[47] HER recommendations for promoting food acceptance and intake of healthy foods highlight the role of structure-related feeding practices (providing repeated exposure and making healthy foods available) and other feeding practices that may encourage children to try (i.e., taste) new foods (modeling, providing small rewards and praise, and providing non-taste sensory exposure).

Committee's Advice to the Departments

Complementary Feeding

Findings from the systematic reviews support existing general recommendations from the *Dietary Guidelines for Americans, 2020-2025* and provide additional details on specific complementary foods:

- Introduce complementary foods around age 6 months to complement human milk and/or iron-fortified infant formula, based on developmental signs of readiness to eat solid foods.
- Encourage infants and young children to consume a variety of foods from all food groups. Include foods rich in iron and zinc, particularly for infants fed human milk.
- Based on this Committee's review of the evidence, fruits, vegetables, and grains are complementary food options between ages 6 and 24 months that were not associated with unfavorable outcomes related to growth and risk of obesity. Vegetables, fruits, and grains are nutrient-dense options that are part of healthy dietary patterns recommended for all life stages.

- Introduce nutrient-dense foods of varying flavors and textures to ensure adequate nutrition and to promote acceptance of a variety of foods and avoid food and beverages with added sugars, and limit foods and beverages high in sodium. Because children's nutrient needs during the complementary feeding period are high relative to energy requirements, dietary patterns during this period have little to no room for less nutrient-dense choices. (See **Part E. Chapter 1: Overarching Advice to the Departments** for information on the dietary pattern for ages 12 through 23 months.
- Offer developmentally appropriate size and texture of foods to help prevent choking.
- Other considerations: Continue to recommend exclusive human milk feeding during the first 6 months of life and continue to provide inclusive language to reflect current practices; many infants in the United States are fed both human milk and infant formula at some point during infancy.[48]

Feeding Styles and Practices

Findings from the systematic reviews are consistent with general recommendations for supporting healthy eating among children and adolescents ages 2 through 18 years in the *Dietary Guidelines for Americans, 2020-2025* and provide a strong scientific basis for significantly expanding guidance about how to feed children. Three separate lines of systematic reviews conducted by the Committee highlight the supportive role of structured approaches to feeding children: associations of structured feeding practices with vegetable and fruit intake among children ages 2 to 6 years; effects of repeated exposure on acceptance of vegetables and fruit among children up to age 6 years; and effects of food portion size on energy intake among children ages 2 to 6 years (see **Part D. Chapter 7: Portion Size** for detailed presentation of this evidence).[49,50] Based on these findings, the Committee advises expanding recommendations in the *Dietary Guidelines for Americans, 2025-2030* about how to feed children, building on the existing recommendations:

- Emphasize benefits of structured feeding practices for children's consumption of healthy foods aligned with *Dietary Guidelines*. Structured feeding practices organize physical and social aspects of children's eating environments. The Committee recommends that the Departments continue to encourage specific practices mentioned in the *Dietary Guidelines for Americans, 2020-2025* that emphasize structure and expand emphasis on potential benefits for children's consumption of a diet aligned with the *Dietary Guidelines*. The Committee's work revealed favorable associations of the use of structured feeding practices with consumption of vegetables and fruit among children ages 2 to 6 years. Guidance should be enhanced to describe practices that organize physical and social aspects of children's eating environments and provide concrete examples of how these strategies can be employed by caregivers at home and in other settings where children routinely eat. Structured practices that organize physical aspects of children's eating environment dictate what, when, and how much food is available and accessible to children in the home and at meals and snacks. These include making healthy foods readily available in the home and in forms that are accessible to children (e.g., pre-cut fruit), providing repeated exposure to those foods, and providing child-sized portions. Structured practices that organize social aspects of children's eating serve to guide children's behaviors and enhance positive experiences around eating. These include having regular eating routines, offering children guided choices that allow them to choose between 2 healthy options, and providing a positive social environment where caregivers eat and enjoy healthy foods together with children.

- Emphasize benefits of repeated exposure on food acceptance for children up to age 6 years and highlight opportunities for other types of non-sensory exposure to healthy foods. Repeated exposure is a type of structured feeding practice that organizes physical aspects of children's eating environment by shaping how often children are offered specific types of foods at meals and snacks. This Committee recommends that the Departments continue to encourage caregivers of young children up to age 24 months to offer 8 to 10 exposures for acceptance of new foods. The Committee's systematic review findings provide robust evidence that the favorable effects of repeated exposure on food acceptance continue up to age 6 years. Enhancements to current guidance should include older children (up to age 6 years) and emphasize the importance of providing repeated exposure to foods in positive eating context, without pressure; caregivers can support children's acceptance of new foods by eating and enjoying those foods with children. The Committee also recommends enhancing recommendations to include other types of sensory exposure such as reading picture books and involving children in food activities. Systematic review findings indicate that providing children with non-sensory exposure to healthy foods may increase the success of repeated exposure by increasing children's willingness to try (i.e., taste) those foods. Repeated exposure is a straightforward strategy that all caregivers can adopt, including early care educators.
- Include explicit focus on the importance of providing child-appropriate portion sizes. The portion sizes of foods and beverages offered to children is an aspect of structured feeding that shapes physical aspects of children's eating environments. The Committee found robust evidence (see **Part D. Chapter 7: Portion Size**) that offering children large portions of energy-dense foods promotes energy intake at meals and over longer periods. This finding suggests that recommendations about how to feed children should be enhanced to increase attention to the importance of providing child-sized portions, emphasizing practical strategies for portion control. The Committee also found evidence that increasing vegetable and fruit portion sizes may be used strategically to promote intake without appreciable effects on children's energy intakes. The success of this strategy may be tied to the use of other practices that promote acceptance of such foods.

The Committee also highlights other considerations regarding how to feed:

- Delineate distinctions between feeding styles and feeding practices in recommendations about how to feed. Enhancements to current guidance should focus on feeding practices, which refer to specific goal-oriented behaviors used by caregivers to shape and/or guide children's eating behaviors. The Committee recommends describing feeding practices along higher-order conceptual dimensions of structure, autonomy support, and control. Although practices emphasizing structure and autonomy support are believed to have favorable influences on children's eating, the systematic review findings provided empirical support only for structured feeding practices; evidence regarding autonomy support and control was limited. Given the lack of evidence in these areas, recommendations about how to feed should focus on structured practices vs. practices that reflect autonomy support or control.

References

1. Lutter CK, Grummer-Strawn L, Rogers L. Complementary feeding of infants and young children 6 to 23 months of age. *Nutr Rev*. Jul 7 2021;79(8):825-846. doi:https://doi.org/10.1093/nutrit/nuaa143
2. D'Auria E, Borsani B, Pendezza E, et al. Complementary Feeding: Pitfalls for Health Outcomes. *Int J Environ Res Public Health*. Oct 29 2020;17(21) doi:https://doi.org/10.3390/ijerph17217931
3. DeSilva D, Cruz CM, Beckman K, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Food Groups*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://doi.org/10.52570/DA.DGAC2025.DA02
4. DeSilva D, Cruz CM, Beckman K, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Nutrients and Dietary Components*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. https://doi.org/10.52570/DA.DGAC2025.DA03
5. Black MM, Walker SP, Fernald LCH, et al. Early childhood development coming of age: science through the life course. *Lancet*. Jan 7 2017;389(10064):77-90. doi:https://doi.org/10.1016/S0140-6736(16)31389-7
6. Rousham EK, Goudet S, Markey O, et al. Unhealthy Food and Beverage Consumption in Children and Risk of Overweight and Obesity: A Systematic Review and Meta-Analysis. *Adv Nutr*. Oct 2 2022;13(5):1669-1696. doi:https://doi.org/10.1093/advances/nmac032
7. Forestell CA. Flavor Perception and Preference Development in Human Infants. *Ann Nutr Metab*. 2017;70 Suppl 3:17-25. doi:https://doi.org/10.1159/000478759
8. Hughes S, Power T. Parenting Influences on Appetite and Weight. In: Lumeng JC, Fisher JO, eds. *Pediatric Food Preferences and Eating Behaviors*. 2018:165-182:chap 9.
9. Wood AC, Blissett JM, Brunstrom JM, et al. Caregiver Influences on Eating Behaviors in Young Children: A Scientific Statement From the American Heart Association. *J Am Heart Assoc*. May 18 2020;9(10):e014520. doi:https://doi.org/10.1161/JAHA.119.014520
10. Mennella JA. Ontogeny of taste preferences: basic biology and implications for health. *Am J Clin Nutr*. Mar 2014;99(3):704s-11s. doi:https://doi.org/10.3945/ajcn.113.067694
11. Mennella JA, Trabulsi JC. Complementary foods and flavor experiences: setting the foundation. *Ann Nutr Metab*. 2012;60 Suppl 2(Suppl 2):40-50. doi:https://doi.org/10.1159/000335337
12. Hughes SO, Power TG, Orlet Fisher J, Mueller S, Nicklas TA. Revisiting a neglected construct: parenting styles in a child-feeding context. *Appetite*. Feb 2005;44(1):83-92. doi:https://doi.org/10.1016/j.appet.2004.08.007

13. Stoody EE, Spahn JM, Casavale KO. The Pregnancy and Birth to 24 Months Project: a series of systematic reviews on diet and health. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):685s-697s. doi:https://doi.org/10.1093/ajcn/nqy372
14. English LK, Obbagy JE, Wong YP, et al. Timing of introduction of complementary foods and beverages and growth, size, and body composition: a systematic review. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):935s-955s. doi:https://doi.org/10.1093/ajcn/nqy267
15. English LK, Obbagy JE, Wong YP, et al. Types and amounts of complementary foods and beverages consumed and growth, size, and body composition: a systematic review. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):956s-977s. doi:https://doi.org/10.1093/ajcn/nqy281
16. English LK, Obbagy JE, Wong YP, et al. Complementary feeding and developmental milestones: a systematic review. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):879s-889s. doi:https://doi.org/10.1093/ajcn/nqy321
17. Obbagy JE, English LK, Psota TL, et al. Complementary feeding and micronutrient status: a systematic review. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):852s-871s. doi:https://doi.org/10.1093/ajcn/nqy266
18. Obbagy JE, English LK, Wong YP, et al. Complementary feeding and food allergy, atopic dermatitis/eczema, asthma, and allergic rhinitis: a systematic review. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):890s-934s. doi:https://doi.org/10.1093/ajcn/nqy220
19. Obbagy JE, English LK, Wong YP, et al. Complementary feeding and bone health: a systematic review. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):872s-878s. doi:https://doi.org/10.1093/ajcn/nqy227
20. Spill MK, Johns K, Callahan EH, et al. Repeated exposure to food and food acceptability in infants and toddlers: a systematic review. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):978s-989s. doi:https://doi.org/10.1093/ajcn/nqy308
21. Spill MK, Callahan EH, Shapiro MJ, et al. Caregiver feeding practices and child weight outcomes: a systematic review. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):990s-1002s. doi:https://doi.org/10.1093/ajcn/nqy276
22. Yee AZ, Lwin MO, Ho SS. The influence of parental practices on child promotive and preventive food consumption behaviors: a systematic review and meta-analysis. *Int J Behav Nutr Phys Act*. Apr 11 2017;14(1):47. doi:https://doi.org/10.1186/s12966-017-0501-3
23. Beckers D, Karssen LT, Vink JM, Burk WJ, Larsen JK. Food parenting practices and children's weight outcomes: A systematic review of prospective studies. *Appetite*. Mar 1 2021;158:105010. doi:https://doi.org/10.1016/j.appet.2020.105010
24. Vaughn AE, Ward DS, Fisher JO, et al. Fundamental constructs in food parenting practices: a content map to guide future research. *Nutr Rev*. Feb 2016;74(2):98-117. doi:https://doi.org/10.1093/nutrit/nuv061
25. Fisher JO, Abrams SA, Andres A, et al. *Complementary Feeding and Growth, Body Composition, and Risk of Obesity: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR18
26. Fisher JO, Eicher-Miller HA, Odoms-Young A, et al. *Repeated Exposure to Foods and Food Acceptance: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR06
27. Fisher JO, Eicher-Miller HA, Odoms-Young A, et al. *Parental and Caregiver Feeding Styles and Practices and Consuming a Dietary Pattern that is Aligned with the Dietary Guidelines for Americans: A Systematic Review* U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR25
28. Deierlein AL, Raynor HA, Andres A, et al. *100% Juice and Growth, Body Composition, and Risk of Obesity: A Systematic Review with Meta-Analysis* U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR05

29. Deierlein AL, Raynor HA, Andres A, et al. *Sugar-Sweetened Beverages and Growth, Body Composition, and Risk of Obesity: A Systematic Review with Meta-Analysis*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR23
30. Harrison L, Oh C, Charbonneau KD, Owais A, Keats EC, Bhutta ZA. *The consumption of varying frequencies, varieties, and quantities of fruits & vegetables and pulses, nuts & seeds among children 6-23 months of age and their association with dietary and health outcomes: A systematic review and meta-analysis*. n.d.
31. Das JK, Padhani ZA, Siddiqui FA, et al. *Optimal timing of introduction of complementary feeding: A systematic review and meta-analysis*. n.d.
32. Spahn JM, Callahan EH, Spill MK, et al. Influence of maternal diet on flavor transfer to amniotic fluid and breast milk and children's responses: a systematic review. *Am J Clin Nutr*. Mar 1 2019;109(Suppl_7):1003s-1026s. doi:10.1093/ajcn/nqy240
33. Raymundo GP, Souza Dos Santos C, da Rosa SV, et al. Influences in food selection during complementary feeding in breastfeeding infants: A systematic review and metasynthesis of qualitative studies. *Appetite*. Nov 1 2024;202:107626. doi:https://doi.org/10.1016/j.appet.2024.107626
34. Annan RA, Agyapong NAF, Aduku LNE, Boakye OA, Akenteng MW. *Qualitative systematic reviews of complementary feeding recommendations' impact on preferences, equity and rights, resource implications, acceptability, and feasibility.* Organization TWH; 2021. https://cdn.who.int/media/docs/default-source/nutrition-and-food-safety/complementary-feeding/cf-guidelines/qualitative-review-preferences-equity-resources-acceptability-and-feasibility.pdf?sfvrsn=996ad2df_3
35. Spyreli E, McKinley MC, Dean M. Parental considerations during complementary feeding in higher income countries: a systematic review of qualitative evidence. *Public Health Nutr*. Jul 2021;24(10):2834-2847. doi:https://doi.org/10.1017/S1368980021001749
36. Milani GP, Edefonti V, De Cosmi V, et al. Protein and growth during the first year of life: a systematic review and meta-analysis. *Pediatr Res*. Sep 2023;94(3):878-891. doi:https://doi.org/10.1038/s41390-023-02531-3
37. Markey O, Pradeilles R, Goudet S, et al. Unhealthy Food and Beverage Consumption during Childhood and Risk of Cardiometabolic Disease: A Systematic Review of Prospective Cohort Studies. *J Nutr*. Jan 2023;153(1):176-189. doi:https://doi.org/10.1016/j.tjnut.2022.11.013
38. Simeone G, Bergamini M, Verga MC, et al. Do Vegetarian Diets Provide Adequate Nutrient Intake during Complementary Feeding? A Systematic Review. *Nutrients*. Aug 31 2022;14(17) doi:https://doi.org/10.3390/nu14173591
39. Correia L, Sousa AR, Capitão C, Pedro AR. Complementary feeding approaches and risk of choking: A systematic review. *J Pediatr Gastroenterol Nutr*. Nov 2024;79(5):934-942. doi:https://doi.org/10.1002/jpn3.12298
40. Fu X, Lovell AL, Braakhuis AJ, Mithen RF, Wall CR. Type of Milk Feeding and Introduction to Complementary Foods in Relation to Infant Sleep: A Systematic Review. *Nutrients*. Nov 16 2021;13(11) doi:https://doi.org/10.3390/nu13114105
41. National Academies of Sciences E, Medicine, Health, et al. In: Delaney KM, Savitz DA, eds. *Complementary Feeding Interventions for Infants and Young Children Under Age 2: Scoping of Promising Interventions to Implement at the Community or State Level*. National Academies Press (US Copyright 2023 by the National Academy of Sciences. All rights reserved; 2023.
42. Blaine RE, Kachurak A, Davison KK, Klabunde R, Fisher JO. Food parenting and child snacking: a systematic review. *Int J Behav Nutr Phys Act*. Nov 3 2017;14(1):146. doi:https://doi.org/10.1186/s12966-017-0593-9
43. Shloim N, Edelson LR, Martin N, Hetherington MM. Parenting Styles, Feeding Styles, Feeding Practices, and Weight Status in 4-12 Year-Old Children: A Systematic Review of the Literature. *Front Psychol*. 2015;6:1849. doi:https://doi.org/10.3389/fpsyg.2015.01849

44. Ruzicka EB, Darling KE, Sato AF. Controlling child feeding practices and child weight: A systematic review and meta-analysis. *Obes Rev*. Mar 2021;22(3):e13135. doi:https://doi.org/10.1111/obr.13135
45. Appleton KM, Hemingway A, Rajska J, Hartwell H. Repeated exposure and conditioning strategies for increasing vegetable liking and intake: systematic review and meta-analyses of the published literature. *Am J Clin Nutr*. Oct 1 2018;108(4):842-856. doi:https://doi.org/10.1093/ajcn/nqy143
46. Holley CE, Farrow C, Haycraft E. A Systematic Review of Methods for Increasing Vegetable Consumption in Early Childhood. *Curr Nutr Rep*. 2017;6(2):157-170. doi:https://doi.org/10.1007/s13668-017-0202-1
47. Fisher J, Lumeng J, Miller L, Smethers A, Lott M. *Evidence-Based Recommendations and Best Practices for Promoting Healthy Eating Behaviors in Children 2 to 8 Years*. 2021. https://healthyeatingresearch.org/
48. Centers for Disease Control and Prevention, Division of Nutrition PA, and Obesity,. *Breastfeeding Report Card*. 2022. June 11, 2024. http://www.cdc.gov/breastfeeding
49. Andres A, Fisher JO, Anderson CAM, et al. *Portion Size and Energy Intake: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR28
50. Raynor HA, Gardner CD, Anderson CAM, et al. *Portion Size and Growth, Body Composition, and Risk of Obesity: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR17

Part D. Chapter 6: Frequency of Meals and/or Snacking

Introduction

Eating behaviors are important determinants of dietary intake and some can be investigated as strategies to enhance health. Although eating behaviors are often characterized in terms of preferences, appetite, and types and amounts of foods ingested during meals, frequency of eating occasions can also be considered an eating behavior that may meaningfully affect health. Eating occasions include meals and snacks. Although no consensus exists on the specific definition of eating occasions, diets in many contexts, including the United States, are organized around daily meals—typically breakfast, lunch, and dinner. Meals include specific foods or types of foods served and consumed at set times of the day, with breakfast occurring in the morning, lunch in the afternoon, and dinner in the evening. In addition to providing nourishment, meals are often social occasions that include family members or friends.[1] Snacks are usually characterized by smaller amounts of food consumed outside of typical mealtimes.[1]

Definitions of meals may differ between populations. For example, people in certain life stages (such as infants who require more frequent feeding), people who follow different cultural norms for eating occasions, or people who have irregular schedules (such as shift workers) may consume meals at different times.[2] Given such inconsistencies with how people may categorize eating occasions, many dietary assessment methods rely on the participant to define the eating occasion. While this method allows a way to operationalize assessment of eating occasions, it makes it difficult to standardize meals and snacks. For example, breakfast is often defined as the first meal of the day. Although many adults eat breakfast early in the morning, others might skip breakfast or eat a small snack rather than a defined meal. The lack of standardization introduces challenges to conducting systematic reviews of the current literature; recommendations to address these challenges are discussed further in this chapter and in **Part E. Chapter 2: Future Directions**.

In addition to eating behaviors, another important factor that might influence nutritional and health status is timing and size of eating occasions. Recent interest has emerged in approaches such as intermittent fasting, where fasting periods are systematically applied to certain times during the day or to specific days of the week. Common dietary practices that represent patterns of time-restricted eating include breakfast skipping and after dinner meals or snacking, which may have implications for energy intake and risk of obesity. For example, skipping breakfast could reduce energy intake early in the day, but its effect on total daily energy intake, diet quality, and risk of obesity may be complex. A greater proportion of energy intake might be shifted to later in the day and could have implications for development of obesity. Breakfast consumption is also an important focus because it typically represents the breaking of an extended fasting period. Time-restricted eating, especially when foods are consumed earlier in the day, may be linked to improvements in metabolic conditions.[3,4]

This chapter provides data analysis highlights for frequency of meals/snacking from the What We Eat in America (WWEIA), National Health and Nutrition Examination Survey (NHANES) 2017-March 2020,[5] describes the Committee's systematic reviews across the lifespan on relationships between frequency of meals and/or snacking and consuming a dietary pattern that is better aligned with the *Dietary Guidelines for Americans;* energy intake; and growth, body composition, and risk of obesity. The chapter also discusses and integrates the results of these reviews of the science and provides the Committee's advice to the Departments for developing the *Dietary Guidelines for Americans, 2025-2030.*

Data Analysis Highlights for Frequency of Meals/Snacking

Breakfast

Most younger children consume breakfast (96 percent among ages 2-5 years, 88 percent among ages 6-11 years), but breakfast consumption is significantly lower among older children and adolescents (72 percent among ages 12-19 years). Breakfast consumption is significantly higher among adults ages 60 years and older (93 percent) compared to adults ages 40-59 years (85 percent) and adults ages 20-39 years (77 percent). Differences in breakfast consumption also exist among different racial and/or ethnic groups as well as among family income levels, with individuals of higher family income reporting more frequent breakfast consumption compared to individuals with lower family income.

Snacking

Snacking is highly prevalent in the United States, with 93 percent of children and adolescents ages 2-19 years and 86 percent of adults ages 20 years and older reporting 1 or more snacks on a given day (excluding snacks of only plain water). Among snack consumers ages 2-19 years, snacks contribute to daily nutrient intakes, including 27 percent of total energy, 42 percent of added sugars, 26 percent of saturated fat, and 17 percent of sodium intake. Among snack consumers ages 20 years and older, snacks contribute 23 percent of total daily energy, 43 percent of daily added sugars, 21 percent of daily saturated fat, and 14 percent of daily sodium. Among adults ages 20 years and older, mean daily energy intake is higher when a greater number of snacks are consumed in a day. For instance, adults who report 0 snacks consume an average of 1,778 kcals per day, whereas adults who report 4 or more snacks consume an average of 2,353 kcals per day. Adults who report snacks consume 304 more kcals per day compared to adults who don't report snacks, with snacks contributing an average of 520 kcals per day. The most frequently reported food categories consumed during snack occasions are snacks and sweets (including savory snacks, crackers, snack/meal bars, sweet bakery products [e.g., cakes and pies, cookies and brownies], candy, and ice cream and frozen dairy desserts) and non-alcoholic beverages.

Late Evening

Late evening consumption is defined as consumption of any food or beverage other than plain water between 8:00 p.m. and 11:59 p.m. on the intake day. Late evening consumption is significantly lower among adults ages 60 years and older (57 percent) compared to adults ages 20-59 years (66 percent). Among adults ages 20 years and older who are late evening consumers, average energy intake from foods and beverages consumed in the late evening is about 550 kcals, or 25 percent of total daily energy intake. Late evening consumption provides 26 percent of total daily intake of added sugars, 26 percent of total daily saturated fat intake, and 22 percent of total daily sodium intake. Adults ages 20 years and older who are late evening consumers have a significantly higher total daily energy intake (2,243 kcal) compared to those who are not late evening consumers (1,930 kcal). Among late evening consumers, the most commonly reported food categories consumed during the late evening period are snacks and sweets.

Setting the Systematic Review Criteria

Frequency of meals and/or snacking has been a topic of interest for multiple iterations of the *Dietary Guidelines for Americans,* with the 2010 and 2020 Committees completing systematic reviews on related topics. However, the 2025 Committee's focus on identifying strategies for individuals and families related to diet quality and weight management—a topic in which there is also public interest—led it to approach the questions presented in this chapter as new systematic reviews that included literature that met inclusion criteria and were published from 2000 to 2024. The Committee's systematic reviews on frequency of meals and/or snacking evaluated scientific literature on occasion-based measures such as meals (e.g., breakfast), snacking, frequency of meals, and number of eating occasions as defined by the studies. The Committee considered studies that enrolled participants across life stages from young children to older adults, including individuals during pregnancy and postpartum.

Consistent with the Committee's other reviews involving growth, body composition, and risk of obesity outcomes, favorable growth and body composition was distinguished from unfavorable growth and body composition. Favorable growth and body composition outcomes were increases in or greater height (children and adolescents only) or lean body mass, and reductions in or lower weight-for-age, BMI-for-age, fat mass, or waist circumference. Unfavorable growth and body composition outcomes were increases in or greater weight-for-age, BMI-for-age, fat mass, or waist circumference, and lower height (for children and adolescents only) or reductions in lean body mass. Risk of obesity included changes in incidence of overweight and obesity or increases in weight or BMI. Several key confounders were examined when interpreting results from studies of frequency of eating and/or snacking, including variables in consideration of health equity such as sex, age, race and/or ethnicity, and socioeconomic position.

List of Questions

1. What is the relationship between frequency of meals and/or snacking and consuming a dietary pattern that is better aligned with the *Dietary Guidelines for Americans*?[6]
2. What is the relationship between frequency of meals and/or snacking and energy intake?[7]
3. What is the relationship between frequency of meals and/or snacking and growth, body composition, and risk of obesity?[8]

Conclusion Statements

Question 1. What is the relationship between frequency of meals and/or snacking and consuming a dietary pattern that is better aligned with the *Dietary Guidelines for Americans*?

Approach to Answering Question: Systematic Review

A conclusion statement cannot be drawn about the relationship between frequency of meals and/or snacking and consuming a dietary pattern that is better aligned with the *Dietary Guidelines for Americans* because there is not enough evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/frequency-meals-snacks_diet-quality

Question 2. What is the relationship between frequency of meals and/or snacking and energy intake?

Approach to Answering Question: Systematic Review

Frequency of Meals and/or Snacking in Children and Adolescents

A conclusion statement cannot be drawn about the relationship between frequency of meals and/or snacking in children and adolescents and energy intake because of substantial concerns with heterogeneity of exposures in a small body of evidence. (Grade: Grade Not Assignable)

Breakfast in Adults and Older Adults

A conclusion statement cannot be drawn about the relationship between breakfast consumption in adults and total daily energy intake because of substantial concerns with consistency and generalizability in the body of evidence. (Grade: Grade Not Assignable)

A conclusion statement cannot be drawn about the relationship between breakfast consumption in older adults and energy intake because there is no evidence available. (Grade: Grade Not Assignable)

Number of Eating Occasions in Adults and Older Adults

A conclusion statement cannot be drawn about the relationship between number of eating occasions per day in adults and older adults and energy intake because of substantial concerns with generalizability in a small body of evidence. (Grade: Grade Not Assignable)

Snacking in Adults and Older Adults

A conclusion statement cannot be drawn about the relationship between snacking in adults and older adults and energy intake because of substantial concerns with generalizability in the body of evidence. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/frequency-meals-snacks_energy-intake

Question 3. What is the relationship between frequency of meals and/or snacking and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review

Breakfast

Children and Adolescents

Regular breakfast consumption by children and adolescents may be associated with favorable outcomes related to growth, body composition, and/or lower risk of obesity. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Adults and Older Adults

Breakfast skipping in adults and older adults is not associated with favorable outcomes related to body weight and composition and risk of obesity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Snacking

Children and Adolescents

Frequency of daily snacking during childhood may not be associated with outcomes related to growth, body composition, and/or risk of obesity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Adults and Older Adults

Overall snacking in adults may not be associated with outcomes related to body composition and risk of obesity. However, after dinner/evening snacking in adults may be associated with less favorable outcomes related to body composition and risk of obesity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between snacking in older adults and body composition and risk of obesity because there is not enough evidence available. (Grade: Grade Not Assignable)

Number of Eating Occasions

Children and Adolescents

Higher number of eating occasions per day during childhood may be associated with favorable outcomes related to growth, body composition, and/or lower risk of obesity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

Adults and Older Adults

Number of eating occasions per day in adults is not associated with outcomes related to change in body composition and weight. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

A conclusion statement cannot be drawn about the relationship between number of eating occasions in older adults and body composition and risk of obesity because there is not enough evidence available. (Grade: Grade Not Assignable)

Meal Frequency

Children and Adolescents

Meal frequency/skipping by children and adolescents may not be associated with outcomes related to risk of overweight or obesity. This conclusion statement is based on evidence graded as limited. (Grade: Limited)

A conclusion statement cannot be drawn about the relationship between meal frequency/skipping by children and adolescents and growth and body composition because there is not enough evidence available. (Grade: Grade Not Assignable)

Adults and Older Adults

A conclusion statement cannot be drawn about the relationship between lunch or dinner frequency in adults and older adults and outcomes related to body composition and risk of obesity because of substantial concerns related to directness and generalizability in a small body of evidence. (Grade: Grade Not Assignable)

Frequency of Meals and/or Snacking

Individuals During Pregnancy

A conclusion statement cannot be drawn about the relationship between frequency of meals and/or snacking during pregnancy and gestational weight gain because there is not enough evidence available. (Grade: Grade Not Assignable)

During Postpartum

A conclusion statement cannot be drawn about the relationship between frequency of meals and/or snacking during postpartum and postpartum weight change because there is not enough evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/frequency-meals-snacks_growth-obesity

Integration

The Committee developed scientific questions to comprehensively examine the relationship between frequency of meals and/or snacking and 3 outcomes: consuming a dietary pattern that is better aligned with the *Dietary Guidelines for Americans*; energy intake; and growth, body composition, and risk of obesity. Given the *Dietary Guidelines* focus on life stages, evidence was synthesized separately for children and adolescents and for adults and older adults. Evidence for individuals during pregnancy and postpartum was synthesized, if available, for each outcome. In addition, the outcomes of gestational weight gain and postpartum weight change were included in the systematic reviews on growth, body composition, and risk of obesity. When sufficient evidence was available, it was also synthesized by exposure categories: breakfast consumption or skipping, snacking, number of eating occasions, and frequency of meals. Evidence was not available for all outcomes, age groups, or exposure categories, therefore conclusions statements were developed only if sufficient evidence was available. This evidence will support development of population-level food-based recommendations to promote healthy dietary patterns and weight.

For the relationship between frequency of meals and/or snacking and consuming a dietary pattern that is better aligned with the *Dietary Guidelines*, conclusion statements could not be developed because not enough evidence was available across all life stages.

For the relationship between frequency of meals and/or snacking and energy intake, conclusion statements could not be developed. Substantial concerns with heterogeneity of exposures in a small body of evidence characterized the evidence base reviewed for children and adolescents, and substantial concerns with consistency and/or generalizability were present in the evidence base reviewed for adults and older adults.

The Committee developed conclusion statements for outcomes related to growth, body composition, and risk of obesity that were described as favorable (i.e., better growth pattern in children, lower risk of obesity), unfavorable (i.e., higher body weight, higher waist circumference, higher risk of obesity), or no association (i.e., no change in body weight or waist circumference, no change in the risk of obesity). The conclusion statements varied depending on the type and frequency of meal and/or snacking studied. For example, regular breakfast consumption by children and adolescents may be associated with favorable outcomes related to growth, body composition, and/or lower risk of obesity. In adults and older adults, the evidence on breakfast focused on breakfast skipping rather than regular breakfast consumption, and the Committee concluded that breakfast skipping was not associated with favorable outcomes related to body weight and composition and risk of obesity. With regard to number of eating occasions, a higher number of eating occasions in children may be associated with favorable outcomes related to growth, body composition, and/or lower risk of obesity, whereas in adults, number of eating occasions was not associated with body weight and composition.

Among children, frequency of daily snacking may not be associated with outcomes related to growth, body composition, and/or risk of obesity. In adults, overall snacking may not be associated with outcomes related to body composition and risk of obesity, whereas after dinner/evening snacking may be associated with less favorable outcomes related to body composition and risk of obesity. Lastly, meal frequency/skipping by children and adolescents may not be associated with outcomes related to risk of overweight or obesity, however, not enough evidence was available to evaluate the relationship between meal frequency/skipping in children and growth and body composition. Conclusion statements could not be developed for the relationship between frequency of lunch or dinner and outcomes related to body composition and risk of obesity in adults and older adults because of substantial concerns related to directness and generalizability in a small body of evidence. Conclusion statements could not be developed for frequency of meals/snacking and outcomes related to gestational weight gain or postpartum weight change, because there was not enough evidence available.

Most of the conclusion statements were either not assigned a grade or graded as limited, although 2 were graded as moderate. Evidence was graded as moderate for regular breakfast consumption by children and adolescents and favorable outcomes related to growth, body composition, and/or lower risk of obesity, as well as for no association between number of eating occasions per day and change in body composition and weight in adults.

Summary

Taken together, the Committee found that in children and adolescents, regular breakfast consumption and higher number of eating occasions may be associated with favorable outcomes related to growth, body composition, and/or lower risk of obesity; frequency of daily snacking among children may not be associated with outcomes related to growth, body composition, and/or risk of obesity; and meal frequency/skipping among children may not be associated with risk of overweight or obesity. Heterogeneity of exposures in a small body of evidence prevented the ability to rigorously evaluate associations between frequency of meals and/or snacking with energy intake.

Among adults and older adults, breakfast skipping, overall snacking, and number of eating occasions may not be associated with outcomes related to body composition, body weight, and/or risk of obesity, but after dinner/evening snacking may be associated with less favorable outcomes related to body composition and risk of obesity. Not enough evidence and serious limitations related to generalizability made it challenging to evaluate the relationship between frequency of meals and/or snacking and energy intake.

For all life stages, not enough evidence was available to assess the frequency of meals and/or snacking and consuming a dietary pattern that is better aligned with the *Dietary Guidelines*, as measured by the Healthy Eating Index. Similarly, not enough evidence was available to assess the relationship between frequency of meals and/or snacking and gestational weight gain or postpartum weight change.

Discussion

Regarding breakfast, the Committee found that in children and adolescents, regular breakfast consumption may be associated with favorable outcomes related to growth, body composition, and/or risk of obesity. The evidence suggests that regular breakfast consumption should be encouraged for children and adolescents. In adults and older adults, the Committee concluded that breakfast skipping is not associated with favorable outcomes related to body weight and composition and risk of obesity. Due to serious heterogeneity in the direction and the significance of the results in the 19 included articles (18 randomized controlled trials and 1 prospective cohort study) that could not be explained by participant characteristics, the Committee was unable to develop a conclusion statement on the relationship between breakfast consumption in adults and total daily energy intake.

Regarding snacking, the Committee found that in children, frequency of daily snacking may not be associated with outcomes related to growth, body composition, and/or risk of obesity, whereas in adults, after dinner/evening snacking may be associated with less favorable outcomes related to body weight and composition and risk of obesity. The Committee reviewed 19 articles in total (7 in children and adolescents and 12 in adults and older adults). This large body of evidence enabled the Committee to consider frequency of snacking, which may be more important than snacking in general for outcomes related to growth, body composition, and/or risk of obesity. An important note is that the Committee was unable to review the quality of the snack consumed, due to inconsistencies in reporting and/or description of snack quality in the included studies. Future studies should consider snack type and quality, because certain foods such as fruits, nuts, seeds, and dairy products, if consumed as a snack, will likely contribute to an overall dietary pattern that is better aligned with the *Dietary Guidelines*.

Regarding frequency of meals, the Committee found that meal frequency/skipping by children and adolescents may not be associated with risk of obesity, based on 13 studies. No conclusion statements were drawn for growth and body composition in children (5 observational studies) or for body weight, composition, and risk of obesity in adults and older adults (5 cohort studies with most finding a null relationship) due to not enough evidence.

Regarding number of eating occasions, the Committee concluded that a higher number of eating occasions may be associated with favorable outcomes related to growth, body composition, and/or risk of obesity in children, whereas number of eating occasions is not associated with outcomes related to changes in body weight and composition in adults. Although this conclusion points to the need for developing food-based guidance that takes into account number of eating occasions for children, the studies did not consistently report or describe the quality of foods consumed at the eating occasions. Therefore, future studies that evaluate the number of eating occasions in combination with food types and quality are needed to refine food-based guidance that will help align children's dietary intake to meet *Dietary Guidelines* recommendations. Nevertheless, considering that little room is available for high energy-dense foods in children's diets (particularly younger children and children during rapid growth periods), the nutritional quality of the foods consumed during each eating occasion is important.

Comparison to Other Systematic Reviews and Meta-Analyses

The Committee's conclusions for breakfast intake and outcomes related to growth, body composition, and/or risk of obesity in children agree in part with findings of other published systematic reviews.[9-12] A 2023 systematic review of 40 retrospective studies of 323,244 children found that skipping breakfast was positively associated with overweight in children and adolescents (odds ratio [OR]=1.37, 95% confidence interval [CI]: 1.23, 1.54; p<0.001).[11] A 2020 systematic review of 9 cohort studies and 36 cross-sectional studies with participants ranging from children to adults found that low frequency of weekly breakfast intake was related to a higher risk for overweight/obesity (relative risk [RR]=1.44, 95% CI: 1.25, 1.66; I^2=61%; p=0.009) compared to high frequency of weekly breakfast intake, with no significant difference in results by age, gender, geographic region of residence, or financial status.[9] A 2021 systematic review found an 11 percent increase in relative risk for overweight/obesity when breakfast was skipped ≥3 days per week compared to ≤2 days per week based on 2 cohort studies (95% CI: 1.04, 1.19), but BMI change was not different between the breakfast skipping group and the breakfast eating group from 2 studies (β = -0.02; 95% CI: -0.05, 0.01).[12] Lastly, a 2019 meta-analysis of 13 trials examining weight change and/or energy intake found a small difference in weight among breakfast skippers compared to habitual breakfast eaters (mean difference=0.44 kg, 95% CI: 0.07, 0.82), but the results were heterogeneous (I^2=43%).[10] Individuals randomized to the breakfast eating group had a higher total daily energy intake than individuals in the breakfast skipping group (mean difference=260 kcal/day, range 79 to 441 kcal/day), but results were highly heterogeneous (I^2=80%). These trials were short in duration (2 weeks for energy intake and 7 weeks for body weight) and risk of bias concern was present in at least 1 domain.[10] Although this Committee did not conduct a meta-analysis, it similarly found that results in the body of evidence were mixed and had many limitations, including lack of diversity in the study populations, different study designs and interventions, and diversity in energy intake assessments. Study duration may be an unexplained driver of the mixed results in the trials that the Committee reviewed.

With respect to snacking, prior systematic reviews are limited. A 2024 systematic review evaluated the relationship between consumption of discretionary snacks (defined as “non-core foods that typical dietary guidance does not recommend for regular consumption and that are usually consumed outside of main meals”) and weight status. For adults, the review found a positive association between consumption of such snacks and weight status (based on 4 longitudinal studies); for children, it found a negative association between consumption of snacks and weight status (based on 3 longitudinal studies).[13] That review, however, did not specify the time during which the snack occurred, which this Committee considered an important factor. Indeed, this Committee concluded that only after dinner/evening snacking was found to be associated with less favorable body composition and risk of obesity outcomes in adults. A 2020 systematic review of 21 observational studies (most of which were cross-sectional) found that consuming snacks ≥4 times/week compared to <4 times/week was associated with lower odds of overweight or obesity in children (OR=0.84, 95% CI: 0.71, 1.00; p=0.050).[14] That finding differs from this Committee’s conclusion statement, which states that frequency of daily snacking among children may not be associated with outcomes related to growth, body composition, and/or risk of obesity. Differences in findings may be driven by the review’s population (ages 5 to 19 years), the categorization of snacking as number of snacks per day with a cut-off at 4, and inclusion of cross-sectional studies.

No previous systematic reviews were found for number of eating occasions or frequency of meals and outcomes related to growth, body composition, and/or risk of obesity. Similarly, no previous systematic reviews were found to examine relationships between frequency of meals and/or snacking and gestational weight gain or postpartum weight change.

Committee's Advice to the Departments

The Committee's advice to the Departments as they develop the *Dietary Guidelines for Americans*, *2025-2030*, is to continue to recommend regular breakfast consumption as part of a dietary pattern that is better aligned with the *Dietary Guidelines*, particularly for children and adolescents. Among children and adolescents, regular breakfast consumption may be associated with favorable outcomes related to growth, body composition, and/or lower risk of obesity. Among adults, breakfast skipping was not associated with favorable outcomes related to body weight and composition, and risk of obesity. Individuals might choose not to consume breakfast for a variety of reasons. For children, these can include lack of time, not being hungry, food preferences, not understanding the benefits of consuming breakfast, and possible stigma associated with breakfast consumption at school.[15-17] The School Breakfast Program can be an important facilitator of breakfast consumption among children. Strategies to reduce stigma and increase breakfast consumption in this setting include providing universal breakfast (i.e., all children in schools participating in the School Breakfast Program receive free breakfast, regardless of family income), providing 'grab and go' breakfasts, allowing breakfast to be served after the bell, and advertising breakfast offerings along with the benefits of eating breakfast.[17,18] For adults, reasons for not consuming breakfast include using this behavior as a weight-loss strategy, limited knowledge of the potential benefits of consuming breakfast, and time constraints.[15,19] Breakfast provides an important opportunity for individuals to improve the nutritional quality of foods they consume to meet nutrient requirements as well as to consume a diet that is aligned with *Dietary Guidelines* recommendations.

The Committee advises the Departments to continue recommending nutrient-dense snacks as part of a dietary pattern that is better aligned with the *Dietary Guidelines* for children and adolescents. Nutrient-dense snacks are key opportunities for children—particularly younger children and children during periods of rapid growth—to meet intake goals for key nutrients for growth and development when meals alone might not fulfill the goals. The nutrition standards for snacks served in early care and education and after-school programs that participate in the Child and Adult Care Food Program (CACFP), National School Lunch Program (NSLP), and Summer Food Service Program (SFSP) should continue to align with the *Dietary Guidelines*.[20-22] Starting in School Year 2014-2015, all foods sold at school during the school day were required to meet nutrition standards.[23] The Smart Snacks in School regulations apply to foods sold à la carte, in the school store, vending machines, and any other venues where food is sold to students.[24] USDA's Food and Nutrition Service provides tools and resources to help schools and other organizations and programs that provide snacks to identify foods that meet Smart Snacks criteria. These tools and resources can help caregivers support and encourage children to make healthier snack choices that are consistent with the *Dietary Guidelines*. The Committee also recommends the *Dietary Guidelines for Americans*, *2025-2030* provide specific strategies to improve the nutritional quality of the foods and beverages consumed as a snack. Snacking occasions are often associated with consumption of foods and beverages high in energy density and low in nutrient density which could be replaced by nutrient-dense options such as fruits, vegetables, whole grains, and non-fat or low-fat dairy.

The Committee recommends that the Departments incorporate guidance about after dinner/evening snacking in the *Dietary Guidelines*, as the Committee found that this type of snacking may be associated with less favorable outcomes related to body composition and risk of obesity in adults, potentially because the types of snacks typically consumed after dinner or late in the evening are high in energy density and low in nutrient density. The Committee recommends including strategies such as reducing consumption of snacks high in energy density and low in nutrient density and increasing consumption of nutrient-dense snacks consumed after dinner or late in the evening to improve the quality of the foods and beverages consumed, and as part of a dietary pattern that is better aligned with the *Dietary Guidelines*.

The Committee recommends promoting diets with a higher number of eating occasions in children, as this may be associated with favorable outcomes related to growth, body composition, and/or lower risk of obesity. It is important to note that the studies did not specify the types of foods consumed during these eating occasions, but considering that little room is available for high energy-dense foods in children's diets, particularly younger children and children during rapid growth periods, the nutritional quality of the foods consumed during each eating occasion is important. Therefore, the Committee's advice includes dividing nutrient-dense foods into smaller meals/snacks throughout the day to allow children to consume key nutrients for healthy growth and development. This recommendation is in line with the finding that meal frequency/skipping in children and adolescents may not be associated with risk of obesity, therefore a higher number of eating occasions is not expected to negatively affect outcomes related to growth, body composition, and/or lower risk of obesity. In adults, the number of eating occasions was not associated with outcomes related to body composition and/or lower risk of obesity. Therefore, guidance for adults may include consuming the recommended dietary patterns in accordance with an individual's preferences and schedules.

References

1. St-Onge MP, Ard J, Baskin ML, et al. Meal Timing and Frequency: Implications for Cardiovascular Disease Prevention: A Scientific Statement From the American Heart Association. *Circulation*. Feb 28 2017;135(9):e96-e121. doi:https://doi.org/10.1161/CIR.0000000000000476
2. Ansu Baidoo VY, Zee PC, Knutson KL. Racial and Ethnic Differences in Eating Duration and Meal Timing: Findings from NHANES 2011-2018. *Nutrients*. Jun 11 2022;14(12)doi:https://doi.org/10.3390/nu14122428
3. Rovira-Llopis S, Luna-Marco C, Perea-Galera L, Banuls C, Morillas C, Victor VM. Circadian alignment of food intake and glycaemic control by time-restricted eating: A systematic review and meta-analysis. *Rev Endocr Metab Disord*. Apr 2024;25(2):325-337. doi:https://doi.org/10.1007/s11154-023-09853-x
4. Chaix A, Manoogian ENC, Melkani GC, Panda S. Time-Restricted Eating to Prevent and Manage Chronic Metabolic Diseases. *Annu Rev Nutr*. Aug 21 2019;39:291-315. doi:https://doi.org/10.1146/annurev-nutr-082018-124320
5. Cruz CM, DeSilva D, Beckman K, al. e. Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Patterns of Food and Beverage Intake. 2024;doi:https://doi.org/10.52570/DA.DGAC2025.DA01
6. Palacios C, Andres A, Odoms-Young A, et al. *Frequency of Meals and/or Snacking and Consuming a Dietary Pattern That is Aligned With the Dietary Guidelines for Americans: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR09

7. Andres A, Giovannucci E, Fisher JO, et al. *Frequency of Meals and/or Snacking and Energy Intake: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR10
8. Palacios C, Raynor HA, Anderson CAM, et al. *Frequency of Meals and/or Snacking and Growth, Body Composition, and Risk of Obesity: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR16
9. Ma X, Chen Q, Pu Y, et al. Skipping breakfast is associated with overweight and obesity: A systematic review and meta-analysis. *Obes Res Clin Pract*. Jan-Feb 2020;14(1):1-8. doi:https://doi.org/10.1016/j.orcp.2019.12.002
10. Sievert K, Hussain SM, Page MJ, et al. Effect of breakfast on weight and energy intake: systematic review and meta-analysis of randomised controlled trials. *BMJ*. Jan 30 2019;364:l42. doi:https://doi.org/10.1136/bmj.l42
11. Wang K, Niu Y, Lu Z, Duo B, Effah CY, Guan L. The effect of breakfast on childhood obesity: a systematic review and meta-analysis. *Front Nutr*. 2023;10:1222536. doi:https://doi.org/10.3389/fnut.2023.1222536
12. Wicherski J, Schlesinger S, Fischer F. Association between Breakfast Skipping and Body Weight-A Systematic Review and Meta-Analysis of Observational Longitudinal Studies. *Nutrients*. Jan 19 2021;13(1)doi:https://doi.org/10.3390/nu13010272
13. Cooke CB, Greatwood HC, McCullough D, et al. The effect of discretionary snack consumption on overall energy intake, weight status, and diet quality: A systematic review. *Obes Rev*. Apr 2024;25(4):e13693. doi:https://doi.org/10.1111/obr.13693
14. Poorolajal J, Sahraei F, Mohamdadi Y, Doosti-Irani A, Moradi L. Behavioral factors influencing childhood obesity: a systematic review and meta-analysis. *Obes Res Clin Pract*. Mar-Apr 2020;14(2):109-118. doi:https://doi.org/10.1016/j.orcp.2020.03.002
15. Eck KM, Delaney CL, Clark RL, et al. The "Motor of the Day": Parent and School-Age Children's Cognitions, Barriers, and Supports for Breakfast. *Int J Environ Res Public Health*. Sep 4 2019;16(18)doi:https://doi.org/10.3390/ijerph16183238
16. Dykstra H, Davey A, Fisher JO, et al. Breakfast-Skipping and Selecting Low-Nutritional-Quality Foods for Breakfast Are Common among Low-Income Urban Children, Regardless of Food Security Status. *J Nutr*. Mar 2016;146(3):630-6. doi:https://doi.org/10.3945/jn.115.225516
17. Hearst MO, Shanafelt A, Wang Q, Leduc R, Nanney MS. Altering the School Breakfast Environment Reduces Barriers to School Breakfast Participation Among Diverse Rural Youth. *J Sch Health*. Jan 2018;88(1):3-8. doi:https://doi.org/10.1111/josh.12575
18. Mumm J, Hearst M, Shanafelt A, Wang Q, Leduc R, Nanney M. Increasing Social Support for Breakfast: Project BreakFAST. *Sage Journals*. 2017;18(6)doi:https://doi.org/10.1177/1524839917711123
19. Smith KJ, McNaughton SA, Cleland VJ, Crawford D, Ball K. Health, behavioral, cognitive, and social correlates of breakfast skipping among women living in socioeconomically disadvantaged neighborhoods. *J Nutr*. Nov 2013;143(11):1774-84. doi:https://doi.org/10.3945/jn.113.181396
20. U.S. Department of Agriculture, Food and Nutrition Service. Afterschool Snacks. https://www.fns.usda.gov/cn/afterschool-snacks
21. U.S. Department of Agriculture, Food and Nutrition Service. SUN Meals (Summer Food Service Program) Meal Patterns. https://www.fns.usda.gov/sfsp/meal-patterns#item3
22. U.S. Department of Agriculture, Food and Nutrition Service. Nutrition Standards for CACFP Meals and Snacks. Updated October 31, 2024. https://www.fns.usda.gov/cacfp/nutrition-standards
23. U.S Department of Agriculture, Food and Nutrition Service. National School Lunch Program and School Breakfast Program: Nutrition Standards for All Foods Sold in School as Required by the Healthy, Hunger-Free Kids Act of 2010 (81 FR 50132, July 29, 2016) https://www.federalregister.gov/documents/2016/07/29/2016-17227/national-school-lunch-program-and-school-breakfast-program-nutrition-standards-for-all-foods-sold-in.
24. Competitive Food Service and Standards. In: U.S. Department of Agriculture, Food and Nutrition Service, editors. 7 CFR2024 https://www.ecfr.gov/current/title-7/subtitle-B/chapter-II/subchapter-A/part-210/subpart-C/section-210.11.

Part D. Chapter 7: Portion Size

Introduction

Dietary patterns that include a variety of nutrient-dense foods with appropriate calories are integral to health promotion and disease prevention. The *Dietary Guidelines for Americans, 2020–2025* encourages Americans to monitor portion size and to consider reducing portions to accommodate a variety of food choices that can fit within their calorie needs. Portion size refers to the amount of food or beverage served at a given time during a singular eating occasion and includes pre-portioned, self-served, and packaged foods and beverages. Portion size differs from serving size, which has often been used to refer to the customary or standard amount of a particular food or beverage consumed for the purpose of evaluating nutritional content or providing dietary guidance.

The *Dietary Guidelines* has provided guidance on portion size since 2005, and such guidance has evolved throughout the past 2 decades in response to the rising U.S. prevalence and profound health consequences of obesity.[1] Hill and Peters' landmark 1999 paper in *Science* was among the first to call out environmental contributions to obesity, citing potential contributing effects of an "unlimited supply of convenient, relatively inexpensive, highly palatable, energy-dense foods."[2] Those and other scientific observations of environmental contributions spurred a new direction of scientific research, which moved beyond diet-health relationships to consider external factors that influence what and how much people eat. Understanding how portion sizes influence selection and consumption of food is critical for identifying strategies to help individuals follow a healthy dietary pattern with appropriate calories to achieve or maintain a healthy weight.[3]

This chapter describes the Committee's examination of evidence on relationships between food and beverage portion sizes and 1) growth, body composition, and risk of obesity; and 2) energy intake. The chapter also discusses the results of those systematic reviews and provides the Committee's advice to the Departments for developing the *Dietary Guidelines for Americans, 2025-2030*.

Setting the Review Criteria

The Committee conducted systematic reviews across life stages from young children to older adults, including individuals during pregnancy and postpartum. Given general public interest in identifying strategies that support healthy dietary patterns as well as a healthy weight, the Committee's work evaluated scientific literature on portion size that considered energy density, nutrient density, and/or the quality or type of food/beverage served. As the Committee synthesized evidence on portion size and growth, body composition, and risk of obesity, it considered studies of food and beverage portion size that provided 1) pre-portioned or pre-packaged foods at snacks and meals; 2) education on portion control as a behavioral strategy; and 3) tools or aids to facilitate portion control, such as graduated or smaller tableware (i.e., bowls, glasses, plates), smaller serving utensils and dishware, and technology/software aids for portion control. During synthesis of the evidence for portion size and energy intake, the Committee delineated effects of portion size and energy density (i.e., amount of energy per weight (g) of food or drink) by separately evaluating foods low in energy density (e.g., vegetables) vs. foods high in energy density (e.g., macaroni and cheese). The Committee also separately evaluated studies that provided pre-portioned foods given their relevance for translatable portion size strategies, such as batch cooking, meal prepping, and pre-packaged point-of-purchase meals.

The Committee examined several key confounders when interpreting results of its systematic reviews, including variables it prioritized in consideration of health equity such as sex, age, race and/or ethnicity, and socioeconomic position. Given interests in the implications of portion size for energy balance and weight maintenance, the Committee identified energy intake and anthropometry at baseline as important potential confounders of relationships between portion size and 1) growth, body composition, and risk of obesity; and 2) energy intake outcomes. Consistent with the Committee's other reviews involving growth, body composition, and risk of obesity outcomes, it distinguished favorable growth and body composition outcomes from unfavorable growth and body composition outcomes, a distinction that was extended to the examination of the relationship between portion size and energy intake as well. Favorable growth and body composition outcomes were increases in or greater height (children and adolescents only) or lean body mass, and reductions in or lower weight-for-age, BMI-for-age, fat mass, or waist circumference. Unfavorable growth and body composition outcomes were increases in or greater weight-for-age, BMI-for-age, fat mass, or waist circumference, and lower height (for children and adolescents only) or reductions in lean body mass. For the relationship between portion size and energy intake, energy intake as an outcome was examined within a singular eating occasion as well as over longer time periods (depending on what was measured in the study).

Expansion of Previous Reviews

Numerous narrative reviews have examined the body of empirical studies on portion size that has accumulated between 2000 and 2023.[4-6] Review topics include studies of portion size effects on food intake among children and adults,[7,8] potential mechanisms of effects on behaviors,[9,10,11] and the role of portion size in development of obesity and in weight management.[3,12-15] Surprisingly few systematic reviews, however, have been conducted to rigorously evaluate the scientific evidence on portion size. A 2015 meta-analysis of 58 studies of children and adults found a small to moderate effect of portion size, package size, and/or tableware size on food consumption at meals and snacks.[16] A 2023 systematic review and meta-analysis of 14 short-term studies of children and adults found moderate to large effects of offering small vs. large portion sizes on daily energy intake over different periods of exposure (1 to 11 days in 12 studies and 1 to 6 months in 2 studies).[17]

These findings provide robust scientific rationale for the Committee's consideration of portion size as a potential strategy for reducing excessive energy intake and risk of obesity. However, prior research lacks explicit consideration of certain parameters, such as energy density, that are important for evaluating portion size as a population-based strategy for achieving healthy dietary patterns and achieving or maintaining a healthy weight.[3,15] Therefore, the Committee prioritized integrating the concepts of food type, portion size, and energy density in its comprehensive review of the evidence on portion size in order to identify specific evidence-based strategies that individuals can use to achieve the *Dietary Guidelines* recommendations.

List of Questions

1. What is the relationship between portion size and growth, body composition, and risk of obesity?[18]
2. What is the relationship between portion size and energy intake?[19]

Conclusion Statements

Question 1. What is the relationship between portion size and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review

Young Children, Children, and Adolescents

A conclusion statement cannot be drawn about the relationship between portion sizes consumed by young children, children, and adolescents and growth, body composition, and risk of obesity because there is not enough evidence available. (Grade: Grade Not Assignable)

Adults and Older Adults

A conclusion statement cannot be drawn about the relationship between portion sizes consumed by adults and older adults and body composition or risk of obesity because of inconsistency in the interventions, comparators, and outcomes in the body of evidence. (Grade: Grade Not Assignable)

Individuals During Pregnancy

A conclusion statement cannot be drawn about the relationship between portion sizes consumed during pregnancy and gestational weight gain because there is not enough evidence available. (Grade: Grade Not Assignable)

Individuals During Postpartum

A conclusion statement cannot be drawn about the relationship between portion sizes consumed during postpartum and postpartum weight change because there is no evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/portion-size_growth-obesity

Question 2. What is the relationship between portion size and energy intake?

Approach to Answering Question: Systematic Review

Young Children, Children, and Adolescents

Serving larger portions of energy dense foods increases energy intake in children. This conclusion statement is based on evidence graded as strong. (Grade: Strong)

Serving larger portions of vegetables and fruits increases intake of those foods without increasing energy intake in children. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

A conclusion statement cannot be drawn about the relationship between portion size and energy intake in young children and adolescents because there is no evidence available. (Grade: Grade Not Assignable)

A conclusion statement cannot be drawn about the relationship between pre-portioned foods by young children, children, and adolescents and energy intake because there is not enough evidence available. (Grade: Grade Not Assignable)

Adults and Older Adults

Serving larger portions of foods increases food and energy intake in adults and older adults. This conclusion statement is based on evidence graded as strong. (Grade: Strong)

Portion size and energy density are independent and additive in their effects on energy intake in adults and older adults. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Serving foods as smaller pre-portioned amounts decreases energy intake in adults and older adults. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Individuals During Pregnancy

A conclusion statement cannot be drawn about the relationship between portion size and energy intake during pregnancy because there is no evidence available. (Grade: Grade Not Assignable)

A conclusion statement cannot be drawn about the relationship between pre-portioned foods and energy intake during pregnancy because there is no evidence available. (Grade: Grade Not Assignable)

Individuals During Postpartum

A conclusion statement cannot be drawn about the relationship between portion size and energy intake during postpartum because there is no evidence available. (Grade: Grade Not Assignable)

A conclusion statement cannot be drawn about the relationship between pre-portioned foods and energy intake during postpartum because there is no evidence available. (Grade: Grade Not Assignable)

View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/portion-size_energy-intake

Integration

The Committee developed scientific questions to comprehensively examine the effects of food and beverage portion size on 1) growth, body composition, and risk of obesity; and 2) energy intake consumed to support the development of graded, population-level, food-based recommendations that could be used to achieve healthy dietary patterns and healthy weight. Given the focus of guidelines on life stage, the evidence was synthesized separately across life stages. Although only 2 broad questions on portion size were developed, the evidence base for portion size and growth, body composition, and risk of obesity contained fewer studies, therefore conclusion statements could not be developed for this question. The evidence base for portion size and energy intake was large enough to organize the evidence such that separate conclusion statements could be developed for portion size and types of foods consumed (energy-dense foods, vegetables and fruits, and pre-portioned foods). When conclusions could be drawn from the Committee's review of evidence on portion size and energy intake, they included favorable (i.e., reduction in energy intake), unfavorable (i.e., increase in energy intake), and no association (i.e., no change in energy intake) relationships.[18,19] All conclusion statements were graded as moderate or strong, pointing to the potential for portion size to be used as a favorable strategy to manage energy intake.

Portion Size and Growth, Body Composition, and Risk of Obesity Outcomes for Which Conclusions Could Not Be Drawn

No conclusions could be drawn from the Committee's review of the evidence on portion size and growth, body composition, and risk of obesity. For young children, children, adolescents, and individuals during pregnancy and during postpartum, not enough evidence was available to draw a conclusion. For adults and older adults, inconsistency in the interventions, comparators, and outcomes within the evidence prevented the ability to draw a conclusion.[18] The inability to draw conclusions regarding food and beverage portion size in relation to growth, body composition, and risk of obesity highlights the need for more research in this area. This is important because consuming less energy-dense foods over time may help prevent obesity.

Favorable Relationships Between Portion Size and Energy Intake

Two conclusion statements about portion size and energy intake found favorable outcomes. Among children, serving larger portions of vegetables and fruits was not related to greater energy intake, due to the low energy density of these foods, which is favorable and consistent with recommendations to consume more vegetables and fruits.[19] Among adults and older adults, the use of pre-portioned foods decreases energy intake.

Unfavorable Relationships Between Portion Size and Energy Intake

Three conclusion statements about portion size and energy intake found unfavorable outcomes. Among children, larger portions of energy-dense foods were related to greater energy intake. Among adults and older adults, larger portions of food were related to greater energy intake, and among adults and older adults, portion size and energy density of foods independently and additively increased energy intake.[19,20]

Portion Size and Energy Intake Relationships for Which Conclusions Could Not Be Drawn

No conclusions could be drawn for portion size and energy intake among young children and adolescents because no evidence was available. In addition, no conclusions could be drawn for pre-portioned foods and energy intake among young children, children, or adolescents because the body of evidence was too small and included only 1 RCT. In addition, no conclusions could be drawn for portion size or pre-portioned foods and energy intake among individuals during pregnancy or postpartum because no evidence was available.[19]

Summary

The conclusion statements for relationships between portion size and energy intake indicate that serving larger portion sizes increases food and beverage intake, but the impact of portion size on energy intake depends on the energy density of the food or beverage consumed. In general, for both children and adults, larger portion sizes increase intake, and if the larger portion is an energy-dense food, energy intake increases. If the larger portion is of lower energy-dense foods or beverages, energy intake may not change even though food intake increases, particularly among children. Pre-portioned foods, which generally are foods that have been portioned as a recommended standard serving size or as a smaller portion, reduces energy intake in adults and older adults. Thus, consuming smaller portions of energy-dense foods or beverages, which could be achieved by using pre-portioned foods, may be related to reduced energy intake. Although the body of evidence considered demonstrates robust influences of food and beverage portion size on intake among children and adults, evidence is lacking with regard to the relationship between portion size and energy intake in young children, adolescents, and individuals during pregnancy and during postpartum. Evidence is also lacking with regard to the role of portion size in achieving or maintaining a healthy weight and growth, body composition, and risk of obesity overall. The scientific literature has noted that the relationships described in the conclusion statements have been found to be consistent 1) across participant characteristics, such as age and body mass index, and 2) across many types of foods, such as unit foods (e.g., sandwiches) and amorphous entrees (e.g., macaroni and cheese).[20]

Discussion

Comparison to Previous Dietary Guidelines Advisory Committee Findings

This Committee's systematic reviews build on a narrative review of the evidence conducted by the 2005 Committee on portion size and energy intake and a systematic review conducted by the 2010 Committee's review on portion size and body weight, both of which considered much smaller and narrower bodies of evidence than the current review.[21,22]

The 2005 Committee indicated that, based on the findings of 6 short-term feeding studies, 1 longitudinal study, and 3 observational studies, "The amount of food offered to a person influences how much he or she eats; and, in general, more calories are consumed when a large portion is served rather than a small one." The 2005 Committee also called out the importance of limiting portions of energy-dense foods.

The current Committee's conclusions generally agree with the 2005 findings and extend it in several important ways.[19] First, the Committee evaluated the evidence separately for children and adults and concluded that strong evidence demonstrates that intake of larger portions of energy-dense foods promote higher energy intake. This conclusion points to an opportunity to develop food-based guidance on portion size across the lifespan that is sensitive to life stage considerations and energy density of foods and beverages. Second, the Committee concluded that for children, increasing the portion sizes of vegetables and fruits offered was not related to greater energy intake, which may have beneficial effects on children's vegetable and fruit consumption with negligible effects on energy intake. This conclusion highlights the potential strategic use of portion size to promote consumption of foods aligned with the *Dietary Guidelines*. Third, the Committee found sufficient evidence among adults and older adults to conclude that effects of portion size on energy intake are independent and additive to those of energy density. This conclusion underscores the need to jointly consider portion size and energy density in food-based guidance for dietary patterns that can be used to achieve or maintain a healthy weight. Fourth, the Committee concluded that among adults and older adults, pre-portioned meals are associated with reduced energy intakes, providing direct evidence in support of strategies that promote portion control, such as meal planning and prepping for several days.

The 2010 Committee was the first to review evidence on portion size and body weight, as part of that Committee's charge to comprehensively review the science on environmental drivers of dietary intake and weight. The 2010 Committee concluded that, based on the findings of 3 randomized controlled trials and 1 case-control study, "Strong evidence documents a positive relationship between portion size and body weight." In contrast, the current Committee judged the evidence insufficient to draw meaningful conclusions about the association between portion size and growth, body composition, and risk of obesity outcomes during childhood, adulthood, pregnancy, and the postpartum life stages.[18] The difference in conclusions stemmed from a lack of evidence noted by this Committee for specific life stages of pregnancy, postpartum, childhood, and adolescence as well as inconsistencies in interventions, comparators, and outcomes in the body of evidence among adults and older adults. Importantly, few studies considered portion sizes in the context of energy density, which likely contributed to inconsistencies in findings.

Comparison to Other Systematic Reviews and Meta-Analyses

The Committee's conclusions for portion size and energy intake generally agree with the findings of 2 previous systematic reviews. A 2015 Cochrane review evaluated the effects of portion, package, and tableware size on food selection and consumption among children and adults.[16] This meta-analysis of 58 studies found small to moderate effects of portion, package, or tableware size on food consumption among children and adults. The authors projected that this effect size, if sustained across the entire diet, would translate to a 12 to 16 percent increase in average daily energy intake. Although the findings are generally aligned with the Committee's conclusions, it is notable that the Cochrane review focused on food consumption and did not explicitly focus on energy intake or growth, body composition, and risk of obesity outcomes.

The Committee's findings on portion size and energy intake are also aligned with those of a 2023 systematic review and meta-analysis that focused on prevention of weight gain.[17] The 2023 effort included 14 experimental studies (12 in adults and 2 in children) that evaluated effects of reducing portion size on daily energy intake during time periods that ranged from 1 day to 6 months.[17] Investigators found a moderate to large reduction in energy intake when smaller vs. larger portions were offered. Adjustments in consumption of non-portion-manipulated foods were not sufficient to fill the energy gap, such that a 10 percent reduction in portion sizes served was associated with a 1.6 percent reduction in daily energy intake. Larger effects were seen in studies that manipulated portion sizes at most meals compared to studies that manipulated portions at 1 to 2 meals. In a subset of 4 studies that measured body weight, being served smaller vs. larger portion sizes was associated with less weight gain.[17] The authors concluded that reducing portion sizes may be an effective strategy for preventing weight gain, but because their review did not explicitly evaluate the role of food type or energy density, their conclusion differs from the Committee's finding that the body of evidence on portion size and growth, body composition, and risk of obesity is insufficient to draw conclusions. These differences are likely due to the Committee's stringent inclusion and exclusion criteria, its rigorous evaluation of the quality of evidence, and its consideration of energy density.

Neither of the reviews discussed above evaluated evidence by life stage, although both included studies of children and adults.[17,23] The Committee's interest in evaluating the evidence by life stage represents an important contribution given questions in early studies as to whether young children might be less susceptible to portion size effects than adults.[6,24] The body of evidence reviewed by the Committee (and examined in previous systematic reviews) demonstrates that the relationship between large portion sizes and increased energy intake extends to children. The Committee's conclusions collectively highlight the importance of offering developmentally appropriate portion sizes to promote healthy growth and prevent obesity during childhood. However, little empirical evidence directly addresses this possibility as the Committee found only 1 study of this relationship during childhood.

In addition, neither of the reviews explicitly evaluated the role of food type or energy density.[18,19] Nonetheless, the Committee's conclusions with regard to independent and additive effects of portion size and energy density among adults and older adults align with 2 recent systematic reviews and a host of other narrative reviews.[12,25] A 2022 systematic review and meta-analysis of 38 within-subjects randomized controlled trials evaluated effects of food energy density on energy intake among children and adults. It found that consuming lower energy-dense foods, compared to higher energy-dense foods, resulted in significantly reduced energy intake. Further, energy density was not associated with food intake (weight/volume consumed) but showed a positive linear relationship with energy intake.[26] Another systematic review and meta-analysis of 31 experimental studies (27 studies of adults, 4 studies of children) similarly demonstrated a large effect of energy density on daily energy intake.[27] Collectively, these studies suggest that reducing food energy density may promote weight management by allowing individuals to eat satiating quantities of food while consuming less energy. Taken together with the Committee's findings, these reviews suggest that targeting portion size as a population-based strategy for healthy dietary patterns and achieving or maintaining a healthy weight will require explicit consideration of energy density.

The Committee reviewed studies of portion size tools and determined that evidence in this area was insufficient to develop specific conclusions about consumer-oriented strategies for portion control. A 2021 meta-analysis focused specifically on the effect of portion size tools on portion size awareness, selection, and intake found that most studies (n=28) compared standard size plates, bowls, and spoons to those of smaller diameter and/or volume and used calibrated tableware with printed indicators or indented segments to aid portion control.[28] Findings supported an overall beneficial effect of portion control tools on consumption. Effects differed by type of tools, with effects seen for bowls and spoons—but not plates—on the amount of foods served and consumed. These findings point to the need for future consideration of tools designed to provide visual cues and promote portion control.

Summary

The Committee's comprehensive examination of the evidence and resulting conclusions extend previous Committees' systematic reviews and conclusions for the influence of portion size on 1) growth, body composition, and risk of obesity; and 2) energy intake outcomes across life stages. The body of evidence on portion size is predominated by robust randomized controlled trials. Large portions, particularly of energy-dense foods and beverages, promote energy intake among both adults and children. Portion size effects have been observed across a variety of different types of foods, participant characteristics, and packaging types and sizes, suggesting that larger portion sizes may have universal effects to promote food consumption. The implications of portion size for energy intake, however, may depend on food type. Among adults and older adults, portion size and energy density have independent and additive effects on energy intake. Among children, larger portion sizes of low energy-dense foods such as vegetables and fruits promote consumption of those foods without appreciable effects on energy intake. Strategies to promote portion control include selection of smaller package sizes and use of pre-portioned meals for energy-dense foods and beverages.

Committee's Advice to the Departments

The Committee's advice to the Departments as they develop the *Dietary Guidelines for Americans, 2025-2030* is to recommend that adults and children consume smaller portions of foods and beverages that are high in energy density and low in nutrient density. The recommendation to consume smaller portions does not apply to vegetables and fruits in children, as evidence indicates that larger portions of these healthy foods were not related to greater energy intake despite increased intake of vegetables and fruits. Among adults and older adults, consuming smaller portions of energy-dense, nutrient-poor foods and beverages could be achieved by using pre-portioned foods. Among young children, children, adolescents, and pregnancy and postpartum the evidence was not clear about use of pre-portioned foods. Although the concept for portion size is already included in the *Dietary Guidelines for Americans, 2020-2025*, more emphasis could be made on use of pre-portioned foods among adults and older adults to achieve lower intakes of energy-dense foods and beverages.

In summary, the Committee recommends that the Departments include the following concepts in the next edition of the *Dietary Guidelines*:

- For children and adults, consume smaller portions of energy-dense foods to stay within energy requirements.
- Use portion size strategically to promote children's intake of vegetables and fruits, some of which are sources of some of the nutrients of public health concern (calcium, potassium, and fiber)
- For adults, use pre-portioned foods to help reduce intake of energy-dense foods. This could include:
  - For foods prepared in the home, consider meal planning; and when prepping food for multiple meals in the home, store energy-dense foods in pre-portioned sizes.
  - For foods consumed away from home, such as in commercial, non-commercial, and retail and food service establishments, choose energy-dense foods in smaller, pre-portioned packages as a default.
- For foods available in retail stores and food service establishments, offer choices so that energy-dense foods can be purchased in smaller, pre-portioned packages. In parallel, strategies to decrease packaging chemical exposures and increase sustainability should be considered, which can include repackaging bulk- or value-sized foods at home into smaller portions using sustainable options.
- Prioritize, support, and fund research that examines relationships between pre-portioned foods and energy intake among young children, children, and adolescents; and that examines food portion size in relation to growth, body composition, and risk of obesity among all age groups and life stages.

References

1. Young LR, Nestle M. The contribution of expanding portion sizes to the US obesity epidemic. *Am J Public Health*. Feb 2002;92(2):246-9. doi:https://doi.org/10.2105/AJPH.92.2.246
2. Hill JO, Peters JC. Environmental contributions to the obesity epidemic. *Science*. May 29 1998;280(5368):1371-4. doi:https://doi.org/10.1126/science.280.5368.1371
3. Smethers AD, Rolls BJ. Dietary Management of Obesity: Cornerstones of Healthy Eating Patterns. *Med Clin North Am*. Jan 2018;102(1):107-124. doi:https://doi.org/10.1016/j.mcna.2017.08.009
4. Edelman B, Engell D, Bronstein P, Hirsch E. Environmental effects on the intake of overweight and normal-weight men. *Appetite*. Mar 1986;7(1):71-83. doi:https://doi.org/10.1016/s0195-6663(86)80043-5
5. Marriott BM. *Not Eating Enough: Overcoming Underconsumption of Military Operational Rations*. 1995. https://www.ncbi.nlm.nih.gov/pubmed/25121269
6. Rolls BJ, Engell D, Birch LL. Serving portion size influences 5-year-old but not 3-year-old children's food intakes. *J Am Diet Assoc*. Feb 2000;100(2):232-4. doi:https://doi.org/10.1016/s0002-8223(00)00070-5
7. Benton D. Portion size: what we know and what we need to know. *Crit Rev Food Sci Nutr*. 2015;55(7):988-1004. doi:https://doi.org/10.1080/10408398.2012.679980

8. Steenhuis IH, Vermeer WM. Portion size: review and framework for interventions. *Int J Behav Nutr Phys Act*. Aug 21 2009;6:58. doi:https://doi.org/10.1186/1479-5868-6-58
9. Steenhuis I, Poelman M. Portion Size: Latest Developments and Interventions. *Curr Obes Rep*. Mar 2017;6(1):10-17. doi:https://doi.org/10.1007/s13679-017-0239-x
10. Peter Herman C, Polivy J, Pliner P, Vartanian LR. Mechanisms underlying the portion-size effect. *Physiol Behav*. May 15 2015;144:129-36. doi:https://doi.org/10.1016/j.physbeh.2015.03.025
11. English L, Lasschuijt M, Keller KL. Mechanisms of the portion size effect. What is known and where do we go from here? *Appetite*. May 2015;88:39-49. doi:https://doi.org/10.1016/j.appet.2014.11.004
12. Livingstone MB, Pourshahidi LK. Portion size and obesity. *Adv Nutr*. Nov 2014;5(6):829-34. doi:https://doi.org/10.3945/an.114.007104
13. Herman CP, Polivy J, Vartanian LR, Pliner P. Are large portions responsible for the obesity epidemic? *Physiol Behav*. Mar 15 2016;156:177-81. doi:https://doi.org/10.1016/j.physbeh.2016.01.024
14. Berg C, Forslund HB. The Influence of Portion Size and Timing of Meals on Weight Balance and Obesity. *Curr Obes Rep*. Mar 2015;4(1):11-8. doi:https://doi.org/10.1007/s13679-015-0138-y
15. Almiron-Roig E, Forde CG, Hollands GJ, Vargas MA, Brunstrom JM. A review of evidence supporting current strategies, challenges, and opportunities to reduce portion sizes. *Nutr Rev*. Feb 1 2020;78(2):91-114. doi:https://doi.org/10.1093/nutrit/nuz047
16. Hollands GJ, Shemilt I, Marteau TM, et al. Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco. *Cochrane Database Syst Rev*. Sep 14 2015;2015(9):CD011045. doi:https://doi.org/10.1002/14651858.cd011045.pub2
17. Robinson E, McFarland-Lesser I, Patel Z, Jones A. Downsizing food: a systematic review and meta-analysis examining the effect of reducing served food portion sizes on daily energy intake and body weight. *Br J Nutr*. Mar 14 2023;129(5):888-903. doi:https://doi.org/10.1017/s0007114522000903
18. Raynor HA, Gardner CD, Anderson CAM, et al. *Portion Size and Growth, Body Composition, and Risk of Obesity: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR17
19. Andres A, Fisher JO, Anderson CAM, et al. *Portion Size and Energy Intake: A Systematic Review*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.SR28
20. Robinson E, Haynes A. Individual differences and moderating participant characteristics in the effect of reducing portion size on meal energy intake: Pooled analysis of three randomized controlled trials. *Appetite*. Apr 1 2021;159:105047. doi:https://doi.org/10.1016/j.appet.2020.105047
21. Dietary Guidelines Advisory Committee. *Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2005, To the Secretary of Health and Human Services and the Secretary of Agriculture*. 2005.
22. Dietary Guidelines Advisory Committee. *Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010 To the Secretary of Agriculture and the Secretary of Health and Human Services*. 2010.
23. Dietary Guidelines Advisory Committee. *Scientific Report of the 2015 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Health and Human Services and Secretary of Agriculture*. 2015. https://odphp.health.gov/sites/default/files/2019-09/Scientific-Report-of-the-2015-Dietary-Guidelines-Advisory-Committee.pdf
24. Fisher JO. Effects of age on children's intake of large and self-selected food portions. *Obesity (Silver Spring)*. Feb 2007;15(2):403-12. doi:https://doi.org/10.1038/oby.2007.549
25. Kral TV, Rolls BJ. Energy density and portion size: their independent and combined effects on energy intake. *Physiol Behav*. Aug 2004;82(1):131-8. doi:https://doi.org/10.1016/j.physbeh.2004.04.063
26. Klos B, Cook J, Crepaz L, Weiland A, Zipfel S, Mack I. Impact of energy density on energy intake in children and adults: a systematic review and meta-analysis of randomized controlled trials. *Eur J Nutr*. Apr 2023;62(3):1059-1076. doi:https://doi.org/10.1007/s00394-022-03054-z

27. Robinson E, Khuttan M, McFarland-Lesser I, Patel Z, Jones A. Calorie reformulation: a systematic review and meta-analysis examining the effect of manipulating food energy density on daily energy intake. *Int J Behav Nutr Phys Act*. Apr 22 2022;19(1):48. doi:https://doi.org/10.1186/s12966-022-01287-z
28. Vargas-Alvarez MA, Navas-Carretero S, Palla L, Martinez JA, Almiron-Roig E. Impact of Portion Control Tools on Portion Size Awareness, Choice and Intake: Systematic Review and Meta-Analysis. *Nutrients*. Jun 9 2021;13(6) doi:https://doi.org/10.3390/nu13061978

Part D. Chapter 8: Culturally Responsive Interventions to Improve Diet

Introduction

Culture—defined as the "shared values, norms, and belief systems that collectively shape a group's attitudes, behaviors, and perceptions through their interactions with and within their environments"—plays an important role in an individual's experiences with foods and beverages.[1] Culture informs the significance and the symbolic meanings that a person attaches to foods and beverages and guides their beliefs about the relationship between diet and health.[1] Dietary behaviors result from a complex interplay of psychological, sociological, economic, and sensory factors, all of which are influenced by culture.[2-4] Foodways, which include the types of foods eaten, how they are prepared, and when and with whom they are consumed, are deeply woven into the social fabric of communities and are central to understanding dietary behaviors.[2-4] Cultural oppression, in which a person's cultural norms are marginalized or restricted, also plays a significant role in shaping dietary behaviors.[5,6]

The U.S. population has become more racially and ethnically diverse—particularly among children—during the past decade,[7] highlighting the need to ensure that the *Dietary Guidelines for Americans* are representative of the country's diverse populations and their various nutritional needs and cultural preferences. Furthermore, marked racial, ethnic, and socioeconomic disparities in diet quality and related chronic disease outcomes have persisted despite modest improvements in overall dietary quality in the United States from 1999 to 2020.[8]

This chapter presents the rationale, methods, and results for the Committee's evidence scan of culturally responsive (also referred to as culturally tailored) approaches to dietary interventions, which have garnered significant interest based on their promise for improving equitable access to healthcare and nutrition services and in supporting health behavior change (**Box D.8.1**). The chapter also discusses the results of the evidence scan and compares them to those from other reviews and provides the Committee's advice to the Departments in terms of considerations for federal programs, future research, and further efforts to apply the *Dietary Guidelines* across a variety of cultural contexts.

Box D.8.1: Culturally Responsive Dietary Interventions

Culturally responsive dietary interventions are designed to align with specific cultural practices, beliefs, and preferences of the target population, with the aim of improving their diet quality and health outcomes. Different cultures have varied understandings of what constitutes a healthy diet based on their traditional knowledge, historical food practices, and external factors such as globalization, migration, and cultural exchange that impact groups as they transition across contexts. Nutrient-dense foods that align with the dietary patterns recommended by the *Dietary Guidelines for Americans* are present in all cultural diets, and a goal of culturally responsive dietary interventions is to identify and recognize such foods and how their preparation may promote health.

Context for the Committee's Evidence Scan

Previous reviews that examine the efficacy of cultural adaptations of dietary interventions have highlighted substantial areas for improvement, including lack of diversity among participants and inconsistency among study designs, intervention components, and measurement. A federal government-led workshop held in September 2023, titled "*Advancing Health Equity Through Culture-Centered Dietary Interventions to Address Chronic Diseases,"* addressed these topics as it identified gaps and opportunities for 1) research on the cultural tailoring and adaptation of evidence-based dietary approaches and 2) research on heritage foodways to prevent, manage, and treat diet-related diseases in culturally diverse populations and historically minoritized communities. Key takeaways from the workshop included the need to broaden the definition of culture to include a diverse array of shared values, knowledge, and practices that significantly influence perceptions about health and food, as well as the need to collaborate with community representatives to create dietary interventions to apply the *Dietary Guidelines* across a variety of cultural contexts.

For this evidence scan, the Committee considered the main takeaways of this workshop, as well as previous research experiences from Committee members, the public's comments, and recommendations from the 2020 Committee.

Rationale for Pursuing an Evidence Scan

An evidence scan is an exploratory evidence description project in which systematic methods are used to search for and describe the volume and characteristics of evidence available on a nutrition question or topic of public health importance.[9] The Committee conducted an evidence scan for this topic because further definition of the scope of work was needed before moving forward with a systematic review. An evidence scan provides a basis for a future expert Committee to develop systematic review protocol(s).

The goal of the evidence scan was to better understand the breadth and depth of the diverse body of evidence on culturally responsive dietary intervention studies. Such studies emphasize how cultural considerations have been incorporated into interventions to address the needs of a given population and explore the impact of culture on dietary intake and health. The Committee refined the scope of the evidence scan to include studies conducted in the United States and Canada, establishing a focus on interventions with cultural relevance to the U.S. population and recognizing the importance of being inclusive of Indigenous peoples. The evidence scan recorded each included study's population of interest (including key characteristics such as age, gender, race, ethnicity, and geographic location) and outcomes assessed (diet-related psychosocial factors, dietary intake, diet quality, and health outcomes). This evidence scan also identified strengths and gaps in the literature.

Key Considerations Guiding the Evidence Scan

For purposes of the evidence scan, the Committee chose a broad definition of culture to ensure inclusivity of diverse interpretations and definitions of culture, allowing for a comprehensive understanding of how cultural factors influence dietary behaviors and health outcomes.

The Committee's decisions about which outcomes to examine in the evidence scan were informed by results from its data analysis findings on dietary intake and prevalence of nutrition-related chronic health conditions. For example, dietary intakes of food groups vary by racial and/or ethnic group, such that certain groups are more or less likely to achieve recommended intakes. Variation also exists among racial and/or ethnic groups in the food categories and subcategories that contribute to food group intakes. Similarly, prevalence varies by race and/or ethnicity for several nutrition-related chronic health conditions examined, including obesity, diabetes, hypertension, and stroke. The disparities that are apparent in these findings underscore the role of culturally responsive dietary interventions that address dietary intakes and specific health outcomes in various population groups. See **Part D. Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions** for details of the Committee's data analyses.

The evidence scan also explored intervention opportunities, emphasizing the potential for social, economic, and environmental strategies to improve overall diet and diet quality among populations disproportionately affected by health disparities. Such interventions could significantly enhance health outcomes by addressing the root causes of poor dietary habits.

Community engagement throughout the research process is one way to create and implement interventions that are responsive to the community's needs. These types of collaborations, including community-based participatory research (CBPR) approaches, were an important consideration and target for information-gathering in this evidence scan. In addition, previous studies have identified gaps in funding for community-engaged health disparities research and as a result, the Committee was interested in gaining a better understanding of the funding sources for articles in this evidence scan.[10,11]

Culturally Responsive Classification Systems

A wide range of methodologies and theoretical frameworks have been used to examine cultural factors in the design, implementation, and evaluation of interventions in nutrition research. The Committee applied concepts from 2 such frameworks to categorize the culturally responsive intervention strategies in the literature it described: 5 types of cultural targeting/tailoring intervention strategies[12] and dimensions of cultural sensitivity,[12] both of which provide approaches describing how dietary interventions can be adapted to meet the unique cultural needs of diverse U.S. populations. The Committee applied concepts from 2 such frameworks to categorize the culturally responsive intervention strategies in the literature it described: 5 types of cultural targeting/tailoring intervention strategies[13] and dimensions of cultural sensitivity,[12] both of which provide approaches describing how dietary interventions can be adapted to meet the unique cultural needs of diverse U.S. populations. Integrating the concepts from these 2 frameworks provided a theoretical and practical foundation for the Committee to classify the intervention components within the evidence scan and interpret the scan's results within the broader context of the literature. The following sections briefly describe the 2 frameworks.

Culturally Targeting/Tailoring Intervention Strategies

Kreuter and colleagues[13] provide a comprehensive overview of 5 strategies commonly used to develop or adapt health promotion programs for culturally defined groups. The 5 strategies, described in **Table D.8.1**, emphasize use of cultural targeting (e.g., designing health interventions aimed at a particular cultural group by incorporating shared characteristics such as common values, beliefs, and experiences that are broadly representative of that group) and tailoring (considering broader shared cultural characteristics while customizing the intervention to the specific cultural, psychosocial, and behavioral traits of an individual) to improve acceptance and efficacy of dietary interventions.

TABLE D.8.1
INTERVENTION STRATEGIES

Intervention Strategy	Description
Peripheral	Seek to give programs or materials the appearance of cultural appropriateness by packaging them in ways likely to appeal to a given group
Evidential	Seek to enhance the perceived relevance of a health issue for a given group by presenting evidence of its impact on that group
Linguistic	Seek to make health education programs and materials more accessible by providing them in the dominant or native language of the target group
Constituent Involving	Draw directly on the experience of members of the target group
Sociocultural	Discuss health-related issues in the context of broader social and/or cultural values and characteristics of the intended audience

Source: Kreuter et al., 2003[13]

Dimensions of Cultural Sensitivity

Resnicow and colleagues[12] drew on concepts introduced in ethnic and linguistic studies and proposed application of cultural sensitivity in developing and/or adapting interventions to be more responsive to cultural context, including resonating with the cultural beliefs and practices of the study population. They defined cultural sensitivity using 2 dimensions: surface-structure and deep-structure (**Table D.8.2**).

TABLE D.8.2
DIMENSIONS OF CULTURAL SENSITIVITY

Surface-Structure	Deep-Structure
Addresses observable, "superficial" characteristics of a population	Requires understanding the cultural, social, historical, environmental, and psychological forces that influence target health behavior in target population
Employs audio/visual materials, channels, and settings appropriate for intervention delivery	Includes perceptions of how religion, family, society, and economics may influence the target behavior

Source: Resnicow et al.,1999[12]

Question

1. What evidence has been published on the relationship between culturally tailored dietary interventions and diet-related psychosocial factors, dietary intake, diet quality, and health outcomes?[14]

View the full evidence scan, including details on the methodology and the evidence underlying the review of the science, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/evidence-scan_culturally-tailored-dietary-interventions

Review of the Science

What evidence has been published on the relationship between culturally tailored dietary interventions and diet-related psychosocial factors, dietary intake, diet quality, and health outcomes?

Approach to Answering Question: Evidence Scan

Description of the Evidence

The body of published evidence identified in the evidence scan included 178 articles (139 randomized controlled trials, 39 non-randomized controlled trials). Seven articles were published from 1980 through 2000; the remainder were published between 2001 and September 2023. Beginning with the 5-year time frame of 2001 through 2005, the number of articles published per 5-year cycle increased over time, reaching an apex of 53 articles published from 2016 through 2020. Nearly all studies were conducted in the United States (172 articles), and 6 articles were from studies conducted in Canada.

Population

Analytic sample sizes ranged from n=20 to n=4,333. Most studies were in adults only (104 articles), and 22 articles enrolled or randomized adults and children and/or adolescents. In total, 67 articles included children and/or adolescents. Six articles were in pregnant or postpartum populations. Most articles (127 articles) included both men and women, although in many cases these participant populations were predominantly female. Forty-five articles included only women, while 1 article included only men, and 1 article in adults did not report the gender of participants. Three articles included mother-child dyads and 1 article included father-child dyads. The evidence scan protocol was inclusive of studies with gender-expansive participants; however, no articles in these populations were present in the final body of evidence.

The most common racial and/or ethnic groups (as reported in the articles and defined in this scan as having ≥20 percent of participants from a given racial and/or ethnic group) in the study populations were Black, African American, or of African Descent (78 articles), and Hispanic or Latinx (71 articles), followed by American Indian, Alaska Native, or Indigenous (27 articles), White (16 articles), Asian (11 articles), and Native Hawaiian or Pacific Islander (3 articles).

Interventions and Intervention Strategies

Intervention duration ranged from a single session (e.g., watching an educational video) to 5 years. Most studies (141 articles) reported use of an underlying theoretical framework when designing the intervention tested. Of those, most (84 articles) used 2 or more frameworks, while 57 articles cited a single framework. Eighty-four articles cited use of social cognitive theory to inform intervention development. The interventions in 24 articles (from 21 studies) were modeled after the CDC's Diabetes Prevention Program.

Most articles reported either a high level of community involvement (71 articles) or at least some community involvement (58 articles) in designing the intervention. Fifty-three articles specifically mentioned using a CBPR model to guide their research. Forty-nine articles did not involve community members in the intervention design or did not report doing so in the publication. During the publication date range of January 1980 to September 2023, the proportion of articles reporting a high degree of community involvement grew over time.

Based on the 2 frameworks that the Committee used to classify intervention components,[13,12] the most frequently used approaches were constituent-involving strategies (161 articles), followed by sociocultural (150 articles), peripheral (100 articles), linguistic (83 articles), and evidential (18 articles) strategies. All peripheral and evidential strategies used were considered to be surface-structure, as were all but 1 of the linguistic strategies. Constituent-involving strategies encompassed a range of surface- and deep-structure levels of cultural sensitivity, with 42 articles including both levels of sensitivity in their constituent-involving techniques. All sociocultural strategies employed were considered to be deep-structure. Most articles reported using between 2 to 4 strategies (164 articles); 7 articles used all 5 strategies, and 7 articles used 1 strategy.

Outcomes

The most commonly reported outcomes were growth, body composition, and risk of obesity (GBCO) (117 articles) and dietary intake (109 articles). Fewer articles assessed risk of cardiovascular disease (52 articles), diet-related psychosocial factors (50 articles), energy intake (38 articles), risk of type 2 diabetes (35 articles), diet quality (23 articles), and postpartum weight change (4 articles). No articles examined gestational weight gain as an outcome. A greater proportion of articles conducted only in children and/or adolescents included GBCO outcomes compared with articles conducted only in adults (76 percent and 60 percent of articles, respectively). Higher proportions of articles in adults included outcomes related to risk of cardiovascular disease and type 2 diabetes, compared with articles in children and/or adolescents. Similar proportions of articles in each life stage included outcomes of dietary intake, diet-related psychosocial factors, energy intake, and diet quality.

The frequency of strategy use was generally consistent across outcomes. Sociocultural and constituent-involving strategies were the most frequently used for each outcome, with linguistic strategies included about half as often. The use of peripheral strategies tended to be either equal to or somewhat higher than linguistic strategies for each outcome, with the exception of type 2 diabetes, for which linguistic strategies were used in a greater number of articles compared to peripheral strategies. This observation can be at least partly explained by the fact that a larger proportion of articles assessed type 2 diabetes outcomes in Hispanic or Latino populations, which was also the group for which linguistic strategies—such as translations or intervention delivery in Spanish—were employed more often than any other type of strategy.

Funding Sources

As noted earlier in the chapter, the Committee's awareness of funding gaps for community-engaged health disparities research led to its interest in describing the funding sources for culturally responsive interventions. Most studies were funded by the U.S. or Canadian government (144 articles). Other sources of funding included nonprofit organizations (31 articles), academic institutions (27 articles), state governments (4 articles), the food industry (3 articles), and a variety of other sources (e.g., hospital systems, private funding, or professional associations; 15 articles). Ten articles did not report funding sources, and 2 articles reported receiving no funding.

Application of the Frameworks: An Example

To illustrate how the Committee used the frameworks to classify intervention components, this section describes a comprehensive example from an intervention included in its evidence scan, Kwon et al.'s Project RICE (**Table D.8.3**).[15]

This intervention was developed for Korean American adults at risk for type 2 diabetes in the metropolitan New York City area using the CDC's Diabetes Prevention Program as a model. First, the researchers employed a peripheral intervention strategy by incorporating culturally appropriate images and photos of typical Korean foods into their program. This surface-structure approach ensured that the materials resonated with Korean American participants by reflecting familiar and culturally relevant dietary elements. By using visuals with which participants could easily identify, the intervention became more engaging and relatable, potentially increasing the program's effectiveness in promoting dietary changes and diabetes prevention.

Second, Kwon and colleagues used an evidential strategy by incorporating specific educational content into the diabetes prevention sessions. This strategy involved discussing the prevalence of diabetes and the increased risk faced by Asian American communities, providing an explanation of body mass index (BMI), and highlighting the at-risk BMI thresholds specific to Asian populations. Additionally, the authors addressed and dispelled common cultural misconceptions about diabetes. By presenting evidence-based information that was directly relevant to the participants' cultural context, the intervention aimed to enhance understanding and awareness, thereby empowering participants to make informed health decisions. This surface-structure approach ensured that the content was not only informative but also culturally meaningful and applicable.

Third, the researchers applied a linguistic approach by ensuring all curriculum materials were accessible to Korean-speaking participants. Initially developed in English, these materials were translated into Korean and reviewed by bilingual study staff to ensure accuracy and cultural relevance. This surface-structure strategy helped to eliminate language barriers, making the content accessible to participants who were more comfortable with Korean than with English. Additionally, the session topics were translated into Korean through a collaborative process involving a community-academic partnership. This collaboration ensured that the translations were not only linguistically accurate but also culturally appropriate. Before the translated sessions were implemented in the study, they were piloted to test their effectiveness and comprehension. By involving community partners in the translation process, Kwon and colleagues enhanced the cultural and linguistic resonance of the materials, thereby improving participant engagement and understanding.

Fourth, Kwon and colleagues employed a constituent-involving approach by forming a coalition that included community partners, researchers, health providers, and community health workers (CHWs) as active and equal partners throughout the research process. This deep-structure strategy ensured that the research was grounded in the community's needs and perspectives, fostering a sense of ownership and collaboration among all stakeholders involved. The coalition was strengthened by the active involvement of CHWs and staff from a Korean American-serving community-based organization. These members served as vital sources of community knowledge, offering valuable input and guidance during all phases of the study, from design and implementation to evaluation. Their involvement ensured that the intervention was culturally and contextually appropriate, aligning with the community's unique characteristics and needs. Furthermore, the intervention was led by a bilingual Korean American CHW, which was a crucial aspect of the constituent-involving approach. This leadership role not only facilitated effective communication and trust-building with participants but also ensured that the intervention was delivered in a culturally sensitive and linguistically appropriate manner. By deeply involving constituents in every aspect of the research, Kwon and colleagues were able to create an effective, relevant, and sustainable intervention.

Finally, Kwon and colleagues integrated a sociocultural approach by incorporating findings from formative research to enhance the curriculum with culturally relevant topics and strategies, addressing the deep-structure needs of the Korean American community with whom they worked. This approach ensured that the intervention was not only linguistically accessible but also culturally meaningful and effective.

The curriculum was enriched with discussions on several culturally pertinent topics:

- **Traditional Korean dietary practices:** The authors explored traditional practices such as eating fruits as alternatives to high-fat desserts, aligning dietary recommendations with familiar cultural habits to encourage healthier choices without abandoning cultural preferences.
- **Korean cuisine and health:** By identifying healthy elements within traditional Korean cooking and discussing Korean foods that may have an adverse effect on blood glucose levels, the curriculum provided participants with practical guidance for maintaining cultural eating habits while managing health risks.
- **Dining practices:** The use of small plates typical of Korean dining was related to the Plate Method, a common portion control strategy, making it easier for participants to apply this strategy to a culturally relevant context.
- **Cultural expectations and social dining:** The curriculum addressed the challenge of managing cultural expectations when eating in other homes, providing strategies for navigating social situations while adhering to dietary recommendations.
- **Emotional and family dynamics:** Discussions included the emotional aspect of food-related guilt tied to family expectations and perceived shortcomings with regard to traditional dietary practices, acknowledging the psychological and social dimensions of dietary behaviors.
- **Community resources:** A list of community resources and providers was included, offering participants culturally and linguistically appropriate support options.

By embedding these culturally specific topics into the curriculum, Kwon and colleagues ensured that the intervention was not only informative but also resonated deeply with participants' cultural identities and everyday experiences. This sociocultural approach helped facilitate greater acceptance and adherence to the health recommendations provided.

TABLE D.8.3
CLASSIFICATION OF INTERVENTION COMPONENTS: KWON ET AL., 2022

Intervention Component	Use in Kwon et al., 2022	Dimension of Cultural Sensitivity
Peripheral	Use of culturally appropriate images and photos of typical Korean foods.	Surface-Structure
Evidential	Discussion topics during diabetes prevention sessions included diabetes prevalence and increased risk of diabetes in Asian American communities, explanation of BMI and at-risk BMI thresholds in Asian communities, and dispelling common cultural misconceptions regarding diabetes.	Surface-Structure
Linguistic	All curriculum materials developed in English, translated into Korean, and reviewed by bilingual study staff.	Surface-Structure

Intervention Component	Use in Kwon et al., 2022	Dimension of Cultural Sensitivity
	Session topics translated into Korean using a collaborative process with community-academic partnership; translated sessions piloted before study.	
Constituent Involving	Coalition of community partners, researchers, health providers, and community health workers (CHWs) engaged as active and equal partners in the research process. CHW and staff at Korean American-serving community-based organization were active members of coalition and a source of community knowledge, providing input and guidance during all study phases. Intervention was led by bilingual Korean American CHW.	Deep-Structure
Sociocultural	Findings from formative research were used to add culturally relevant topics and strategies to curriculum. Discussions involved: • Traditional Korean practice to eat fruits as alternative to high-fat desserts • Healthy elements in traditional Korean cooking; Korean foods that may have an adverse effect on blood glucose levels • Small plates typical of Korean dining in relation to the Plate Method • Managing cultural expectations for eating in other homes when invited as a guest • Food-related guilt with respect to family member expectations and perceived shortcomings around dietary practices List of community resources and providers offered culturally and linguistically appropriate support options.	Deep-Structure

Source: Kwon et al., 2022 [15]

Discussion

Comparisons to Other Reviews and Frameworks

Vincze and colleagues[16] used a similar integration of the Resnicow et al.[12] and Kreuter et al.[13] classification systems to conduct a scoping review of culturally adapted health interventions for Indigenous peoples. They identified 66 unique intervention studies targeting Indigenous populations in the United States, Canada, and Australia, most of which focused on type 2 diabetes prevention or management. As with the current evidence scan, the most common strategy reported was visual adaptation (which could be defined as a peripheral intervention strategy). Most studies applied more than 1 strategy to culturally tailor the intervention, combining surface- and deep-structure adaptation approaches. However, fewer than half of the interventions in this scoping review involved Indigenous constituents on a deep-structure level.

Another systematic review of behavioral interventions with culturally adapted strategies to improve diet and weight outcomes in African American women was conducted by Kong and colleagues.[17] Among the 28 interventions included in the review, the most frequently identified strategies were sociocultural and constituent-involving. The studies that had significant findings for improving diet and weight commonly reported constituent-involving strategies during the formative phases of the intervention. This work underscores the critical role of cultural adaptation in enhancing the efficacy of dietary interventions.

Considerations and Limitations of the Evidence Scan

This evidence scan demonstrated that many diverse culturally responsive dietary interventions have been conducted in the United States and Canada to improve diet and energy intake as well as various health outcomes such as growth, body composition, risk of obesity, and risk of cardiovascular disease and type 2 diabetes. None of the studies included in the evidence scan addressed gestational weight gain as an outcome and only a few addressed postpartum weight change. Although the evidence scan yielded 10,579 search results, only the 178 articles that met the inclusion criteria were included in the body of evidence that the Committee described. These articles do not represent the absolute number of published articles on this topic. Refining search strategies in future systematic reviews will be key to comprehensively identify the existing evidence.

The Committee's application of the Resnicow et al.[12] framework to evaluate the level of cultural sensitivity integrated into dietary interventions, and its application of the Kreuter et al.[13] framework to classify how the 5 strategies were used to design/implement the culturally responsive intervention, enabled a comprehensive assessment of the type and extent of cultural tailoring within the body of evidence examined. Most interventions reported either a high level or some level of community involvement when designing the intervention. In addition, most used constituent-involving, sociocultural, and peripheral strategies, while linguistic and evidential strategies were used less often. Nevertheless, information provided in the included studies may be incomplete. This is because the scan relied on information included in the published articles, but some articles may not have described all of their intervention's methods. This could be due to the word limits imposed by most journals or the lack of use of these types of frameworks when reporting intervention components.

Committee discussion also underscored the chronic underfunding of health disparities research, which impacts the availability and quality of literature included in the evidence scan. Such underfunding limits both the development of effective interventions and the understanding of health disparities, emphasizing the need for increased investment in this area.

Committee's Considerations for the Departments

Based on the results of its evidence scan on culturally responsive dietary interventions, the Committee suggests the following considerations to the Departments as they develop the *Dietary Guidelines for Americans, 2025-2030*.

Considerations for Federal Programs

This evidence scan on culturally responsive interventions may provide insights as to the importance of allowing for flexibilities around dietary patterns to be more culturally responsive. (See **Part E. Chapter 1: Overarching Advice to the Departments** for details of this Committee's proposed dietary pattern).

Dietary Pattern.) The evidence scan also could serve as a springboard for future, more targeted systematic reviews that assess the effectiveness of the interventions on outcomes of interest. Although this evidence scan, by design, did not provide results on how these culturally responsive interventions affected diet or related health outcomes, cultural adaptations may be a welcome component across federal nutrition assistance programs such as the Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and the National School Lunch Program (NSLP) and School Breakfast Program (SBP), among others. Ensuring that federal food and nutrition programs apply culturally responsive strategies and foods may help promote adequate nutrient intakes and food security by providing individuals with foods that align with their cultural practices and preferences. For example, incorporation of certain cultural foods (e.g., Beans, Peas, Lentils, and Dark-Green Vegetables) could help individuals from all cultures meet dietary recommendations and enhance dietary variety. In turn, this may promote higher program acceptability and utilization rates, improve adherence to the *Dietary Guidelines*, and offer a stronger connection to participants' heritage, ultimately contributing to overall health and well-being, especially within diverse communities.

Considerations for Future Research

- Develop a classification system and checklist similar to tools such as Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Equity[18] or Consolidated Standards of Reporting Trials (CONSORT)[19] for researchers to submit as an attachment when publishing manuscripts describing culturally responsive dietary interventions. This checklist would include the details of how the culturally responsive dietary interventions were developed and implemented, using the frameworks highlighted in this report (**Tables D.8.1** and **D.8.2**).
- Address social determinants of health when tailoring interventions to enhance the effectiveness and equity of dietary interventions across diverse populations. The Nutrition Equity Framework, introduced by Nisbett and colleagues[20] conceptually illustrates how addressing sociopolitical determinants of nutrition is essential for sustainable improvement in nutrition equity and can provide a broader context for understanding the fundamental and sustainable ways to enhance nutrition equity, reinforcing the importance of culturally responsive dietary interventions.
- Diversify search terms and use an iterative process to better understand and incorporate common terminology relevant to the interventions of interest when conducting future systematic reviews or similar research efforts. Further, expand the range of search databases to provide a more comprehensive view of the available literature. For specific populations of interest such as pregnant populations, consider additional relevant outcomes, such as nutritional adequacy, to ensure that the research addresses the most pertinent health concerns of these groups. By adopting these strategies, the content of systematic reviews or related projects can be more effectively tailored to better understand the diverse needs of various communities and populations.
- Allocate sufficient funding for culturally responsive research given that these types of interventions take extended time to develop and implement, due in part to the process of

building trusted relationships with community members and authentically engaging them in all stages of the intervention. These essential activities enhance the relevance and effectiveness of interventions and contributes to their sustainability.

- Revise funding mechanisms to allow extended time to develop the trusting relationships that are critical for culturally responsive research. The current standard of 5 years of research funding should be lengthened as investigators build partnerships that engage community-based organizations in driving the research agenda and co-creating research questions and methods.
- Communicate plans for community involvement and intervention sustainability in academic and professional publications; for example, details about use of the community-based participatory research approach.
- Tailor interventions not only to racial and/or ethnic group considerations but also to other relevant characteristics such as time spent in the United States or country of birth. It is equally important to apply this tailored approach across all levels of research (design, implementation, and evaluation), ensuring that the lived experiences of leadership and staff at the community and research team are reflected.
- To further strengthen the body of evidence on culturally responsive interventions, the Committee recommends more research to fully elucidate the effect of cultural tailoring on program acceptability and effectiveness for health outcomes.

Considerations for Future Committees

- Conduct a systematic review on the effectiveness of culturally responsive interventions for improving diet and health outcomes and use this evidence scan to inform the population, intervention, comparator, and outcome(s) outlined in the systematic review protocol (i.e., the PICO elements).
- Consider factors beyond racial and/or ethnic group categorizations in future reviews, such as time spent in the United States, geographic location of residence, and income, which can significantly influence community needs and responses to interventions.
- Use an intersectional approach when considering the population of interest. It is also important to consider that many discrete categories can shape cultural identity and dietary behaviors and intakes, such as race, ethnicity, gender, income, and geography. This lens could be applied when designing the PICO table.
- Expand evidence-gathering efforts to include qualitative studies, which may enable recognition of the potential for diverse interventions to be effective in different communities and identify barriers and facilitators that explain the outcomes. This may also help address the evolving changes in culture between generations of immigrants, with second generation becoming more acculturated to the dominant culture, communities with several different cultures residing

together, and differences of culture within ethnicities (e.g., Caribbean vs. Central America vs. South America).

References

1. Airhihenbuwa CO. Of Culture and Multiverse: Renouncing "the Universal Truth" in Health. *Journal of Health Education*. 1999;30(5):267-273. doi:https://doi.org/10.1080/10556699.1999.10603409
2. Cachelin A, Ivkovich L, Jensen P, Neild M. Leveraging foodways for health and justice. *Local Environment*. 2019;24:1-11. doi:https://doi.org/10.1080/13549839.2019.1585771
3. Alkon A, Block D, Moore K, Gillis C, DiNuccio N, Chavez N. Foodways of the urban poor. *Geoforum*. 2013;48:126–135. doi:https://doi.org/10.1016/j.geoforum.2013.04.021
4. Shortridge BG, Shortridge JR. Cultural Geography of American Foodways: An Annotated Bibliography. *Journal of Cultural Geography*. 1995/03/01 1995;15(2):79-108. doi:https://doi.org/10.1080/08873639509478355
5. McKinley CE, Jernigan VBB. "I don't remember any of us ... having diabetes or cancer": How historical oppression undermines indigenous foodways, health, and wellness. *Food Foodways*. 2023;31(1):43-65. doi:https://doi.org/10.1080/07409710.2023.2172795
6. Price LL, Cruz-Garcia GS, Narchi NE. Foods of Oppression. Perspective. *Frontiers in Sustainable Food Systems*. 2021;5doi:https://doi.org/10.3389/fsufs.2021.646907
7. Bureau USC. Racial and Ethnic Diversity in the United States: 2010 Census and 2020 Census. https://www.census.gov/library/visualizations/interactive/racial-and-ethnic-diversity-in-the-united-states-2010-and-2020-census.html
8. Liu J, Mozaffarian D. Trends in Diet Quality Among U.S. Adults From 1999 to 2020 by Race, Ethnicity, and Socioeconomic Disadvantage. *Ann Intern Med*. Jul 2024;177(7):841-850. doi:https://doi.org/10.7326/m24-0190
9. USDA Nutrition Evidence Systematic Review Branch. USDA Nutrition Evidence Systematic Review: Methodology Manual U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review. https://nesr.usda.gov/methodology-overview.
10. Brown AGM, Shi S, Adas S, et al. A Decade of Nutrition and Health Disparities Research at NIH, 2010-2019. *Am J Prev Med*. Aug 2022;63(2):e49-e57. doi:https://doi.org/10.1016/j.amepre.2022.02.012
11. Hoppe TA, Litovitz A, Willis KA, et al. Topic choice contributes to the lower rate of NIH awards to African-American/black scientists. *Sci Adv*. Oct 2019;5(10):eaaw7238. doi:https://doi.org/10.1126/sciadv.aaw7238
12. Resnicow K, Baranowski T, Ahluwalia JS, Braithwaite RL. Cultural sensitivity in public health: defined and demystified. *Ethn Dis*. Winter 1999;9(1):10-21.
13. Kreuter MW, Lukwago SN, Bucholtz RD, Clark EM, Sanders-Thompson V. Achieving cultural appropriateness in health promotion programs: targeted and tailored approaches. *Health Educ Behav*. Apr 2003;30(2):133-46. doi:https://doi.org/10.1177/1090198102251021
14. Odoms-Young A, Stanford FC, Palacios C, et al. *Culturally Tailored Dietary Interventions and Diet-Related Psychosocial Factors, Dietary Intake, Diet Quality, and Health Outcomes: An Evidence Scan Protocol*. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review; 2024. https://doi.org/10.52570/NESR.DGAC2025.ES01
15. Kwon SC, Wyatt LC, Kum SS, et al. Evaluation of a Diabetes Prevention Intervention for Korean American immigrants at Risk for Diabetes. *Health Equity*. 2022;6(1):167-177. doi:https://doi.org/10.1089/heq.2021.0137
16. Vincze L, Barnes K, Somerville M, et al. Cultural adaptation of health interventions including a nutrition component in Indigenous peoples: a systematic scoping review. *Int J Equity Health*. May 22 2021;20(1):125. doi:https://doi.org/10.1186/s12939-021-01462-x
17. Kong A, Tussing-Humphreys LM, Odoms-Young AM, Stolley MR, Fitzgibbon ML. Systematic review of behavioural interventions with culturally adapted strategies to improve diet and weight outcomes in African American women. *Obes Rev*. Oct 2014;15 Suppl 4(0 4):62-92. doi:https://doi.org/10.1111/obr.12203

18. Welch V, Petticrew M, Petkovic J, et al. Extending the PRISMA statement to equity-focused systematic reviews (PRISMA-E 2012): explanation and elaboration. *International Journal for Equity in Health*. 2015/10/08 2015;14(1):92. doi:https://doi.org/10.1186/s12939-015-0219-2
19. Schulz KF, Altman DG, Moher D, Group C. CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *BMJ*. Mar 23 2010;340:c332. doi:10.1136/bmj.c332
20. Nisbett N, Harris J, Backholer K, Baker P, Jernigan VBB, Friel S. Holding no-one back: The Nutrition Equity Framework in theory and practice. *Glob Food Sec*. Mar 2022;32doi:https://doi.org/10.1016/j.gfs.2021.100605

Part D. Chapter 9: Nutrient Profile Development

Introduction

Systematic reviews provide scientific evidence to support a link between dietary patterns and health outcomes. Food pattern modeling (FPM) is a complementary process that translates this evidence into dietary patterns that meet nutritional needs across the life span. A strength of FPM is that it can help define quantitative dietary patterns that simultaneously reflect population dietary intakes (in nutrient-dense forms), include components of health-promoting diets identified via evidence from systematic reviews, and meet energy and nutrient needs. FPM can also be used to illustrate how hypothetical changes to the quantities or types of foods and beverages in an existing dietary pattern, such as the 2020 USDA Healthy U.S.-Style Dietary Pattern (HUSS), might improve and/or worsen nutrient adequacy of the pattern across diverse age groups and life stages.

The *Dietary Guidelines for Americans, 2020-2025* includes 3 dietary patterns developed by previous Dietary Guidelines Advisory Committees to align with systematic review evidence on diet and health outcomes and achieve nutrient recommendations established in the Dietary Reference Intakes (DRI) from the National Academies of Sciences, Engineering, and Medicine (NASEM), with few exceptions (e.g., vitamins D and E).[1-6] The 2020-2025 USDA Dietary Patterns include:

- Healthy U.S.-Style Dietary Pattern for Toddlers Ages 12 Through 23 Months
- Healthy U.S.-Style Dietary Pattern for Ages 2 and Older
- Healthy Vegetarian Pattern for Toddlers Ages 12 Through 23 Months
- Healthy Vegetarian Pattern for Ages 2 and Older
- Healthy Mediterranean-Style Dietary Pattern for Ages 2 and Older

FPM facilitates balancing recommendations for nutrients and dietary components commonly underconsumed and overconsumed in the U.S. population. FPM analyses use a theoretical framework in which modeled patterns and corresponding nutrients are examined for the lowest estimated energy requirements for each age-sex group given reference heights and weights with an assumption that higher calorie levels would also meet the strata-specific nutrient needs. The calorie levels specified and modeled for each age-sex group must simultaneously meet recommendations for energy, nutrients, and other dietary components while not exceeding recommendations to limit added sugars, saturated fat, and sodium. Thus, modeling the nutrient-dense versions of the foods and beverages is important to achieve and maintain this balance.

The nutrient-dense foods modeled in FPM are called nutrient-dense representative foods because they are paired with or represent an item cluster (**Box D.9.1**) of similar foods. Representative foods that are selected for each item cluster are the forms with little saturated fat and little or no added sugars, where possible. For example, a boiled egg is the representative food for the eggs item cluster, which also contains other similar foods such as fried or scrambled eggs prepared in butter, oil, or margarine. To better represent forms of foods with the least amounts of sodium, salt is removed from the underlying recipes in the USDA Food and Nutrient Database for Dietary Studies (FNDDS), with the assumption that salt is added during food preparation at home, rather than sodium inherent to the food itself or salt added in commercial preparation. In addition, the *Dietary Guidelines* recommendations are intended to be practical and equitable such that all individuals of varying racial and ethnic groups and income levels may implement the patterns with foods that are accessible and commonly consumed. Thus, FPM is also used to evaluate whether the modeled patterns and the underlying assumptions of nutrients provided by foods and beverages in each food group are representative of variations in dietary intakes for different population groups. **Box D.9.1** provides more detailed descriptions of key FPM terms.

Box D.9.1: Key Terms

Established Nutritional Goals: The established nutritional goals (hereafter referred to in this chapter as "goals") for food pattern modeling (FPM) analyses are defined as the Estimated Energy Requirement (EER) for energy,[7] less than 10 percent of energy from saturated fat, less than 10 percent of energy from added sugars,[8] lower than the Chronic Disease Risk Reduction intakes (CDRR) for sodium,[3] and 90 percent of the Recommended Dietary Allowance (RDA), or Adequate Intake (AI) when an RDA is not established.[2-4]

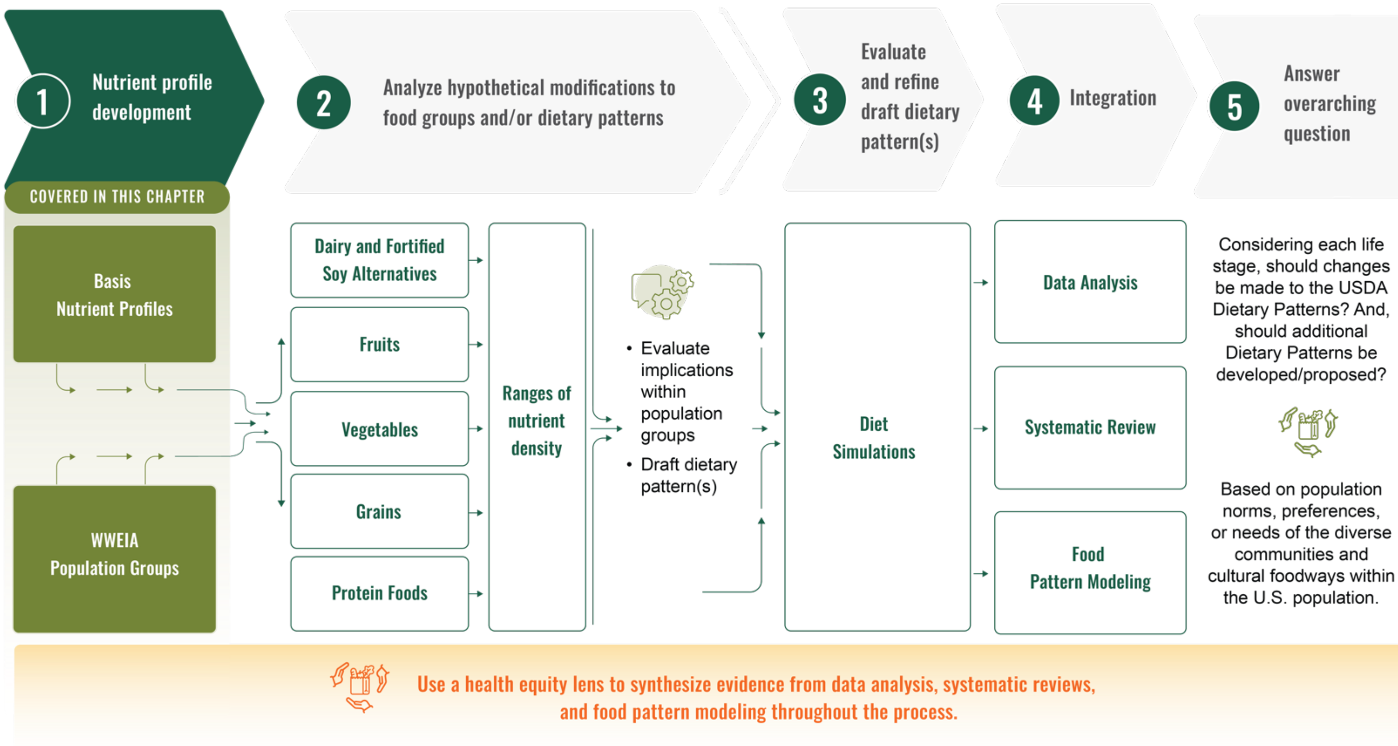
Nutrient-Dense Representative Foods: For purposes of USDA's FPM, each item cluster is assigned a nutrient-dense representative food which are those foods or beverages that represent the forms with the least amounts of added sugars, saturated fat, and sodium. The nutrient composition of the nutrient-dense representative food is used to represent the nutrient composition of the entire item cluster when calculating the nutrient profile for a food group or subgroup.

Item Clusters: Identified groupings of the same or similar foods or beverages that make up each food group and subgroup. Item clusters are used to calculate the weighted average consumption for use in calculating a nutrient profile for each food group and subgroup used in USDA FPM.

Nutrient Profiles: The proportional nutrient composition from the item clusters that represent each food group and subgroup from the variety of foods in each food group in their nutrient-dense forms. The nutrient profiles are based on a weighted average of nutrient-dense forms of foods (i.e., a composite of nutrient-dense forms of foods and beverages within a food group or subgroup). The calculated weighted average considers a range of foods and beverages reported by individuals in the United States, but are modeled using nutrient-dense forms, and results in a food pattern that can be adapted to fit an individual's preferences.

This chapter describes the multi-phased approach that considered evidence from 2 FPM protocols: 1) Basis Nutrient Profiles and 2) What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES) Population Groups (**Figure D.9.1**). These protocols were developed to inform whether the existing or the revised methods would be used to develop the food group nutrient profiles for all subsequent FPM analyses by the 2025 Dietary Guidelines Advisory Committee (Committee).

FIGURE D.9.1
2025 FOOD PATTERN MODELING PROCESS



Nutrient Profile Development: Basis Nutrient Profiles

The nutrient profile that is derived to represent the nutritional contribution of each food group and subgroup to the overall pattern is based on the nutrient composition of the foods or beverages in their nutrient-dense forms, proportional to their consumption in a given population. Specifically, the nutrient profiles are based on a weighted average of foods and beverages consumed by all individuals ages 1 year and older in WWEIA, NHANES, and represented by a form of the food with the least amounts of added sugars, saturated fat, and/or sodium. As such, all foods and beverages within food groups and subgroups are matched to a nutrient-dense representative food, which will be referred to as representative foods, to estimate its energy and nutrients.

Nutrient-dense versions of foods and beverages were used in previous FPM analyses (i.e., representative foods); however, prior Committees and public comments suggested additional modeling considerations to examine whether foods and beverages of lower nutrient density should also contribute toward the calculations of nutrient profiles. Most item clusters include similar foods or beverages with a range of added sugars, saturated fat, or sodium. For example, cooked carrots could be prepared with or without salt, butter, or a brown sugar glaze. The nutrient-dense representative food for this item cluster is a steamed carrot with no added salt, fat, or sugar. The inclusion of foods regardless of their nutrient density is straightforward when nutrient-dense versions (without added sugars, saturated fat, or sodium) are present and can be selected as the representative food. However, for some item clusters, a majority of the included foods may be lower in nutrient density and the selection of a nutrient-dense representative food, even if it has the least added sugars, saturated fat, or sodium, may be less in alignment with the purpose to model nutrient-dense forms of foods and beverages. For example, a lower-fat or reduced-sugar ice cream could be used as a representative food for "ice creams" in developing the overall nutrient profile for Dairy and Fortified Soy Alternatives. Alternatively, ice cream could be excluded from the development of the Dairy and Fortified Soy Alternatives nutrient profile altogether.

This chapter describes the examination of alternative approaches for calculating nutrient profiles that considers—for the first time—which, if any, foods lower in nutrient density should be excluded from the foods contributing to the nutrient profile calculations. Analysis results inform which nutrient profile calculation method are used in subsequent FPM analyses.

Nutrient Profile Development: WWEIA Population Groups

The nutrient profile of each food group has previously been developed to reflect the dietary intakes of the total U.S. population overall, and within age groups. The Committee, through its health equity lens, proposed population group-specific nutrient profiles by race, Hispanic origin, and socioeconomic position using income measures related to federal assistance program eligibility. The population groups identified as those with data publicly available in WWEIA, NHANES include:

- Population groups by race and/or Hispanic origin
  - Non-Hispanic Black
  - Non-Hispanic Asian
  - Non-Hispanic White
  - Hispanic (Mexican American and Other Hispanic)
- Population groups for household income as a percentage of the federal poverty level
  - <131 percent poverty
  - ≤185 percent poverty
  - 186 to 350 percent poverty
  - >350 percent poverty

The Committee was concerned that the development of nutrient profiles based on intakes of the total U.S. population may obscure important differences from a health equity perspective, such as food access, preferences and choices, and cultural foodways, among others. Thus, consideration of the representativeness of the proportions of foods and beverages reported among individual population groups, other than among age, is a new direction (**Box D.9.2**). Recognizing this potentially informative diversity in intakes among population groups, the analytic plan for the WWEIA Population Groups protocol included nutrient profiles that were derived according to a group's proportions of foods and beverages within food groups and subgroups. Findings from these analyses were then evaluated to inform the degree of generalizability of the nutrient profiles based on the total U.S. population.

Addressing these 2 important goals—the nutrient density of the nutrient profiles and the generalizability of the nutrient profiles—informed development of the nutrient profiles for each food group and subgroup used in subsequent FPM analyses. This aimed to ensure that the dietary pattern(s) that are ultimately proposed by the Committee to the Departments are nutrient dense, practical, and representative of foods commonly consumed by diverse U.S. population groups.

Box D.9.2: Representation in Food Pattern Modeling

This Committee's food pattern modeling work considered an expansion of the methods used by the 2020 Dietary Guidelines Advisory Committee to develop nutrient profiles. This expansion applied a health equity lens that broadened representation of foods and beverages consumed in the United States by considering the dietary intakes of additional individual population groups. The Committee carried forward methods to develop nutrient profiles using the dietary intakes of the total U.S. population and considered expansion of methods using individual population group-specific nutrient profiles by race, Hispanic origin, and socioeconomic position using income measures related to federal assistance program income eligibility. The results of these analyses provided the Committee with confidence in the underlying nutrient profiles used for all analyses in **Part D. Chapter 10: Food Group and Subgroup Analysis** and led the Committee to add an additional step in which the population group specific nutrient profiles were applied when evaluating its proposed dietary pattern that is presented in **Part E. Chapter 1: Overarching Advice to the Departments.** Representation in food pattern modeling is also extensively discussed in **Part D. Chapter 11: Diet Simulations**. Health equity considerations that were applied across the Committee's work, including for food pattern modeling, are further described in **Part C. Methodology.**

Both the Basis Nutrient Profiles and WWEIA Population Groups analyses were conducted prior to implementing the other FPM protocols (**Figure D.9.1**) so that findings could inform all subsequent analyses. As a result, the nutrient profiles developed represent nutrient-dense foods that are foods commonly consumed by diverse U.S. population groups by race, Hispanic origin, and income to improve the utility and generalizability of proposed dietary patterns in the population.

List of Questions

1. Should foods and beverages with lower nutrient density (i.e., those with added sugars, saturated fat, and sodium) contribute to item clusters, representative foods, and therefore the nutrient profiles for each food group and subgroup used in modeling the USDA Dietary Patterns?[9]

2. What are the differences between nutrient profiles calculated using the dietary intakes of the total U.S. population and population groups?[10]

Methodology

FPM methodology is briefly described in **Part C: Methodology** (see section titled Food Pattern Modeling).

Review of the Science

Question 1: Should foods and beverages with lower nutrient density (i.e., those with added sugars, saturated fat, and sodium) contribute to item clusters, representative foods, and therefore the nutrient profiles for each food group and subgroup used in modeling the USDA Dietary Patterns?

Approach to Answering Question: Food Pattern Modeling

Summary Statement

The exclusion of foods and beverages of lower nutrient density from the calculations used to establish food group and subgroup nutrient profiles for food pattern modeling provided less energy, added sugars, and saturated fat, with limited implications for other nutrients. The revised methodology that excluded desserts, candies, and other sweets from the calculation of nutrient profiles was used in subsequent FPM analyses. Exclusion of these foods results in nutrient profiles that align better with the intent to model nutrient-dense foods and beverages as part of a healthy dietary pattern.

Summary of the Evidence

To develop and refine the process to determine which foods and beverages of lower nutrient density to consider for exclusion from the nutrient profiles in FPM, the Committee reviewed a summary of FPM approaches used by scientists in other countries including Canada, Australia, Japan, United Kingdom, Ireland, and Denmark.[11] Although reviewing the approaches from other countries was insightful, the methods did not fully align with the goals of the proposed analyses.

The Committee discussed ways to empirically define foods lower in nutrient density, including existing methods applied in other USDA modeling and in the FDA draft Dietary Guidance Statements.[12] Neither of these approaches were well-suited to apply to FPM nutrient profile development. Another method entailed an empirical definition for outliers of foods and beverages, i.e., those containing quantities of added sugars, saturated fat, and/or sodium that fell outside the 75th percentile within the food group or subgroup. However, identified outliers among the nutrient-dense representative foods were not meaningful. Added sugars, saturated fat, and sodium do not have normal distributions among the representative foods in a food group or subgroup as most representative foods have little to none of these food components. For example, when nearly all representative foods have zero added sugars, a food with any added sugars above zero could be identified as an outlier. Therefore, the foods and beverages of lower nutrient density were identified using the WWEIA food categories.[13] with the additional consideration of their place in dietary patterns, as many were desserts, candies, and other sweets outside of the existing *Dietary Guidelines* recommendations to consume nutrient-dense foods and beverages from each food group.

The Committee discussed the contribution of added sugars, saturated fat, and sodium in main dishes, but there were concerns that removal of main dish categories (e.g., mixed dishes) could be too restrictive and would impact many cultural dishes from proportionally contributing to nutrient profile calculations. In addition, these main dishes are disaggregated into their ingredients and assigned to item clusters with nutrient-dense representative foods that align with existing *Dietary Guidelines* recommendations to consume foods in nutrient-dense forms.

The Committee discussed excluding foods from nutrient profiles based on their sodium content, but several limitations and concerns were noted, including the limited availability in the food supply of lower-sodium versions. Unlike added sugars, for which the top sources are clustered in sugar-sweetened beverages – which are not included in calculating nutrient profiles – and desserts and sweets, sodium content can vary within food categories and is ubiquitous across many categories of food, making it difficult to isolate categories of foods for exclusion. Additionally, nutrient-dense representative foods already exclude, where possible, the addition of salt assumed to be added during food preparation at home. Ultimately, the Committee decided that foods would not be removed on the basis of sodium alone. Based on this rationale, the following WWEIA Food Categories[13] were excluded from the calculation of the revised nutrient profiles:

- 1402 Milk shakes and other dairy drinks
- 5502 Cakes and pies
- 5504 Cookies and brownies
- 5506 Doughnuts, sweet rolls, pastries
- 5702 Candy containing chocolate
- 5704 Candy not containing chocolate
- 5802 Ice cream and frozen dairy desserts
- 5804 Pudding
- 5806 Gelatins, ices, sorbets
- 8802 Sugars and honey
- 8806 Jams, syrups, toppings
- 9012 Baby food: snacks and sweets

Using this list of WWEIA Food Categories, 508 FNDDS food codes were excluded based on their category assignment, which also removed 11 associated item clusters.

Applying these food and beverage exclusions had minimal impact on the resulting composition of the nutrient profiles, with little to no change for most of the food group and subgroup profiles. There were small implications for the nutrient profile of Dairy and Fortified Soy Alternatives when milk shakes, ice cream, and frozen yogurt were excluded from contributing to item clusters for foods and beverages. Specifically, there were small, proportional decreases in fluid milk in the food group, due to the removal of the fluid milk contributed by these removed foods, resulting in a proportional increase in the contribution of cheese. Given that the energy per cup equivalent (cup eq) for cheese with a representative food as fat-free cheese varieties is lower than the energy per cup eq as fat-free milk; these proportional shifts lead to a modest decrease in the estimated energy (17 kcal) per cup eq for Dairy and Fortified Soy Alternatives. Further, this proportional reduction of fluid milk has modest reductions in the content of calcium, vitamin A, D, and sodium per cup eq.

The exclusion of desserts and sweets impacted the nutrient profile estimates for the Refined Grains and decreased the proportions of their affiliated item clusters (e.g., refined grains with flour). The exclusion of grain-based desserts and shifts in proportional contributions of item clusters led to decreases of ~0.5 g of added sugars and 4 kcal per ounce equivalent of refined grains. These negligible changes in the nutrient profile estimates for Refined Grains are as expected, given that nutrient-dense representative foods used to calculate nutrient profiles are intended to be in forms with no or little added sugars and the majority of the proportional contribution to refined grains is breads, rice, and pasta.

All analyses and a summary of results by age, sex, and life stage can be found in the Basis Nutrient Profiles FPM Report at: https://www.dietaryguidelines.gov/2025-advisory-committee-report/food-pattern-modeling

Question 2: What are the differences between nutrient profiles calculated using the dietary intakes of the total U.S. population and population groups?

Approach to Answering Question: Food Pattern Modeling

Summary Statement

The evaluation of nutrient profiles specific to individual population groups demonstrated some differences in the proportions of specific foods and beverages that contributed to the calculation of nutrient profiles, but had limited differences on the overall macronutrient and micronutrient composition of the nutrient profiles. No changes were made to the nutrient profiles used in subsequent food pattern modeling analyses based on this evaluation. Instead, the individual population group nutrient profiles were used as part of the final synthesis to evaluate proposed pattern(s) against nutritional goals using the:

1. Nutrient profiles for the total population; and
2. Nutrient profiles for individual population groups classified by race, Hispanic origin, and socioeconomic position using income measures related to federal assistance program income eligibility.

Summary of the Evidence

The 2020 Dietary Guidelines Advisory Committee evaluated possible differences in the nutrient profiles through a life stage approach, which was consistent with their overarching examination of the evidence across all life stages. An analysis was conducted in which nutrient profiles were based on the proportions of foods consumed specific to each life stage, including infants and young children up to age 24 months, children ages 2 through 3 years, children and adolescents ages 4 through 18 years, adults ages 19 through 70 years, and older adults ages 71 years and older.[14,15] The Committee noted that the different intake proportions by life stage could be related to lifestyle and socialization patterns for each age group. The 2025 Committee's work emphasized health equity and, throughout FPM analyses, aimed to consider variation in dietary intakes in the population. Further, calculation of nutrient profiles was completed using foods and beverages reported by individuals categorized based on racial and/or ethnic group and socioeconomic position using income measures related to federal assistance program income eligibility, which allowed additional insights for the purpose of assessing generalizability of FPM analyses. The dietary intake data from WWEIA, NHANES have publicly available variables for race and/or ethnicity as well as income measures. These categories, however, do not represent all individuals in the population and considerable heterogeneity exists within each subgroup identified for this analysis that may not be fully accounted for. Additional population groups would also be relevant to consider; however, this analysis represents a step toward accounting for variation in dietary intake, will potentially inform the subsequent protocols such as the diet simulations protocol, and may generate hypotheses for future FPM work.

To determine whether nutrient profiles based on dietary intakes of the total U.S. population ages 1 year and older are generalizable to individual population groups, separate nutrient profiles were calculated based on each group's proportional intakes of foods and beverages.

Resulting nutrient profiles indicate that the proportions of fluid milk, yogurt, and cheese in the Dairy and Fortified Soy Alternatives food group were different for non-Hispanic Asians such that milk and yogurt were higher, and cheese was lower, compared with other groups. For non-Hispanic Blacks, proportions of milk and yogurt were the lowest and cheese highest. Differences were also observed across income categories, with higher-income groups having higher proportional intakes of cheese and yogurt and lower proportional intakes of fluid milk, compared with other income groups. The estimated proportional intakes contributed to small variations in nutrient profiles (e.g., cheese has lower energy per cup eq compared to milk and yogurt; fluid milk has greater quantities of vitamin A and D and calcium per cup eq than yogurt or cheese).

Additionally, the proportions of item clusters within the Refined Grain and Whole Grain Food Subgroups were notably different among individuals classified as non-Hispanic Asian. In this group, white rice contributed a larger proportion to the Refined Grains nutrient profile, resulting in higher folate, but lower vitamin A and calcium. However, a lower proportion of ready-to-eat breakfast cereals within Whole Grains produced a nutrient profile lower in vitamins A and D, folate, and potassium. Other differences in nutrient profiles of Refined and Whole Grains by population group by income categories indicated less notable variation.

All analyses and a summary of results by age, sex, and life stage can be found in the
WWEIA Population Groups FPM Report at :
https://www.dietaryguidelines.gov/2025-advisory-committee-report/food-pattern-modeling

Discussion

Nutrient Profile Development: Basis Nutrient Profiles

The decision to exclude a selection of less nutrient-dense foods from the calculation of nutrient profiles aligns with existing dietary guidance to focus on meeting food group needs with nutrient-dense foods and beverages. The food group nutrient profiles were calculated based on proportional intakes of foods reported in WWEIA, NHANES, which includes foods from a variety of cultural foodways and reflects actual eating patterns, reflected in nutrient-dense forms. Although some food categories (i.e., desserts, candies, and other sweets) were excluded, this does not suggest that foods and beverages lower in nutrient density no longer contribute to a given food group or subgroup as variability in nutrient composition exist within each food group. Other foods that may be lower in nutrient density (e.g., canned fruit in syrup) were not excluded from proportionally contributing to nutrient profiles as the nutrient-dense representative food (e.g., canned fruit in 100% juice) aligns with existing dietary guidance to consume canned, frozen, or fresh fruits in nutrient-dense versions. The Committee noted challenges with excluding main dishes (e.g., burgers, sandwiches, grain-based mixed dishes) that are top food category sources of saturated fat and sodium in the U.S. population. While the principle was to use mostly nutrient-dense foods, not excluding main dishes that are sources of saturated fat and sodium makes nutrient profile calculation more realistic to what people are eating.

Ultimately, exclusions of desserts and sweets had limited impact on the overall nutrient profile of the HUSS pattern. Where implications were most notable—on energy and certain nutrients in the profiles for Dairy and Fortified Soy Alternatives and Refined Grains—such implications were small. The Committee noted that variation exists between the nutrient-dense representative foods used in calculating nutrient profiles. With rapid changes in formulation in the food supply, the food composition data available in FNDDS may not fully capture the variation of foods by, for example, commercial formulation or home preparation at the individual level. Nutrient composition may vary within a given food, with potential further variation by climate, location, and cultivar, which can create large ranges in nutrient content. Therefore, any small changes in nutrient profile could fall within normal variation in nutrient content of the individual foods, so results should be interpreted with caution.

Nutrient Profile Development: WWEIA Population Groups

After the FPM methodology was adapted with the decision to exclude certain foods and beverages lower in nutrient density from the calculation of nutrient profiles, the Committee evaluated the use of dietary intake data from individual population groups.

If the nutrient profiles of subgroup-based food and beverage patterns differed among individual population groups or were appreciably different from the nutrient profile of the total population, this situation would provide rationale to consider additional approaches, including using multiple population-specific nutrient profiles in all subsequent FPM analyses to improve generalizability to the diverse U.S. population.

As expected, variation was present in the proportions of different foods and beverages when the FPM was conducted according to the dietary intake data for a given WWEIA population group. However, these differences only minimally impacted the overall nutrient profile results, likely due to the modest differences in the proportions and because the representative foods for the item clusters did not change. The Committee concluded that the consistency in nutrient profiles using WWEIA population group dietary intake data provided sufficient rationale to proceed with the single nutrient profile for the U.S. population. However, the Committee decided to add another review step in the synthesis phase that used the nutrient profiles from individual population groups to avoid the possibility of exacerbating inadequacies among nutrients of concern.

There were caveats to these analyses that the Committee hopes will stimulate future research. First, the Committee was limited to the individual population groups for which publicly available NHANES data were available. While the Committee considered these demographic population groups to be a robust test of generalizability, the results of the analyses were not intended to be comprehensive for the diverse groups living in the United States. Furthermore, the individual population group categories themselves are broad. For example, individual population groups include individuals who may have heterogenous dietary intakes related to differences in region of origin. It is challenging to examine these cultural differences due to limitations in sample size.

Another caveat to these analyses was the estimation of dietary intakes that represent commonly consumed foods by diverse U.S. population groups. The sampling scheme for NHANES is meant to be representative of the general U.S. population, but some groups are underrepresented in the survey. Therefore, foods that are unique to individual population groups may not be fully included in the food composition database. Future expansion of the food composition databases will provide further opportunities to test the generalizability of the nutrient profile calculations.

Next Steps in the 2025 FPM Process

This chapter described the nutrient profile development stage described in **Figure D.9.1**. As a result of the variations noted in the exclusion of foods and beverages with lower nutrient density, the revised nutrient profile described in this chapter was then used for subsequent FPM analyses, as described in **Part D. Chapter 10: Food Group and Subgroup Analysis.** Moving toward the final synthesis analyses, proposed hypothetical changes to food groups and/or dietary patterns were examined against nutritional goals. The Committee also used population group-specific nutrient profiles during the final synthesis phase to test proposed patterns against nutritional goals while considering variation in dietary intakes.

References

1. Dietary Guidelines Advisory Committee. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. Washington, DC: U.S. Department of Agriculture, Agricultural Research Service; 2020. https://doi.org/10.52570/DGAC2020
2. Institute of Medicine. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids*. Washington, DC: The National Academies Press; 2005. https://doi.org/10.17226/10490
3. National Academies of Sciences, Engineering, and Medicine. *Dietary Reference Intakes for Sodium and Potassium*. Washington, DC: The National Academies Press; 2019. https://doi.org/10.17226/25353
4. National Academies of Sciences, Engineering, and Medicine. *Dietary Reference Intakes for Calcium and Vitamin D*. Washington, DC: The National Academies Press; 2011. https://doi.org/10.17226/13050
5. Institute of Medicine. *Dietary Reference Intakes: The Essential Guide to Nutrient Requirements*. Washington, DC: The National Academies Press; 2006. https://doi.org/10.17226/11537
6. Institute of Medicine. *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*. Washington, DC: The National Academies Press; 2001. https://doi.org/10.17226/10026
7. National Academies of Sciences, Engineering, and Medicine. *Dietary Reference Intakes for Energy*. Washington, DC: The National Academies Press; 2023. https://doi.org/10.17226/26818
8. U.S. Department of Agriculture and U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2020-2025, 9th Edition*. Washington, DC: U.S. Department of Agriculture; 2020. https://www.dietaryguidelines.gov/
9. Taylor CA, Eicher-Miller HA, Abrams SA, et al. *Should foods and beverages with lower nutrient density (i.e., those with added sugars, saturated fat, and sodium) contribute to item clusters, representative foods, and therefore the nutrient profiles for each food group and subgroup used in modeling the USDA Dietary Patterns? Food Pattern Modeling Report*. November 2024. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition and Economic Analysis Branch.2024;doi: https://doi.org/10.52570/DGAC2025.FPM01
10. Taylor CA, Talegawkar SA, Abrams SA, et al. *What are the differences between nutrient profiles calculated using the dietary intakes of the total U.S. population and population groups? Food Pattern Modeling Report*. *What are the differences between nutrient profiles calculated using the dietary intakes of the total U.S. population and population groups? Food Pattern Modeling Report.* November 2024. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition and Economic Analysis Branch.2024;doi: https://doi.org/10.52570/DGAC2025.FPM02
11. Davis KA, Esslinger K, Elvidge Munene LA, St-Pierre S. International approaches to developing healthy eating patterns for national dietary guidelines. *Nutr Rev*. Jun 1 2019;77(6):388-403. doi:https://doi.org/10.1093/nutrit/nuy058
12. U.S Department of Health and Human Services, Food and Drug Administration, Center for Food Safety and Applied Nutrition. *Questions and Answers About Dietary Guidance Statements in Food Labeling: Guidance for Industry Draft Guidance*. 2023. https://www.fda.gov/media/166342/download"Draft
13. U.S. Department of Agriculture, Agricultural Research Service. *What We Eat in America Food Categories 2017-2018*. 2020. www.ars.usda.gov/nea/bhnrc/fsrg
14. 2020 Dietary Guidelines Advisory Committee and Food Pattern Modeling Team. *Food Pattern Modeling Report: Under 2 Years of Age*. Washington, DC: U.S. Department of Agriculture; 2020. *2020 Dietary Guidelines Advisory Committee Project*. https://www.dietaryguidelines.gov/sites/default/files/2020-07/FoodPatternModeling_Report_Under2Years.pdf
15. 2020 Dietary Guidelines Advisory Committee and Food Pattern Modeling Team. *Food Pattern Modeling Report: Ages 2 Years and Older*. Washington, DC: U.S. Department of Agriculture; 2020. *2020 Dietary Guidelines Advisory Committee Project*. https://www.dietaryguidelines.gov/sites/default/files/2020-07/FoodPatternModeling_Report_2YearsandOlder.pdf

Part D. Chapter 10: Food Group and Subgroup Analyses

Introduction

Food pattern modeling (FPM) is a methodology used to illustrate how changes to the amounts or types of foods and beverages in a dietary pattern might affect meeting nutrient needs. This method is also used to develop quantitative dietary patterns that reflect health-promoting food intakes identified in systematic reviews and meet energy and nutrient needs. The use of FPM methodology affords the opportunity to explore changes to the quantities or proportions of food groups and subgroups within USDA Dietary Patterns, while also assessing the energy and nutrient-level implications of these changes. Historically, the food groups and subgroups have been comprised of foods and beverages that share a similar nutrient profile. Through an iterative process, the collective work of prior Committees has used these food groups and subgroups to generate the 3 current USDA Dietary Patterns: Healthy U.S.-Style Dietary Pattern (referred to as HUSS throughout this chapter), Healthy Vegetarian Pattern (referred to as H-VEG throughout this chapter), and Healthy Mediterranean-Style Dietary Pattern (referred to as H-MED throughout this chapter).[1] The USDA Dietary Patterns have 12 calorie levels in 200 kilocalorie increments to meet Dietary Reference Intakes for energy and nutrients, and other nutritional goals for age-sex groups across the lifespan, with few exceptions.[1]

This chapter presents the series of questions that were addressed using FPM to explore hypothetical changes to each of the food groups and subgroups, as well as a question exploring an estimate of calories available for other uses. The chapter explores the implications on nutrient adequacy given proposed shifts in the quantities of food groups and subgroups, mostly tested within the 2020 HUSS, to determine if modifications or flexibilities should be made to the existing patterns, or if new dietary pattern variations should be developed. See **Box D.10.1** for information about how the Committee operationalized these terms (including “nutrient adequacy,” which is explained in the box as “Established Nutritional Goals”).

Box D.10.1: Key Terms

Established Nutritional Goals: The established nutritional goals (hereafter referred to in this chapter as "goals") for food pattern modeling analyses are defined as the Estimated Energy Requirement (EER) for energy,[2] less than 10 percent of energy from saturated fat, less than 10 percent of energy from added sugars,[3] lower than the Chronic Disease Risk Reduction intakes (CDRR) for sodium,[4] and 90 percent of the Recommended Dietary Allowance (RDA), or Adequate Intake (AI) when an RDA is not established.[4-6]

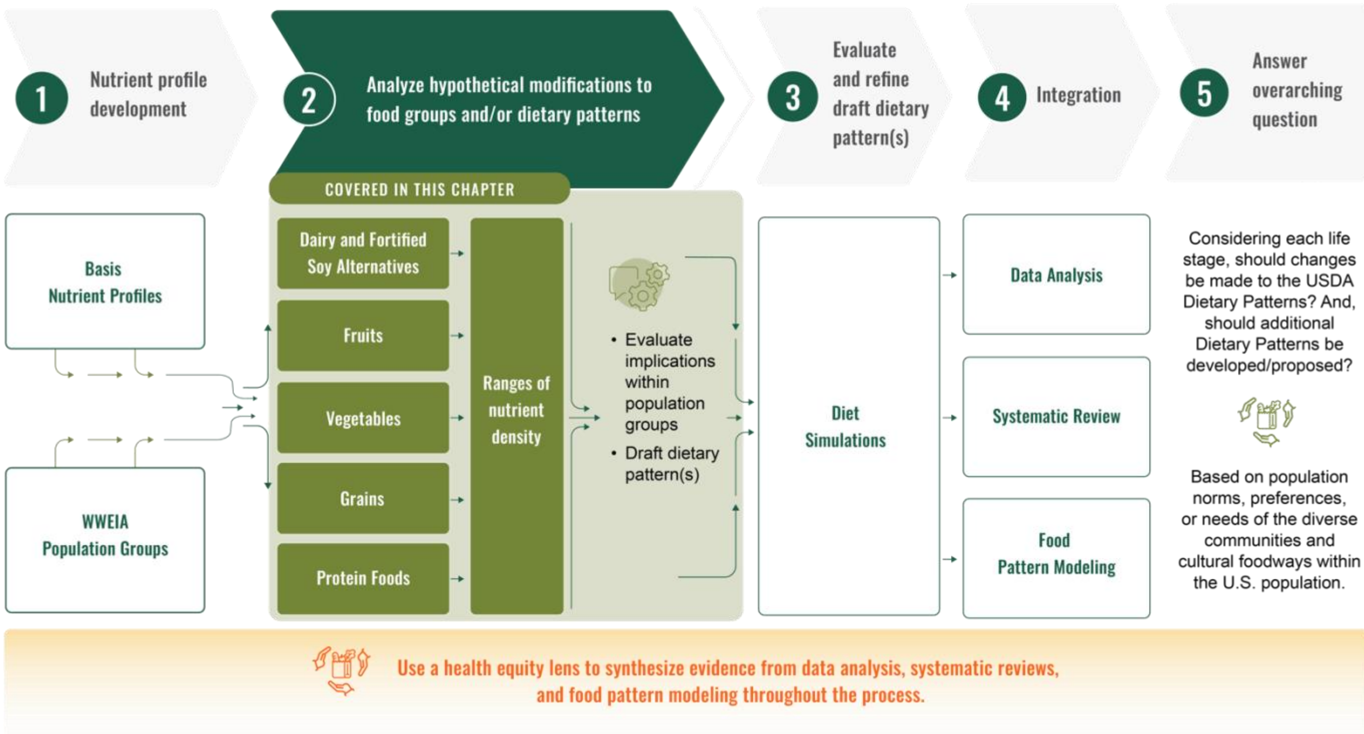
Dietary Pattern Modifications: The Committee operationalized the term 'Modifications' (e.g., modified 2020 HUSS) as any proposed change to the food group or subgroup quantities provided in the 3 patterns included in the *2020-2025 Dietary Guidelines for Americans*.

Dietary Pattern Flexibilities: The Committee operationalized the term 'Flexibilities' (e.g., Protein Foods flexibilities) as narrative advice around options for meeting nutrient needs outside of quantitative pattern recommendations.

Dietary Pattern Variations: The Committee operationalized the term 'Variation' as the creation of a new dietary pattern.

Building on the foundation laid by prior Dietary Guidelines Advisory Committees, the *Dietary Guidelines for Americans* has promoted consumption of a variety of nutrient-dense foods and beverages from food groups and subgroups to meet nutrient needs of the U.S. population. FPM offers the ability to introduce quantitative evidence-based modifications to fine-tune the current USDA Dietary Patterns (i.e., HUSS, H-VEG, H-MED), and to evaluate the implications of such modifications on the nutrient adequacy within energy limits relative to the nutritional requirements for each age-sex group or life stage. The FPM analyses were informed by and complementary to systematic review evidence and current population consumption estimates from data analyses. Protocols were developed to test the nutritional implications of modifications to the 2020 HUSS and 2020 H-VEG that meet nutrient recommendations through the selection of nutrient-dense foods and beverages with limited amounts of added sugars, saturated fat, and sodium as described in **Part D. Chapter 9: Nutrient Profile Development**. As noted by previous Committees, nutrient shortfalls in the existing patterns are noted in cases where natural sources of the nutrient are limited (e.g., vitamin D or E) or when the Dietary Reference Intake value is high compared to energy needs (e.g., iron and folate during pregnancy).[1] Therefore, the implications of reduction or removal of specific food groups or subgroups were presented in the context of the amount of these nutrients in the pattern falling further below the goal. **Figure D.10.1** shows how the analyses described in Chapter 9 form the foundation for the analyses presented in this Chapter and how they contribute to the total body of FPM work completed by the Committee.

FIGURE D.10.1
2025 FOOD PATTERN MODELING PROCESS



Beyond estimating the nutrient contribution of varying quantities of food groups and subgroups, FPM was used to: a) illustrate how hypothetical changes to the amounts or types of foods and beverages in a dietary pattern might affect meeting nutrient needs, and b) assist in defining quantitative dietary patterns that reflect the evidence for health-promoting diets synthesized from systematic reviews, while meeting energy and nutrient needs. Starting in 2005, prior USDA Dietary Patterns included a small amount of calories remaining for other uses, though the terminology and definitions for such calories have varied slightly in these editions.[3,7-9] FPM was used to calculate the energy from the pattern of food groups and subgroups, which provided about 85 percent of the total energy intended from the calorie level. The estimated energy that remained (i.e., total energy minus energy from food groups and subgroups) was designated for other uses. This Committee carried out additional FPM analyses to assess the viability of presenting an estimate of calories that represents those available after meeting the quantities of the food groups and subgroups of the dietary pattern with nutrient-dense foods and beverages.

The FPM analyses were used to answer questions exploring modifications or flexibilities in the proportions of the food groups and subgroups in the 2020 HUSS, as well as presentation of calories for other uses. The collective results were then integrated in considering a final pattern with recommended modifications and flexibilities. The final dietary pattern(s) are presented in **Part E. Chapter 1: Overarching Advice to the Departments**.

List of Questions

1. What are the implications for nutrient intakes when modifying the Dairy and Fortified Soy Alternatives food group quantities within the Healthy U.S.-Style Dietary Pattern? What are the implications for nutrient intakes when dairy food and beverage sources are replaced with non-dairy alternatives?[10]
2. What are the implications for nutrient intakes when modifying the Fruits food group quantities within the Healthy U.S.-Style Dietary Pattern?[11]
3. What are the implications for nutrient intakes when modifying the Vegetables food group and subgroup quantities within the Healthy U.S.-Style Dietary Pattern?[12]
4. What are the implications for nutrient intakes when modifying the quantities of the Grains group within the Healthy U.S.-Style Dietary Pattern? What are the implications for nutrient intakes when specific individual staple grains are emphasized; or when the Grains group is replaced with other staple carbohydrate foods (i.e., Starchy Vegetables; Beans, Peas, and Lentils; starchy Red and Orange vegetables)?[13]
5. What are the implications for nutrient intakes when modifying the Protein Foods group and subgroup quantities within the Healthy U.S.-Style Dietary Pattern or Healthy Vegetarian Dietary Pattern? What are the implications for nutrient intakes when proportions of animal-based Protein Foods subgroups are reduced and proportions of plant-based Protein Foods subgroups are increased?[14]
6. What quantities of foods and beverages lower in nutrient density can be accommodated in the USDA Dietary Patterns while meeting nutritional goals within calorie levels?[15]

Methodology

FPM methodology is briefly described in **Part C. Methodology** and detailed methods are provided in the FPM reports. Two of the FPM reports describe exploratory analyses that the Committee conducted to examine removal of animal products as well as restriction of carbohydrate-containing foods. See **Box D.10.2** for more information about these analyses.

Box D.10.2: Exploratory Analyses

The Committee explored special considerations around removal of animal products as well as restriction of carbohydrate-containing foods. Considerable public interest was present around both topics and the Committee conducted exploratory analyses to assess the nutritional implications of these dietary modifications. These analyses included:

- Can nutrient goals be met when animal sources of foods and beverages are removed from the Healthy Vegetarian Dietary Pattern for ages 2 years and older?
- Can nutrient goals be met when carbohydrate-containing foods and beverages are reduced in the Healthy U.S-Style Dietary Pattern for ages 2 years and older?

The FPM analyses that examined the nutritional implications of the hypothetical removal of animal products was conducted by starting with the 2020 H-VEG for ages 2 years and older. This pattern is a lacto-ovo vegetarian dietary pattern that was developed to meet nutritional goals without meat, poultry, and seafood. In the analyses by this Committee, animal sources of foods and beverages contributing to the Dairy and Fortified Soy Alternatives and Protein Foods groups and subgroups were removed from the 2020 H-VEG. Although these analyses broadly address a vegan eating style, the Committee was constrained by insufficient data on the appropriate substitution of foods and beverages that would replace those excluded as part of the analyses and the variability of how a vegan dietary pattern can be operationalized. In other FPM analyses, national consumption data were used to determine trends in food group and subgroup intakes; however, nationally representative data do not exist specifically for people following a vegan dietary pattern to determine the replacement with the same rigor as used for other FPM analyses. The marketplace of products that are not from animal sources is rapidly evolving and is not fully reflected in the food composition data. Further, replacement foods and beverages must be modeled to bridge nutrient gaps that emerge and not be based solely on replacement of calories in the pattern(s). Therefore, the objectives described in this protocol do *not* include analyses that specify the amounts of food groups or subgroup quantities to achieve the energy target or develop a new dietary pattern.

Evaluation of the restriction of carbohydrate-containing foods was completed with a similar process, starting with 2020 HUSS. Similar concerns existed in that a lack of scientific evidence exists to establish the target carbohydrate level and specific foods sources to exclude, as well as lack of consensus to inform the substitution of foods that would replace the foods and beverages excluded to limit carbohydrate intakes. The marketplace is also rapidly evolving to include more foods that have reduced carbohydrate content, which presents challenges in estimating patterns using FPM when food composition data may not reflect the full spectrum of such products. Thus, removal occurred at the food group level to examine potential nutritional gaps, but the Committee did not make subjective decisions about the foods and beverages that might be retained to meet the RDA for carbohydrate.

Results from these analyses may be used to discuss the degree to which nutritional goals might be met after the removal of food groups and subgroups that contribute animal source foods and beverages or carbohydrates, and to help inform future directions, such as nutritional composition priorities for replacement foods.

All analyses and a summary of results can be found in the following FPM Reports:

- Removing Animal-Source Foods FPM Report: https://www.dietaryguidelines.gov/2025-advisory-committee-report/food-pattern-modeling
- Reducing Carbohydrate-Containing Foods FPM Report: https://www.dietaryguidelines.gov/2025-advisory-committee-report/food-pattern-modeling

Review of the Science

This section presents the 6 questions that the Committee addressed in examining modifications to individual food groups or subgroups and their respective implications for the nutrient content and ability of the 2020 HUSS to meet nutritional goals. For the first 5 questions, the Committee provides an overview of the food group being examined, the types of foods or beverages that count towards each food group, which should be consumed in forms with the least amounts of added sugars, saturated fat, and/or sodium (**Box D.10.3**, **Box D.10.4**, **Box D.10.5**, **Box D.10.6**, **Box D.10.7**), a table of the percentage of total nutrient contributions from that food group to the 2020 HUSS (**Table D.10.1**, **Table D.10.3**, **Table D.10.4**, **Table D.10.5**, **Table D.10.6**), and synthesis statements and a summary of the evidence. For the 6th question, which is about potential accommodation in USDA Dietary Patterns of quantities of foods and beverages lower in nutrient density, synthesis statements and a summary of the evidence are presented. The FPM analyses that examined modifications to the individual food groups and subgroups were carried out individually. Upon examining the evidence of each analysis, the Committee developed synthesis statements that outline any proposed modifications or flexibilities to be pursued with additional analyses in the synthesis phase. In the synthesis phase, proposed modifications were examined concurrently to inform a proposed modified 2020 HUSS.

Question 1: What are the implications for nutrient intakes when modifying the Dairy and Fortified Soy Alternatives food group quantities within the Healthy U.S.-Style Dietary Pattern? What are the implications for nutrient intakes when dairy food and beverages sources are replaced with non-dairy alternatives?

Approach to Answering Question: Food Pattern Modeling

Introduction to the Dairy and Fortified Soy Alternatives Food Group

Box D.10.3: Dairy and Fortified Soy Alternatives

What is included? The Dairy and Fortified Soy Alternatives Food Group in the 2020 USDA Dietary Patterns includes all fluid, dry, or evaporated milk, including lactose-free and lactose-reduced products and fortified soy beverages (soy milk), buttermilk, yogurt, kefir, frozen yogurt, dairy desserts, and cheese. The *Dietary Guidelines, 2020-2025* notes that most choices should be fat-free or low-fat and nutrient-dense such as those prepared without added sugars, saturated fat, and/or sodium. Cream, sour cream, and cream cheese are not included due to their low calcium content.

How much? The 2020 USDA Dietary Patterns recommend 1½ to 2 cup equivalents (cup eq) of Dairy and Fortified Soy Alternatives each day for young children ages 12 through 23 months and 2 to 3 cup eq of Dairy and Fortified Soy Alternatives each day for individuals ages 2 years and older.

What counts? The Food Pattern Equivalents Database (FPED) converts all foods and beverages in the Food and Nutrient Database for Dietary Studies (FNDDS) into USDA Dietary Pattern components. FPED shows that 1 cup eq of Dairy and Fortified Soy Alternatives equates to approximately 1 cup of milk or fortified soymilk, 1 cup of yogurt or fortified soy yogurt, and 1½ to 2 ounces of cheese.

Table D.10.1 shows that the Dairy and Fortified Soy Alternatives Food Group contributes 60-80 percent of the total calcium in the 2020 HUSS across all age groups starting at 12 months of age. The food group also contributes >70 percent of the total vitamin D for young children ages 12 through 23 months and >50 percent for those ages 2 years and older. Dairy and Fortified Soy Alternatives also contribute 15 percent or more to the total nutrient content in the 2020 HUSS for more than 1 dozen additional nutrients across most calorie levels.

TABLE D.10.1
PERCENTAGE OF TOTAL NUTRIENT CONTRIBUTION FROM THE DAIRY AND FORTIFIED SOY ALTERNATIVES FOOD GROUP IN THE 2020 HEALTHY U.S.-STYLE (HUSS) DIETARY PATTERN AS A RANGE OF ESTIMATES ACROSS CALORIE LEVELS FOR AGES 12 THROUGH 23 MONTHS AND 2 YEARS AND OLDER

Nutrient	Range of contribution (%) in HUSS for ages 12 through 23 months	Range of contribution (%) in HUSS for ages 2 years and older
Energy (kcal)	28-31*	8-17*
Carbohydrate (g)	13-17	6-13
Fiber (g)	<1	≤3
Protein (g)	39-43*	23-41*
Fat (g)	38-44*	3-6
Saturated Fatty Acids (g)	66-71*	8-18*
Linoleic acid (18:2) (g)	5-7	≤1
Linolenic acid (18:3) (g)	7-10	≤1
Vitamin A (mcg RAE)	38-43*	23-39*
Vitamin C (mg)	<1	<1
Vitamin D (IU)	73-76*	55-74*
Vitamin E (mg AT)	6-7	≤1
Vitamin K (mcg)	≤3	≤1
Thiamin (mg)	19-22*	10-21*
Riboflavin (mg)	52-55*	30-50*
Niacin (mg)	≤4	4-9
Vitamin B6 (mg)	17-18*	10-19*
Folate (mcg DFE)	6-7	≤5
Vitamin B12 (mcg)	57-63*	41-61*
Choline (mg)	28-30*	17-32*
Calcium (mg)	77-80*	60-78*
Copper (mg)	≤5	6-12
Iron (mg)	≤2	≤2
Magnesium (mg)	24-25*	14-27*
Phosphorus (mg)	54-55*	30-50*
Potassium (mg)	27-30*	15-28*
Sodium (mg)	48-51*	25-43*
Zinc (mg)	36-39*	21-39*

AT = alpha-tocopherol, DFE = dietary folate equivalents, g = grams, IU = international units, kcal = calories, mcg = micrograms, mg = milligrams, RAE = retinol activity equivalents

*Dairy and Fortified Soy Alternatives Food Group contributes more than 15 percent of the total amount of these nutrients in the 2020 HUSS for at least half of the calorie levels.

Synthesis Statements and Summary of the Evidence

Synthesis Statement 1 of 2

Potential Modification to the HUSS for Ages 2 and Older

FPM results provide support for exploring a modification that reduces Dairy and Fortified Soy Alternatives in the overall synthesis that integrates the food groups in a healthy dietary pattern.

Supporting Evidence and Considerations for Synthesis Statement 1

Reduction Analyses

Reductions in Dairy and Fortified Soy Alternatives by 0.5 to 1.0 cup eq can be made for most of the age, sex, and/or life stage groups before introducing new nutrient implications (i.e., other than those nutrients for which the 2020 HUSS is already below goals). For females ages 9 through 18 years and males ages 9 through 13 years, Dairy and Fortified Soy Alternatives cannot be reduced without calcium falling below goals. Therefore, any modification that reduces Dairy and Fortified Soy Alternatives in the overall synthesis may not be feasible for these 2 age-sex groups without a commensurate increase in calcium from another food group or subgroup for these 2 age-sex groups.

The FPM results did not support exploring a reduction in Dairy and Fortifies Soy Alternatives greater than 0.5 to 1.0 cup eq because multiple nutrients then fell below goals as indicated in the reduction analyses (not including complete removal). These include calcium (all groups), vitamin A (females ages 51 through 70 years; males ages 31 years and older; and all pregnancy groups), riboflavin (males ages 51 years and older; all pregnancy groups; and lactation groups ages 31 years and older), magnesium (females ages 14 years and older; males ages 31 through 50 years; pregnancy ages 19 years and older), potassium (children ages 2 through 8 years and males ages 51 years and older), phosphorus (females ages 9 through 13 years), and zinc (males ages 51 years and older and all pregnancy groups). Any reduction in quantities of Dairy and Fortified Soy Alternatives results in the amount of vitamin D in the pattern—which is already below the goal in the 2020 HUSS—falling further below the goal.

Considerations for Examining a Modification

Each of the 3 existing USDA Dietary Patterns have consistent age-specific recommendations for quantities of Dairy and Fortified Soy Alternatives such that regardless of energy needs, the recommended quantity for children ages 2 through 3 years is 2 cup eq, for children ages 4 through 8 years is 2.5 cup eq, and for children ages 9 through 18 years is 3 cup eq. In contrast, the current HUSS and H-VEG has 3 cup eq of Dairy and Fortified Soy Alternatives for adults older than age 18 years, whereas the H-MED has 2.5 cup eq for adults older than age 18 years. Therefore, for adults, but not children, there is precedent in the USDA Dietary Patterns for a modification that reduces Dairy and Fortified Soy Alternatives by 0.5 cup eq without introducing new nutrient implications and provides a flexibility for dietary patterns presented in **Part E. Chapter 1: Overarching Advice to the Departments**. Nonetheless, when exploring an age- and/or life stage-specific modification to reduce Dairy and Fortified Soy Alternatives during the synthesis phase, a reduction may not be feasible for adolescents who are in peak bone acquisition without a commensurate increase in calcium and other bone-building nutrients from other food groups or subgroups.

Synthesis Statement 2 of 2

Potential Flexibility to the HUSS for Ages 2 Years and Older

FPM results provide support for exploring a flexibility in which fortified plant-based milk alternatives are substituted for the Dairy and Fortified Soy Alternatives food group.

Supporting Evidence and Considerations for Synthesis Statement 2

Comparison of Milk Products

To address the question of fortified plant-based milk alternatives, the Committee focused on a comparison of fat-free milk as well as a nutrient-dense version of fortified soy milk which is already part of the Dairy and Fortified Soy Alternatives Food Group; and almond and oat milk alternatives which are not currently in the established food group. This decision was based on the availability of food composition data in the 2017-2018 FNDDS[16] and in the USDA Foundation Foods Database within USDA's FoodData Central,[17] and on the popularity of these products at the time of the analyses. The Committee acknowledges that the data presented in **Table D.10.2** reflect limited existing food composition data for products that are part of a rapidly evolving market and may not reflect all products currently available. The Committee also discussed the possibility of creating an aggregate nutrient profile for plant-based milk, yogurt, and cheese, but ultimately decided against this approach due to the lack of consumption pattern data and food composition data for these plant-based versions.

Considerations for Examining a Flexibility

A flexibility in which fortified plant-based milk alternatives are substituted for the Dairy and Fortified Soy Alternatives Food Group in the 2020 HUSS was proposed for consideration in recognition of this rapidly emerging market. Fortification plays a considerable role in determining the comparability of plant-based milk alternatives for replacement of cow's milk in the HUSS. Dairy and Fortified Soy Alternatives Food Group is a significant contributor of calcium and vitamin D to the 2020 HUSS. The plant-based milk alternatives have similar or higher quantities of calcium and vitamin D compared to an equivalent amount of fat-free milk, which support consideration for examining this flexibility. However, considerable variation exists in the broader nutrient composition of different types of plant-based milks. Nutrient composition is influenced by plant source (e.g., oat vs. soy vs. almond) and/or by differences in product fortification, which influences the degree to which a plant-based milk alternative may offer more or less of a nutrient compared to cow's milk. Further complicating the comparison is variation in fortification levels across formulations of products from the same manufacturer and from different manufacturers. Therefore, the direct substitution of plant-based milk alternatives for cow's milk within the patterns may introduce unintended consequences for meeting other nutrient recommendations and may vary by product selected. This is especially a concern in children where nutrients such as protein, phosphorus, and magnesium are critical for bone mineral development.[18] Therefore, the Committee emphasized that any proposal for a flexibility that considered plant-based milks as part of a healthy dietary pattern requires meaningful guidance on how to select plant-based milks, which are not nutritionally equivalent to cow's milk and exhibit variability in nutrient content across products. Further, a flexibility would require meaningful guidance on integration with other food groups to identify where to otherwise obtain nutrients found in cow's milk or soy milk.

TABLE D.10.2
COMPARISON OF NUTRIENT PROFILES OF THE DAIRY AND FORTIFIED SOY ALTERNATIVES FOOD GROUP, AND SINGLE FOOD CODES FOR FAT-FREE MILK, UNSWEETENED ALMOND MILK, OAT MILK (FOUNDATION FOODS), AND LIGHT SOY MILK (FNDDS 2017-2018)

Nutrient	Fat-free milk[a] (cup eq)	Almond milk[b] (cup eq)	Oat milk[c] (cup eq)	Soy milk, light[d] (cup eq)
Energy (kcal)	82.9	36.6	117.9	73.2
Carbohydrate (g)	11.9	3.2	12.4	8.6
Fiber (g)	0.0	0.5	0.0	0.7
Protein (g)	8.4	1.0	1.9	5.8
Fat (g)	0.2	2.3	6.7	1.9
Saturated Fatty Acids (g)	0.1	0.2	N/A[e]	0.0
Linoleic acid (18:2) (g)	0.0	0.6	N/A[e]	0.9
Linolenic acid (18:3) (g)	0.0	0.0	N/A[e]	0.1
Vitamin A (mcg RAE)	156.1	219.5	206.7	148.8
Vitamin C (mg)	0.0	0.0	N/A[e]	0.0
Vitamin D (IU)	107.3	97.6	165.9	117.1
Vitamin E (mg AT)	0.0	6.9	N/A[e]	0.1
Vitamin K (mcg)	0.0	0.0	1.0	3.9
Thiamin (mg)	0.1	0.0	0.1	0.1
Riboflavin (mg)	0.3	0.0	0.7	0.5
Niacin (mg)	0.3	0.2	0.2	0.5
Vitamin B6 (mg)	0.1	0.0	0.0	0.0
Folate (mcg DFE)	4.9	2.4	N/A[e]	22.0
Vitamin B12 (mcg)	1.4	0.0	1.2	2.4
Choline (mg)	44.4	7.6	N/A[e]	30.0
Calcium (mg)	322.0	448.8	362.2	300.0
Copper (mg)	0.0	0.0	0.1	0.2
Iron (mg)	0.0	0.7	0.6	1.0
Magnesium (mg)	29.3	14.6	14.4	36.6
Phosphorus (mg)	261.0	22.0	217.5	212.2
Potassium (mg)	407.3	163.4	362.0	285.4
Sodium (mg)	100.0	175.6	102.4	117.1
Zinc (mg)	1.1	0.1	0.2	0.6

AT = alpha-tocopherol, DFE = dietary folate equivalents, FNDDS = Food and Nutrient Database for Dietary Studies, g = grams, IU = international units, kcal = calories, mcg = micrograms, mg = milligrams, RAE = retinol activity equivalents

[a]FNDDS 2017-2018 code 11113000

[b]FNDDS 2017-2018 code 11350020

[c]FDC ID 2257046

[d]FNDDS 2017-2018 code 11320100

[e]Data on nutrients marked N/A are not available from the Foundation Foods database.

All analyses and a summary of results by age, sex, and life stage can be found in the:
Dairy and Fortified Soy Alternatives FPM Report at:
https://www.DietaryGuidelines.gov/2025-advisory-committee-report/food-pattern-modeling

Question 2: What are the implications for nutrient intakes when modifying the Fruits food group quantities within the Healthy U.S.-Style Dietary Pattern?

Approach to Answering Question: Food Pattern Modeling

Introduction to the Fruits Food Group

Box D.10.4: Fruits

What is included? The Fruits Food Group in the 2020 USDA Dietary Patterns includes all fresh, frozen, canned, and dried fruits and 100% fruit juices; for example: apples, Asian pears, bananas, berries, citrus fruit, cherries, dates, figs, grapes, guava, jackfruit, lychee, mangoes, melons, nectarines, papaya, peaches, pears, persimmons, pineapple, plums, pomegranates, raisins, rhubarb, sapote, and soursop. The *2020-2025 Dietary Guidelines* notes that most choices should be nutrient-dense such as those prepared without added sugars, saturated fat such as butter, and/or sodium.

How much? The 2020 USDA Dietary Patterns recommend ½ to 1 cup equivalent (cup eq) of Fruits each day for young children ages 12 through 23 months and 1 to 3 cup eq of Fruits each day for individuals ages 2 years and older. The *Dietary Guidelines for Americans, 2020-2025* recommend that at least half of Total Fruit should be Whole Fruit.

What counts? The FPED converts all foods and beverages in FNDDS into USDA Dietary Pattern components. FPED shows that 1 cup eq of Fruits equates to approximately 1 cup of raw or cooked fruit, 1 cup of fruit juice, and ½ cup of dried fruit.

Table D.10.3 shows that the Fruits Food Group contributes 44-57 percent of the total vitamin C in the 2020 HUSS across all age groups, starting at 12 months of age. The Fruits Food Group also contributes 15 percent of the total carbohydrates, total fiber, and total potassium in the 2020 HUSS for most calorie levels.

TABLE D.10.3
PERCENTAGE OF TOTAL NUTRIENT CONTRIBUTION FROM THE FRUITS FOOD GROUP IN THE 2020 HEALTHY U.S.-STYLE (HUSS) DIETARY PATTERN AS A RANGE OF ESTIMATES ACROSS CALORIE LEVELS FOR AGES 12 THROUGH 23 MONTHS AND 2 YEARS AND OLDER

Nutrient	Range of contribution (%) in HUSS for ages 12 through 23 months	Range of contribution (%) in HUSS for ages 2 years and older
Energy (kcal)	7-11	9-12
Carbohydrate (g)	18-25*	17-23*
Fiber (g)	15-21*	14-21*
Protein (g)	≤2	≤2
Fat (g)	≤1	≤1
Saturated Fatty Acids (g)	≤1	≤1
Linoleic acid (18:2) (g)	≤1	≤1
Linolenic acid (18:3) (g)	≤4	≤3
Vitamin A (mcg RAE)	≤4	≤5
Vitamin C (mg)	48-57*	44-57*
Vitamin D (IU)	<1	<1
Vitamin E (mg AT)	5-9	6-8
Vitamin K (mcg)	3-6	3-6
Thiamin (mg)	7-10	6-9
Riboflavin (mg)	4-7	5-8
Niacin (mg)	4-6	≤5
Vitamin B6 (mg)	10-16	11-15
Folate (mcg DFE)	6-10	6-9
Vitamin B12 (mcg)	<1	<1
Choline (mg)	3-6	5-6
Calcium (mg)	≤3	≤4
Copper (mg)	10-15	10-14
Iron (mg)	4-6	4-6
Magnesium (mg)	7-11	8-11
Phosphorus (mg)	≤3	≤3
Potassium (mg)	13-18*	14-18*
Sodium (mg)	≤1	≤1
Zinc (mg)	≤2	≤3

AT = alpha-tocopherol, DFE = dietary folate equivalents, g = grams, IU = international units, kcal = calories, mcg = micrograms, mg = milligrams, RAE = retinol activity equivalents

*The Fruits Food Group contributes more than 15 percent of the total amount these nutrients in the 2020 HUSS pattern for at least half of the calorie levels.

Synthesis Statements and Summary of the Evidence

Synthesis Statement 1 of 1

No Potential Modifications to the HUSS

FPM results support not reducing existing quantities of Fruits in the overall synthesis that integrates the food groups in a healthy dietary pattern.

Supporting Evidence and Considerations for Synthesis Statement 1

Reduction Analyses

In scenarios that incrementally reduced the Fruits Food Group from the 2020 HUSS recommendations, negative nutrient implications were evident with a 0.25 to 0.5 cup eq reduction for children ages 2 through 8 years; 0.5 cup eq reduction for females ages 14 years and older and males ages 9 through 13 years; 1 cup eq reduction of Fruits for males ages 31 years and older; complete removal for all pregnancy groups; and 1.5 cup eq reduction for lactating individuals. In these scenarios, the changes reduced the content of vitamin C, fiber, potassium, and magnesium in the pattern to levels below goals. Note that fortified orange or apple juice were not used in FPM analyses.

Considerations for No Proposed Modifications

In summary, these analyses confirm that reduction in Fruits would have negative nutrient implications, so the Committee did not recommend any overall reduction in Fruits in the modified 2020 HUSS (**Box D.10.8**).

The 2020 HUSS does not include quantitative recommendations for whole fruit and 100% fruit juice although narrative guidance recommends that at least half of total fruit consumption should be from whole fruits. Item clusters for 100% fruit juices and nectars comprise approximately 26 percent of the nutrient profile for Fruits used in FPM analyses reflecting proportional consumption in the U.S. population. In analyses that investigated different proportions of whole fruits and 100% fruit juice, the results showed little to no difference in meeting nutritional goals. In scenarios that modified the proportion to include 50 to 100 percent whole fruits and 0 to 50 percent fruit juice, results showed fiber in the pattern increased with increasing proportions of whole fruit. However, there were no negative nutrient implications when 50 percent of Fruits were modeled as 100% fruit juice. Therefore, the Committee did not recommend a modification to existing guidance on proportions of whole fruit.

All analyses and a summary of results by age, sex, and life stage can be found in the:
Fruits FPM Report at:
https://www.DietaryGuidelines.gov/2025-advisory-committee-report/food-pattern-modeling

Question 3: What are the implications for nutrient intakes when modifying the Vegetables food group and subgroup quantities within the Healthy U.S.-Style Dietary Pattern?

Approach to Answering Question: Food Pattern Modeling

Introduction to the Vegetables Food Group

Box D.10.5: Vegetables

What is included? The Vegetables Food Group in the 2020 USDA Dietary Patterns includes 5 subgroups: Dark-Green Vegetables; Red and Orange Vegetables; Beans, Peas, and Lentils; Starchy Vegetables; and Other Vegetables. The *2020-2025 Dietary Guidelines* notes that most choices should be nutrient-dense such as those prepared without added sugars, saturated fat such as butter, and/or sodium.

Dark-Green Vegetables: all fresh, frozen, and canned dark-green leafy vegetables and broccoli, cooked or raw; for example: amaranth leaves, bok choy, broccoli, chamnamul, chard, collards, kale, mustard greens, poke greens, romaine lettuce, spinach, taro leaves, turnip greens, and watercress.

Red and Orange Vegetables: all fresh, frozen, and canned red and orange vegetables or juice, cooked or raw; for example: calabaza, carrots, red and orange bell peppers, sweet potatoes, tomatoes, 100% tomato juice, and winter squash.

Beans, Peas, and Lentils: all cooked from dry or canned beans, peas, chickpeas, and lentils; for example: black beans, black-eyed peas, bayo beans, chickpeas (garbanzo beans), edamame, kidney beans, lentils, lima beans, mung beans, pigeon peas, pinto beans, and split peas. Does not include green beans or green peas.

Starchy Vegetables: all fresh, frozen, and canned starchy vegetables; for example: breadfruit, burdock root, cassava, corn, jicama, lotus root, lima beans, plantains, white potatoes, salsify, taro root (dasheen or yautia), water chestnuts, yam, and yucca.

Other Vegetables: all other fresh, frozen, and canned vegetables, cooked or raw; for example: asparagus, avocado, bamboo shoots, beets, bitter melon, Brussels sprouts, cabbage (green, red, napa, savoy), cactus pads (nopales), cauliflower, celery, chayote (mirliton), cucumber, eggplant, green beans, kohlrabi, luffa, mushrooms, okra, onions, radish, rutabaga, seaweed, snow peas, summer squash, tomatillos, and turnips.

How much? The 2020 USDA Dietary Patterns recommend ⅔ to 1 cup equivalents (cup eq) of Total Vegetables each day for young children ages 12 through 23 months and 1 to 4 cup eq of Total Vegetables each day for individuals ages 2 years and older. Weekly recommendations are provided for each Subgroup.

What counts? The FPED converts all foods and beverages in FNDDS into USDA Dietary Pattern components. FPED shows that 1 cup eq of Vegetables equates to approximately 1 cup of raw or cooked vegetables, 1 cup of vegetable juice, 2 cups leafy salad greens, and ½ cup of dried vegetables.

Table D.10.4 shows that the Vegetables Food Group contributes >60 percent of total vitamin K, >40 percent of total vitamin C, approximately 30-40 percent of total fiber, and 31-43 percent of total potassium to the 2020 HUSS across all age groups starting at age 12 months. The Vegetables Food Group also contributes at least 15 percent of the total nutrient content for more than 1 dozen different nutrients in the 2020 HUSS for most calorie levels.

TABLE D.10.4
PERCENTAGE OF TOTAL NUTRIENT CONTRIBUTION FROM THE VEGETABLES FOOD GROUP IN THE 2020 HEALTHY U.S.-STYLE (HUSS) DIETARY PATTERN AS A RANGE OF ESTIMATES ACROSS CALORIE LEVELS FOR AGES 12 THROUGH 23 MONTHS AND 2 YEARS AND OLDER

Nutrient	Range of contribution (%) in HUSS for ages 12 through 23 months	Range of contribution (%) in HUSS for ages 2 years and older
Energy (kcal)	10-12	12-18*
Carbohydrate (g)	17-20*	18-25*
Fiber (g)	29-39*	31-43*
Protein (g)	7-8	7-13
Fat (g)	4-6	7-10
Saturated Fatty Acids (g)	≤3	6-8
Linoleic acid (18:2) (g)	4-8	5-8
Linolenic acid (18:3) (g)	7-10	7-11
Vitamin A (mcg RAE)	28-35*	36-48*
Vitamin C (mg)	40-49*	41-54*
Vitamin D (IU)	<1	<1
Vitamin E (mg AT)	19-24*	20-26*
Vitamin K (mcg)	61-76*	61-74*
Thiamin (mg)	15-18*	14-21*
Riboflavin (mg)	7-8	8-14
Niacin (mg)	11-16*	13-17*
Vitamin B6 (mg)	19-24*	22-30*
Folate (mcg DFE)	21-33*	19-30*
Vitamin B12 (mcg)	<1	<1
Choline (mg)	10-13	13-21*
Calcium (mg)	4-6	5-11
Copper (mg)	25-30*	24-34*
Iron (mg)	15-22*	16-24*
Magnesium (mg)	17-21*	19-28*
Phosphorus (mg)	7-9	10-17*
Potassium (mg)	28-32*	31-43*
Sodium (mg)	6-9	9-13
Zinc (mg)	7-8	8-14

AT = alpha-tocopherol, DFE = dietary folate equivalents, g = grams, IU = international units, kcal = calories, mcg = micrograms, mg = milligrams, RAE = retinol activity equivalents

*The Vegetables Food Group contributes more than 15 percent of the total amount of these nutrients in the 2020 HUSS pattern for at least half of the calorie levels.

Synthesis Statements and Summary of the Evidence

Synthesis Statement 1 of 2

No Potential Modifications to the HUSS

FPM results support not reducing existing quantities of Total Vegetables in the overall synthesis that integrates the food groups in a healthy dietary pattern.

Supporting Evidence and Considerations for Synthesis Statement 1

Reduction Analyses

In scenarios that incrementally reduced Total Vegetables for young children ages 12 through 23 months, the 2020 HUSS pattern fell below or further below the goals at all calorie levels for several nutrients (e.g., carbohydrates, fiber, vitamin K, vitamin E, iron, potassium, and choline). For the lowest calorie level (700 calories), the additional nutrients falling below or further below the goals were vitamin A, thiamin, folate, calcium, copper, and linoleic acid. Linoleic acid also falls below the goal in the 900-calorie level scenario.

For other age-sex groups, Total Vegetables incremental reduction scenarios indicated additional negative nutrient implications for carbohydrates (children ages 2 through 8 years and lactation groups ages 31 through 50 years), vitamin A (children ages 4 through 8 years; females all ages; males all ages; and all pregnancy groups), vitamin C (females ages 31 years and older; all lactation groups; males ages 19 years and older; and pregnancy groups ages 19 years and older), folate (females ages 31 years and older; lactating individuals ages 31 years and older; and males ages 51 years and older), copper (lactating individuals only); iron (females ages 14 through 18 years), magnesium (females ages 14 years and older), vitamin K (all groups ages 4 years and older), potassium (all groups), and fiber (all groups).

Considerations for No Proposed Modifications

In summary, these analyses confirm that reduction in Total Vegetables would have negative nutrient implications, therefore the Committee did not recommend any overall reduction in Total Vegetables in the modified 2020 HUSS (**Box D.10.8**).

Synthesis Statement 2 of 2

Potential Modification to the HUSS Across All Life Stages Starting at 12 Months

FPM results provide support for exploring a modification to the proportions of Vegetables subgroups that increases Beans, Peas, and Lentils and Dark-Green Vegetables in the overall synthesis that integrates food groups in a healthy dietary pattern.

Supporting Evidence and Considerations for Synthesis Statement 2

Equal Proportion Analyses

To achieve a scenario where intakes of each of the Vegetables subgroups are in equal proportion within the Total Vegetables quantity, the cup eq of Beans, Peas, and Lentils and the Dark-Green Vegetables subgroups would need to increase, while the Red and Orange Vegetables, Starchy Vegetables, and Other Vegetables subgroups would need to decrease relative to the 2020 HUSS. In this scenario when the Vegetables subgroups quantities were equal, positive nutrient implications, including vitamin E, folate, iron, magnesium, and choline were noted. One negative nutrient implication included vitamin A for individuals who are lactating and males ages 51 years and older. These analyses provided initial supporting evidence to consider a modification that increases Beans, Peans and Lentils and Dark-Green Vegetables while keeping existing quantities of Total Vegetables constant.

Total Vegetables from One Subgroup Analyses

All Beans, Peas, and Lentils: Positive and negative nutrient implications were noted when the total quantity of Vegetables recommended in the 2020 HUSS came exclusively from Beans, Peas, and Lentils. Positive implications included improvements in quantities of potassium and carbohydrate for young children ages 12 through 23 months. Choline increased across all age, sex, and life stage groups (ages 1 year and older). Iron improved in young children ages 12 through 23 months and children ages 4 through 8 years, females ages 14 through 50 years, and all pregnancy groups. Vitamin E improved across all groups (ages 1 year and older). Folate in pregnancy groups shifted to meeting nutrient goals. Lastly, magnesium in males ages 51 years and older increased. Negative nutrient implications included vitamin A in most age-sex groups, vitamin C (females ages 31 years and older, lactating individuals, and males ages 19 years and older), and vitamin K (for young children ages 12 through 23 months at the 700-, 800-, and 900-calorie levels, children ages 4 through 8 years, females ages 14 through 70 years, lactating individuals ages 19 through 50 years, males ages 19 years and older, and individuals during pregnancy). Finally, energy was exceeded across most age-sex groups.

All Dark-Green Vegetables: Positive nutrient implications were noted when the total quantities of Vegetables recommended in the 2020 HUSS came exclusively from Dark-Green Vegetables. Vitamin A in individuals who are lactating, folate in individuals during pregnancy, and iron in children ages 4 through 8 shifted from not meeting nutrient goals in the 2020 HUSS pattern to meeting nutrient goals. Improvements in nutrients were observed for magnesium in males ages 51 years and older, iron in females ages 19 through 50 years and in individuals during pregnancy, and vitamin E in most age, sex, and life stage groups; however, these nutrients were still below goals. Negative nutrient implications were noted in carbohydrates for children ages 1 through 8 years and linoleic acid for young children ages 12 through 23 months (700- and 900-calorie levels).

All Starchy, All Other, or All Red and Orange Vegetables: Negative nutrient implications were observed in key nutrients for some age, sex, and life stage groups when all vegetables were exclusively obtained from the Starchy, Other, or Red and Orange Vegetable subgroups. Examples include reductions in folate in calorie levels tested for individuals during pregnancy and reductions in iron for children, females, and pregnancy groups.

Reduction/Removal Subgroup Analyses

Beans, Peas, and Lentils: Negative nutrient implications were noted when quantities of the Beans, Peas, and Lentils subgroup were reduced or removed from the Vegetables Food Group in the 2020 HUSS. Fiber fell below the goals for most age-sex groups. The magnitude of decline of several additional nutrients across life stages was also of concern: the decline in folate and iron in patterns relevant during pregnancy;

iron in children ages 4 through 8 years, and females ages 14 through 50 years; and magnesium in males ages 51 and older and pregnancy ages 14 through 18 years.

Dark-Green Vegetables: Negative nutrient implications were also noted when quantities of the Dark-Green Vegetables subgroup were reduced or removed from the 2020 HUSS. The magnitude of decline of several nutrients across life stages was of concern, such as the decline in folate in patterns relevant during pregnancy; decline in vitamin A in patterns relevant during lactation and in males ages 51 years and older (removal only); decline in iron for children ages 4 through 8, females ages 14 through 50, and individuals during pregnancy; magnesium in males ages 51 years and older and pregnancy groups ages 14 through 18 years; vitamin K in males ages 31 years and older and females ages 51 years and older (removal only).

Starchy, Other, or Red and Orange Vegetables: When Other, Starchy, and Red and Orange Vegetables were incrementally reduced, iron (for children ages 4 through 8, females ages 14 through 50, and individuals during pregnancy), folate (pregnancy groups only), magnesium (males ages 51 years and older and pregnancy groups ages 14 through 18 years), vitamin A (lactating groups only), and choline fell below or further below nutrient goals. For Other Vegetables, potassium fell below goals for children ages 4 through 8 years. For Starchy and Red and Orange Vegetables, potassium fell below goals for children ages 4 through 8 years and males ages 51 years and older. For Starchy Vegetables, fiber fell below goals for several groups when less than ~0.15 cup eq per day was in the pattern. For Red and Orange Vegetables, vitamin A and fiber fell below goals in most groups.

Considerations for Examining a Modification

These scenarios provide evidence of potential nutrient improvements, which supports further analyses to explore a modification to the proportions of Vegetables subgroups that increases Beans, Peas, and Lentils and Dark-Green Vegetables in the overall synthesis that integrates food groups in a healthy dietary pattern.

All analyses and a summary of results by age, sex, and life stage can be found in the:
Vegetables FPM Report at:
https://www.DietaryGuidelines.gov/2025-advisory-committee-report/food-pattern-modeling

Question 4: What are the implications for nutrient intakes when modifying the quantities of the Grains group within the Healthy U.S.-Style Dietary Pattern? What are the implications for nutrient intakes when specific individual staple grains are emphasized; or when the Grains group is replaced with other staple carbohydrate foods (i.e., Starchy Vegetables; Beans, Peas, and Lentils; starchy Red and Orange vegetables)?

Approach to Answering Question: Food Pattern Modeling

Introduction to the Grains Food Group

Box D.10.6: Grains

What is included? The Grains Food Group in the 2020 USDA Dietary Patterns includes 2 subgroups: Whole Grains and Refined Grains. The *2020-2025 Dietary Guidelines* notes that most choices should be nutrient-dense such as those prepared without added sugars, saturated fat such as butter, and/or sodium.

Whole Grains: all whole-grain products and whole grains used as ingredients; for example: amaranth, barley (not pearled), brown rice, buckwheat, bulgur, millet, oats, popcorn, quinoa, dark rye, whole-grain cornmeal, whole-wheat bread, whole-wheat chapati, whole-grain cereals and crackers, and wild rice.

Refined Grains: All refined-grain products and refined grains used as ingredients; for example: white breads, refined-grain cereals and crackers, corn grits, cream of rice, cream of wheat, barley (pearled), masa, pasta, and white rice. Refined grain choices should be enriched.

How much? The 2020 USDA Dietary Patterns recommend 1¾ to 3 ounce equivalents (oz eq) of Grains each day for young children ages 12 through 23 months and 3 to 10½ oz eq of Grains each day for individuals 2 years and older. The *Dietary Guidelines for Americans, 2020-2025* include that at least half of Grains are whole grain.

What counts? The FPED converts all foods and beverages in FNDDS into USDA Dietary Pattern components. FPED shows that 1 oz eq of Grains equates to approximately ½ cup cooked rice, pasta, or cereal; 1 ounce dry pasta or rice, 1 medium (1 ounce) slice bread, tortilla, or flatbread, 1 ounce ready-to-eat cereal (about 1 cup of flaked cereal).

Table D.10.5 shows that the Grains Food Group contributes approximately 50-60 percent of the total folate and total iron, approximately 40-50 percent of the total carbohydrate, total fiber, and total thiamin, and approximately 30-40 percent of the total niacin, total copper, total magnesium, and total zinc to the 2020 HUSS across most age groups starting at age 12 months. The Grains Food Group also contributes at least 15 percent of the total nutrient content for several additional nutrients in the 2020 HUSS for most calorie levels.

TABLE D.10.5
PERCENTAGE OF TOTAL NUTRIENT CONTRIBUTION FROM THE GRAINS FOOD GROUP IN THE 2020 HEALTHY U.S.-STYLE (HUSS) DIETARY PATTERN AS A RANGE OF ESTIMATES ACROSS CALORIE LEVELS FOR AGES 12 THROUGH 23 MONTHS AND 2 YEARS AND OLDER

Nutrient	Range of contribution (%) in HUSS for ages 12 through 23 months	Range of contribution (%) in HUSS for ages 2 years and older
Energy (kcal)	23-28*	30-37*
Carbohydrate (g)	41-45*	44-51*
Fiber (g)	43-50*	37-44*
Protein (g)	14-19*	17-24*
Fat (g)	9-11	14-18*
Saturated Fatty Acids (g)	5-7	16-21*
Linoleic acid (18:2) (g)	16-21*	15-20*
Linolenic acid (18:3) (g)	7-10	8-11
Vitamin A (mcg RAE)	13-15	12-16*
Vitamin C (mg)	≤3	≤2
Vitamin D (IU)	5-6	7-11
Vitamin E (mg AT)	10-13	9-12
Vitamin K (mcg)	≤5	≤4
Thiamin (mg)	41-48*	45-53*
Riboflavin (mg)	11-16	18-27*
Niacin (mg)	35-43*	34-41*
Vitamin B6 (mg)	20-23*	18-22*
Folate (mcg DFE)	47-58*	55-63*
Vitamin B12 (mcg)	11-14	12-18*
Choline (mg)	8-11	10-13
Calcium (mg)	10-12	12-21*
Copper (mg)	33-38*	28-33*
Iron (mg)	53-63*	56-62*
Magnesium (mg)	33-39*	31-37*
Phosphorus (mg)	17-20*	21-29*
Potassium (mg)	12-13	11-13
Sodium (mg)	19-27*	28-39*
Zinc (mg)	27-33*	29-36*

AT = alpha-tocopherol, DFE = dietary folate equivalents, g = grams, IU = international units, kcal = calories, mcg = micrograms, mg = milligrams, RAE = retinol activity equivalents

*For these nutrients, the Total Grains Food Group contributes more than 15 percent of the total amount of these nutrients in the HUSS pattern for at least half of the calorie levels.

Synthesis Statements and Summary of the Evidence

Synthesis Statement 1 of 3

Potential Modification to the HUSS Across All Life Stages Starting at Age 12 Months

FPM results provide support for exploring a modification that reduces Total Grains in the overall synthesis that integrates the food groups in a healthy dietary pattern.

Supporting Evidence and Considerations for Synthesis Statement 1

Reduction Analyses

Generally, a 1-oz eq reduction in the Total Grains daily recommendation (maintaining 50 percent Whole Grains) for ages 2 years and older does not introduce any additional nutrients falling below the goal. Although most calorie levels in the 2020 HUSS have a level of sodium below the CDRR, a small reduction in Total Grains has positive implications in further reducing sodium. For age-sex groups for whom the 2020 HUSS contributes <90 percent of iron, folate, or magnesium, a small reduction in Total Grains has additional negative implications. For example, iron decreases an additional 5-10 percent for groups including children ages 4 through 8, females ages 14 through 50, and the pregnancy life stage. Folate decreases approximately 8 percent in patterns that apply to the pregnancy life stage.

Reducing Whole Grains has more negative implications than reducing Refined Grains. In incremental reduction analyses for Whole Grains (not including complete removal), nutrients that fell below goals include carbohydrates (children ages 2 through 8 years and lactating individuals ages 31 through 50 years), vitamin A (males ages 51 years and older), folate (females ages 51 years and older), iron (children ages 2 through 3 years; females ages 14 through 18 years and 51 years and older), magnesium (females ages 14 through 18 years and 31 years and older; males ages 14 through 50 years; and pregnancy groups 19 years and older), zinc (individuals who are lactating ages 14 through 18 years; males 51 years and older; individuals during pregnancy 14 through 18 years), and fiber (all groups).

In incremental reduction analyses for Refined Grains (not including complete removal), nutrients that fell below goals in at least 1 age, sex, or life stage group include carbohydrates (for children ages 2 through 8 years), folate (females ages 51 years and older; lactating groups ages 31 years and older), and iron (females ages 14 through 18 years).

Considerations for Examining a Modification

The nutrient profile for Refined Grains and Whole Grains reflects the contribution of several commonly consumed foods, including breads, rice, and pasta that are enriched with iron, folic acid, and B vitamins, as well as ready-to-eat breakfast cereals which are often fortified with iron and other micronutrients. Results suggest that a small reduction in Total Grains has minimal implications for most age-sex groups. The Committee recognizes, however, that larger implications exist for age groups and life stages for whom the contribution of nutrients in enriched and/or fortified grain products is of particular public health importance, especially the peri-conceptional and early pregnancy stages. The synthesis statement was developed with the intent to explore a potential reduction in Total Grains as part of the broader synthesis in which other proposed modifications might ameliorate the negative implications for iron and/or folate.

Synthesis Statement 2 of 3

Potential Flexibility to the HUSS Across Life Stages Starting at Age 12 Months

FPM results provide support for exploring a flexibility that increases Beans, Peas, and Lentils above the proposed quantities in a healthy dietary pattern while simultaneously decreasing Total Grains.

Supporting Evidence and Considerations for Synthesis Statement 2

Decrease Grains and Increase Beans, Peas, and Lentils Analyses

When Refined Grains or Whole Grains are incrementally decreased by 1 oz eq per week and the total quantity of Beans, Peas, and Lentils in the 2020 HUSS is increased by ⅜ cup eq per week, positive implications exist for folate, iron, choline, potassium, and fiber for ages 1 year and older. The positive implications for iron are more notable when Refined Grains (vs. Whole Grains) are substituted with Beans, Peas, and Lentils.

For most age-sex groups, the quantity of folate, iron, potassium, and fiber in the 2020 HUSS is already above goals. Up to half of Total Grains (maintaining a 50 percent Whole Grain ratio) could be replaced with Beans, Peas, and Lentils and would result in primarily positive implications for achieving goals. For example, the goal for choline is not achieved for many age-sex groups in the 2020 HUSS. When at least 25 percent of Total Grains are substituted with Beans, Peas, and Lentils, choline approaches the goal for many but not all age-sex groups.

Considerations for Examining a Flexibility

These scenarios provide evidence to support further analyses to explore a flexibility that increases Beans, Peas, and Lentils above the proposed quantities in a healthy dietary pattern while simultaneously decreasing Total Grains.

Synthesis Statement 3 of 3

Potential Flexibility to the HUSS Across All Life Stages Starting at Age 12 Months

FPM results provide support for exploring a flexibility that increases Starchy Vegetables (including starchy Red and Orange Vegetables) above the proposed quantities in a healthy dietary pattern while simultaneously decreasing Total Grains.

Supporting Evidence and Considerations for Synthesis Statement 3

Decrease Grains and Increase Starchy Vegetables Analyses

In general, decreasing Whole Grains and/or Refined Grains by 1 oz eq per week and increasing Starchy Vegetables, including starchy Red and Orange Vegetables such as sweet potatoes and pumpkin, by 0.5 cup eq per week has limited nutritional implications in the 2020 HUSS.

For those age, sex, and life stages for which the 2020 HUSS falls short of the goal for vitamin A, positive implications are introduced when Whole Grains and/or Refined Grains are decreased by 1 oz eq and starchy Red and Orange vegetables in the 2020 HUSS is increased by 0.5 cup eq. Specifically, a 2 oz eq per week decrease of Whole Grains with a 1 cup eq per week increase in starchy Red and Orange vegetables would be needed to meet the nutrient goals for vitamin A during lactation.

In scenarios where Total Grains are decreased and replaced with Starchy Vegetables and/or starchy Red and Orange vegetables, negative implications are introduced for iron and folate, which are often enriched and/or fortified in Grains foods. These flexibilities would not meet the nutritional goals for iron and folate in calorie levels tested for adolescent females and would exacerbate the issues for individuals during pregnancy. For example, for individuals ages 14 through 18 years who are pregnant, negative nutrient implications for zinc and magnesium were observed when Whole Grains were replaced with any of the vegetable subgroups. In scenarios where Starchy Vegetables replaced Total Grains for this group, magnesium fell below goals. Zinc also fell below goals when Total Grains were replaced with Starchy Vegetables or Starchy Vegetables plus starchy Red and Orange Vegetables. In contrast, when Refined Grains or Total Grains are replaced with starchy Red and Orange Vegetables (including in combination with Starchy Vegetables), magnesium increases in the pattern for males 51 years and older. Of note, fortification of grain products does not typically include zinc and magnesium.

Replacing Whole, Refined, and Total Grains with Starchy Vegetables (only) had negative implications for vitamin A among individuals who are lactating as well as males ages 51 years and older. In contrast, positive nutrient implications are observed across most age-sex groups for choline and sodium in scenarios where Total Grains were replaced with Starchy Vegetables and/or starchy Red and Orange Vegetables; however, these positive nutrient implications were often in tandem with negative nutrient implications in iron and folate.

Considerations for Examining a Flexibility

These scenarios provide evidence to support further analyses to explore a flexibility that increases Starchy Vegetables (including starchy Red and Orange Vegetables) above the proposed quantities in a healthy dietary pattern while simultaneously decreasing Total Grains. Given the implications for age groups and life stages for whom the contribution of nutrients in enriched and/or fortified grain products may be of particular public health importance, the Committee emphasized that any proposal for a flexibility that considered increasing Starchy Vegetables while simultaneously decreasing Total Grains would require meaningful guidance on integration with other food groups to identify where to otherwise obtain these nutrients that are found in Total Grains.

All analyses and a summary of results by age, sex, and life stage can be found in the:
Grains FPM Report at:
https://www.DietaryGuidelines.gov/2025-advisory-committee-report/food-pattern-modeling

Question 5: What are the implications for nutrient intakes when modifying the Protein Foods group and subgroup quantities within the Healthy U.S.-Style Dietary Pattern or Healthy Vegetarian Dietary Pattern? What are the implications for nutrient intakes when proportions of animal-based Protein Foods subgroups are reduced and proportions of plant-based Protein Foods subgroups are increased?

Approach to Answering Question: Food Pattern Modeling

Introduction to the Protein Foods Group

Box D.10.7: Protein Foods

What is included? The Protein Foods group in the 2020 USDA Dietary Patterns includes 4 subgroups: Meats, Poultry, and Eggs; Seafood; Nuts, Seeds, and Soy Products; and Beans, Peas, and Lentils. Beans, Peas, and Lentils can also be included as a Vegetables subgroup. The *2020-2025 Dietary Guidelines* notes that most choices should be nutrient-dense such as those prepared without added sugars, additional saturated fat such as butter, and/or sodium.

Meats, Poultry, Eggs: Meats include beef, goat, lamb, pork, and game meat (e.g., bison, moose, elk, deer). Poultry includes chicken, Cornish hens, duck, game birds (e.g., ostrich, pheasant, and quail), goose, and turkey. Organ meats include chitterlings, giblets, gizzard, liver, sweetbreads, tongue, and tripe. Eggs include chicken eggs and other birds' eggs. Meat and poultry should be lean or low-fat.

Seafood: Seafood examples that are lower in methylmercury include anchovy, black sea bass, catfish, clams, cod, crab, crawfish, flounder, haddock, hake, herring, lobster, mullet, oyster, perch, pollock, salmon, sardine, scallop, shrimp, sole, squid, tilapia, freshwater trout, light tuna, and whiting.

Nuts, Seeds, and Soy Products: Nuts and seeds include all nuts (tree nuts and peanuts), nut butters, seeds (e.g., chia, flax, pumpkin, sesame, and sunflower), and seed butters (e.g., sesame, tahini, and sunflower). Soy includes tofu, tempeh, and products made from soy flour, soy protein isolate, and soy concentrate. Nuts should be unsalted.

Beans, Peas, and Lentils: all cooked from dry or canned beans, peas, chickpeas, and lentils; for example: black beans, black-eyed peas, bayo beans, chickpeas (garbanzo beans), edamame, kidney beans, lentils, lima beans, mung beans, pigeon peas, pinto beans, and split peas. Does not include green beans or green peas.

How much? The 2020 USDA Dietary Patterns recommend 1 to 2 ounce equivalents (oz eq) of Protein Foods per day for young children ages 12 through 23 months and 1 to 8 oz eq of Protein Foods per day for individuals ages 2 years and older. Weekly recommendations are provided for each Subgroup.

What counts? The FPED converts all foods and beverages in FNDDS into USDA Dietary Pattern components. FPED shows that 1 oz eq of Protein Foods equates to approximately 1 ounce lean meats, poultry, or seafood; 1 egg; ¼ cup cooked beans or tofu; 1 tablespoon nut or seed butter; ½ ounce nuts or seeds.

Table D.10.6 shows that the Protein Foods group contributes approximately 40-50 percent of the total choline and approximately 30-40 percent of the total protein, total niacin, and total vitamin B12 to the 2020 HUSS across most age groups starting at age 12 months. The Protein Foods group also contributes at least 15 percent of the total nutrient content for more than 1 dozen additional nutrients in the 2020 HUSS for most calorie levels. It should be noted that although the Protein Foods group in the 2020 HUSS can include Beans, Peas, and Lentils, the Protein Foods group was not modeled with the inclusion of Beans, Peas, and Lentils. Therefore, the nutrient data shown in **Table D.10.6** do not include the nutritional contribution from Beans, Peas, and Lentils.

TABLE D.10.6
PERCENTAGE OF TOTAL NUTRIENT CONTRIBUTION FROM THE PROTEIN FOODS GROUP IN THE 2020 HEALTHY U.S.-STYLE (HUSS) DIETARY PATTERN AS A RANGE OF ESTIMATES ACROSS CALORIE LEVELS FOR AGES 12 THROUGH 23 MONTHS AND 2 YEARS AND OLDER

Nutrient	Range of contribution (%) in HUSS for ages 12 through 23 months	Range of contribution (%) in HUSS for ages 2 years and older
Energy (kcal)	11-16	12-18*
Carbohydrate (g)	≤2	≤2
Fiber (g)	≤2	≤3
Protein (g)	29-37*	29-42*
Fat (g)	12-16*	16-24*
Saturated Fatty Acids (g)	10-13	20-30*
Linoleic acid (18:2) (g)	9-12	9-13
Linolenic acid (18:3) (g)	4-6	4-7
Vitamin A (mcg RAE)	8-11	6-9
Vitamin C (mg)	<1	<1
Vitamin D (IU)	18-22*	19-34*
Vitamin E (mg AT)	15-19*	14-21*
Vitamin K (mcg)	≤2	≤2
Thiamin (mg)	8-14	8-12
Riboflavin (mg)	17-23*	15-24*
Niacin (mg)	33-47*	33-42*
Vitamin B6 (mg)	22-32*	22-30*
Folate (mcg DFE)	5-7	4-6
Vitamin B12 (mcg)	23-31*	25-40*
Choline (mg)	42-49*	37-48*
Calcium (mg)	≤3	≤5
Copper (mg)	16-23*	16-22*
Iron (mg)	13-19*	13-17*
Magnesium (mg)	10-13	11-15
Phosphorus (mg)	14-19*	16-24*

Nutrient	Range of contribution (%) in HUSS for ages 12 through 23 months	Range of contribution (%) in HUSS for ages 2 years and older
Potassium (mg)	11-17	11-16*
Sodium (mg)	16-23*	17-26*
Zinc (mg)	18-27*	21-31*

AT = alpha-tocopherol, DFE = dietary folate equivalents, g = grams, IU = international units, kcal = calories, mcg = micrograms, mg = milligrams, RAE = retinol activity equivalents

*For these nutrients, the Protein Foods Group contributes more than 15 percent of the total amount of these nutrients in the HUSS pattern for at least half of the calorie levels.

Synthesis Statements and Summary of the Evidence

Synthesis Statement 1 of 3

Potential Modification to the HUSS Ages 2 Years and Older

FPM results provide support for exploring a modification that reduces Total Protein Foods in the overall synthesis that integrates food groups in a healthy dietary pattern.

Supporting Evidence and Considerations for Synthesis Statement 1

Reduction Analyses

The magnitude by which Total Protein Foods or its subgroups can be reduced without additional implications on nutrients falling short of goals depends on the age-sex group. For age, sex, and life stage groups already below goals for vitamin D, vitamin A, magnesium, folate, iron, choline, and vitamin E, when the Protein Foods subgroups were reduced, the quantities for these nutrients also decreased further below goals; for certain age-sex groups, potassium or zinc may also fall below goals.

Generally, a modest reduction in the weekly quantity of Meats, Poultry, and Eggs, with all other subgroups held constant, can occur without negative implications on meeting nutritional goals. For example, the following decreases are the point at which a negative nutrient implication occurs with a reduction in Meats, Poultry, and Eggs: for children ages 4 through 8 years, potassium falls below the goal with a decrease of 5.5 oz eq per week; for females ages 14 through18 years, iron falls below the goal with a decrease of 4 oz eq per week; for females who are lactating, zinc falls below the goal when nearly all Meats, Poultry and Eggs are removed.

When incrementally reducing Beans, Peas, and Lentils (not including complete removal), iron (females ages 14 through 18 years) fell below goals. When incrementally reducing Nuts, Seeds, and Soy (not including complete removal), iron (females ages 14 through 18 years) fell below goals. When incrementally reducing Seafood (not including complete removal), iron (females ages 14 through 18 years) fell below goals.

Considerations for Examining a Modification

With these scenarios, the Committee determined that a modification to decrease Total Protein Foods could be explored. However, when exploring an age- and/or life stage-specific modification to reduce Total Protein Foods during the synthesis phase, a reduction may not be feasible for children ages 4 through 8 years or females ages 1 through 18 years without a commensurate increase in nutrient shortfalls, such as iron, potassium, and zinc, from other food groups or subgroups.

Synthesis Statement 2 of 2

Potential Flexibility to the HUSS Across All Life Stages Starting at Age 12 Months

FPM results provide support for exploring a flexibility that increases Beans, Peas, and Lentils and Nuts, Seeds, and Soy Products, while simultaneously decreasing Meats, Poultry, and Eggs.

Supporting Evidence and Considerations for Synthesis Statement 2

FPM results show positive and negative nutrient implications when Beans, Peas, and Lentils, and Nuts, Seeds, and Soy Products are increased above existing quantities in the 2020 HUSS, and Meats, Poultry and Eggs are reduced. For instance, nutrients that increase include fiber, linoleic acid, vitamin E, folate, calcium, and potassium for young children ages 12 through 23 months, and fiber, vitamin E, folate, and magnesium for individuals 2 years and older. Nutrients that decrease include vitamin D and sodium for young children ages 12 through 23 months and individuals ages 2 years and older. The nutrients that decrease are either already below nutritional goals or newly fall below nutritional goals. It is also noted that this scenario shifts iron from heme to non-heme sources, which will reduce the bioavailability of the iron and potentially increase phytates.

Considerations for Examining a Flexibility

These scenarios provide evidence to support further analyses to explore a flexibility that increases Beans, Peas, and Lentils, and Nuts, Seeds, and Soy Products, while simultaneously decreasing Meats, Poultry, and Eggs. The 2025 Committee prioritized analyses that moved the Beans, Peas, and Lentils subgroup from Vegetables to Protein Foods to examine hypothetical flexibilities of animal vs. plant-based Protein Foods.

Synthesis Statement 3 of 3:

Potential Flexibility to the 2020 H-VEG Across All Life Stages Starting at Age 12 Months

FPM results provide support for exploring a flexibility of the 2020 H-VEG in which Seafood is added.

Supporting Evidence and Considerations for Synthesis Statement 3

Seafood Added to H-VEG Analyses

In scenarios where Seafood is added (8 oz or less per week, depending on the calorie range) to the existing Protein Foods in the 2020 H-VEG, no negative implications are noted for ages 2 years and older. That is, no additional nutrients fall below established goals for this age group. Additionally, vitamin D increases modestly above the amounts in the 2020 H-VEG for all age-sex groups (including patterns relevant to young children ages 12 through 23 months). Although there are no negative nutrient implications for the patterns relevant to individuals ages 2 years and older, negative implications are noted when plant-based protein foods are decreased and replaced with Seafood for young children ages 12 through 23 months, specifically that fiber falls below goals in the patterns relevant for these ages.

Considerations for Examining a Flexibility

These scenarios provide evidence to support further analyses to explore modifications of the Total Protein Foods to the 2020 HUSS and a flexibility of a seafood addition to the H-VEG.

All analyses and a summary of results by age, sex, and life stage can be found in the:
Protein Foods FPM Report at:
https://www.DietaryGuidelines.gov/2025-advisory-committee-report/food-pattern-modeling

Question 6: What quantities of foods and beverages lower in nutrient density can be accommodated in the USDA Dietary Patterns while meeting nutritional goals within calorie levels?

Approach to Answering Question: Food Pattern Modeling

Synthesis Statements and Summary of the Evidence

Synthesis Statement 1 of 2

Potential Modification to All Dietary Patterns Across All Life Stages Starting at Age 2 Years

The energy is variable among nutrient-dense representative foods and beverages underlying the nutrient profile calculation for each food group and subgroup. The variability in energy precludes the ability to estimate the quantity of remaining calories per day within the recommended calorie allotments. Therefore, FPM results provide support for exploring a modification that does not include specific quantities of remaining daily calories for other uses in the presentation of the patterns.

Supporting Evidence and Considerations for Synthesis Statement 1

The nutrient profiles of food groups and subgroups used in FPM were calculated using only the nutrient-dense versions of foods and beverages, as described in **Part D. Chapter 9: Nutrient Profile Development**. In addition, desserts, sweets, and milkshakes were excluded from nutrient profile calculations. Thus, the patterns' estimated nutrient profiles and calories do not necessarily convey the variability in these estimates across the possible foods and beverages within a food group or subgroup.

When the nutrient-dense forms of foods and beverages were used, the proposed food group and subgroup quantities in the 2020 HUSS represented an average of ~86 percent of daily energy across calorie levels and age-sex groups. Modeling the nutrient profiles and the proposed quantities of food groups and subgroups in the 2020 HUSS using nutrient-dense foods and beverages contributed, on average, <2 percent of calories as added sugars and ~6 percent of calories from saturated fat. Although these estimates are <100 percent for daily energy, <10 percent of calories from added sugars and <10 percent of calories from saturated fat, the estimates do not reflect the potential range for energy when selecting from all nutrient-dense options within various food or beverage choices.

The nutrient profiles were constructed as the weighted average among diverse foods and beverages within food groups and subgroups, thus the amount of energy of the pattern was higher or lower depending on the foods and beverages being modeled. For example, the nutrient profile for Red and Orange Vegetables estimates that 1 cup eq has 53 calories with a range of 31 calories per cup eq for raw tomatoes to 180 calories per cup eq for cooked sweet potatoes. Depending on the food consumed, meeting the recommendation for Red and Orange Vegetables could result in more or less energy than the modeled estimate. Thus, the actual calories per day from nutrient-dense foods and beverages may be higher or lower than the average estimates. In summary, a single estimate of remaining calories for other uses does not represent the underlying variability. Therefore, a modification to the Dietary Patterns that does not present quantities of remaining calories per day—previously referred to as “Limit on Calories for Other Uses”—is proposed.

Synthesis Statement 2 of 2

An assessment of the energy contributions of various foods and beverages that are lower in nutrient density demonstrate challenges to meeting nutrient goals while remaining within the daily allotment for calories, added sugars, and saturated fat. Analysis to evaluate the inclusion of lower nutrient-dense foods is not justified.

Supporting Evidence and Considerations for Synthesis Statement 2

Given the findings of Synthesis Statement 1, which concludes that it is not feasible to provide an estimate of daily calories for other uses, the subsequent evaluation of foods and beverages lower in nutrient density for feasible inclusion is not warranted. The nutrient profiles of food groups and subgroups used in FPM analyses are calculated using nutrient-dense forms of foods and beverages and do not include any contribution from desserts, sweets, or milkshakes. For more information on the development of nutrient profiles used in the 2025 FPM process, see **Part D. Chapter 9: Nutrient Profile Development**.

Synthesis of Hypothetical Dietary Pattern Modifications

Each of the 6 questions presented in this chapter examined modifications to individual food groups or subgroups and their respective implications on the nutrient content and ability of the 2020 HUSS to meet nutritional goals. As a first step, these analyses modified quantities in food groups and subgroups while the rest of the pattern remained unchanged. Subsequently, assessment of the concurrent modifications to the 2020 HUSS food groups and subgroup quantities was conducted to determine the summative impact on the nutritional content after proposed changes are implemented. In **Table D.10.7**, each of the proposed modifications to the 2020 HUSS Dietary Pattern are listed. The table identifies proposed modifications with a strikethrough which were identified during synthesis of the individual food group analyses but were not carried forward in cumulative synthesis analyses The resulting modified 2020 HUSS (**Box D.10.8** and **Table D.10.8**) could then be assessed through the diet simulations, which are presented in **Part D. Chapter 11: Diet Simulations**.

The modified 2020 HUSS in **Table D.10.8** was the pattern used in diet simulations to evaluate modifications to food groups and subgroups. Multiple modifications were proposed as part of the analyses for the food groups and subgroups. The final modifications proposed by the Committee were determined through evaluation of the FPM results in conjunction with the evidence from systematic reviews and in consideration of data analysis.

TABLE D.10.7
SUMMARY OF MODIFICATIONS AFTER EVIDENCE SYNTHESIS: PROPOSED MODIFICATIONS TO THE 2020 HUSS DIETARY PATTERN

Proposed Modifications to the 2020 HUSS Dietary Pattern	Ages
• Modify Vegetables subgroups • Increase Beans, Peas, and Lentils • Increase Dark-Green Vegetables • Decrease Starchy Vegetables	2+
• Reduce Total Grains	1+
• Reduce Total Protein Foods	2+
• Reduce Dairy and Fortified Soy Alternatives	2+
• Remove “Limits on Calories for Other Uses” from visual presentation of the pattern(s)	2+*

*The 2020 USDA Dietary Patterns for young children ages 12 through 23 months do not contain “Limits on Calories for Other Uses.”

The proposed modifications with a strikethrough were identified during synthesis of the individual food group analyses but were not carried forward in cumulative synthesis analyses

To examine the impact of changes to the quantities of the food groups and subgroups, the revised nutrient profiles presented in **Part D. Chapter 9: Nutrient Profile Development** were used to evaluate the nutrient implications of modifying the food group quantities in the 2020 HUSS. Outcomes from various scenarios were examined, including cumulative combinations of modifications to examine the impact on meeting nutritional goals across age-sex groups and life stages within calorie limits. These evaluations allowed the Committee to determine the synergistic impact of multiple food group and subgroup changes on the total energy and nutrient content of the modified 2020 HUSS (**Box D.10.8**).

Box D.10.8: The Modified 2020 HUSS

The modified 2020 HUSS was the proposed pattern used by the 2025 Dietary Guidelines Advisory Committee in the synthesis of all FPM analyses discussed in this chapter and in diet simulations discussed in **Part D. Chapter 11: Diet Simulations**. The final pattern(s) that integrated evidence across food pattern modeling, systematic review, and data analysis can be found in **Part E. Chapter 1. Overarching Advice to the Departments.**

Cumulative Effects of Hypothetical Dietary Pattern Modifications, by Food Group

No modifications were proposed that change the quantities of Total Vegetables in the modified 2020 HUSS; however, modifications were proposed to change the proportional quantities of Vegetable subgroups within the Vegetables Food Group, including an increase in the quantity of Dark-Green Vegetables and Beans, Peas, and Lentils, and a reduction in the quantity of Starchy Vegetables. While increasing the proportion of vegetables from Dark-Green Vegetables increased the nutrient content of the HUSS, evidence from the systematic reviews was limited in supporting a modification to the quantity in the HUSS. Therefore, the Committee chose not to propose any modification in Dark-Green Vegetables.

In contrast, compelling evidence was noted in the systematic reviews in which dietary patterns that had higher levels of Beans, Peas, and Lentils (often presented in the literature as "legumes") were associated with beneficial health outcomes. Similarly, increasing the proportion of the Beans, Peas, and Lentils subgroup in the Vegetables Food Group produced positive gains in potassium, choline, vitamin E, folate, and magnesium. Beans, Peas, and Lentils were increased across calories levels in the modified 2020 HUSS for ages 2 years and older, with a 0.5 cup equivalent per week increase in the 1,000-, 1,200-, 2,600-, and 2,800-calorie levels and a 1.0 cup equivalent per week increase in 1,400- to 2,400-calorie levels. The quantities were increased to a maximum of 3 cup equivalents per week, as this level approaches the 95th percentile of intake in the population.[19]

With no change to the total quantity of the Vegetables Food Group, the increase in Beans, Peas, and Lentils requires a redistribution of the sources of the cup equivalents from the Vegetable Subgroups. When Starchy Vegetables are reduced in proportion to an increase to Beans, Peas, and Lentils, no negative implications on nutrients were introduced and the compensation for energy kept the patterns within energy limits. Of the Vegetable subgroups, Starchy Vegetables makes up among the largest proportions of Total Vegetables and is also (like Beans, Peas, and Lentils) more energy-dense than other Vegetable subgroups. This shift in Vegetable subgroups does not have implications for meeting the goal for potassium. Starchy Vegetables and Beans, Peas, and Lentils contribute potassium to the dietary pattern. Quantities of Starchy Vegetables established in FPM conducted by previous Committees were important for helping the patterns come closer to achieving the DRI for potassium, which at the time was nearly 2-fold higher than in the updated DRI published in 2019. Additionally, conclusion statements from the Committee's systematic reviews noted higher intakes of fried potatoes to be associated with negative health outcomes (see **Part D. Chapter 2: Dietary Patterns**). The World Cancer Research Fund Third Expert Report on Diet, Nutrition, Physical Activity and Cancer recommends increased intake of vegetables in the form of non-starchy vegetables for cancer prevention.[20] Therefore, the Committee proposed a reduction in Starchy Vegetables equal to the increase in Beans, Peas, and Lentils in the modified 2020 HUSS.

Modifications to Protein Foods Groups and Subgroups were proposed for synthesis in the modified 2020 HUSS. Systematic review evidence consistently indicated that dietary patterns higher in red and processed meats were related to negative health consequences, while higher intakes of fish and seafood were related to beneficial health outcomes (see **Part D. Chapter 2: Dietary Patterns**). Intakes of animal protein foods considered in systematic reviews are within the range of typical intakes in U.S. diets, which may not be nutrient-dense. In contrast, the representative foods in FPM analyses use the most nutrient-dense form with the lowest saturated fat and added sugars content. While examining potential reductions in the Protein Foods Group through reduction in the Meats portion of the Meats, Poultry, and Eggs subgroup, it became evident that reductions at or below the 2,000-calorie level had negative implications on meeting nutritional goals, especially for children and adolescents. This underscores the importance of nutrient density and the challenge of meeting nutritional goals within lower calorie levels (2,000 calories or below). Instead, the 2,200-calorie level emerged as a threshold where modifications could be made without introducing numerous nutrient gaps.

The Committee initially proposed modifications for reductions in the Dairy and Fortified Soy Alternatives Food Group, but ultimately chose not to pursue such reductions due to the negative implications on nutrients for many age-sex groups, especially children and adolescents and older adults for whom nutrient needs related to bone acquisition and retention are higher.[6]

The Committee also initially proposed modifications for reductions in Total Grains. FPM analyses in food group isolation indicated the potential to reduce the quantities of Total Grains in the HUSS, which would free up additional calories without producing negative nutrient implications. A reduction of Total Grains also results in reductions in sodium, which is a nutrient that is overconsumed. When these modifications were tested in concert with the other modifications, however, they were no longer feasible without introducing nutritional gaps. Specifically, the reduction in the Grains Food Group negated many of the gains introduced by increasing quantities of the Beans, Peas, and Lentils subgroup in the HUSS. The Committee recognizes the implications for age groups and life stages for whom the contribution of nutrients in enriched and/or fortified grain products may be of particular public health importance, especially the peri-conceptional and early pregnancy periods, and it was apparent that no other proposed modifications would ameliorate the negative implications for iron and/or folate. Therefore, the Committee chose not to propose modifications to Total Grains.

No modifications to the Fruits Food Group were explored by the Committee. Systematic review evidence supports positive health outcomes related to 100% juice, dietary patterns, and complementary feeding. Those systematic reviews support dietary patterns higher in fruit. Further, data analysis indicates that the population is below recommendations for fruit intake, and FPM analyses did not support making modifications because fruit is the main contributor of vitamin C, fiber, and potassium in the 2020 HUSS Dietary Pattern.

Differences in Nutritional Adequacy from Modifications to the HUSS

The proposed modifications shown in **Table D.10.8** allowed the Committee to further optimize the nutritional adequacy of the HUSS. The work of prior Committees has made incremental improvements to the pattern, which broadly meets the nutritional goals across age-sex groups and life stages, with few exceptions. Therefore, modest changes to the quantities in the pattern are not likely to produce large shifts in nutrition content (as shown in **Table D.10.9**), but when integrating the evidence from systematic reviews and data analysis with FPM results, the modifications of food groups and subgroups had positive impacts on the nutrients provided in the modified 2020 HUSS and aligned with the Committee's review of evidence from systematic reviews.

TABLE D.10.8
THE MODIFIED 2020 HEALTHY U.S.-STYLE DIETARY PATTERN (HUSS)

	Calorie Level											
Food Group or Subgroup	**1,000**	**1,200**	**1,400**	**1,600**	**1,800**	**2,000**	**2,200**	**2,400**	**2,600**	**2,800**	**3,000**	**3,200**
Vegetables (cup eq/day)	1.0	1.5	1.5	2.0	2.5	2.5	3.0	3.0	3.5	3.5	4.0	4.0
Dark-Green Vegetables (cup eq/week)	0.5	1.0	1.0	1.5	1.5	1.5	2.0	2.0	2.5	2.5	2.5	2.5
Red and Orange Vegetables (cup eq/week)	2.5	3.0	3.0	4.0	5.5	5.5	6.0	6.0	7.0	7.0	7.5	7.5
Beans, Peas, and Lentils (cup eq/week)	1.0*	1.0*	1.5*	2.0*	2.5*	2.5*	3.0*	3.0*	3.0*	3.0*	3.0	3.0
Starchy Vegetables (cup eq/week)	1.5*	3.0*	2.5*	3.0*	4.0*	4.0*	5.0*	5.0*	6.5*	6.5*	8.0	8.0
Other Vegetables (cup eq/week)	1.5	2.5	2.5	3.5	4.0	4.0	5.0	5.0	5.5	5.5	7.0	7.0
Fruits (cup eq/day)	1.0	1.0	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.5	2.5	2.5
Grains (oz eq/day)	3.0	4.0	5.0	5.0	6.0	6.0	7.0	8.0	9.0	10.0	10.0	10.0
Whole Grains (oz eq/day)	1.5	2.0	2.5	3.0	3.0	3.0	3.5	4.0	4.5	5.0	5.0	5.0
Refined Grains (oz eq/day)	1.5	2.0	2.5	2.0	3.0	3.0	3.5	4.0	4.5	5.0	5.0	5.0
Dairy and Fortified Soy Alternatives (cup eq/day)	2.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Protein Foods (oz eq/day)	2.0	3.0	4.0	5.0	5.0	5.5	5.5*	6.0*	6.0*	6.5*	6.5*	6.5*
Meats, Poultry, and Eggs (oz eq/week)	10.0	14.0	19.0	23.0	23.0	26.0	24.5*	27.0*	27.0*	29.0*	29.0*	29.0*
Seafood (oz eq/week)	2.0-3.0	4.0	6.0	8.0	8.0	8.0	9.0	10.0	10.0	10.0	10.0	10.0
Nuts, Seeds, and Soy Products (oz eq/week)	2.0	2.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	6.0	6.0	6.0
Oils (g/day)	15.0	17.0	17.0	22.0	24.0	27.0	29.0	31.0	34.0	36.0	44.0	51.0

*Indicates a change from the 2020 HUSS. Weekly quantities of Beans, Peas, and Lentils increased. Weekly quantities of Starchy Vegetables decreased. Daily quantities of Protein Foods decreased. Weekly quantities of Meats, Poultry, and Eggs decreased.

TABLE D.10.9
DIFFERENCE (PERCENT CHANGE) IN NUTRIENT ADEQUACY OF THE MODIFIED 2020 HUSS COMPARED TO THE 2020 HUSS

Age-Sex Group	Calorie Level	Energy	Energy From Added Sugars	Energy From Total Fat	Energy From Saturated Fat	Sodium CDRR	Protein RDA	Vitamin A RDA	Vitamin D RDA	Vitamin E RDA	Folate RDA	Calcium RDA	Iron RDA	Magnesium RDA	Fiber AI	Potassium AI	Choline AI
Children 2-3	1,200	0	0	0	0	-1	7	0	0	1	10	1	4	5	6	1	1
Children 4-8	1,200	0	0	0	0	-1	5	0	0	1	8	0	3	3	6	1	1
Males 9-13	2,000	0	0	0	0	-1	5	0	0	1	10	1	7	3	7	1	1
Males 14-18	2,600	-1	0	0	0	-3	- 5	-1	0	0	3	0	0	0	3	-2	-2
Males 19-30	2,600	-1	0	0	0	-3	- 5	-1	0	0	3	0	0	0	3	-1	-2
Males 31-50	2,200	-1	0	0	0	-3	-3	-1	0	0	7	1	4	1	6	-1	-1
Males 51+	1,800	0	0	0	0	-1	3	0	0	1	8	1	7	2	8	1	1
Females 9-13	1,800	0	0	0	0	-1	- 5	0	0	1	10	1	7	3	8	1	1
Females 14-18	2,000	0	0	0	0	-1	4	0	0	1	8	1	4	2	7	1	1
Females 19-30	2,000	0	0	0	0	-1	4	0	0	1	8	1	3	3	7	1	1
Females 31-50	1,800	0	0	0	0	-1	4	0	0	1	8	1	3	2	8	1	1
Females 51+	1,600	0	0	0	0	-1	4	0	0	1	8	1	7	2	9	1	1
Pregnancy 14-18	2,000	0	0	0	0	-1	2	0	0	1	5	1	2	2	7	1	1
Pregnancy 19-30	2,000	0	0	0	0	-1	2	0	0	1	5	1	2	2	7	1	1
Pregnancy 31-50	2,000	0	0	0	0	-1	2	0	0	1	5	1	2	2	7	1	1
Lactation 14-18	2,400	-1	0	0	0	-3	-3	-1	0	0	6	0	3	1	6	-1	-1
Lactation 19-30	2,400	-1	0	0	0	-3	-3	-1	0	0	6	1	3	2	6	-1	-1
Lactation 31-50	2,200	-1	0	0	0	-3	-3	-1	0	0	6	1	3	2	6	-1	-1

With the proposed modifications to the 2020 HUSS, improvements toward the DRI goal were noted in the protein, folate, iron, magnesium, and fiber content of the pattern. Even with several nutrients that had a modest decrease in percentage of the DRI, the pattern still met goals. The modifications to the pattern resulted in an increase in folate across all age-sex groups; however, the folate goal is not met by the pattern for individuals who are pregnant. The increased folate needs during this life stage are difficult to achieve, as noted by the 2020 Committee, but the modified 2020 HUSS moves closer to meeting the goal. Finally, the modified 2020 HUSS has a modest reduction in sodium across all age-sex groups.

Removal of "Limits on Calories for Other Uses"

The 2020 HUSS contains a line for "Limits on Calories for Other Uses" within the pattern to represent a quantitative estimate of calories remaining after all other foods in the pattern are consumed in their most nutrient-dense forms, such as lean or low-fat and prepared with minimal added sugars, refined starches, saturated fat, or sodium.[3] Guidance in the *Dietary Guidelines for Americans, 2020-2025* was that these calories can be used for added sugars, saturated fat, and/or alcohol, or to eat more than the recommended amount of food in a food group. The FPM methodology produces a nutrient profile that is based on the foods and beverages within the food group and weighted to represent distribution of reported consumption in What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES). Therefore, variability exists in the energy and nutrient content of foods and beverages within food groups and subgroups. If foods or beverages with lower or higher calorie content in their nutrient-dense forms are used, the energy from the pattern may be below the estimates from FPM analyses but could also exceed the calorie level for the pattern. Further, the dietary data provided by WWEIA, NHANES provide a reliable point estimate to represent nutrient content of foods and beverages that account for the variability of nutritional content of foods and beverages in the U.S. food supply. Finally, data analysis results indicate that foods and beverages consumed in the United States are not commonly in the most nutrient-dense forms. With the inherent variability in the calories of nutrient-dense foods and beverages and the current dietary intake patterns in the United States, presenting a quantified number of additional calories was not considered prudent and may be misleading in that calories for other uses may not be available.

All analyses and a summary of results by age, sex, and life stage can be found in the:
Synthesis FPM Report at:
https://www.DietaryGuidelines.gov/2025-advisory-committee-report/food-pattern-modeling

Discussion

The Committee identified supporting evidence to explore potential modifications to the 2020 HUSS that simultaneously modify at certain calorie levels: (1) Vegetable subgroups, specifically to increase Beans, Peas, and Lentils and decrease Starchy Vegetables while keeping the quantity of Total Vegetables unchanged; and (2) reduce Total Protein Foods by reducing the Meat portions of Meats, Poultry and Eggs for some calorie levels. Overall, the Committee concluded that there was no scientific justification to recommend modifications for the quantities of other food groups or subgroups in any pattern. The Committee also recommended to not include a quantified number of calories that may be left for other uses. The scientific evidence also supported exploration of multiple flexibilities within and across food groups, which allowed a rigorous, extensive, evidence-based evaluation using FPM. Overall, the committee decided that with these proposed modifications and/or flexibilities, there was insufficient evidence to support proposal of new dietary patterns.

The collective activities described in this chapter describe a unique opportunity to examine each food group in depth with a “what if” philosophy. As changes are made to the food groups and subgroups within the HUSS, there are nutrient ramifications that need to be evaluated within the context of meeting nutritional goals. Each food group was thoughtfully explored as not to introduce biases withing FPM, through independent analyses (i.e., each food group was explored on its own), to isolate the resulting implications for nutrients in the HUSS and to not introduce biases within FPM activities. The Committee’s goal was to build on the current *Dietary Guidelines* to explore what modifications and flexibilities can be introduced within and between food groups to enhance dietary guidance for all individuals. The integration of systematic reviews and FPM through a health equity lens allowed the Committee to explore different combinations of foods within individual food groups and subgroups to maximize capacity of the healthy dietary patterns to address individual differences while optimizing health.

An overarching theme of the questions in this chapter underscores the necessity of dietary variety within and across the food groups to meet nutritional goals. The analyses in this chapter demonstrated the unique but varied contributions that each food group and subgroup across the 2020 and modified 2020 HUSS makes to meeting nutritional goals. This collective contribution to total nutrients across the pattern demonstrates the synergistic effect of dietary variety in meeting nutrient needs, as well as the implications of exclusions of dietary components without thoughtful replacement. Further, some food groups may be primary sources of key nutrients. For example, the Protein Foods group is a primary source of dietary protein in the pattern, and the Dairy and Fortified Soy Alternatives Food Group as well as the Beans, Peas, and Lentils Vegetables Subgroup provide additional dietary protein to the pattern.

When considering individual food groups and subgroups, interesting issues emerged from the analysis phase. The Committee decided that no modifications or flexibilities to the Fruits Food Group in 2020 HUSS were justified based on scientific evidence. In FPM, Fruits are divided into whole fruits and fruit juice. The Committee explored the nutrient implications of changing the narrative guidance regarding the proportion of Total Fruits contributed by whole fruits relative to fruit juice, but based on the data using representative foods, concluded that there was no scientific justification to change the recommended ratios.

Within the Vegetables group, the Committee determined through review of multiple FPM scenarios that increased quantities of Beans, Peas, and Lentils and/or Dark-Green Vegetables had additional nutrient benefits above and beyond the 2020 HUSS. In general, the systematic reviews did not explicitly call out Dark-Green Vegetables as a food subgroup, so the Committee chose not to pursue this proposed modification within the Vegetables group. Beans, Peas, and Lentils are a unique food subgroup in that they can contribute to either Vegetables or Protein Foods and will be referred to in different food groups throughout this report, depending on the context. Furthermore, systematic reviews indicated that dietary patterns emphasizing Beans, Peas, and Lentils (commonly presented as “legumes”) as well as Vegetables are related favorably to health outcomes (see **Part D. Chapter 2: Dietary Patterns**). Accordingly, Beans, Peas, and Lentils were considered in terms of both modifications and flexibilities. The FPM results provided support for exploring flexibilities that increase Beans, Peans, and Lentils above the proposed quantities in a healthy dietary pattern while either simultaneously decreasing Total Grains or reducing Meats, Poultry, and Eggs within the 2020 HUSS. One of the challenges with making these recommendations was understanding how often and in what quantity the flexibilities can be implemented, particularly when considering individual population groups. For example, it was not deemed practical to consume only Beans, Peas, and Lentils in lieu of Total Grains, and indeed, Beans, Peas, and Lentils are often consumed with grains. Similarly, a flexibility that occurs occasionally would have different implications than a modification that recommended a specific amount within a specific time frame. Please see **Part E. Chapter 1: Overarching Advice to the Departments** for the Committee's overarching advice on Beans, Peas, and Lentils**.**

With respect to the Grains Food Group, multiple issues arose. The evidence indicated that in individuals older than age 2 years, an individual can reduce intake of Total Grains from current recommendations in the 2020 HUSS without negative nutritional implications. However, the quantity by which Grains can be reduced without negative nutrient implications varies by age-sex group, making it challenging to provide a single value that would be applicable to every group. The distribution of Total Grains is also a challenge. Refined grains are fortified with nutrients including folate at approximately twice the amount found in whole grains, whereas most whole grain versions of commonly consumed grains are not fortified (e.g., rice, pasta, and other cooked grains).[21-24] An exception is fortified ready-to-eat breakfast cereal which, due to it being a top food category source of whole grain consumption, influences the nutrient profile for Whole Grains used in FPM. The Committee had extensive discussion on this imbalance within the food supply and considered potential approaches to incentivize fortification of whole grains with nutrients such as folate and iron to shift the flexibilities to the modified 2020 HUSS to include more whole grains without compromising nutrient needs primarily achieved through fortification. The methods used in FPM focus on absolute nutrient contents of food groups and subgroups. The Committee discussed variation of bioavailability and bioaccessibility of nutrients which is important when considering the contribution of a food group to nutrient status or health outcomes, e.g., food groups that are sources of nutrients such as iron, which presents in the food supply in forms that vary in bioavailability.

When discussing flexibilities that increased Starchy Vegetables while reducing Total Grains, and acknowledging cultural foodways followed by individual population groups, the Committee considered the Revision to Meal Patterns Consistent with the 2020-2025 Dietary Guidelines for Americans final rule published in the Federal Register which states that "School food authorities and schools that are tribally operated, operated by the Bureau of Indian Education, and that serve primarily American Indian or Alaska Native children, may serve any vegetable, including vegetables such as breadfruit, prairie turnips, plantains, sweet potatoes, and yams, to meet the grains component."[25] This is a concrete example of a flexibility already in place and provided an opportunity to use FPM methods to examine the implications. The Committee expressed concerns that with consistent replacement of Starchy Vegetables for Total Grains over time, iron needs might not be met, specifically if Starchy Vegetables were substituted for iron-fortified grains. Committee members also expressed concerns and hesitancy with this flexibility due to differences among age-sex groups in achieving nutrient adequacy over the lifespan, as an intent of the *Dietary Guidelines* is to promote young children's learning about a healthy dietary pattern and following such a pattern across the lifespan. The Committee emphasized the need to assess—at a more defined quantitative level—implications for substitutions of food groups and subgroups, as a clearer understanding about what group/subgroup is being displaced due to substitution would provide more confidence in estimation of corresponding nutrient implications.

The Committee had extensive discussion on the evidence that provided support for exploring a modification to reduce the Dairy and Fortified Soy Alternatives Food Group in the overall synthesis that integrates the food groups in a healthy dietary pattern (see **Part D. Chapter 3. Beverages** and **Part D. Chapter 4: Food Sources of Saturated Fat**). It was emphasized that these analyses were conducted related to patterns for individuals ages 2 years and older. The Dairy and Fortified Soy Alternatives Food Group contributes to multiple nutrients that are related to bone health. Although the emphasis has been on calcium and vitamin D, a combination of multiple nutrients (energy, protein, calcium, phosphorous, magnesium, zinc, and vitamin A) is critical for children's bone health. Reducing or removing the Dairy and Fortified Soy Alternatives Food Group reduces levels of certain nutrients, which would need to be accounted for by proposed substitutions/synthesis. Ultimately, the Committee chose not to recommend any reduction in this food group out of concern about the negative impact on bone health.

The Committee evaluated the potential of widely available plant-based milk options as a flexibility for the 2020 HUSS recommendations on low-fat and fat-free milk, or lactose-free and soy milk. The evidence indicated that non-dairy alternative products are fortified with calcium and vitamin D but may not be fortified with other nutrients necessary for bone health. Moreover, the variability in nutrient composition of plant-based milk alternatives creates challenges in assessing the implications of their substitution for foods within the Dairy and Fortified Soy Alternatives group. For example, almond milk is calcium-fortified but low in phosphorus (20:1 ratio of calcium to phosphorus) compared to fat-free milk, which is suboptimal for bone development in young children.[18] In addition, wide variation exists in nutrient composition, including protein, across plant-based milks. While protein is not considered a nutrient of public health concern, protein intake is already low among adolescent females and is a critical nutrient for bone health (see **Part D. Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions**). New forms of plant-based milks are rapidly emerging in this evolving market, and insufficient food composition data are available to compare these new products to dairy beverages. The Committee emphasized that any proposal for a flexibility considering plant-based milks as part of a healthy dietary pattern would require guidance for selecting plant-based milks as they are not equivalent to cow's milk in protein and other nutrients, may contain added sugars, and would require integration with other food groups to otherwise obtain nutrients that are found in dairy milks, but not plant-based milks.

The Committee took a multi-phased approach for understanding if nutritional goals could be achieved when the Protein Foods group and subgroup quantities were hypothetically modified, including with lower quantities of animal-based Protein Foods and greater quantities of plant-based Protein Foods than are currently recommended in the 2020 HUSS or the H-VEG Patterns. The 2020 H-VEG differs from the 2020

HUSS because the former has no meat and poultry, but does include eggs, and soy is separate from nuts and seeds. When discussing Total Protein Foods, the Committee proposed evaluation of the nutrient implications when reducing the amount of Total Protein Foods and Meats, Poultry and Eggs, while simultaneously increasing the amount of Beans, Peas, and Lentils, currently presented as Vegetables in the 2020 HUSS, which provides nutrient benefits as discussed earlier in this chapter. Total Protein Foods is a broad category with a variety of Protein Foods subgroups around which flexibilities can be explored. In exploring flexibilities for this food group, however, evidence did not support consuming all Protein Foods from a single subgroup to meet nutrient needs.

Considering the results from data analysis of the U.S. prevalence of overweight and obesity, meeting nutrient goals within calorie levels is critical, especially among children and adolescents and older adults (see **Part D. Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions**). When evaluating reductions of food groups and subgroups in the patterns, few reductions in quantities within the modified 2020 HUSS were possible without introducing nutritional gaps in modeling the lower calorie levels. This underscores the importance of nutrient density and the challenge of meeting nutritional goals within lower calorie levels (2,000 calories or below). With the Estimated Energy Requirements calculations used to estimate calorie levels, the calorie needs were computed estimating inactive activity levels. Meeting Physical Activity Guidelines would increase energy expenditure and increase energy needs that would increase the chances to meet nutritional goals within less stringent calorie needs given that estimates for remaining energy are higher with sequentially higher calorie levels defined in the modified 2020 HUSS.[26] The 2020 HUSS presents estimates of calories that might remain after food group and subgroup quantities within the HUSS are fulfilled. This presentation is based on the energy estimates of nutrient-dense representative foods and their proportional contributions to nutrient profile calculations. However, these modeled nutrient profiles may not reflect how an individual eats; either the proportional intake of a given individual on a given day or across time. With this practical grounding, and realization that individuals select real foods, not composite profiles of a food group, the actual energy contributions may vary considerably for each food group or subgroup modeled within the HUSS and maximal energy level for each calorie level may easily be reached when fulfilling the food group and subgroup quantities in the HUSS. Therefore, the Committee decided not to portray any calories (i.e., energy) that might be left for other uses, because on a given day, achieving the modified 2020 HUSS may account for all calories.

Next Steps in the 2025 FPM Process

The previous chapter, **Part D. Chapter 9: Nutrient Profile Development**, described how the Committee developed the underlying food group nutrient profiles for all FPM analyses described in this chapter: **Part D. Chapter 10: Food Group and Subgroup Analysis**. As a result of the findings detailed here, the Committee developed a modified 2020 HUSS that continues to meet nutritional goals across life stages and age-sex groups, with few exceptions. The modified 2020 HUSS was then evaluated for potential refinement using diet simulations, which are described in **Part D. Chapter 11: Diet Simulations**.

For more information on the final pattern(s) proposed to the Departments, see **Part E. Chapter 1: Overarching Advice to the Departments**.

References

1. Dietary Guidelines Advisory Committee. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. Washington, DC: U.S. Department of Agriculture, Agricultural Research Service; 2020. https://doi.org/10.52570/DGAC2020
2. National Academies of Sciences, Engineering, and Medicine. *Dietary Reference Intakes for Energy*. Washington, DC: The National Academies Press; 2023. https://doi.org/10.17226/26818
3. U.S. Department of Agriculture and U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2020-2025, 9th Edition*. Washington, DC: U.S. Department of Agriculture; 2020. https://www.dietaryguidelines.gov/
4. National Academies of Sciences, Engineering, and Medicine. *Dietary Reference Intakes for Sodium and Potassium*. Washington, DC: The National Academies Press; 2019. https://doi.org/10.17226/25353
5. Institute of Medicine. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids*. Washington, DC: The National Academies Press; 2005. https://doi.org/10.17226/10490
6. National Academies of Sciences, Engineering, and Medicine. *Dietary Reference Intakes for Calcium and Vitamin D*. Washington, DC: The National Academies Press; 2011. https://doi.org/10.17226/13050
7. U.S Department of Health and Human Services and U.S. Department of Agriculture. *Dietary Guidelines for Americans, 2005, 6th Edition*. Washington, DC: U.S. Government Printing Office; 2005. https://www.dietaryguidelines.gov/about-dietary-guidelines/previous-editions/2005-dietary-guidelines-americans
8. U.S. Department of Agriculture and U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2010, 7th Edition*. Washington, DC: U.S. Government Printing Office; 2010. https://www.dietaryguidelines.gov/about-dietary-guidelines/previous-editions/2010-dietary-guidelines
9. U.S. Department of Health and Human Services and U.S. Department of Agriculture. *2015-2020 Dietary Guidelines for Americans, 8th Edition*. Washington, DC: U.S. Department of Health and Human Services; 2015. https://www.dietaryguidelines.gov/about-dietary-guidelines/previous-editions/2015-dietary-guidelines
10. Taylor CA, Abrams SA, Eicher-Miller HA, et al. *What are the implications for nutrient intakes when modifying the Dairy and Fortified Soy group quantities within the Healthy U.S.-Style Dietary Pattern? What are the implications for nutrient intakes when dairy food and beverage sources are replaced with non-dairy alternatives? Food Pattern Modeling Report.* U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition and Economic Analysis Branch; 2024. https://doi.org/10.52570/DGAC2025.FPM04
11. Taylor CA, Byrd-Bredbenner C, Abrams SA, et al. *What are the implications for nutrient intakes when modifying the Fruits food group quantities within the Healthy U.S.-Style Dietary Pattern? Food Pattern Modeling Report.* U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition and Economic Analysis Branch; 2024. https://doi.org/10.52570/DGAC2025.FPM07
12. Taylor CA, Byrd-Bredbenner C, Abrams SA, et al. *What are the implications for nutrient intakes when modifying the Vegetables food group and subgroup quantities within the Healthy U.S.- Style Dietary Pattern? Food Pattern Modeling Report.* U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition and Economic Analysis Branch; 2024. https://doi.org/10.52570/DGAC2025.FPM06
13. Taylor CA, Fung T, Booth SL, et al. *What are the implications for nutrient intakes when modifying the quantities of the Grains group within the Healthy U.S.-Style Dietary Pattern? What are the implications for nutrient intakes when specific individual staple grains are emphasized; or when Grains are replaced with other staple carbohydrate foods (i.e., Starchy vegetables; Beans, Peas,*

and Lentils; starchy Red and Orange vegetables)? Food Pattern Modeling Report. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition and Economic Analysis Branch; 2024. https://doi.org/10.52570/DGAC2025.FPM05

14. Taylor CA, Talegawkar SA, Fung T, et al. *What at are the implications for nutrient intakes when modifying the Protein Foods group and subgroup quantities within the Healthy U.S.-Style Dietary Pattern or Healthy Vegetarian Dietary Pattern? What are the implications for nutrient intakes when proportions of animal-based Protein Foods subgroups are reduced and proportions of plant-based Protein Foods subgroups are increased? Food Pattern Modeling Report.* U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition and Economic Analysis Branch; 2024.doi:https://doi.org/10.52570/DGAC2025.FPM03
15. Taylor CA, Booth SL, Abrams SA, et al. *Synthesis of Hypothetical Dietary Pattern Modifications to the 2020 Healthy U.S.-Style (HUSS) Dietary Pattern: Food Pattern Modeling Report.* U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition and Economic Analysis Branch; 2024. doi:https://doi.org/10.52570/DGAC2025.FPM10
16. U.S. Department of Agriculture, Agricultural Research Service. *USDA Food and Nutrient Database for Dietary Studies 2017-2018*. 2020. https://www.ars.usda.gov/nea/bhnrc/fsrg
17. U.S. Department of Agriculture, Agricultural Research Service, Beltsville Human Nutrition Research Center. *FoodData Central*. 2019. https://fdc.nal.usda.gov
18. Weaver CM, Gordon CM, Janz KF, et al. The National Osteoporosis Foundation's position statement on peak bone mass development and lifestyle factors: a systematic review and implementation recommendations. *Osteoporos Int*. Apr 2016;27(4):1281-1386. doi: https://doi.org/10.1007/s00198-015-3440-3
19. DeSilva D, Cruz CM, Adler M, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Food Groups*. U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion and U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion; 2024. doi:https://doi.org/10.52570/DA.DGAC2025.DA02
20. World Cancer Research Fund, American Institute for Cancer Research. Diet, nutrition, physical activity and cancer: a global perspective. Continuous Update Project Expert Report. 2018;
21. 21 CFR 136, 137, and 139, Food Standards: Amendment of Standards of Identify For Enriched Grain Products to Require Addition of Folic Acid Vol. 61, No. 44. Pages 8781-8797 (1996).
22. Center for Disease Control and Prevention. *MMWR: Folic Acid and Prevention of Spina Bifida and Anencephaly: 10 Years After the U.S. Public Health Service Recommendation*. 2002. https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5113a1.htm
23. CDC Grand Rounds: additional opportunities to prevent neural tube defects with folic acid fortification. *MMWR Morb Mortal Wkly Rep*. Aug 13 2010;59(31):980-4.
24. FDA approves folic acid foritification of corn masa flour. U.S. Food and Drug Administration; 2016. https://www.fda.gov/news-events/press-announcements/fda-approves-folic-acid-fortification-corn-masa-flour
25. U.S. Department of Agriculture. *Child Nutrition Programs: Revisions to Meal Patterns Consistent with the 2020 Dietary Guidelines for Americans, 7 CFR 210, 215, 220, 225, and 226.* 2023. https://www.federalregister.gov/documents/2023/02/07/2023-02102/child-nutrition-programs-revisions-to-meal-patterns-consistent-with-the-2020-dietary-guidelines-for
26. U.S. Department of Health and Human Services. *Physical Activity Guidelines for Americans, 2nd edition*. 2018. https://odphp.health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf

Part D. Chapter 11: Diet Simulations

Introduction

Food pattern modeling (FPM) activities enabled the Dietary Guidelines Advisory Committee (Committee) to refine the USDA Dietary Patterns to meet the nutritional goals of the U.S. population by modeling food groups and subgroups using nutrient-dense representative foods and beverages. The resulting quantitative patterns specify the recommended amounts of foods and beverages from each food group and subgroup, which individuals and programs use as a guide when selecting among the wide variety of nutrient-dense foods and beverages included in each group. This flexible framework provides the opportunity to include food and beverage choices that result from many factors, including access, affordability, individual dietary requirements and preferences, and foodways.

As part of continuous quality advancement between the work of the 2020 and 2025 Dietary Guidelines Advisory Committees, the FPM methods team, which is composed of federal staff with expertise in FPM methodology and the *Dietary Guidelines* process, explored methods to consider dietary intake variability in diverse populations. The FPM methods team conducted an evidence scan prior to the appointment of the Committee, which revealed opportunities to expand the ability to refine the USDA Dietary Patterns through use of simulated diet methodologies.[1-3] Such approaches would provide another opportunity, in addition to existing rigorous FPM methods, to consider intake variability of foods and beverages.

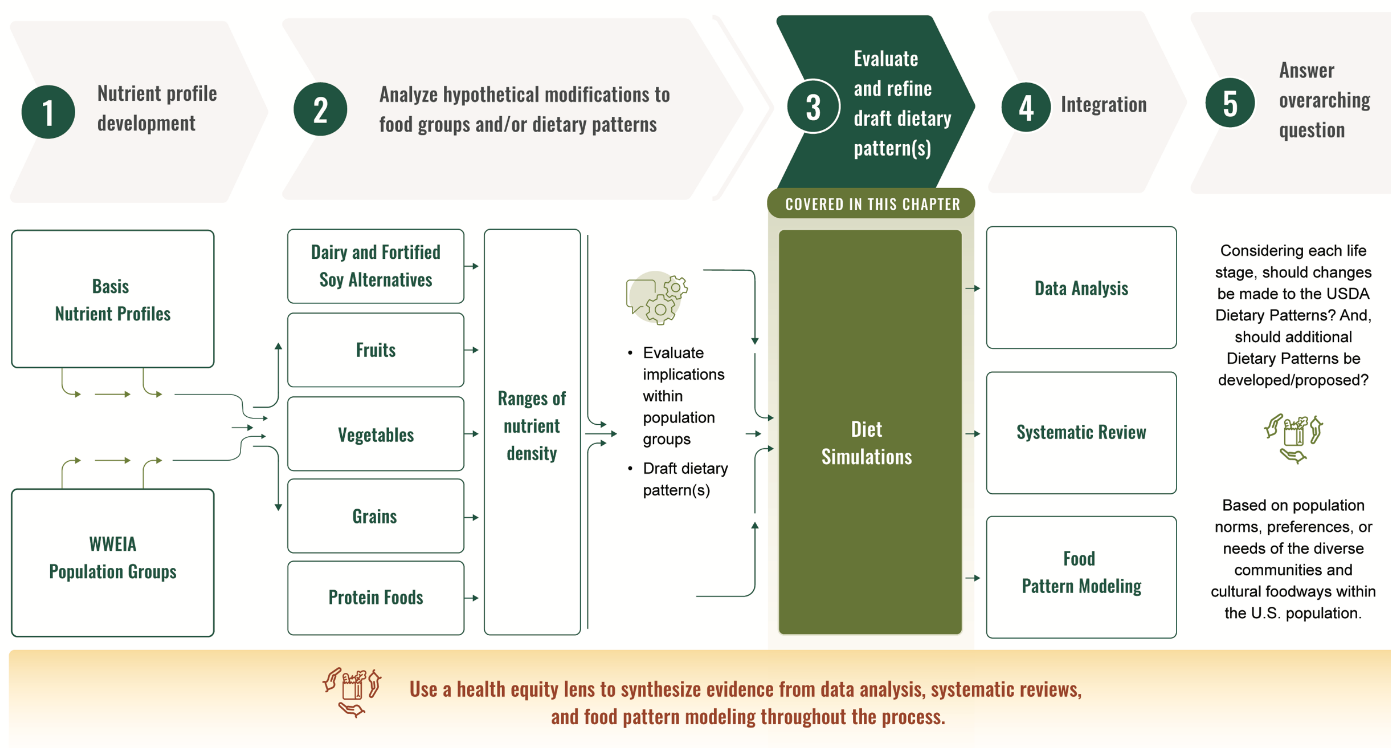
Diet simulations[a] can test the capacity of a wide range of foods and beverages to meet a given dietary pattern and achieve nutritional adequacy. Use of a wide range of foods and beverages is important because it can represent variation in consumption patterns. As an addition to the approach of using a composite nutrient profile based on proportional consumption and the nutrient profile of nutrient-dense representative foods (see **Part D. Chapter 9: Nutrient Profile Development**), diet simulation can be used to examine the energy and nutrient composition of hundreds or thousands of individual foods and beverages that could be selected in different combinations to meet nutritional goals and quantitative amounts of a dietary pattern. The addition of this systems science approach allowed the Committee to test the modified 2020 Healthy U.S.-Style Dietary Pattern (hereafter referred to as the 'modified 2020 HUSS') to ensure the final pattern(s) recommended to the Departments of Health and Human Services and Department of Agriculture are inclusive of a broader range of dietary intakes and consider health equity (**Box D.11.1**). This approach is also supported by public interest that dietary patterns recommended in the *Dietary Guidelines* address the wide variation in U.S. dietary practices. Application of this approach is also responsive to a recommendation from the National Academies of Science, Engineering, and Medicine to apply systems science approaches, such as simulation, to FPM to account for variability in food consumption.[4,5]

---

[a]Simulation is a systems science method that has been defined as "a mathematical model that describes or recreates computationally a system process".[7]

This chapter describes the analytic approach to evaluate the proposed modifications to the 2020 HUSS, considering a wide variability in the selection of foods and varying amounts of lower nutrient-dense foods (i.e., foods lower in nutrient density). This is the first use by a Dietary Guidelines Advisory Committee of simulation analysis to construct daily or weekly diets from thousands of different combinations of individual foods and beverages in amounts designed to meet food group and subgroup recommendations across age-sex groups. The Committee synthesized results from these analyses along with scientific evidence from FPM analyses, data analysis, and systematic reviews to inform recommendations to the Departments for the 2025 USDA Dietary Patterns. **Figure D.11.1** illustrates how the analyses presented in this chapter contribute to the Committee's total body of FPM work. To learn more about the modifications to the HUSS (modified 2020 HUSS) that was used for diet simulations, see **Part D. Chapter 10: Food Group and Subgroup Analysis**.

FIGURE D.11.1
2025 FOOD PATTERN MODELING PROCESS



Question

Do simulated diets that meet the updated USDA Dietary Patterns and reflect variation in dietary intakes achieve nutrient adequacy?[6]

Methodology

The analyses presented in this chapter were conducted to assess whether the modified 2020 HUSS proposed by the 2025 Committee meet established nutritional criteria (energy and nutrient requirements and dietary recommendations) irrespective of which predominantly nutrient-dense foods and beverages are selected from each food group and subgroup. An overview of the methodological approach is provided in this section. Detailed methods are provided in a separate report by the USDA contractor who conducted the analysis.[6]

The assessment of the modified 2020 HUSS for variation in dietary intakes was accomplished by using simulation with replacement (allowing the same foods to be selected more than once within a diet) to construct 2,500 randomly generated 7-day diets to meet the modified 2020 HUSS for each of 13 age-sex groupings (2-3, 4-8, 9-13, 14-18, 19-30, 31-50, and 51+ years).[7] The age groupings are based on the age groupings for the Dietary Reference Intakes used in assessment of the modified 2020 HUSS. A separate simulation was conducted to generate 2,500 7-day diets to meet the 2020 HUSS (which was not modified) for ages 12 through 23 months at the 800 kilocalories per day level for this age group. The assessments for all age-sex groups were conducted to the extent possible using foods and beverages included in U.S. diets and in select American Indian and Alaska Native diets.

The simulation analysis for U.S. diets randomly selected foods and beverages from those reported as consumed in CDC's National Health and Nutrition Examination Surveys and included in the Food and Nutrition Database for Dietary Studies, 2017-2018 (FNDDS).[8] Foods and beverages from the FNDDS will be referred to as "foods" throughout the chapter.

Separate simulations were conducted to randomly select foods identified as included in select American Indian diets and in Alaska Native diets through a pilot study. For the pilot, 3 experts with professional and lived experience in an American Indian or Alaska Native cuisine (hereafter referred to as experts throughout the chapter) were identified through a separate USDA project. One expert has professional and lived experience in Navajo Nation foodways, a second has this experience in Blackfeet and Cherokee; and a third has this experience in Alaska Native foodways. Each expert reviewed foods in FNDDS[8] and USDA FoodData Central Standard Reference Legacy (SR Legacy)[9] for the cuisine with which they have relevant experience. During this review, the experts identified foods as 1) integral to the cuisine; 2) eaten but not integral to the cuisine; or 3) never eaten in the cuisine. Food identified as 1) integral to the cuisine or 2) eaten but not integral to the cuisine were included in the diet simulations. The pilot does not address representativeness of dietary patterns for all American Indian or Alaska Native groups, but is an approach being tested and refined for future application in the *Dietary Guidelines* process (**Box D.11.1**).

Box D.11.1: Diet Simulations

The simulation analyses for overall U.S. diets were conducted by considering foods and beverages reported as consumed in CDC's National Health and Nutrition Examination Surveys. Separately, a pilot was conducted to simulate foods and beverages identified by experts as included in select American Indian and Alaska Native diets. This provided an opportunity to consider variation in dietary practices across diverse cultural groups and environments. A long-term goal is to simulate foods and beverages that are integral to all the various foodways in the United States, but for this cycle the Committee prioritized foods and beverages integral to and consumed by individuals from select American Indian and Alaska Native populations as a separate pilot. This was also an opportunity to be responsive to public comments that included a call for *Dietary Guidelines* to be inclusive of American Indian and Alaska Native populations by considering the traditional foods of these populations in the *Dietary Guidelines* and federal programs.

The main analyses for U.S., American Indian, and Alaska Native diets used equal probability for the random selection of all included foods from each food group and subgroup to meet the amounts recommended in the modified 2020 HUSS. Simulation advanced separately for each food group or subgroup to meet the recommended amounts. Simulation analyses were also conducted using a lower probability of selection for lower nutrient-dense foods relative to the probability of all other foods. In these simulations for each age-sex group, the lower probabilities of selection calculated for foods defined as being lower nutrient-dense were 75 percent, 50 percent, 25 percent, 15 percent, and 0 percent of the calculated probabilities of all other foods. Lower nutrient-dense foods were defined as foods higher in added sugars, saturated fat, and/or sodium using defined criteria (**Table D.11.1**). Once the simulated diets were constructed, the energy and nutrient content of each food selected for each simulated diet was used to calculate the energy and nutrient content of the simulated diets and a series of percentile distributions to summarize the content of the aggregated simulated diets for each of the 13 age-sex groups. The percentile distributions include energy and 26 nutrients (**Table D.11.2**)

The energy and nutrient distributions of the simulated diets for U.S., American Indian, and Alaska Native diets were compared to the established nutritional criteria (**Box D.11.2**) to determine if criteria were met. For nutrients with an Estimated Average Requirement (EAR), the nutritional criteria were a low percent (<10 percent) of simulated diets below the EAR for the age-sex group. When an EAR is not established, the Adequate Intake (AI) was used to evaluate the simulated diets, with the nutritional criteria being the median nutrient content for the aggregated simulation diets at or above the AI for the nutrient.

Nutritional criteria evaluated also included a low percent (<10 percent) of simulated diets exceeding the Tolerable Upper Intake Level (UL) for most nutrients or the Chronic Disease Risk Reduction Intake (CDRR) for sodium; a low percent (≤20 percent) of simulated diets outside the Acceptable Macronutrient Distribution Range (AMDR) for carbohydrate, protein, and total lipid content; less than 10 percent of simulated diets (ages 2 years and older) with more than 10 percent of energy from saturated fatty acids and added sugars; and the median energy content of the aggregated simulation diets at or below the assigned Estimated Energy Requirement (EER) for the age-sex group. The assigned EER was the lowest estimated energy requirements for each age-sex group given reference heights and weights. For all comparisons, results are available by age-sex group in addition to a weighted overall finding for all age groups combined.

Box D.11.2: Key Term

Nutritional Criteria for the Distribution of Simulated Diets: The nutritional criteria to evaluate the energy and nutrient content of simulated diets were defined as: 1) less than 10 percent of diets below the Estimated Average Requirement (EAR); 2) the median nutrient content of the distribution at or above the Adequate Intake (AI) when an EAR is not established for the nutrient; 3) less than 20 percent of diets outside the Acceptable Macronutrient Distribution Range (AMDR) for carbohydrate, protein, and total lipids; 4) less than 10 percent of diets above the Chronic Disease Risk Reduction Intake (CDRR) for sodium; 5) less than 10 percent of diets above the Tolerable Upper Intake Level (UL); 6) less than 10 percent of diets with ≥10 percent of energy from saturated fat; 7) less than 10 percent of diets with ≥10 percent of energy from added sugars; 8) median energy content of the distribution at or below the Estimated Energy Requirement (EER) for energy.

The diet simulation methods used for this assessment build on methods used in Canada[1,2] and Australia[3] to evaluate and refine quantitative dietary patterns developed using a composite nutrient profile system; however, methodological differences exist. In the Canadian and Australian studies, the probability of selection of individual foods and beverages to construct simulated diets was based on reported consumption patterns in national or provincial surveys, whereas the current analyses use equal probability of selection to increase the representation of foods infrequently reported in U.S. dietary surveys. Another methodological difference is that the Canadian and Australian studies simulated foods and beverages consistent with dietary guidance, whereas the current analyses also assess the impact of including foods of lower nutrient-density in simulated diets on meeting energy and nutrient requirements and dietary recommendations.

TABLE D.11.1
CRITERIA FOR IDENTIFYING LOWER NUTRIENT-DENSE FOODS AND BEVERAGES FOR SIMULATION ANALYSES

Foods and Beverages		Criteria*		
Standard portion amount consumed	**Food category**	**High in saturated fat**	**High in sodium**	**High in added sugars**
≤30 grams	Fat and oils	>30% of total fat from saturated fat	>15% of the Daily Value (>345 mg) of sodium per standard portion	>10% of the Daily Value (>5 g) of added sugars per standard portion
	Nuts and seeds	Not applicable because of beneficial fatty acids		
	All other foods and beverages	>10% of the Daily Value (>2 g) of saturated fat per standard portion		
>30 grams	Fats and oils	>30% of total fat from saturated fat	>15% of the Daily Value (>345 mg) of sodium per standard portion	>15% of the Daily Value (>7.5 g) of added sugars per standard portion
	Nuts and seeds	Not applicable because of beneficial fatty acids		
	All other foods and beverages	>15% of the Daily Value (>3 g) of saturated fat per standard portion		

*These criteria for identifying lower nutrient-dense foods are similar to criteria used by FDA in the proposed Dietary Guidance Statements[10] and the criteria for Tier 3 in the Canadian simulations.[11] Canada's Food Classification System is based on Reference Amounts and FDA Draft Guidance is based on Reference Amounts Customarily Consumed. In an earlier analysis, sodium criteria were not applied and high in saturated fat for meats, cheese, and soy versions of cheese was defined as >25% of the Daily Value (>5 g). The results of these analyses are presented in Kranker et al. (2024).[6]

TABLE D.11.2
NUTRITIONAL PARAMETERS USED IN EVALUATION OF DIET SIMULATIONS

Food Component	Energy and Specific Nutrients (Reference Metric)*
Energy	Energy (EER)
Macronutrients	Carbohydrate (AMDR/EAR), Protein (AMDR/EAR), Total Lipid (AMDR)
Fatty acids	Saturated Fatty Acids (DGA 2020-2025, <10% of total energy), 18:2 Linoleic Acid (AI), 18:3 Alpha-Linolenic Acid (AI)
Vitamins	Vitamin A (EAR), Vitamin C (EAR/UL), Vitamin D (EAR/UL), Vitamin E (EAR/UL), Vitamin K (AI), Thiamin (EAR), Riboflavin (EAR), Niacin (EAR), Vitamin B6 (EAR/UL), Folate (EAR), Vitamin B12 (EAR), Choline (AI/UL)
Minerals	Calcium (EAR/UL), Copper (EAR/UL), Iron (EAR/UL), Magnesium (EAR), Phosphorus (EAR/UL), Potassium (AI), Sodium (CDRR), Zinc (EAR/UL)
Added Sugars	Added Sugars (DGA 2020-2025, <10% of energy)
Fiber	Total Dietary Fiber (AI)

*EER = Estimated Energy Requirement; AMDR = Acceptable Macronutrient Distribution Range; DGA 2020-2025 = *Dietary Guidelines for Americans, 2020-2025;* AI = Adequate Intake; EAR = Estimated Average Requirement; CDRR = Chronic Disease Risk Reduction Intake; UL = Tolerable Upper Intake Level.

Review of the Science

Question: Do simulated diets that meet the updated USDA Dietary Patterns and reflect variation in dietary intakes achieve nutrient adequacy?

Approach to Answering Question: Diet Simulations

Synthesis Statement

Diet simulation results suggest that nutrient requirements can generally be met when considering variation in dietary intake.

Given the food group and subgroup quantities in the modified 2020 HUSS, nutrient requirements can be met when considering variation in dietary intake, with few exceptions (e.g., vitamin D, vitamin E). Added sugars criteria were met for all age-sex groups when the probability of including foods lower in nutrient density was 15 percent of the probability of including all other foods. Saturated fat criteria were met for all age-sex groups when foods lower in nutrient density were excluded from the simulations. Sodium criteria could not be met (i.e., simulations exceeded the CDRR for sodium) even when foods lower in nutrient density were excluded from the simulations.

Summary of the Evidence

The results presented in this section provide an overview of the comparisons of the distributions of energy and nutrient contents of simulated diets to nutritional criteria based on energy and nutrients requirements or dietary recommendations. Additional details of findings for the simulations conducted for all age-sex groups for U.S., American Indian, and Alaska Native groups are available in the associated report and data tables.[6]

Diet simulations using foods reported as consumed in the United States overall, as well as foods identified through a pilot as included in select American Indian and Alaska Native diets, showed that for nutrients with an EAR, less than 10 percent of simulated diets for each age-sex group were inadequate (i.e., <EAR) for each nutrient, with the exception of vitamin D and vitamin E. This was achieved regardless of the inclusion of lower nutrient-dense foods, and for simulations conducted with foods and beverages reported as consumed in the United States overall and for simulations with foods and beverages identified as included in select American Indian diets and in Alaska Native diets. The number of simulated diets that were inadequate exceeded 10 percent across simulations for all age-sex groups for vitamin D, and across at least 6 age-sex groups for vitamin E, including simulations using foods identified for the American Indian and Alaska Native diets (**Table D.11.3**).

Simulated diets were also assessed for exceeding the UL for nutrients with a UL for dietary sources. The assessment revealed that for simulations for ages 2 through 3 years, more than 10 percent of diets exceeded the UL for 2 nutrients, copper and zinc. More than 10 percent of simulated diets for ages 4 through 8 exceeded the UL for zinc when the probability of including lower nutrient-dense foods was lower (≤25 percent for U.S., ≤50 percent for American Indian, and 0 percent for Alaska Native simulations) than all other foods.

TABLE D.11.3
ASSESSMENT OF SIMULATED DIETS FOR NUTRIENTS WITH AN ESTIMATED AVERAGE REQUIREMENT (EAR)[a]

	Percentage of Diet Simulations <EAR Across 13 Age-Sex Groups[b]		
Minerals	**Overall U.S.**	**American Indian (pilot[c])**	**Alaska Native (pilot[c])**
Calcium	0% (all groups)	0% (all groups)	0% (all groups)
Copper	0%, (all groups)	0% (all groups)	0% (all groups)
Iron	0% (all groups)	0% (all groups)	0% (all groups)
Magnesium	0% (all groups)	0% (all groups)	0% (all groups)
Phosphorus	0% (all groups)	0% (all groups)	0% (all groups)
Zinc	0% (all groups)	0% (all groups)	0% (all groups)
Vitamins	**Overall U.S.**	**American Indian (pilot[c])**	**Alaska Native (pilot[c])**
Vitamin A	0% (all groups)	0% (all groups)	0% (all groups)

	Percentage of Diet Simulations <EAR Across 13 Age-Sex Groups[b]		
Vitamins	**Overall U.S.**	**American Indian (pilot[c])**	**Alaska Native (pilot[c])**
Vitamin C	0% (all groups)	0% (all groups)	0% (all groups)
Vitamin D	40%-100% (all groups)	45%-100% (all groups)	57%-100% (all groups)
Vitamin E	0%-70% (6/13 groups ≥10%)	0%-68% (6/13 groups ≥10%)	1%-100% (12/13 groups ≥10%)[d]
Thiamin	0% (all groups)	0% (all groups)	0% (all groups)
Riboflavin	0% (all groups)	0% (all groups)	0% (all groups)
Niacin	0% (all groups)	0% (all groups)	0% (all groups)
Vitamin B6	0% (all groups)	0% (all groups)	0% (all groups)
Folate	0%-3% (all groups)	0%-2% (all groups)	0%-4% (all groups)
Vitamin B12	0% (all groups)	0% (all groups)	0% (all groups)

[a]For nutrients with an Estimated Average Requirement (EAR), the nutritional criteria used to define adequacy were <10% of simulated diets with nutrient content below the EAR for the nutrient.

[b] Assessment was conducted for each of 13 age-sex groups and across simulations with 6 variations in the amounts of lower nutrient-dense foods (simulation with no reduction in lower nutrient-dense foods, simulations with reduced probability of including lower nutrient-dense foods at 75 percent, 50 percent, 25 percent, and 15 percent of the probability of all other foods, and simulation with no foods of lower nutrient density [0 percent]).

[c] Results from the pilot conducted to simulate foods and beverages identified as included in select American Indian and Alaska Native diets. Additional details on how the foods were identified are provided in the methodology section.

[d] Vitamin E criteria were not met in 12 of 13 age-sex groups on simulation with no foods of lower nutrient-density (0 percent) and not met in 11 of 13 groups on all other simulations.

For nutrients with an Adequate Intake (AI), the nutrient composition of simulated diets, as defined by the median of the distribution, is adequate (i.e., ≥AI) for alpha-linolenic acid, potassium, and vitamin K for all age-sex groups, including those for the pilot of American Indian and Alaska Native simulated diets with noted exception (**Table D.11.4**). For linoleic acid, adequacy was consistently met for ages 2 years and older, across simulations for foods consumed in U.S. and select American Indian diets. However, for simulations conducted with foods identified with Alaska Native diets, adequacy of simulated diets for linoleic acid was met only for the modified 2020 HUSS for ages 2 through 3 and 9 through 30 years, females 31+ years, and males 50+ years, with some exceptions. For fiber, adequacy was consistently met for the modified 2020 HUSS for U.S. and American Indian simulated diets for females ages 9 through 13 years, males and females 14 through 30 years, and females 31+ years, but not met for all other age-sex groups. For simulations conducted with foods identified with Alaska Native diets, adequacy of fiber was met only for females ages 9 years and above. Similar results were observed with varying inclusion of lower nutrient-dense foods. For choline, simulations of the modified 2020 HUSS for ages 2 through 13 years and for females ages 14 through 30 years were adequate, with some exceptions, but choline adequacy was generally not met for simulated diets for individuals ages 30 years and older for all groups. Adequacy was consistently met for linoleic acid for ages 2 years and older, across simulations for foods consumed in U.S. and select American Indian diets. However, for simulations conducted with foods identified with Alaska Native diets, adequacy of simulated diets for linoleic acid was generally met only for the modified 2020 HUSS for ages 2 through 3 and 9 through 30 years, females 31+ years, and males 50+ years, with some exceptions.

TABLE D.11.4
ASSESSMENT OF SIMULATED DIETS FOR NUTRIENTS WITH AN ADEQUATE INTAKE (AI)[a]

	Age Groups (in Years) that Met Criteria (Nutrient Content of Simulated Diets ≥AI[a,b])		
Nutrient	**Overall U.S.**	**American Indian (pilot[c])**	**Alaska Native (pilot[c])**
Alpha-Linolenic Acid	All age groups 2+	All age groups 2+	All except males 51+[d]
Linoleic Acid	All age groups 2+	All age groups 2+	Ages 2-3, 9-30, females 31+, males 51+[e]
Fiber	Ages 14-30 and females 9-13 and 31+	Ages 14-30 and females 9-13 and 31+	Females ages 9+
Potassium	All age groups 2+	All age groups 2+	All age groups 2+
Choline	Ages 2-13, females 14-30	Ages 2-13, females 14-30	Ages 2-13, females 14-30[f]
Vitamin K	All age groups 2+	All age groups 2+	All age groups 2+

[a]For nutrients without an Estimated Average Requirement, the nutritional criteria used to define adequacy were the median nutrient content of the distribution of simulated diets ≥ Adequate Intake (AI) for the nutrient.

[b]Assessment was conducted for each of 13 age-sex groups and across simulations with 6 variations in the amounts of lower nutrient-dense foods (simulation with no reduction in lower nutrient-dense foods, simulations with reduced probability of including lower nutrient-dense foods at 75 percent, 50 percent, 25 percent, and 15 percent of the probability of all other nutrient-dense foods, and simulation with no foods of lower nutrient density [0 percent]).

[c]Results from the pilot conducted to simulate foods and beverages identified as included in select American Indian and Alaska Native diets. Additional details on how the foods were identified are provided in the methodology section.

[d]Exception for males ages 51+ on simulation with no lower nutrient-dense foods and with 15 percent of the probability of lower nutrient-dense foods relative to all other foods.

[e]Exception where linoleic acid adequacy not met for males 51+ at 15 percent and 0 percent simulation for Alaska Native.

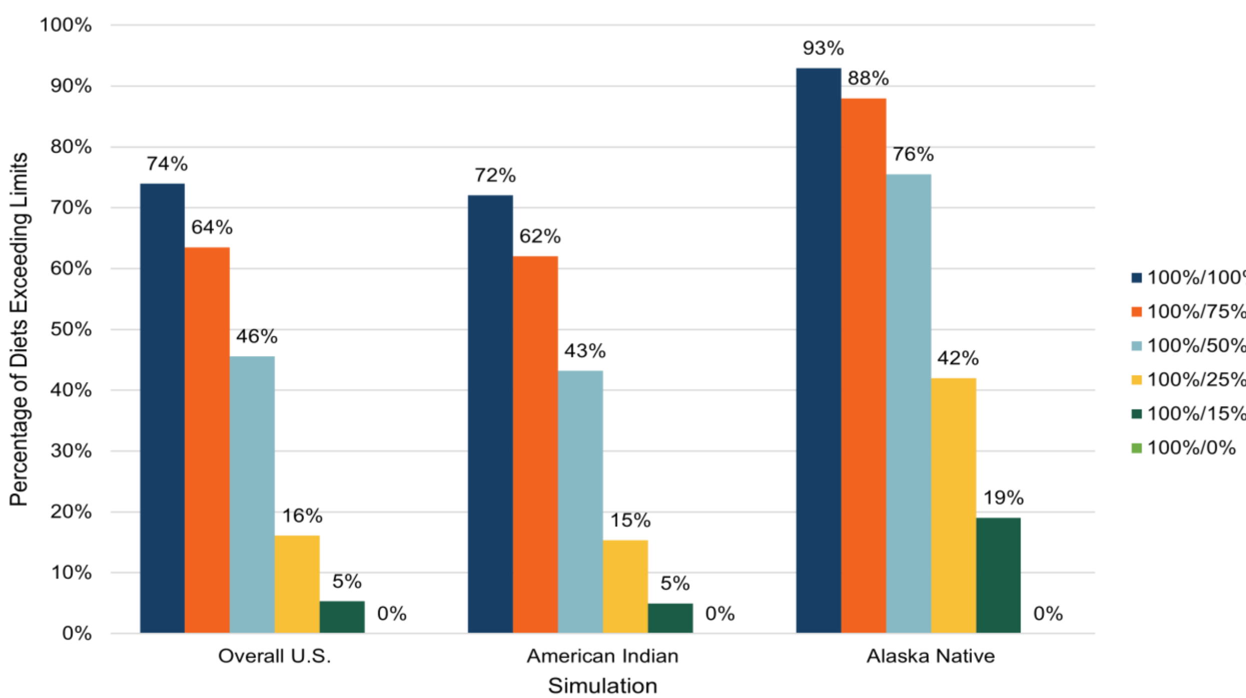
[f]Exceptions where choline adequacy met for females ages 14-18 (and not 14-30) at 25 percent and 0 percent simulation for Alaska Native.

For macronutrients, simulated diets met nutritional criteria if <20 percent were outside the AMDR for the nutrient. All simulated diets, regardless of the likelihood of including lower nutrient-dense foods, met the criteria for carbohydrate for all age-sex groups for overall U.S. and for the pilot simulations for American Indian and Alaska Native diets. For protein, all age-sex groups (including U.S., American Indian, and Alaska Native) met the criteria except for diets simulated to the modified 2020 HUSS for ages 2 through 3 years. Of those simulated diets, 50 percent or more exceeded the AMDR for protein content for the simulations that excluded lower nutrient-dense foods for U.S., American Indian, and Alaska Native diets. All other simulations met criteria. For total lipid content, simulated diets met criteria for all age-sex groups (including U.S., American Indians, and Alaska Native) except the modified 2020 HUSS for ages 2 through

3 years, which was found to be low in fat content. For ages 2 through 3 years, the percentage of diets below the AMDR across simulations with varying levels of lower nutrient-dense foods ranged from 46 percent to 91 percent for U.S., 53 percent to 91 percent for American Indian, and 26 percent to 98 percent for Alaska Native simulations.

Simulated diets met the established nutritional criteria for saturated fat content if <10 percent of diets exceeded the *Dietary Guidelines* recommendation that <10 percent of energy be from saturated fat. Overall, more than 70 percent of simulated diets exceeded the saturated fat limit when lower nutrient-dense foods were as likely to be included in diets as all other foods (100% probability of selection for lower nutrient-dense foods and 100% probability of selection for all other foods). The percentage of simulated diets that exceeded the limit decreased as the likelihood of including lower nutrient-dense foods in simulation decreased from 75 percent to 0 percent of other foods (**Figure D.11.2**). Although nutritional criteria for saturated fat were met overall in the U.S. and American Indian simulations when the likelihood of lower nutrient density was 15 percent of that of other foods (**Figure D.11.2**), criteria were not met in all age-sex groups for U.S., American Indian, and Alaska Native simulations until lower nutrient-dense foods were excluded from simulation.

FIGURE D.11.2
PERCENTAGE OF SIMULATED DIETS EXCEEDING LIMITS FOR SATURATED FAT BY PROBABILITY OF SELECTION OF LOWER NUTRIENT-DENSE FOODS[a, b, c]



[a]Simulated diets met nutritional criteria for saturated fat content if <10 percent of diets exceeded the recommendation that <10 percent of energy be from saturated fat.

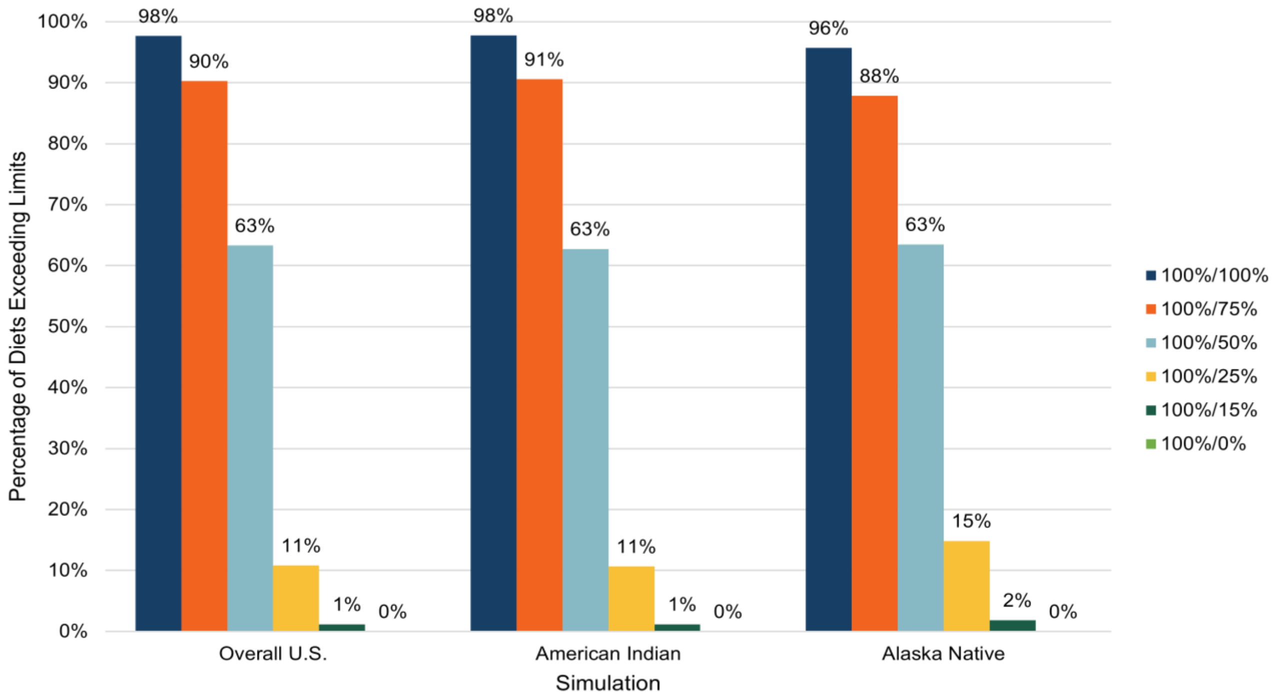
[b]Assessment was conducted for each of 13 age-sex groups, overall with all age-sex groups combined, and across simulations with 6 variations in the amounts of lower nutrient-dense foods relative to all other foods: simulation with no reduction in lower nutrient-dense foods (100%/100%), simulations

with reduced probability of including lower nutrient-dense foods at 75%, 50%, 25%, and 15% of the probability of all other foods (100%/75%, 100%/50%, 100%/25%, and 100%/15%, respectively), and simulation with no foods of lower nutrient density (100%/0%).

[c]Results for American Indian and Alaska Native are from the pilot conducted to simulate foods and beverages identified as included in select American Indian and Alaska Native diets. Additional details on the pilot are provided in the methodology section.

For added sugars, the established nutritional criteria were that <10 percent of simulated diets exceed the *Dietary Guidelines* recommendation that <10 percent of energy be from added sugars. Overall simulation results show that more than 95 percent of simulated diets exceeded the added sugars limit when lower nutrient-dense foods were as likely to be included in diets as all other foods (100%/100%). The percentage of simulated diets that exceeded the added sugars limit decreased as the inclusion of lower nutrient-dense foods in simulation decreased, but the nutritional criteria were not met across all age-sex groups until the probability of including foods of lower nutrient density was 15 percent of that of all other foods (**Figure D.11.3**). This finding was consistent for simulations conducted with foods and beverages reported as consumed across the United States and foods and beverages identified through a pilot as included in select American Indian diets and in Alaska Native diets, with a single exception (for ages 2 through 3 years).

FIGURE D.11.3
PERCENTAGE OF SIMULATED DIETS EXCEEDING LIMITS FOR ADDED SUGARS BY PROBABILITY OF SELECTION OF LOWER NUTRIENT-DENSE FOODS[a, b, c]



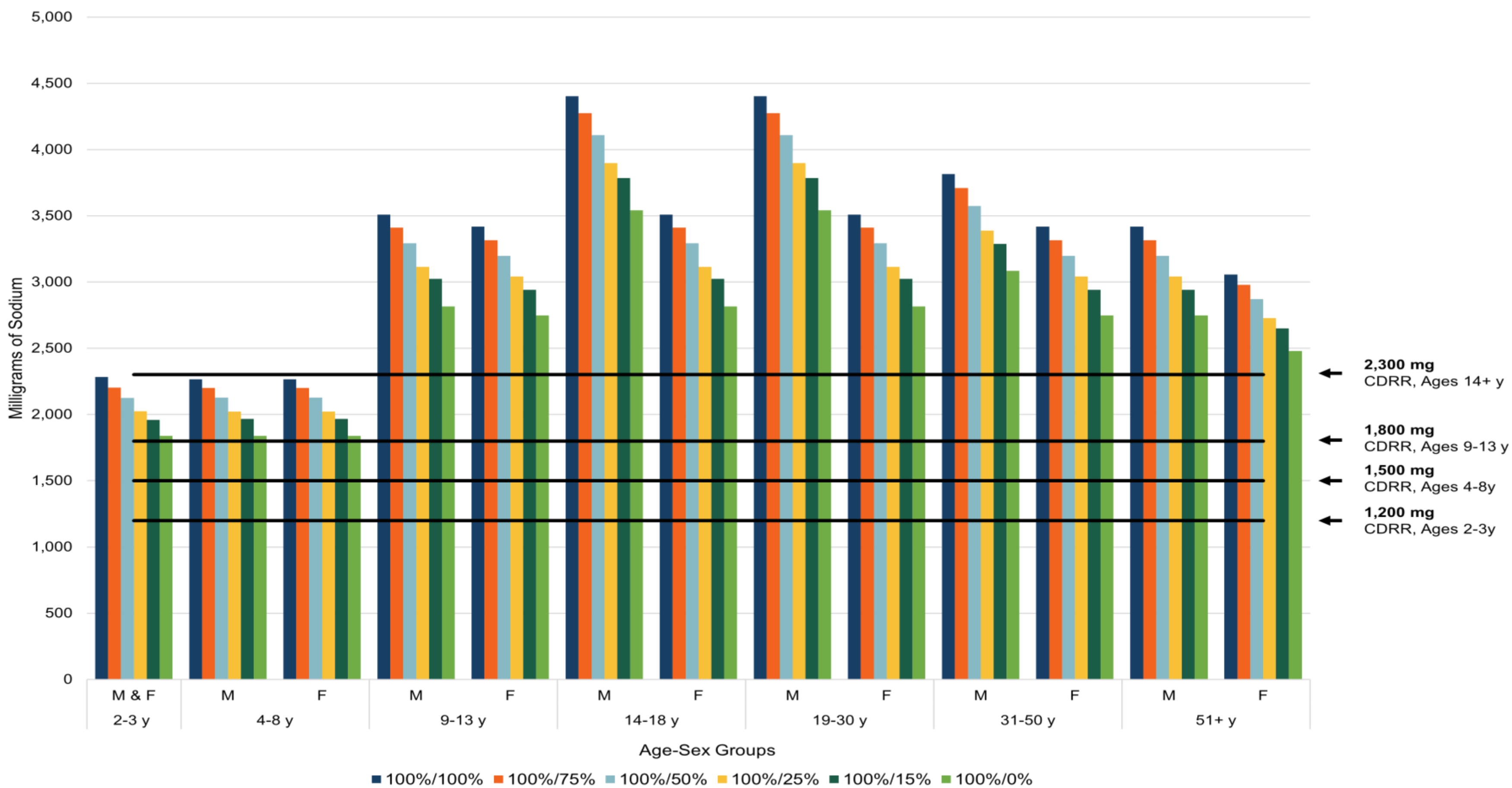
[a]Simulated diets met nutritional criteria for added sugars if <10 percent of diets exceeded the recommendation that <10 percent of energy be from added sugars.

[b]Assessment was conducted for each of 13 age-sex groups, overall for all age-sex groups combined, and across simulations with 6 variations in the amounts of lower nutrient-dense foods relative to all other foods: simulation with no reduction in lower nutrient-dense foods (100%/100%), simulations with reduced probability of including lower nutrient-dense foods at 75%, 50%, 25%, and 15% of the probability of all other foods (100%/75%, 100%/50%, 100%/25%, and 100%/15%, respectively), and simulation with no foods of lower nutrient density (100%/0%).

[c]Results for American Indian and Alaska Native are from the pilot conducted to simulate foods and beverages identified as included in select American Indian and Alaska Native diets. Additional details on the pilot are provided in the methodology section.

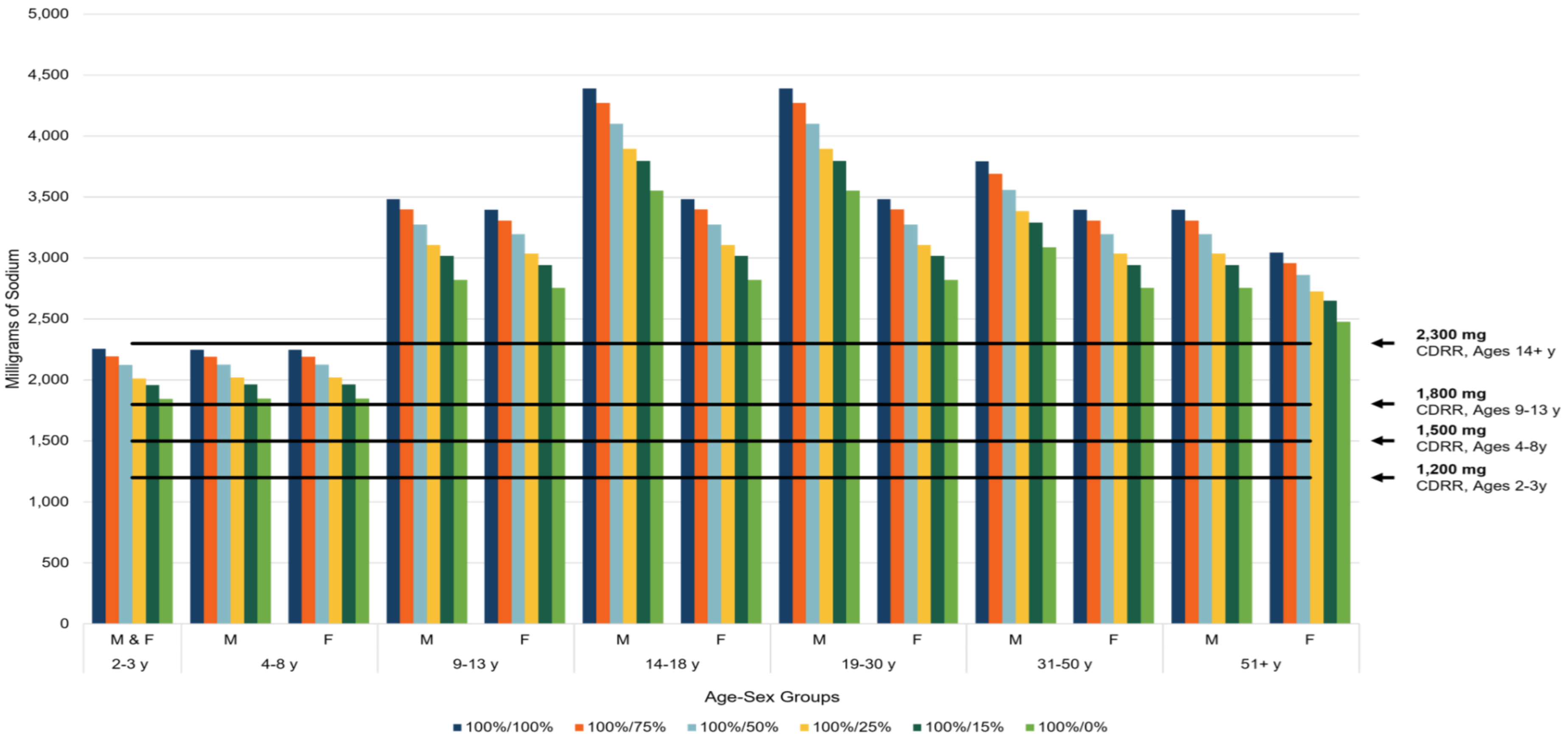
The established nutritional criteria for sodium were based on the Chronic Disease Risk Reduction Intake (CDRR) for the age-sex group. Diets simulated to meet the modified 2020 HUSS met the criteria if <10 percent of diets exceeded the CDRR. The analysis revealed that nearly all simulated diets for nearly all sex-age groups, including the overall U.S. and the pilot for American Indian and Alaska Native groups, exceeded the CDRR. Although the average sodium content of simulated diets for each age-sex group decreased as the inclusion of lower nutrient-dense foods in simulation decreased, CDRR criteria were not met even when lower nutrient-dense foods were excluded (**Figures D.11.4**, **D.11.5**, and **D.11.6**). The average reduction in sodium content of diets from simulation with no reduction in lower nutrient-dense foods (100%/100%) to exclusion of lower nutrient-dense foods (100%/0%) was about 19 percent for U.S. and American Indian simulations and 22 percent for Alaska Native simulations.

FIGURE D.11.4
AVERAGE SODIUM CONTENT OF SIMULATED DIETS BY AGE-SEX GROUP AND PROBABILITY OF SELECTION OF LOWER NUTRIENT-DENSE FOODS, U.S. DIETARY SURVEY DATA[a]



[a]Assessment was conducted for each of 13 age-sex groups and across simulations with 6 variations in the amounts of lower nutrient-dense foods relative to all other foods: simulation with no reduction in lower nutrient-dense foods (100%/100%), simulations with reduced probability of including lower nutrient-dense foods at 75%, 50%, 25%, and 15% of the probability of all other foods (100%/75%, 100%/50%, 100%/25%, and 100%/15%, respectively), and simulation with no foods of lower nutrient density (100%/0%).

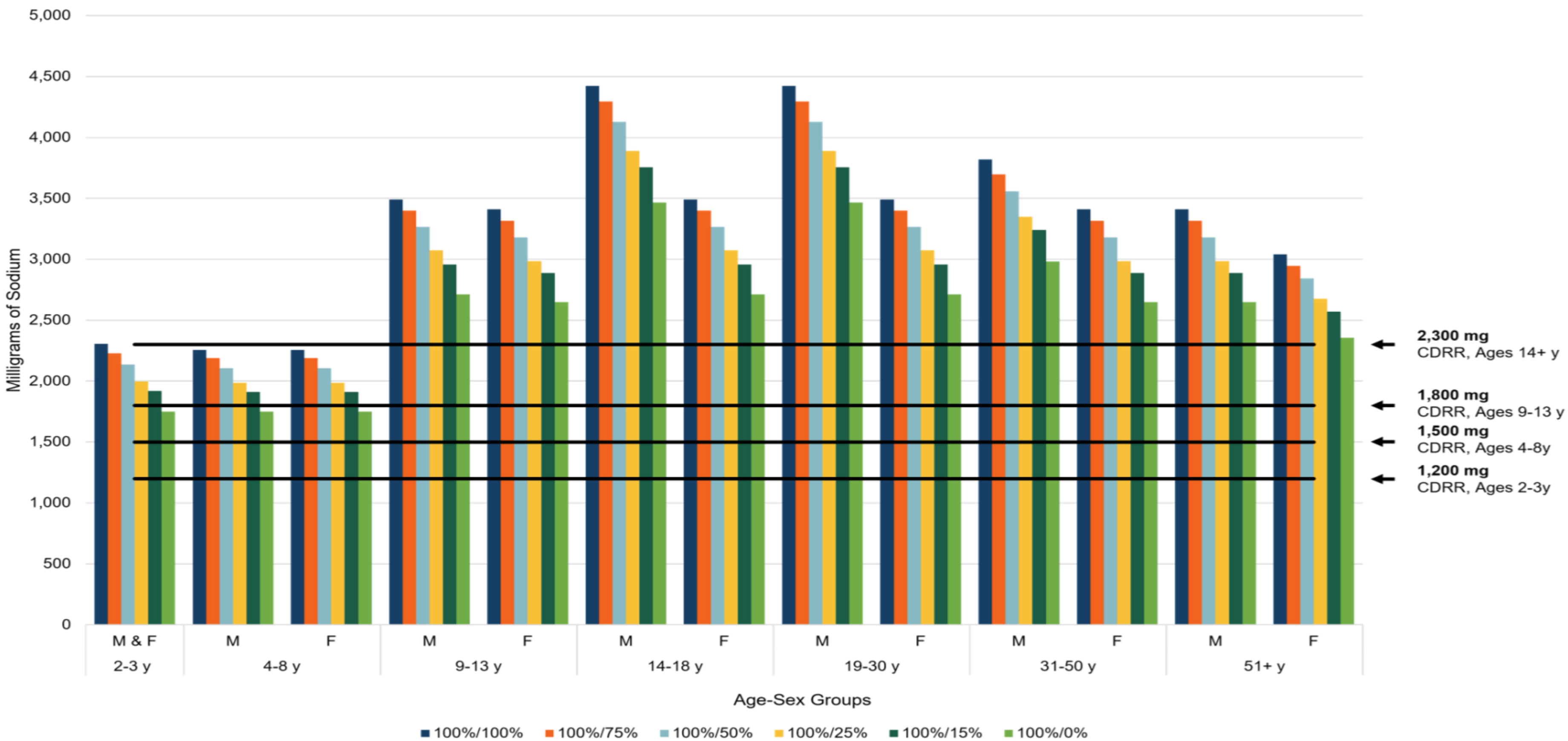
FIGURE D.11.5
AVERAGE SODIUM CONTENT OF SIMULATED DIETS BY AGE-SEX GROUP AND PROBABILITY OF SELECTION OF LOWER NUTRIENT-DENSE FOODS, AMERICAN INDIAN PILOT[a, b]



[a]Results for American Indian are from the pilot conducted to simulate foods and beverages identified as included in select American Indian diets. Additional details on the pilot are provided in the methodology section.

[b]Assessment was conducted for each of 13 age-sex groups and across simulations with 6 variations in the amounts of lower nutrient-dense foods relative to all other foods: simulation with no reduction in lower nutrient-dense foods (100%/100%), simulations with reduced probability of including lower nutrient-dense foods at 75%, 50%, 25%, and 15% of the probability of all other foods (100%/75%, 100%/50%, 100%/25%, and 100%/15%, respectively), and simulation with no foods of lower nutrient density (100%/0%).

FIGURE D.11.6
AVERAGE SODIUM CONTENT OF SIMULATED DIETS BY AGE-SEX GROUP AND PROBABILITY OF SELECTION OF LOWER NUTRIENT-DENSE FOODS, ALASKA NATIVE PILOT[a, b]



[a]Results for Alaska Native are from the pilot conducted to simulate foods and beverages identified as included in Alaska Native diets. Additional details on the pilot are provided in the methodology section.

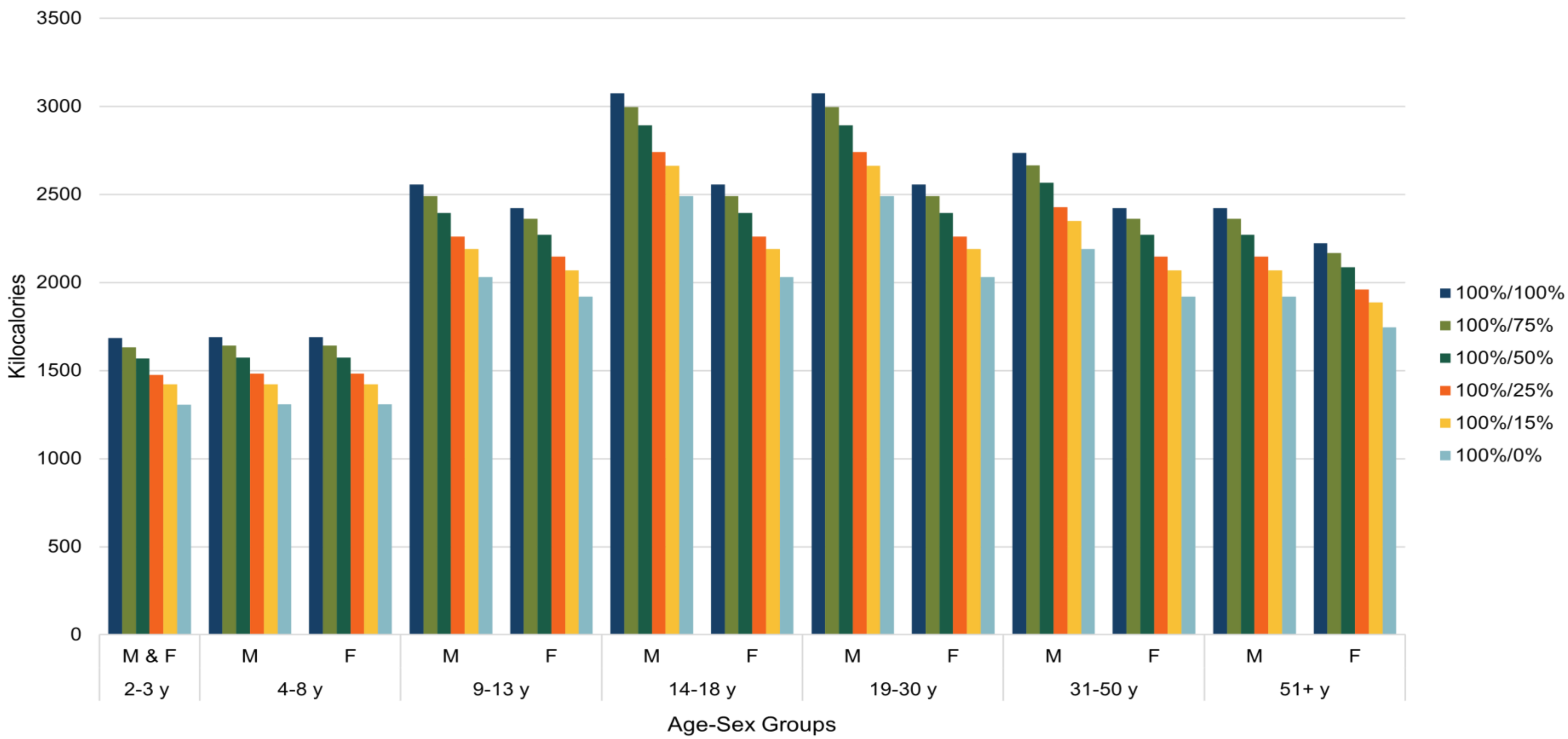
[b]Assessment was conducted for each of 13 age-sex groups and across simulations with 6 variations in the amounts of lower nutrient-dense foods relative to all other foods: simulation with no reduction in lower nutrient-dense foods (100%/100%), simulations with reduced probability of including lower nutrient-dense foods at 75%, 50%, 25%, and 15% of the probability of all other foods (100%/75%, 100%/50%, 100%/25%, and 100%/15%, respectively), and simulation with no foods of lower nutrient density (100%/0%).

The energy content of simulated diets was evaluated by comparing the median energy content of the distribution of simulated diets for each age-sex group to the assigned EER for the group. The nutritional criteria were set at the median being ≤EER. When lower nutrient-dense foods were as likely to be included in simulations as all other foods (100%/100%), U.S., American Indian, and Alaska Native simulated diets exceeded the EER by more than 450 kilocalories across all age-sex groups. When inclusion of lower nutrient-dense foods in simulation decreased, energy content of diets decreased, but only 3 age-sex groups (males ages 14 through 18, 19 through 30, and 31 through 50) met the criteria and that was achieved only when all lower nutrient-dense foods were excluded (**Figures D.11.7**, **D.11.8**, and **D.11.9**). When all foods of lower nutrient density were removed from simulations, the diets that exceeded the EER in the other 10 age-sex groups did so by 27 to 148 kilocalories.

Simulation was also conducted to assess the 2020 HUSS (which was not modified) for ages 12 through 23 months at the 800 kilocalorie per day level for this age group. The simulated diets were evaluated for meeting nutritional criteria for energy and the nutrients presented in this chapter for ages 2 years and older. The results were similar to those for ages 2 years and older, with few exceptions. Simulated diets for ages 12 through 23 months also fell short on potassium and linoleic acid. In addition, 10% to 13% of Alaska Native simulated diets for this age group fell short on folate.

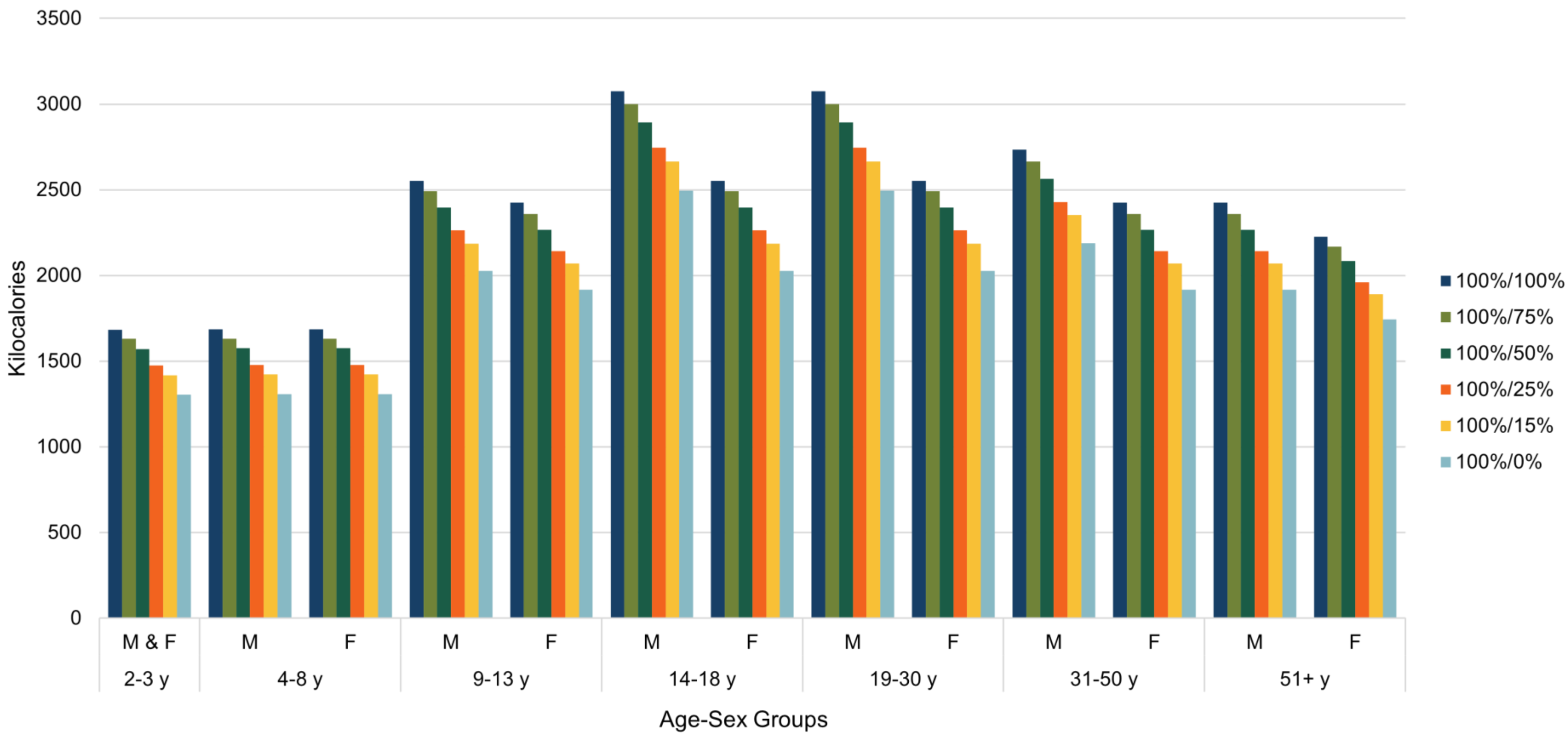
All analyses and a summary of the results can be found at:
http://www.DietaryGuidelines.gov/2025-advisory-committee-report/food-pattern-modeling

FIGURE D.11.7
MEDIAN ENERGY CONTENT OF SIMULATED DIETS BY AGE-SEX GROUP AND PROBABILITY OF SELECTION OF LOWER NUTRIENT-DENSE FOODS, U.S. DIETARY SURVEY DATA, OVERALL U.S.*



*Assessment was conducted for each of 13 age-sex groups and across simulations with 6 variations in the amounts of lower nutrient-dense foods relative to all other foods: simulation with no reduction in lower nutrient-dense foods (100%/100%), simulations with reduced probability of including lower nutrient-dense foods at 75%, 50%, 25%, and 15% of the probability of all other foods (100%/75%, 100%/50%, 100%/25%, and 100%/15%, respectively), and simulation with no foods of lower nutrient density (100%/0%).

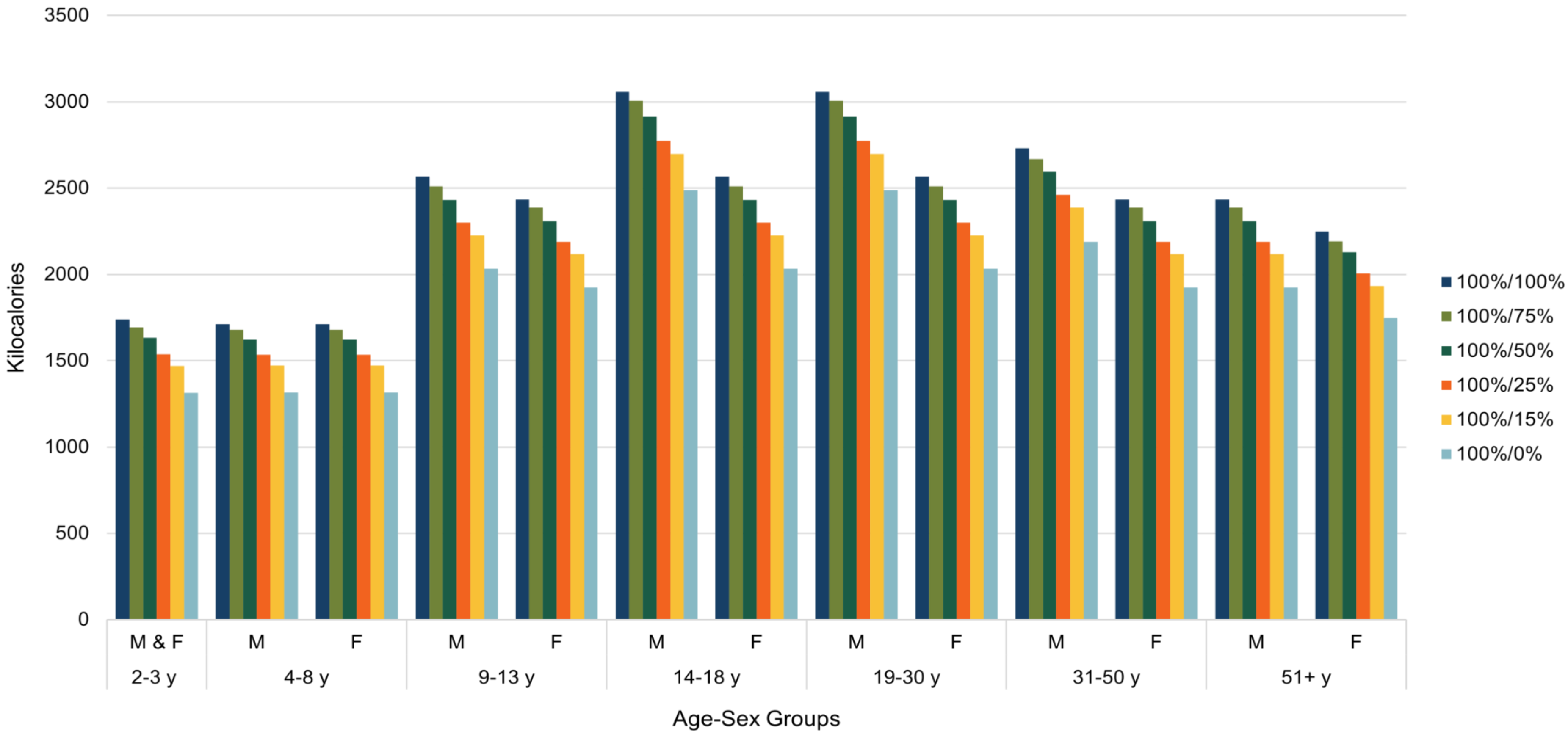
FIGURE D.11.8
MEDIAN ENERGY CONTENT OF SIMULATED DIETS BY AGE-SEX GROUP AND PROBABILITY OF SELECTION OF LOWER NUTRIENT-DENSE FOODS, U.S. DIETARY SURVEY DATA, AMERICAN INDIAN PILOT[a, b]



[a]Results for American Indian are from the pilot conducted to simulate foods and beverages identified as included in select American Indian diets. Additional details on the pilot are provided in the methods section.

[b]Assessment was conducted for each of 13 age-sex groups and across simulations with 6 variations in the amounts of lower nutrient-dense foods relative to all other foods: simulation with no reduction in lower nutrient-dense foods (100%/100%), simulations with reduced probability of including lower nutrient-dense foods at 75%, 50%, 25%, and 15% of the probability of all other foods (100%/75%, 100%/50%, 100%/25%, and 100%/15%, respectively), and simulation with no foods of lower nutrient density (100%/0%).

FIGURE D.11.9
MEDIAN ENERGY CONTENT OF SIMULATED DIETS BY AGE-SEX GROUP AND PROBABILITY OF SELECTION OF LOWER NUTRIENT-DENSE FOODS, U.S. DIETARY SURVEY DATA, ALASKA NATIVE PILOT[a, b]



[a]Results for Alaska Native are from the pilot conducted to simulate foods and beverages identified as included in Alaska Native diets. Additional details on the pilot are provided in the methods section.

[b]Assessment was conducted for each of 13 age-sex groups and across simulations with 6 variations in the amounts of lower nutrient-dense foods relative to all other foods: simulation with no reduction in lower nutrient-dense foods (100%/100%), simulations with reduced probability of including lower nutrient-dense foods at 75%, 50%, 25%, and 15% of the probability of all other foods (100%/75%, 100%/50%, 100%/25%, and 100%/15%, respectively), and simulation with no foods of lower nutrient density (100%/0%).

Discussion

This chapter summarizes the first use by a Dietary Guidelines Advisory Committee of simulation analysis to construct weekly diets from thousands of different combinations of individual foods and beverages in amounts designed to meet food group and subgroup recommendations across age-sex groups. Diet simulation results suggest that nutrient requirements can generally be met when considering variation in dietary intake. Simulations conducted for U.S. diets overall using foods and beverages reported as consumed in national dietary surveys as well as simulations using foods identified by experts as included in select American Indian and Alaska Native diets showed that for nutrients with an Estimated Average Requirement (EAR), less than 10 percent of simulated diets for each sex and age group are inadequate (<EAR) for most nutrients.

Notably, the modified 2020 HUSS evaluated here did not meet the criteria that the Committee used for a few food components and nutrients. Vitamins D and E were inadequate in >10 percent of simulated diets for the U.S., American Indian, and Alaska Native groups. In general, the choline content of simulated diets was not adequate for adults older than age 30 years, and fiber content was not adequate for diets of children younger than age 9 years. Simulated diets for ages 2 through 3 years exceeded the AMDR for protein when lower nutrient-dense foods were excluded and fell below the AMDR for total lipids in all analyses. The percentage of diets outside of the AMDR for protein and total fat was much greater than the target of <20 percent for this age group. The limits for added sugars and saturated fat did not meet the targets for all age-sex groups unless the probabilities of including foods with lower nutrient density was lowered to 15 percent or 0 percent of the probability of including other foods.

An important result to highlight is the failure of any of the simulations across all population groups to meet the nutritional criteria of <10 percent of simulated diets exceeding the CDRR for sodium. Foods higher in sodium were defined as foods containing >345 milligrams of sodium per serving. At this limit, however, simulated diets for the U.S. population as well as select American Indiana and Alaska Native populations, were unable to achieve nutritional criteria for sodium even when all foods exceeding the 345 milligram per serving limit were excluded. Lower limits of sodium would be necessary to achieve CDRR levels in simulated diets. Although the simulation results do not mean that achieving CDRR levels is impossible, the results do suggest that decreasing sodium to levels expected to reduce chronic disease risk is unlikely without considerable efforts to decrease sodium in the U.S. food supply.

The energy content of simulated diets exceeded the assigned EER even when lower nutrient-dense foods were excluded. The exception is for males ages 14 through 50 years for whom simulated diets did not exceed energy estimates when lower nutrient-dense foods were excluded. These analyses differ from prior FPM results in that food pattern modeling used only nutrient-dense foods and beverages. Thus, increased flexibility in food choices demonstrates potential impacts on meeting nutrient needs within energy limits. Even when lower nutrient-dense foods were excluded from simulation, simulations not meeting criteria exceeded EER by 27 to 148 kilocalories per day. Another factor that may have impacted the energy content of simulated diets was a methodological challenge with the oil content of simulated diets exceeding the amount of oils recommended in the modified 2020 HUSS. This challenge was unique to the recommended amount of oils as no other food group or subgroup amount recommended in the modified 2020 HUSS was exceeded in simulated diets. The oil content of foods included across food groups and subgroups contributed to this issue. For example, in the simulation of U.S. diets in the main analysis, as the simulation advanced separately for each food group and subgroup, 58 percent of simulated diets exceeded the amount of oil recommended before simulation advanced to Oils.[6] When the simulation advanced to Oils, oil was only selected into the 42 percent of diets that had not yet met the amount of oil recommended in the modified 2020 HUSS until the recommendation was met. The excess oil in the other 58 percent of simulated diets may have contributed to excess energy content of the diets. However, the contribution does not account for all of the excess energy. For example, the average excess in oil was 22.5 grams per 7-day diet (3.2 grams daily) across the main U.S. simulations. This would account for approximately 29 additional kilocalories per day, similar to the excess energy observed in simulations for males ages 9 through 13 and females ages 14 through 30 years when lower nutrient-dense foods were excluded, but less than the excess observed for 7 other age-sex groups.

Although future efforts will aim to simulate foods and beverages that are integral to all foodways in the United States, in this cycle the opportunity to simulate foods and beverages integral to diets of select American Indian and Alaska Native populations provided valuable information as to the representativeness of the *Dietary Guidelines* within the diets of the tribal communities assessed. The simulations confirmed that nutrient requirements could be met using the foods identified as integral and included in those diets with limited exceptions; that finding was consistent across the U.S. population, not just the select American Indian and Alaska Native diets.

This positive first step in using diet simulations allowed for the inclusion of foods and beverages identified by experts as integral to and consumed by select American Indian and Alaska Native groups, who continue to experience significant health disparities. These simulation analysis efforts advance the Committee-wide goals for health equity and ensuring that the *Dietary Guidelines* are relevant and actionable across all segments of the U.S. population.

Available dietary intake data for American Indian and Alaska Native groups are extremely limited. This chapter describes a pilot conducted to address this limitation by having experts with professional and lived experience in the culture identify the foods and beverages used for simulation of American Indian and Alaska Native diets. The experts represent only a small number of American Indian and Alaska Native groups and do not represent all individuals included within these populations. Research on the dietary patterns and preferences of American Indian and Alaska Native populations is needed to address knowledge gaps regarding the diets of the more than 575 federally recognized Native American Nations that exist in the United States. Improved measures that capture the diverse foods and cultural practices that exist within these populations are greatly needed, particularly measures that include foraged foods and foods not typically available at local grocery stores. Many American Indian and Alaska Native populations distinguish between traditional Indigenous foods, often known only in their Native languages and not easily identified by their English names on surveys, and Western foods, which are those most readily available in stores. Inclusion of American Indian and Alaska Native populations in the design and methods of food intake measures can address the paucity of research within this topic.

Future directions must include prioritizing research that examines dietary intake and food access among marginalized populations with significant health disparities.

Summary

Health equity was a guiding principle across the Committee's work. The Committee took an exciting step toward achieving nutrition and health equity by using a systems science approach—the first use of such an approach in the history of the *Dietary Guidelines* development process—to evaluate the ability of the modified 2020 HUSS to meet people of the United States where they are. Specifically, using diet simulations, the Committee was able to examine the capacity of a wide range of foods consumed in the United States, including lower nutrient-dense foods, to meet the modified 2020 HUSS. The Committee discussed the need for conducting diet simulations by foodways and including considerations for access and price, among other factors. Given time constraints and the novelty of this approach, the Committee unanimously prioritized American Indian and Alaska Native populations in the pilot method to identify foods and beverages to use in the simulation analyses and recommended that future work in this area be expanded to represent all U.S. population groups.

Results from the Committee's analyses indicate that nutrient requirements can generally be met with the modified 2020 HUSS when considering a wide variety of foods consumed in the United States and included in select American Indian and Alaska Native diets. The results also indicate that recommended food group amounts should be met predominantly with foods and beverages lower in added sugars, saturated fat, and sodium. However, the criteria used to reduce the sodium content of simulated diets did not achieve the criteria of <10 percent of simulated diets exceeding the CDRR. This highlights the need for a concerted effort across multiple sectors to decrease sodium in the U.S. food supply.

The Committee chose to include diet simulations, a systems modeling approach, in its review of the evidence. Future Committees should consider expanding these approaches to study the linkages and interrelationships within and between systems to holistically understand diet-disease relationships.

Next Steps in the 2025 FPM Process

The previous chapter (**Part D. Chapter 10: Food Group and Subgroup Analysis**) described the analyses conducted to develop the modified 2020 HUSS. This chapter **Part D. Chapter 11: Diet Simulations** describes the evaluation of the modified 2020 HUSS for a wider variation in dietary intakes using diet simulation. Simulated diets that met the modified 2020 HUSS were also evaluated for variation in the amounts of lower nutrient-dense foods included. As a result of the findings presented for simulations using foods consumed in the United States overall and foods identified as included in select American Indian and Alaska Native diets, the Committee did not further refine the modified 2020 HUSS; however, meeting food group amounts with foods and beverages lower in added sugars, saturated fat, and sodium is emphasized. For more information on the final pattern(s) proposed to the Departments, see **Part E. Chapter 1: Overarching Advice to the Departments**.

References

1. Katamay SW, Esslinger KA, Vigneault M, et al. Eating well with Canada's Food Guide (2007): development of the food intake pattern. *Nutr Rev*. Apr 2007;65(4):155-66. doi:https://doi.org/10.1111/j.1753-4887.2007.tb00295.x
2. Elvidge Munene LA, Dumais L, Esslinger K, et al. A surveillance tool to assess diets according to Eating Well with Canada's Food Guide. *Health Rep*. Nov 2015;26(11):12-20.
3. Dietitians Association of Australia. *A Modelling System to Inform the Revision of the Australian Guide to Healthy Eating*. Australian Government, Department of Health and Ageing, National Health and Medical Research Council; 2011. https://www.eatforhealth.gov.au/sites/default/files/files/the_guidelines/n55c_dietary_guidelines_food_modelling.pdf
4. National Academies of Sciences, Engineering, and Medicine. *Redesigning the Process for Establishing the Dietary Guidelines for Americans*. Washington, DC: The National Academies Press; 2017. https://doi.org/10.17226/24883
5. Gutuskey L, Neenan R, Hammond RA, Wagner H. *Applicability of systems science approaches to the Dietary Guidelines for Americans*. U.S. Department of Agriculture, Food and Nutrition Service; 2023. https://www.dietaryguidelines.gov/sites/default/files/2024-02/Systems%20Science%20DGA%20Report_Final_508-compliant_rev.pdf
6. Kranker K, Hotchkiss J, Bardin S. *Diet Simulations with the Modified 2020 Healthy U.S.-Style Dietary Pattern*. U.S. Department of Agriculture, Food and Nutrition Service; 2024. https://doi.org/10.52570/DGAC2025.FPM12
7. Vallverdú J. What are Simulations? An Epistemological Approach. *Procedia Technology*. 2014 2014;13:6-15. doi:https://doi.org/10.1016/j.protcy.2014.02.003
8. U.S. Department of Agriculture, Agricultural Research Service. *USDA Food and Nutrient Database for Dietary Studies 2017-2018*. 2020. https://www.ars.usda.gov/nea/bhnrc/fsrg
9. U.S. Department of Agriculture, Agricultural Research Service, Beltsville Human Nutrition Research Center. *FoodData Central*. 2019. https://fdc.nal.usda.gov
10. U.S Department of Health and Human Services, Food and Drug Administration, Center for Food Safety and Applied Nutrition. *Questions and Answers About Dietary Guidance Statements in Food Labeling: Guidance for Industry Draft Guidance*. 2023. https://www.fda.gov/media/166342/download
11. Health Canada. *2019 Canada's Food Guide Food Classification System: Development & Validation*. 2022. https://www.canada.ca/content/dam/hc-sc/documents/services/publications/food-nutrition/2019-canada-food-guide-food-classification-system-development-validation/2019-canada-food-guide-food-classification-system-development-validation.pdf

Part E. Chapter 1: Overarching Advice to the Departments

Introduction

The 2025 Dietary Guidelines Advisory Committee's (Committee) evidence from data analysis demonstrates that current U.S. dietary intakes of many food groups, nutrients, and dietary components continue to fall short of recommendations outlined in the *Dietary Guidelines for Americans, 2020-2025*.[1] The result is that dietary intakes—which the Committee examined at the population level and by various sociodemographic groups—do not align with evidence-based dietary patterns that promote consumption of a variety of nutrient-dense foods and beverages. Nutrition-related chronic health conditions and their precursors continue to threaten health throughout the lifespan, starting as early as childhood and adolescence, which does not bode well for the future of health in the United States. These overarching findings, and the conclusion statements supporting them, are consistent with those of the 2020 Committee.[2] More information about diet quality, intakes of food groups and subgroups, prevalence of nutrition-related chronic health conditions, and identification of nutrients and dietary components of public health concern is in **Part D. Chapter 1: Current Dietary Intakes and Prevalence of Nutrition-Related Chronic Health Conditions**.

A cornerstone of the Committee's work is consideration of conclusion statements from systematic reviews to inform evidence-based dietary guidance in relation to key health indicators.[3] Whereas most of the systematic review questions addressed by this Committee were also reviewed by previous Committees, this is the first time that systematic review questions were examined through a health equity lens. The Committee's conclusion statements are generally consistent with findings of prior Committees that have examined relationships between dietary patterns and various health outcomes, especially for adults. At the same time, the current systematic reviews resulted in new evidence and conclusion statements—such as those related to strategies for achieving healthy dietary patterns, including portion sizes and frequency of meals and snacks—that can be translated for incorporation into the *Dietary Guidelines for Americans, 2025-2030*. More information about findings from the systematic reviews is in **Part D: Chapter 2: Dietary Patterns**, **Chapter 3: Beverages**, **Chapter 4: Food Sources of Saturated Fat**, **Chapter 5: Complementary Feeding and Feeding Styles and Practices During Childhood**, **Chapter 6: Frequency of Meals and/or Snacking**, and **Chapter 7: Portion Size**.

The current USDA Dietary Patterns are the amalgamation of strong scientific evidence accumulated over many years and build on the collective work of prior Committees. The 3 existing USDA Dietary Patterns are the 2020 Healthy U.S.-Style (HUSS), the 2020 Healthy Mediterranean-Style (H-MED), and the 2020 Healthy Vegetarian (H-VEG), which include quantities of food groups and subgroups that broadly meet nutrient requirements based on the Dietary Reference Intakes (DRI) and other nutritional goals across age-sex groups and life stages, with few exceptions. The integration of evidence from data analysis, systematic reviews, and food pattern modeling through a health equity lens allowed the Committee to examine how flexibilities and modifications within individual food groups and subgroups could be incorporated into these 3 patterns to represent intakes of diverse population groups. The modified

2020 HUSS was the proposed pattern used by the Committee in the synthesis of all food pattern modeling analyses that are discussed in **Part D: Chapter 9: Nutrient Profiles** and **Chapter 10: Food Group and Subgroup Analyses**. The Committee used diet simulations to evaluate whether the modified 2020 HUSS achieves nutritional goals, considering variability in the selection and consumption of foods and beverages. This was the first use of diet simulations by a Dietary Guidelines Advisory Committee, and this approach of simulating foods and beverages consumed by the overall U.S. population, as well as a pilot to simulate foods identified as included in select American Indian and Alaska Native diets, provided an opportunity to consider a wide selection of foods and beverages obtained from the current food system, across diverse cultural groups and environments. These simulations generally met nutrient goals with few exceptions, suggesting that the modified 2020 HUSS accounts for variation (i.e., the different ways that individuals might eat) in dietary intakes. More information on diet simulations is in **Part D. Chapter 11: Diet Simulations.**

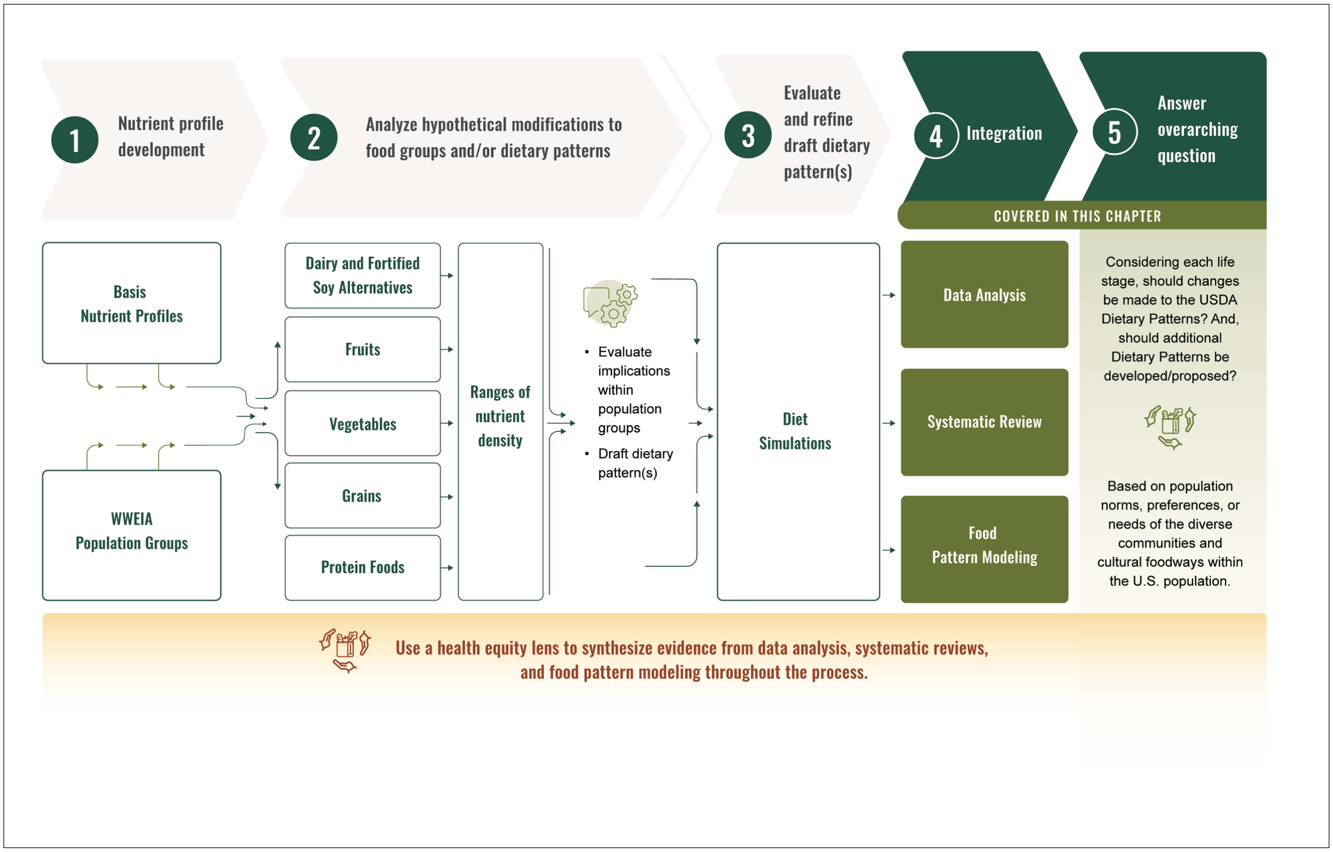
This chapter integrates the Committee's findings and conclusions across the 3 approaches it took to examine evidence—data analysis, systematic reviews, and food pattern modeling (detailed in Part D. Chapters 1 through 11)—to provide overarching advice to the U.S. Departments of Health and Human Services and Agriculture (the Departments), including answering the overarching question of whether changes should be made to current USDA Dietary Patterns (**Figure E.1.1**). The *Dietary Guidelines for Americans, 2020-2025* provides 4 overarching Guidelines that encourage healthy eating patterns at each stage of life and recognize that individuals will need to make shifts in their food and beverage choices to achieve a healthy pattern. This chapter also summarizes the Committee's advice to the Departments regarding these 4 overarching Guidelines.

Overarching Question: Considering each life stage, should changes be made to the USDA Dietary Patterns (Healthy U.S.-Style, Healthy Mediterranean-Style, and/or Healthy Vegetarian), and should additional Dietary Patterns be developed/proposed based on:

- Findings from systematic reviews, data analysis, and/or food pattern modeling analyses; and Population norms, preferences, or needs

Approach to Answering Question: Food Pattern Modeling, Systematic Reviews, and Data Analysis

FIGURE E.1.1
2025 INTEGRATION TO ANSWER OVERARCHING QUESTION



As the Committee considered conclusion statements from the systematic reviews, which encompassed multiple life stages, a dietary pattern emerged that was consistently beneficial for health. This healthy dietary pattern for individuals ages 2 years and older is: (1) higher in vegetables, fruits, legumes, nuts, whole grains, fish/seafood, and vegetable oils higher in unsaturated fat; and (2) lower in red and processed meats, sugar-sweetened foods and beverages, refined grains, and saturated fat. A healthy dietary pattern, as indicated by the systematic reviews, may also include consumption of fat-free or low-fat dairy and foods lower in sodium, and/or may include plant-based dietary options.

Proposed *Eat Healthy Your Way* Dietary Pattern

The Committee's proposed modifications to the 2020 HUSS reflect the synthesis across food pattern modeling (FPM) analyses and integration of evidence from systematic reviews and data analysis. The results are described in detail in the Synthesis FPM report and summarized here.[4] To better align the 2020 HUSS pattern with the systematic evidence reviewed, the Committee recommends modifications that emphasizes dietary intakes of beans, peas, and lentils while reducing intakes of red and processed meats. The Committee also recommends removing the line in the 2020 HUSS that presents "Limits on Calories for Other Uses." The proposed name of this pattern is the *Eat Healthy Your Way* Dietary Pattern. The following sections provide further details about this proposed pattern.

Emphasize Intakes of Beans, Peas, and Lentils and Reduce Intakes of Red and Processed Meats

Compelling evidence was noted in the systematic reviews in which dietary patterns that had higher levels of beans, peas, and lentils (often presented in the literature as "legumes") were associated with beneficial health outcomes. FPM analyses indicated that the energy increase from an increase in the Beans, Peas, and Lentils Subgroup could be offset by a proposed decrease in the Starchy Vegetables Subgroup, with no negative implications on meeting nutritional goals.[5] Systematic review evidence also consistently indicated that dietary patterns with higher intakes of red and processed meats were related to detrimental health consequences, whereas dietary patterns with higher intakes of fish and seafood were related to beneficial health outcomes (see **Part D. Chapter 2: Dietary Patterns** and **Part D. Chapter 4: Food Sources of Saturated Fat**). Intakes of animal protein foods considered in systematic reviews were within the range of typical intakes in U.S. diets, although data analysis results indicate that foods and beverages consumed in the United States are not commonly in the most nutrient-dense forms.

The systematic review findings emphasize the health benefits of increasing beans, peas, and lentils while reducing red and processed meats, and FPM analyses indicate that nutrient goals are generally met and no new nutrient shortfalls are introduced as the 2020 HUSS is shifted to include more plant-based Protein Foods.[5] The Committee also recommends that the Beans, Peas, and Lentils Subgroup move from the Vegetables Food Group to the Protein Foods Group to align with evidence to encourage greater consumption of plant-based Protein Foods. Moving Beans, Peas, and Lentils will reduce the quantity of Vegetables in the pattern by 0 to 0.5 cup eq/day and increase the quantity of Protein Foods in the pattern by 0.50 to 1.75 ounce eq/day in the 2,200 to 3,200 calorie levels. The Committee recognizes that this shift to the pattern would require clear communication to explain that it is not recommending that individuals—many of whom do not meet current Vegetables recommendations—decrease vegetable intake, nor is it recommending that all individuals increase protein intake. The Committee proposes reorganizing the order of the Protein Foods Subgroups to list Beans, Peas, and Lentils first, followed by Nuts, Seeds, and Soy Products, then Seafood, and finally Meats, Poultry, and Eggs. This reordering of Protein Foods emphasizes the health benefits of more plant-based Protein Foods.

Remove Line for "Limits on Calories for Other Uses"

The 2020 HUSS contains a line for "Limits on Calories for Other Uses" within the pattern to represent a quantitative estimate of calories remaining after all other foods in the pattern are consumed in their most nutrient-dense forms. Guidance in the *Dietary Guidelines for Americans, 2020-2025* is that these calories can be used for added sugars, saturated fat, and/or alcohol, or to eat more than the recommended amount of food in a food group. Given inherent variability in energy content of nutrient-dense foods and beverages, depending on the individual item selected, an estimate of remaining energy (i.e., as calories for other uses) may be misleading in that calories for other uses may not actually be available because calorie needs may already be fulfilled. Therefore, the Committee recommends removing the line and portrayal of "Limits on Calories for Other Uses" from the pattern.

Core Elements of Healthy Dietary Patterns and Food Group and Subgroup Quantities in the *Eat Healthy Your Way* Dietary Pattern

Systematic reviews demonstrate that the 2020 HUSS, H-VEG, H-MED (**Table E.1.1.**), and other healthy dietary patterns have similar core elements, regardless of the label used or the name of the dietary pattern. The Committee's proposed modifications retained these core elements. Therefore, the Committee proposes a single, inclusive dietary pattern that offers flexibilities to support individual needs and preferences. The proposed name of this pattern—*Eat Healthy Your Way*—recognizes that a healthy eating style can be flexible to support individual variation in dietary intake. The Committee considered various potential names for the dietary pattern to illustrate flexibility and inclusivity and selected *Eat Healthy Your Way* for the purposes of this report. The Committee recommends the Departments conduct research with consumers and/or health professionals to finalize the dietary pattern name. The food group and subgroup quantities that correspond to daily calorie levels from 1,000 to 3,200 calories for the *Eat Healthy Your Way* Dietary Pattern are provided in **Table E.1.2**.

TABLE E.1.1
CORE ELEMENTS OF HEALTHY DIETARY PATTERNS AT THE 2,000-CALORIE LEVEL, WITH DAILY OR WEEKLY AMOUNTS FROM FOOD GROUPS, SUBGROUPS, AND COMPONENTS

Food Group	2020 Healthy U.S.- Style Dietary Pattern	2020 Healthy Vegetarian Dietary Pattern	2020 Healthy Mediterranean-Style Dietary Pattern
Vegetables (cup eq/day)	**2 ½**	**2 ½**	**2 ½**
Dark-Green Vegetables (cup eq/week)	1 ½	1 ½	1 ½
Red and Orange Vegetables (cup eq/week)	5 ½	5 ½	5 ½
Beans, Peas, and Lentils (cup eq/week)	1 ½	1 ½	1 ½
Starchy Vegetables (cup eq/week)	5	5	5

Food Group	2020 Healthy U.S.- Style Dietary Pattern	2020 Healthy Vegetarian Dietary Pattern	2020 Healthy Mediterranean-Style Dietary Pattern
Other Vegetables (cup eq/week)	4	4	4
Fruits (cup eq/day)	**2**	**2**	**2 ½**
Grains (ounce eq/day)	**6**	**6 ½**	**6**
Whole Grains (ounce eq/day)	≥ 3	≥ 3 ½	≥ 3
Refined Grains (ounce eq/day)	< 3	< 3	< 3
Dairy and Fortified Soy Alternatives (cup eq/day)	**3**	**3**	**2**
Protein Foods (ounce eq/day)	**5 ½**	**3 ½**	**6 ½**
Meats, Poultry, and Eggs (ounce eq/week)	26	3 (Eggs)	26
Beans, Peas, and Lentils (ounce eq/week)	(See Vegetables)	6	(See Vegetables)
Seafood (ounce eq/week)	8	n/a	15
Nuts, Seeds, and Soy Products (ounce eq/week)	5	7 (Nuts, Seeds)	5
Soy Products (ounce eq/week)	(See Nuts, Seeds)	8	(See Nuts, Seeds)
Oils (grams/day)	**27**	**27**	**27**
Limit on Calories for Other Uses (kcal per day)	**240**	**250**	**240**
Limit on Calories for Other Uses (Percentage of Calories per Day)	**12%**	**13%**	**12%**

When Beans, Peas, and Lentils are counted within Vegetables, they are quantified using cup eq. To convert to ounce eq for counting in Protein Foods, the Vegetables quantities can be multiplied by 4 (i.e., 1 cup eq Beans, Peas, and Lentils equals 4 ounce equivalents).

TABLE E.1.2
EAT HEALTHY YOUR WAY **DIETARY PATTERN, WITH DAILY OR WEEKLY AMOUNTS FROM FOOD GROUPS, SUBGROUPS, AND COMPONENTS[a]**

Food Groups and Subgroups	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
Vegetables (cup eq/day)	**¾**	**1 ¼**	**1 ¼**	**1 ¾**	**2 ¼**	**2 ¼**	**2 ½**	**2 ½**	**3**	**3**	**3 ½**	**3 ½**
Dark-Green Vegetables (cup eq/week)	½	1	1	1 ½	1 ½	1 ½	2	2	2 ½	2 ½	2 ½	2 ½
Red and Orange Vegetables (cup eq/week)	2 ½	3	3	4	5 ½	5 ½	6	6	7	7	7 ½	7 ½
Starchy Vegetables (cup eq/week)	1 ½	3	2 ½	3	4	4	5	5	6 ½	6 ½	8	8
Other Vegetables (cup eq/week)	1 ½	2 ½	2 ½	3 ½	4	4	5	5	5 ½	5 ½	7	7
Fruits (cup eq/day)	**1**	**1**	**1 ½**	**1 ½**	**1 ½**	**2**	**2**	**2**	**2**	**2 ½**	**2 ½**	**2 ½**
Grains (ounce eq/day)	**3**	**4**	**5**	**5**	**6**	**6**	**7**	**8**	**9**	**10**	**10**	**10**
Whole Grains (ounce eq/day)	≥ 1 ½	≥ 2	≥ 2 ½	≥ 3	≥ 3	≥ 3	≥ 3 ½	≥ 4	≥ 4 ½	≥ 5	≥ 5	≥ 5
Refined Grains (ounce eq/day)	< 1 ½	< 2	< 2 ½	< 2	< 3	< 3	< 3 ½	< 4	< 4 ½	< 5	< 5	< 5
Dairy and Fortified Soy Alternatives (cup eq/day)	**2**	**2 ½**	**2 ½**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Protein Foods (ounce eq/day)	**2 ½**	**3 ½**	**5**	**6**	**6 ½**	**7**	**7**	**7 ½**	**7 ½**	**8**	**8**	**8**
Beans, Peas, and Lentils (ounce eq/week)[b]	4	4	6	8	10	10	12	12	12	12	12	12
Nuts, Seeds, and Soy Products (ounce eq/week)	1 ½	2 ½	3 ½	4	4	4 ½	5	5 ½	5 ½	5 ½	5 ½	5 ½
Seafood (ounce eq/week)	3	4 ½	6	8	8	8	9	9 ½	9 ½	10 ½	10 ½	10 ½
Meats, Poultry, and Eggs (ounce eq/week)	9 ½	14	19	23	23	26	24 ½	27	27	29 ½	29 ½	29 ½
Oils (grams/day)	**15**	**17**	**17**	**22**	**24**	**27**	**29**	**31**	**34**	**36**	**44**	**51**

[a]Table E.1.2 presents the modeled values that have been rounded for public use. Due to rounding, the daily quantities for Vegetables and Protein Foods may not align with the weekly quantities listed for each subgroup.

[b]When Beans, Peas, and Lentils are counted within Vegetables, they are quantified using cup eq. To convert to ounce eq for counting in Protein Foods, the Vegetables quantities can be multiplied by 4 (i.e., 1 cup eq Beans, Peas, and Lentils equals 4 ounce equivalents).

Nutrient and Dietary Components of Public Health Concern

The Committee supports existing special considerations in the *Dietary Guidelines for Americans, 2020-2025* with regard to the nutrients and dietary components of public health concern.[1] Calcium, potassium, vitamin D, and dietary fiber are not consumed to adequacy; and added sugars, saturated fat, and sodium are consumed in excess by all population groups examined in the Committee's data analyses. Continued emphasis should also be placed on life stages that are particularly vulnerable due to increased nutrient needs or substantial health risks associated with underconsumption or overconsumption. Several life stages, including some during which individuals experience rapid growth and development, have additional nutrients of public health concern: infants (e.g., iron for those primarily fed human milk), adolescents (especially females who have multiple nutritional shortfalls), adults who are menstruating (e.g., iron), or are pregnant (e.g., iron, and during the 1st trimester, folate). Left unaddressed, nutrient shortfalls during these life stages have the potential to negatively impact health in the short-term, throughout the lifespan, and for future generations. Dietary recommendations to support these groups in meeting their nutritional needs should continue to be prioritized.

Eat Healthy Your Way Dietary Pattern for Young Children Ages 12 Through 23 Months

The Committee did not recommend modification to the 2020 HUSS for young children ages 12 through 23 months who are no longer receiving human milk or infant formula, except to change the name of the pattern to the *Eat Healthy Your Way* Dietary Pattern. As noted by the 2020 Committee, the development of dietary patterns for this age group is a challenge. Because young children's nutrient needs are high relative to low estimated energy needs, development of the 2020 HUSS patterns for ages 12 through 23 months included careful consideration of food group and subgroup quantities that would meet nutrient needs for this age group. Thus, when applying a health equity lens with the intent of flexibility and inclusivity, the *Eat Healthy Your Way* Dietary Pattern for children ages 12 through 23 months presents the food group and subgroup quantities alongside a lacto-ovo vegetarian variation at each calorie level (**Table E.1.3**). This variation is shown only for children ages 12 through 23 months because less flexibility exists in meeting nutrient needs and other nutritional goals during this life stage compared to older age-sex groups. When a lacto-ovo vegetarian pattern is provided to young children ages 12 through 23 months, careful planning—e.g., to the quantities provided in the *Eat Healthy Your Way* Dietary Pattern—is critical to meeting nutritional goals. Though the quantities are not changed, the Beans, Peas, and Lentils Subgroup is presented as part of the Protein Foods Group as was applied to the *Eat Healthy Your Way* Dietary Pattern for ages 2 and older.

TABLE E.1.3
EAT HEALTHY YOUR WAY **PATTERN (WITH A LACTO-OVO VEGETARIAN VARIATION) FOR CHILDREN 12 THROUGH 23 MONTHS WHO ARE NO LONGER RECEIVING HUMAN MILK OR INFANT FORMULA, WHO ARE NO LONGER RECEIVING HUMAN MILK OR INFANT FORMULA, WITH DAILY OR WEEKLY AMOUNTS FROM FOOD GROUPS, SUBGROUPS, AND COMPONENTS**

Food Group	**700 (VEG)[a]**	**800 (VEG)[a]**	**900 (VEG)[a]**	**1000 (VEG)[a]**
Vegetables (cup eq/day)	1/2 (1)	¾ (1)	1 (1)	1 (1)
Dark-Green Vegetables (cup eq/week)	1 (1/2)	1/3 (½)	½ (½)	½ (½)
Red and Orange Vegetables (cup eq/week)	1 (2 ½)	1 ¾ (2 ½)	2 ½ (2 ½)	2 ½ (2 ½)
Starchy Vegetables (cup eq/week)	1 (2)	1 ½ (2)	2 (2)	2 (2)
Other Vegetables (cup eq/week)	¾ (1 ½)	1 ¼ (1 ½)	1 ½ (1 ½)	1 ½ (1 ½)
Fruits (cup eq/day)	½ (½)	¾ (¾)	1 (1)	1 (1)
Grains (ounce eq/day)	1 ¾ (1 ¾)	2 ¼ (2 ¼)	2 ½ (2 ¾)	3 (3)
Whole Grains (ounce eq/day)	1 ½ (1 ¼)	2 (1 ¾)	2 (2)	2 (2)
Refined Grains (ounce eq/day)	¼ (½)	¼ (½)	½ (¾)	1 (1)
Dairy and Fortified Soy Alternatives (cup eq/day)	1 2/3 (1 ½)	1 ¾ (1 ¾)	2 (1 ¾)	2 (2)
Protein Foods (ounce eq/day)	2 1/3 (1)	2 (1)	2 (1)	2 (1)
Beans, Peas, and Lentils (ounce eq/week)[b]	3 (3)	1.33 (3)	2 (3)	2 (3)
Meats and Poultry (ounce eq/week)	8 ¾ (0)	7 (0)	7 (0)	7 ¾ (0)
Eggs (ounce eq/week	2 (3 ½)	2 ¾ (3 ½)	2 ¼ (3 ½)	2 ¼ (3 ½)
Seafood (ounce eq/week)	2-3 (0)	2-3 (0)	2-3 (0)	2-3 (0)
Nuts, Seeds, and Soy Products (ounce eq/week)	1 (4)	1 (4)	1 ¼ (4)	1 ¼ (4)
Oils (grams/day)	9 (9)	9 (8 ½)	8 (10)	13 (15)

[a] Food group and subgroup quantities in parentheses indicate quantities that align with flexibility for a lacto-ovo vegetarian dietary pattern that meets nutritional goals for children ages 12 through 23 months.

[b] When Beans, Peas, and Lentils are counted within Vegetables, they are quantified using cup eq. To convert to ounce eq for counting in Protein Foods, the Vegetables quantities can be multiplied by 4 (i.e., 1 cup eq Beans, Peas, and Lentils equals 4 ounce equivalents).

Complementary Feeding

Complementary feeding should not begin before age 4 months, which aligns with the current recommendation to introduce complementary feeding around age 6 months, based on signs of developmental readiness. Infants and young children should consume a variety of foods and beverages from all food groups, including foods rich in iron and zinc, particularly for infants fed human milk. The evidence reviewed by this Committee supported inclusion of fruits, vegetables, and grains as nutrient-dense complementary foods and beverages. The Committee recognizes that many infants in the U.S. are fed both human milk and iron-fortified infant formula at some point during the first 12 months of life and recommends to continue the use of inclusive language to reflect current practices, while continuing to recommend exclusive human milk feeding during the first 6 months of life when possible. More information is available in **Chapter 5: Complementary Feeding and Feeding Styles and Practices During Childhood**.

The Importance of Nutrient-Dense Food and Beverage Choices

Considering the current prevalence of overweight and obesity indicated by data analysis, meeting nutrient goals within calorie levels to maintain a healthy weight is critical for all age-sex groups. The importance of nutrient-dense food and beverage choices is underscored by the limited modifications or flexibilities that can be introduced without introducing nutritional gaps. This is of particular importance when modeling the lower calorie levels in infancy, childhood, and among older adults. During the diet simulations, limits on added sugars were met only when the probability of including foods and beverages (referred to collectively as foods) lower in nutrient density was 15 percent of the probability of including all other foods. Similarly, saturated fat goals were met for many age-sex groups when the probability of including foods lower in nutrient density was 15 percent of that of all other foods, but saturated fat goals were not met for all age-sex groups until foods lower in nutrient density were excluded from the simulations. Finally, sodium goals could not be met (i.e., simulations exceeded the CDRR for sodium) for nearly all age-sex groups even when foods lower in nutrient density were excluded from the simulations. Furthermore, the Committee emphasized that the calorie levels used in FPM assume an activity level of inactive, which make nutrient-dense choices even more important so that nutrient needs can be met within smaller energy allotments. For individuals who increase their physical activity, nutrient-dense choices are still advised to meet the recommended food group and subgroup quantities at a higher calorie level, but flexibilities around those choices increase.

A Lifespan Perspective

Data examining associations between dietary patterns and health outcomes continue to evolve, particularly among adults, but are still relatively limited for certain life stages and considering the diversity of the U.S. population. There is a paucity of data available in infants and young children, children and adolescents, and individuals who are pregnant or postpartum. It can be challenging to study dietary patterns and health outcomes in these populations because of difficulty with data collection, participant recruitment, or ethical considerations. For older adults, it can be challenging to isolate the effects of current from past dietary patterns on current health status without multiple measures of dietary intake during different life stages. The Committee recommends incorporating a lifespan perspective within a chronic disease prevention framework to promote growth and development and to improve the healthspan, i.e., the length of time that a person is in good health. A formal lifespan framework would require future Committees to articulate key outcomes by life stage, and generate questions to address key issues of growth, development, and healthspan.

Flexibilities to the Healthy U.S.-Style Dietary Pattern for Ages 2 and Older

Along with the visual presentation of the *Eat Healthy Your Way* pattern, the Committee recommends narrative advice and tables around the flexibilities within the core elements. Examples might include:

- Vegetables, noting different options across the Vegetable subgroups that still meet nutrient needs (e.g., amounts of Vegetables subgroups in the *Eat Healthy Your Way* pattern, equal distribution of the Vegetable subgroups, increasing Dark-Green Vegetables, etc.).
- Grains, noting how intakes should be at least half Whole Grains, but highlighting shifts to even more Whole Grains.
- Protein Foods, noting how the *Eat Healthy Your Way* Dietary Pattern provides an example of how nutrient needs can be met with various animal- and plant-based Protein Foods. The FPM supports a flexibility in the proportions of plant- to animal-based Protein Foods that further increases plant-based and decreases animal-based Protein Foods because nutrient goals are generally met as the pattern increasingly becomes more plant-based. This flexibility spans the Protein Foods group recommendations across the *Eat Healthy Your Way* dietary pattern and the 2020 H-VEG and H-MED, each of which provide examples of ways to consume a healthy dietary pattern with more plant-based Protein Foods as well as Eggs and/or Seafood.
- Highlight the diversity of possible options within each food group or subgroups that meet the *Eat Healthy Your Way* Dietary Pattern.

Conclusion Statements

- The *Eat Healthy Your Way* Dietary Pattern is the Committee's proposed Dietary Pattern for ages 2 years and older. The modifications are based on the Committee's evidence-based synthesis across systematic reviews and FPM analyses, informed by data analysis, and supported by diet simulations. The modifications reflect a review of scientific evidence through a health equity lens, with a focus on flexibilities and inclusivity. *Eat Healthy Your Way* proposes modifications and flexibilities to the modeled dietary pattern, which ensures food group recommendations meet nutrient requirements. However, current dietary intakes in the U.S. population do not align with the 2020 Dietary Patterns and need to change to improve diet quality and align with the *Eat Healthy Your Way* Dietary Pattern as well. For example, *Eat Healthy Your Way* recommends a 1 cup equivalent reduction of Starchy Vegetables per week compared to the 2020 HUSS pattern at some calorie levels. However, most age-sex groups would still need to increase current intakes of Starchy Vegetables to meet the recommendations in the *Eat Healthy Your Way* pattern.

- The *Eat Healthy Your Way* Dietary Pattern is the Committee's proposed Dietary Pattern for 12 through 23 months. This pattern reflects the 2020 HUSS including a lacto-ovo variation from the 2020 H-VEG. The Committee did not recommend modifications to the existing USDA Dietary Patterns for this age group (only a change in the name of the pattern). Children's nutrients needs are high relative to low energy needs, and careful consideration of food group and subgroup quantities are needed to meet nutrient needs.
- The U.S. population does not meet dietary recommendations, as indicated by the current dietary intake evidence from data analysis. To address the persistent gap between dietary recommendations and actual intakes, the Committee urges HHS and USDA to convene scientists with diverse expertise in behavioral, implementation, and communication sciences to evaluate the science of dietary behavior change and make evidence-based recommendations for strategies to promote dietary intakes that align with *Dietary Guidelines for Americans* recommendations. Behavioral science can identify structural and social drivers of dietary intake that view individual behavior as being nested within complex and interacting interpersonal, organizational, community, and public policy levels. Implementation science provides an opportunity to bring evidence-based dietary guidelines, dietary interventions, and food policy into health care and community settings to move the population toward healthy eating and the goal of improving public health. Communication science is needed to communicate and connect evidence-based guidance on healthy eating to society in a way that is understandable, relevant, and actionable to the diversity of the U.S. population.

The Committee's Advice to the Departments for Overarching Guidelines

Each edition of the *Dietary Guidelines* builds on the previous edition, with scientific justification for changes informed by the Committee's Scientific Report, along with input from federal agencies and the public. As part of this framework, the Committee reviewed the 4 overarching Guidelines and their supporting text in the *Dietary Guidelines for Americans, 2020-2025*. The 4 Guidelines are shown in **Box E.1.1** through **Box E.1.4**. In this section the Committee suggests updates to each Guideline, based on its review of the evidence, for the *Dietary Guidelines for Americans, 2025-2030*.

Box E.1.1: *Dietary Guidelines for Americans, 2020-2025*, Guideline 1

Follow a healthy dietary pattern at every life stage. At every life stage—infancy, toddlerhood, childhood, adolescence, adulthood, pregnancy, lactation, and older adulthood—it is never too early or too late to eat healthfully.

For about the first 6 months of life, exclusively feed infants human milk. Continue to feed infants human milk through at least the first year of life, and longer if desired. Feed infants iron-fortified infant formula during the first year of life when human milk is unavailable. Provide infants with supplemental vitamin D beginning soon after birth.

At about 6 months, introduce infants to nutrient-dense complementary foods. Introduce infants to potentially allergenic foods along with other complementary foods. Encourage infants and toddlers to consume a variety of foods from all food groups. Include foods rich in iron and zinc, particularly for infants fed human milk.

From 12 months through older adulthood, follow a healthy dietary pattern across the lifespan to meet nutrient needs, help achieve a healthy body weight, and reduce the risk of chronic disease.

Box E.1.2: *Dietary Guidelines for Americans, 2020-2025*, Guideline 2

Customize and enjoy nutrient-dense food and beverage choices to reflect personal preferences, cultural traditions, and budgetary considerations.

A healthy dietary pattern can benefit all individuals, regardless of age, race, or ethnicity, or health status. The *Dietary Guidelines for Americans* provides a framework intended to be customized to individual needs and preferences, as well as foodways of the diverse cultures in the United States.

Guidelines 1 and 2: Recommended Updates for 2025-2030

- Emphasize flexibility and inclusion in order to maintain a health equity lens. The Committee envisions that the Dietary Guidelines could shift, through interactive technology, from a static presentation of healthy dietary patterns to provide consumers with more interactive guidance that introduces flexibilities and is more inclusive in its approach.
- Illustrate how the *Dietary Guidelines* can be adapted for different cultural diets. As demonstrated through the Committee's evidence scan—which was the first evidence scan to be conducted by a Dietary Guidelines Advisory Committee—culturally responsive interventions may help promote better adherence and support uptake of dietary guidance by providing individuals with foods that align with their cultural practices and preferences.

- Provide guidance for adaptation of dietary patterns across different social, economic, geographic, and cultural contexts. This can assist federal food and nutrition assistance programs in meeting nutrient needs and support food and nutrition security among a diverse U.S. population. Throughout all dietary guidance, the Committee supports an emphasis on joy and pleasure in eating. Food serves many roles in society and by embracing inclusivity and cultural foodways, the Committee recognizes that any recommended dietary pattern must meet a variety of roles that food plays.

Box E.1.3: Inclusive Language and Terminology

Throughout its work the Committee sought to use identity-affirming language that does not exclude, discriminate, or perpetuate stereotypes of groups of people based on factors such as sex, social gender or gender identity, disability, and health status to the extent possible, while accurately reflecting what was reported in data sources and the scientific literature. The Committee suggests that the Departments consider terminology around life stages and gender identity in the *Dietary Guidelines for Americans, 2025-2030.* For instance, use of “young children ages 12 through 23 months” or “early childhood” instead of “toddlers/toddlerhood” and "individuals who are pregnant (or lactating)” instead of “pregnant women.” In addition, the Committee notes that when USDA Dietary Patterns state, "for those 1+ or 2+" years of age, such language may not resonate with adolescents or adults, especially older adults. For recommendations to enhance the design and reporting of surveys and scientific studies to allow for further inclusivity, see **Part E. Chapter 2: Future Directions**.

Box E.1.4: *Dietary Guidelines for Americans, 2020-2025*, Guideline 3

Focus on meeting food group needs with nutrient-dense foods and beverages, and stay within calorie limits.

An underlying premise of the *Dietary Guidelines* is that nutritional needs should be met primarily from foods and beverages—specifically, nutrient-dense foods and beverages. Nutrient-dense foods provide vitamins, minerals, and other health-promoting components and have no or little added sugars, saturated fat, and sodium. A healthy dietary pattern consists of nutrient-dense forms of foods and beverages across all food groups, in recommended amounts, and within calorie limits.

The core elements that make up a healthy dietary pattern include:

- Vegetables of all types—dark green; red and orange; beans, peas, and lentils; starchy; and other vegetables
- Fruits, especially whole fruit
- Grains, at least half of which are whole grain
- Dairy, including fat-free or low-fat milk, yogurt, and cheese, and/or lactose-free versions and fortified soy beverages and yogurt as alternatives
- Protein foods, including lean meats, poultry, and eggs; seafood, beans, peas, and lentils, and nuts, seeds, and soy products
- Oils, including vegetable oils and oils in food, such as seafood and nuts

Guideline 3: Recommended Updates for 2025-2030:

- Use structured feeding practices to promote children's intake of vegetables and fruits, including making those foods available and accessible in the home, providing repeated exposure to new foods, and modeling healthy eating behaviors. For children and adults, consume smaller portions of energy-dense foods to stay within energy requirements. For children, use portion size strategically to promote intake of vegetables and fruits.
- Increase emphasis on Whole Grains, provide clear definitions and/or examples of Whole Grains, recommend that Grains are “mostly Whole Grains” instead of “at least half Whole Grains,” and support exploring fortification/enrichment of Whole Grains.
- Continue to recommend that for Dairy and Fortified Soy Alternatives, plain cow milk (whole milk) or fortified unsweetened soy beverage can be offered beginning around 12 months of age and that fat-free and low-fat options are recommended for individuals ages 2 years and older.

- State that recommendations for meals and snacks should focus on nutrient-dense foods and beverages and underconsumed food groups.
- Continue to recommend regular breakfast consumption as part of a dietary pattern that is better aligned with the *Dietary Guidelines*, particularly for children and adolescents.
- Consider more education and communication around cup and ounce equivalents and develop interactive tools to make conversions intuitive and easy.
- Consider directional language (e.g., "increase intake of").
- Conduct consumer research on the dietary pattern and food group and subgroup names:
    - Recommend new consumer research regarding the food group name, "Protein Foods" because foods in other food groups also contain protein.
    - For "Dairy and Fortified Soy Alternatives," suggest not referring to lactose-free options and fortified soy milk and yogurt as "alternatives" because they are part of the Dairy group. Determine if "Dairy and Fortified Soy Alternatives" is the best term to capture recommended foods within this food group (i.e., milk and soy milk, yogurt and soy yogurt, and cheese).
- Recommend exploring nomenclature for "Other Vegetables" to better reflect the foods in this food group (e.g., asparagus, avocado, bamboo shoots, beets, bitter melon, Brussels sprouts, cabbage (green, red, napa, savoy), cactus pads (nopales), cauliflower, celery, chayote (mirliton), cucumber, eggplant, green beans, kohlrabi, luffa, mushrooms, okra, onions, radish, rutabaga, seaweed, snow peas, summer squash, tomatillos, and turnips.

Box E.1.5: *Dietary Guidelines for Americans, 2020-2025*, Guideline 4

Limit foods and beverages higher in added sugars, saturated fat, and sodium, and limit alcoholic beverages.

At every life stage, meeting food group recommendations—even with nutrient-dense choices—requires most of a person's daily calorie needs and sodium limits. A healthy dietary pattern doesn't have much room for extra added sugars, saturated fat, or sodium—or alcoholic beverages. A small amount of added sugars, saturated fat, or sodium can be added to nutrient-dense foods and beverages to help meet food group recommendations, but foods and beverages high in these components should be limited. Limits are:

- Added sugars – Less than 10 percent of calories per day starting at age 2. Avoid foods and beverage with added sugars for those younger than age 2.
- Saturated fat – less than 10 percent of calories per day starting at age 2.
- Sodium – less than 2,300 milligrams per day—and even less for children younger than age 14.
- Alcoholic beverages – adults of legal drinking age can choose not to drink, or to drink in moderation by limiting intake to 2 drinks or less in a day for men and 1 drink or less in a day for women, when alcohol is consumed. Drinking less is better for health than drinking more. There are some adults who should not drink alcohol, such as women who are pregnant.

Guideline 4: Recommended Updates for 2025-2030:

- Provide clear advice to consumers that alerts them to sodium levels in foods. Diet simulations confirm that staying below the CDRR for sodium (2,300 mg per day for ages 14 years and older) is difficult for all population groups, even when all foods exceeding a limit of 345 milligrams per serving limit were excluded (i.e., a threshold of 15 percent of the Daily Value).[6]These analyses indicate that the food supply is high in sodium.
- This Committee supports further reducing voluntary targets to further reduce sodium in the food supply. Federal agencies have a long history of encouraging a gradual reduction of sodium in the food supply. The FDA published a final guidance for industry on voluntary sodium reduction targets (Phase 1) to provide measurable, 2.5-year targets in 2021.[7] A preliminary assessment shows progress in reducing sodium and achieving FDA's Phase 1 targets between 2010 and 2022.[8] Overall, 40 percent of food categories had already achieved the Phase I sodium targets or were within 10 percent of meeting the targets. The greatest number of reductions were seen

in packaged food categories. The FDA took another step in its sodium reduction efforts by issuing new, Phase II voluntary sodium reduction targets in draft guidance.[9]

- Maintain current limits on added sugars, saturated fat, and sodium.
- Consider the findings of 2 other expert committees that are addressing alcoholic beverages and health outcomes. HHS and USDA are addressing the scientific reviews on this topic through efforts separate from the work of this Committee, therefore this Committee did not conduct reviews on alcoholic beverages and health outcomes. The scientific reviews on adult alcohol consumption and health are being conducted by a committee convened by HHS and a committee convened by the National Academies of Sciences, Engineering and Medicine (NASEM), working on complementary tracks. Given that these 2 efforts are underway as of the time of this report's preparation and that findings are expected to be available by the end of December 2024, the Committee recommends that the Departments consider these findings when developing the *Dietary Guidelines for Americans, 2025-2030*.

Summary

The 2025 Committee synthesized evidence from data analysis, systematic reviews, and food pattern modeling through a health equity lens to answer an overarching question, "Considering each life stage, should changes be made to the USDA Dietary Patterns (Healthy U.S.-Style, Healthy Mediterranean-Style, and/or Healthy Vegetarian), and should additional Dietary Patterns be developed/proposed?" The Committee concluded that the 2020 HUSS, H-VEG, and H-MED—as well as other healthy dietary patterns—have similar core elements and therefore, a single modified dietary pattern that combines these elements would reflect a review of the scientific evidence through a health equity lens, with a focus on flexibilities and inclusivity. The Committee recommended that the *Eat Healthy Your Way* Dietary Pattern emphasize dietary intakes of beans, peas, and lentils while reducing intakes of red and processed meats, as supported by systematic reviews. The energy increase from Beans, Peas, and Lentils modification would be offset by a decrease in Starchy Vegetables *as this change had the most nutrient improvements*. Diet simulations using foods consumed in the United States generally met nutrient requirements suggesting that the *Eat Healthy Your Way* Dietary Pattern accounts for variation in dietary intakes. The Committee also recommends removing "Limits on Calories for Other Uses" from the quantitative pattern because variability in calorie content exists across the many food and beverage options that may be used to achieve the pattern's food group and subgroup recommendations, meaning that it is possible that no calories may remain for other uses.

The 2020 USDA Dietary Patterns and the proposed *Eat Healthy Your Way* Dietary Pattern ensure that food group recommendations meet nutrient requirements, with few exceptions. Nonetheless, a gap persists between recommended and actual U.S. dietary intakes. Chronic health conditions for which poor nutrition is a risk factor—including overweight and obesity, type 2 diabetes, cardiovascular disease, metabolic syndrome, and certain cancers—are prevalent, presenting major public health challenges. The proposed and future modifications to the USDA Dietary Patterns will not have an impact on U.S. dietary intakes without strengthening efforts to effectively implement the dietary guidance. To that end, the

Committee recommends that future Dietary Guidelines Advisory Committees alternate between 5-year cycles in their focus to ensure that the scientific evidence of *what* Americans should eat is supported by robust science on *how* to eat and how to successfully implement that scientific advice. The Committee recognizes that its evidence-based recommendations to shift some of the intake of animal-source foods to nutrient-dense, plant-source foods through a single USDA Dietary Pattern with built-in flexibilities will need strong behavioral, implementation, and communication science to succeed.

The Committee reviewed the scientific evidence through a health equity lens and identified gaps in knowledge and outreach. Therefore, it recommends that the next Committee be composed of expertise in the disciplines of health equity, nutritional science, and behavioral and implementation sciences to assist HHS and USDA in their efforts to successfully implement dietary guidance for all Americans, regardless of their age, sex, race, ethnicity, and/or socioeconomic position, to narrow the gap between scientifically robust dietary guidance and actual dietary consumption by the U.S. population.

References

1. U.S. Department of Agriculture, U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2020-2025. 9th Edition.* 2020. DietaryGuidelines.gov.
2. Dietary Guidelines Advisory Committee. Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services. 2020;doi:https://doi.org/10.52570/DGAC2020
3. U.S. Department of Agriculture, Nutrition Evidence Systematic Review. Nutrition Evidence Systematic Review home page. https://nesr.usda.gov/
4. Taylor CA, Booth SL, Abrams SA, et al. *Synthesis of Hypothetical Dietary Pattern Modifications to the 2020 Healthy U.S.-Style (HUSS) Dietary Pattern: Food Pattern Modeling Report.* November 2024. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion. Nutrition and Economic Analysis Branch. Available at https://doi.org/10.52570/DGAC2025.FPM10
5. Taylor CA, Talegawkar SA, Abrams SA, et al. *What are the differences between nutrient profiles calculated using the dietary intakes of the total U.S. population and population groups? Food Pattern Modeling Report*. 2024;doi:https://doi.org/10.52570/DGAC2025.FPM02
6. National Academies of Sciences, Engineering, Medicine. Dietary Reference Intakes for Sodium and Potassium. 2019:594. doi:https://doi.org/10.17226/25353
7. U.S. Department of Health and Human Services, Food and Drug Administration Center for Food Safety and Applied Nutrition, . *Voluntary Sodium Reduction Goals: Target Mean and Upper Bound Concentrations for Sodium in Commercially Processed, Packaged, and Prepared Foods: Guidance for Industry* https://www.fda.gov/media/98264/download
8. U.S. Department of Health & Human Services, U.S. Food and Drug Administration. *Sodium Reduction in the U.S. Food Supply 2010-2022: A Preliminary Assessment of Progress*. https://www.fda.gov/food/nutrition-food-labeling-and-critical-foods/sodium-reduction-us-food-supply-2010-2022-preliminary-assessment-progress
9. U.S. Food and Drug Administration, Human Foods Program. *Draft Guidance for Industry: Voluntary Sodium Reduction Goals (Edition 2)*. Accessed FDA-2014-D-0055, https://www.fda.gov/regulatory-information/search-fda-guidance-documents/draft-guidance-industry-voluntary-sodium-reduction-goals-edition-2

Part E. Chapter 2: Future Directions

Introduction

Throughout its review of the science, the Committee identified important gaps in data and identified future directions for nutrition and health research. Each systematic review report contains research recommendations specific to the topic examined.[1] Several cross-cutting priorities emerged that offer important considerations for future Dietary Guidelines Advisory Committees, emphasize the critical support for federal data and other activities related to the *Dietary Guidelines for Americans (Dietary Guidelines),* and identify important research gaps to inform future *Dietary Guidelines*. Communicating these evidence gaps and methodological considerations to funding agencies, and to those who conduct primary research and surveillance data programs, is of paramount importance to the health and well-being of the U.S. population. Advancements in nutrition science are required for dietary recommendations to evolve into stronger, more targeted advice for the U.S. population to improve individual and population-level health. By funding and implementing these future directions, the research community, federal agencies, and future Committees can ensure the certainty, relevance, inclusivity, and effectiveness of future *Dietary Guidelines*, ultimately contributing to better health outcomes for all communities.

Future Directions in the Dietary Guidelines Process

Health Equity

This Committee is the first in the history of the Dietary Guidelines Advisory Committees to purposefully apply a healthy equity lens across its deliberations. The development and implementation of dietary guidance that is applicable to the entire U.S. population requires a robust, rigorous, and reproducible research base that includes representation of diverse population groups. The Committee carefully considered relevant and available sociodemographic indicators to integrate the social determinants of health (SDOH) when interpreting nutrition research across data analysis, systematic reviews, and food pattern modeling. Ultimately, the Committee was limited to examining only a few SDOH variables based on data availability. In this context and based on its review of the evidence, the Committee made several recommendations.

- Prioritization of health equity by future Dietary Guidelines Advisory Committees.[2]

  Rationale: Review of the data analyses through a health equity lens highlighted the importance of considering SDOH indicators, but also made apparent the limitations of available data to fully capture the diversity of the U.S. population. Such diversity includes various racial and/or ethnic and cultural subgroups, as well as life stages such as infancy, early childhood, pregnancy and lactation, and older adulthood. In addition, the Committee did not have access to SDOH variables such as neighborhood, home, and built environmental factors nor neighborhood food availability and cost. The health equity approach used by the 2025 Committee did, however, reveal that although diets across the lifespan fail to align with the *Dietary Guidelines*, some differences exist by sociodemographic groups such as race and/or ethnicity and age. For example, diet quality, per the

Healthy Eating Index (HEI), is meaningfully different by race and/or ethnicity and life stage, as are prevalence of several health outcomes.[3,4] [5] An extensive body of evidence indicates that these differences are driven by broader social, economic, and structural conditions that are beyond the individual's control.[6] Therefore, the SDOH indicators should be considered. Additionally, the Committee advanced methods of testing the proposed patterns with the integration of diet simulations, which provided an additional opportunity to consider intake variability when evaluating a dietary pattern. Representative dietary intake data as an input strengthens diet simulations as an advancement to food pattern modeling. However, extending diet simulations to specific population groups is limited by available dietary intake data. Therefore, the Committee's diet simulations used nationally representative dietary intake data and also piloted an innovative approach that used a database of foods and beverages informed by experts with professional and lived experience with select American Indian and Alaska Native foodways. Future Committees should identify other opportunities for incorporating cultural foodways into diet simulation efforts to expand dietary diversity and health equity. The lack of data on racial and/or ethnic, cultural, and regional subgroups limits the ability of the resulting dietary guidance to fully meet diverse population groups where they are in terms of their current dietary intakes and to provide appropriate recommendations. Ideally, nationally representative longitudinal data from these groups would be available to inform future *Dietary Guidelines*.

- Conduct a systematic review stemming from this Committee's evidence scan to formally evaluate the effectiveness of culturally responsive interventions to improve diet on relevant health outcomes.

Rationale: The Committee was not able to conduct a systematic review regarding the effectiveness of culturally responsive interventions to improve diet due to the lack of information necessary to prepare the Population, Intervention, Comparison, and Outcome (PICO) table. The next Committee could use information obtained from the evidence scan to formulate the PICO elements for a systematic review protocol that evaluates the effectiveness of culturally responsive interventions to improve diet on relevant health outcomes. The initial evidence scan concentrated on a limited set of exploratory outcomes and was not intended to draw conclusions about the relationship between culturally responsive interventions and dietary intake or other relevant outcomes. For future guidelines, it is crucial to identify and incorporate additional outcomes that are significant for specific populations. This includes health outcomes, behavioral changes, and socioeconomic impacts that might be more pertinent to some communities than to others. The Committee also suggests that the next Committee consider factors beyond racial and/or ethnic group categorizations, such as time spent in the United States, nativity, acculturation, geographic location of residence, education level, income, and various intersecting identities as foci for the populations of interest. If culturally responsive interventions are found to be effective to improve dietary patterns and health outcomes in the future, the Committee also recommends that unifying/core factors of these interventions be identified or described for translation to other populations. By expanding the focus, the *Dietary Guidelines* can be better tailored to address the unique needs and challenges faced by diverse populations, thereby improving the effectiveness and acceptance of interventions.

- Conduct a systematic review or additional projects that consider SDOH to improve diet on relevant outcomes.

  Rationale: Assessing and addressing SDOH, specifically the conditions in which people are born, grow, work, live, worship, and age—including access to affordable, healthy foods, access to affordable and safe housing, access to transportation, access to quality healthcare, economic stability, educational opportunities, home and neighborhood conditions, and social cohesion— are necessary to positively impact dietary behaviors that result from a complex interplay of psychological, sociological, and economic factors. Future research should expand the list of determinants to consider when examining the efficacy of interventions to include both culturally appropriate dietary interventions and interventions focused on SDOH and exposure to intersecting systems of disadvantage.

Behavioral Science and Implementation Research

As indicated by the current dietary intake evidence provided through data analysis,[7] the U.S. population does not meet dietary recommendations. To address this persistent gap between dietary recommendations and actual intakes, diverse expertise in behavioral, implementation, and communication sciences is needed to evaluate the science of dietary behavior change, make evidence-based recommendations for strategies to promote dietary intakes that align with *Dietary Guidelines* recommendations, and provide evidence for effective implementation strategies in multiple contexts (e.g., home, daycare, school, workplace) where federal nutrition programs may be provided. In this context, the Committee made recommendations around behavioral science, communication, and implementation.

- Determine evidence-based behavioral and implementation strategies associated with successful adoption of evidence-based recommendations across different life stages, populations, and settings.

  Rationale: Although evidence-based recommendations are formed from the research within a particular field of study, adoption or sustainability of these recommendations are not automatic at the individual or population levels. Failure of U.S. adult diets to align with the *Dietary Guidelines*, as measured by the HEI, indicates that adoption of the *Dietary Guidelines* into practice may be limited.[3] Identifying methods, interventions, and variables that influence adoption and sustainability of evidence-based interventions by individuals, families, and organizations is expected to better support adherence to the *Dietary Guidelines*.[3] Behavioral theories are used to guide the development of effective health behavior interventions because these theories provide frameworks and constructs that facilitate healthy eating behaviors. Systematic reviews of behavioral nutrition studies can provide a list of effective strategies for dietary change at the individual, social, and environmental levels.

- Identify evidence-based policy, systems, and environmental change strategies for implementing the *Dietary Guidelines for Americans* across different life stages, populations, and settings.

Rationale: Implementation of and support for the adoption of population-based dietary guidance requires policy, systems, and environment (PSE) change. PSE research can provide strategies for creating policies that drive changes in environments and systems to accelerate and maintain societal adoption of evidence-based dietary guidance.

- Identify evidence-based health communication strategies for conveying and promoting the *Dietary Guidelines for Americans* across different life stages, populations, and settings.

  Rationale: Effective nutrition communications are critical to ensure that the U.S. population understands the importance of the *Dietary Guidelines* and uses them to make healthy choices. Health communication research can provide evidence-based insights for communicating guidance in a way that is understandable, credible, practical, and actionable for diverse audiences. Health communication research can also provide evidence on the most appropriate strategies to reach diverse populations and life stages and emphasize the multiple roles of food. Interactive technology tools should be explored for effective communication of the flexibilities available within the *Dietary Guidelines.* Adopting an evidence-based approach to communication of the *Dietary Guidelines* to the public is critical for successful implementation and for building public trust and health literacy.

- Select members with expertise in behavioral, communication, policy, and implementation sciences for the next Committee.

  Rationale: Committee members with expertise in behavioral, communication, policy, and implementation sciences, in addition to nutritional sciences, should be prioritized. Integrating robust behavioral and implementation scientific evidence into the execution of dietary guidance can enhance the effectiveness of nutrition policies and interventions, thereby improving public health outcomes. Recommendations for the development of strategies for implementation of the *Dietary Guidelines* in federal food programs, and in home and other eating environments, require examination of nutrition research related to implementation strategies. It will be important to have Committee members with expertise in such data (e.g., implementation and behavioral sciences) to continue to accurately interpret the scientific evidence.

Prioritization of Scientific Questions for Consideration by Future Committees

Prioritization of scientific questions continued throughout the Committee's evidence review to ensure the highest priority questions could be completed within the Committee's term. At the completion of its work, the Committee ranked all the questions it reviewed by level of prioritization for consideration by future Committees. By consensus, the Committee recommended that the questions in **Table E.2.1** not be considered by the next Committee because: 1) they were of lower priority for informing advice to the Departments as they develop the next edition of the *Dietary Guidelines*, (2) they had current conclusion statements that are strong and not likely to change in the next 5 years, and/or (3) the evidence isn't evolving quickly and is not anticipated to have accumulated enough in the next 5 years to be warrant re-examination at that time. However, the Committee recommends ongoing assessment of research availability through continuous evidence monitoring to determine if emerging evidence suggests that modification to the conclusion statements and/or grades may be warranted.[8]

TABLE E.2.1
SCIENTIFIC QUESTIONS FOR THE NEXT COMMITTEE TO DEPRIORITIZE

Question	Approach to Examine Evidence
What is the relationship between dietary patterns consumed and risk of cardiovascular disease?	Systematic Review
What is the relationship between sugar-sweetened beverage consumption and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between sugar-sweetened beverage consumption and risk of type 2 diabetes?	Systematic Review
What is the relationship between dietary patterns consumed and risk of type 2 diabetes in adults and older adults?	Systematic Review
What is the relationship between 100% juice consumption and growth, body composition, and risk of obesity?	Systematic Review
What are the implications for nutrient intakes when modifying the Fruits food group quantities within the Healthy U.S.-Style Dietary Pattern?	Food Pattern Modeling
What is the relationship between beverage patterns consumed and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between food sources of saturated fat consumed and risk of cardiovascular disease?	Systematic Review
What is the relationship between portion size and growth, body composition, and risk of obesity?	Systematic Review
What is the relationship between portion size and energy intake?	Systematic Review
Can nutrient goals be met when animal sources of foods and beverages are removed from the Healthy Vegetarian Dietary Pattern for ages 2 years and older?	Food Pattern Modeling

It is the intention of the Committee to identify questions that have lower priority to allow future Committees to prioritize scientific questions that this Committee did not have the time or resources to pursue as well as to incorporate new, emerging dietary guidance topics. Some of the conclusions to the systematic review questions above had statements that were graded as strong. NESR methodology defines a grade of strong as “the level of certainty in the conclusion is strong, such that if new evidence emerges, modifications to the conclusion are unlikely to be required.”[8] The food pattern modeling results support existing quantities of Fruits in the overall synthesis that integrates the food groups in a healthy dietary pattern so no further consideration is recommended. When considering if nutrient goals can be met when animal sources of foods and beverages are removed from the Healthy Vegetarian Dietary Pattern for ages 2 years and older, the Committee was constrained by insufficient data on the appropriate substitution of foods and beverages that would replace those excluded as part of the analyses and did not recommend further consideration. Other questions were deprioritized because they were of lower priority for informing advice and/or the evidence was not, in the opinion of the Committee, evolving quickly and could be on a delayed update schedule.[8] Many of the questions deprioritized had stronger evidence for adults than other life stages, and it may be appropriate to monitor these questions for life stages with conclusion statements graded as limited or grade not assignable to determine if evidence is available to support the next Committee's re-examination of these questions.

Strengthening the Nutrition Surveillance System

The 2022 White House National Strategy on Hunger, Nutrition and Health and the 2024 President's Council of Advisors on Science and Technology (PCAST) Vision for Advancing Nutrition in the United States emphasize the critical need for federal data and related programs.[9,10] Both reports highlight the importance of enhancing the U.S. food and nutrition surveillance system to facilitate continuous and accurate monitoring of food consumption patterns, dietary composition, nutrient intake, and overall nutritional status. Such advancements are essential for identifying evidence gaps and guiding effective population health interventions. Additionally, targeted funding for nutrition research is crucial to support the development of evidence-based policies that promote and protect public health. The PCAST report makes special mention of the negative repercussions of disruptions in federal funding to critical federal nutrition initiatives. The Committee provides further context for the critical importance of these programs in support of future *Dietary Guidelines*.

National Health and Nutrition Examination Survey (NHANES) and Other National Surveys

- Continue to support and expand investment in NHANES as it is the only nationally representative survey that includes both detailed dietary assessment and a panel of risk factors and health indicators measured using high-quality methods in a continuous survey over time.

  Rationale: The Committee strongly emphasizes the importance of the data generated in the National Health and Nutrition Examination Survey (NHANES), including What We Eat in America (WWEIA).[11,12] NHANES is the only U.S. resource that provides dietary assessment and health outcome data that is representative of the non-institutionalized U.S. population. Its continuous, systematic, technician-measured data collection and high-quality standards for data management, cleaning, and public release enable monitoring of dietary changes in the population over time and evaluation of emerging nutritional improvement, degradation, and disparities in the population. Population-level dietary intakes must be carefully monitored over time to evaluate public health events, policy changes, and other secular trends, to provide unique and unparalleled evidence of impact at a national scale to inform future initiatives and events. NHANES has maintained high-quality, consistent methodology for tracking population dietary intake and health outcomes during the past 20+ years. As such, its data are essential for informing the *Dietary Guidelines* process and developing food group and subgroup recommendations that meet the population where they are in terms of their current dietary intakes, so that guidance is responsive and actionable to the population's foodways. Without these data, evaluation of dietary intake and health outcomes before and after broad public health events, such as the COVID-19 pandemic, or implementation of nutrition-related policy, would not provide essential information. The Committee supports expansion of dedicated resources to fund this essential public health surveillance program.

- Increase sample sizes and oversampling for underrepresented sociodemographic and cultural groups in WWEIA, NHANES and other federal, nationally representative surveys on nutrition or health to adequately address the diversity of the U.S. population.

  Rationale: The Committee acknowledges the substantially lower response rates for the NHANES August 2021-August 2023 cycle, which will be available for the work of the next Committee, and encourages federal efforts to increase response rates for dietary recall and physical examination in future NHANES cycles.[11,13] To achieve this, the Committee strongly recommends that support be provided to enhance community and public engagement. This would help identify strategies to increase response and participation, as well as address the needs, priorities, and experiences of communities in using and accessing the data. The Committee further recommends employing individuals from the communities being studied to assist with data collection and dissemination, ensuring culturally appropriate and trusted engagement. Moreover, NHANES should ensure that sociodemographic groups residing in the United States are adequately represented in the data used to inform national dietary guidance. Dietary intake data that captures diverse cultural and regional dietary patterns, as well as those that vary according to other sociodemographic characteristics, is needed by future Committees to understand current dietary intakes among these groups and determine if the Eat Healthy Your Way Dietary Pattern can meet the nutrient needs of the diverse U.S. population. For example, Native American, Alaska Native, and Pacific Islander populations experience high rates of chronic disease rates, yet are not adequately represented in most federal, nationally representative surveys on nutrition and health.[14] Currently, NHANES does not collect information on tribal affiliation or whether the respondent is a member of a state- or federally recognized tribe. Additionally, NHANES does not ask respondents who report more than 1 race which race they most identify with, and public use files contain only 2 measures of race and ethnicity, which limits the identification of American Indians/Alaska Natives (as well as other racial/ethnic and geographic subgroups that may have higher rates of diet-related conditions) when using public use data. Sample sizes in NHANES also are not adequate to allow for data to be disaggregated by subgroups within larger racial/ethnic categories (e.g., Chinese, Indian, Filipino, etc.) and by other characteristics such as country or region of origin. Likewise, insufficient sample sizes do not allow for disaggregation of race and/or ethnicity classification for most groups when considering different life stages (e.g., older adults ages 80 years and older, infants, young children, and pregnancy and lactation), while maintaining participant confidentiality. Moreover, few national surveys provide information on dietary behaviors and consumption patterns of individuals who are pregnant, postpartum, and/or lactating. Thus, nationally representative data on dietary intakes, health indicators, nutritional status, biospecimen collections, body composition and weight-related metrics, and health outcomes are not available to support surveillance and monitoring of these groups. Consideration of these cultural, geographic, and life stage groups is important for representing substantial shares of the population, fast-growing segments of the population, and life stages during which rapid growth and development occur.

- Incorporate and/or expand instruments in national surveys (e.g., WWEIA, NHANES) that capture SDOH and multilevel factors that influence dietary intakes such as food environments and individuals perceptions of the food environment, food access, acculturation, dietary preferences (e.g., vegetarian diet), and policies that act as barriers and facilitators to healthy food intake.

  Rationale: Questions that assessed individuals' eating behaviors, perceptions, acculturation, and food environments in prior WWEIA, NHANES are limited. For example, questions related to acculturation captured the language spoken at an individual's home and did not examine other acculturation strategies (e.g., shifts in cultural practices and traditions, media use, cuisine, values, attitudes, social norms, and hobbies) that could be useful for understanding differences in dietary intakes among individuals from various cultural backgrounds.

FoodData Central

- Prioritize ongoing updates to national food composition databases that can be used in the development of national nutrition policy, including the *Dietary Guidelines for Americans*.

  Rationale: Food composition data form the foundation for all aspects of national dietary surveillance efforts and are critical to nutrition researchers, dietetics professionals, consumers, the agricultural sector, and food manufacturers. These data ultimately pave the way for nutrition, health, and agricultural policies that include and extend beyond the *Dietary Guidelines* process. The USDA FoodData Central forms the basis for food composition data in the U.S. and includes 5 distinct data types (i.e., Foundation Foods; Standard Reference (SR) Legacy; Food and Nutrient Database for Dietary Studies (FNDDS); Experimental Foods; and Branded Foods).[15] The data from Foundation Foods and SR Legacy feeds into FNDDS, which is critical to the 3 approaches used by the Committee to review the science (i.e., data analysis, systematic reviews, and food pattern modeling). Rigorous analytical food composition data and their corresponding food group contributions (i.e., Food Patterns Equivalents Database [FPED]) are essential for determining nutrient adequacy when developing or refining healthy dietary patterns and when examining associations between dietary exposures and health-related outcomes. Due to the rigor needed for development of national nutrition policy, the Committee did not consider label data from Branded Foods. However, the Committee recommends that concerted effort be made to standardize the Branded Foods data types to expand the overall food composition databases to be sufficiently nimble to reflect current intake patterns. The Committee also recognizes that the full scope of the methodologies used in the *Dietary Guidelines* process go beyond the capabilities of FNDDS, given its purpose is to provide data to be applied to analysis of foods and beverages reported in WWEIA, NHANES cycles. To capture data from the ever-evolving food supply, the Committee recommends bolstering analytical data in other FoodData Central databases to fill data gaps identified by this Committee. Continuous monitoring of market trends (e.g., ultra-processed foods (UPFs), non-dairy milk products, and plant-based meat alternatives), with a goal of updating and expanding the food composition databases, is essential to allow for additional testing of generalizability of nutrient profile calculations. Such monitoring requires additional resources to produce nutritional estimates aligned with the rigor of the FNDDS and FPED databases. Additional actions that are imperative to support the continuous quality of advancement of this work involve expanding FoodData Central datasets to include the following: current, nationally representative food composition data that are consistently analyzed for a complete list of nutrients, links to the FPED, data for cooked foods, and data for multiple portion sizes.

- Support ongoing efforts to expand national food composition data to include more food and beverages consumed across diverse cultural and population groups.

  Rationale: The Committee supports continued efforts to expand FoodData Central to include additional foods and beverages consumed in diverse communities while also acknowledging the amount and importance of data already included in these databases. In addition, the Committee also encourages support and resources to continue to expand the national nutrient databases for inclusion of foods included in the diets of additional population groups. The Committee suggests that prioritization of the next set of foods and beverages to be included in FoodData Central is aligned with the NHANES sampling plan, so that future Committees can analyze the dietary intakes of and evaluate dietary pattern flexibility for additional population groups.

- Expand the national food composition data to include food components, such as phytonutrients, as well as common non-nutritive food and beverage additives that are increasingly used by industrial food manufacturers, such as flavoring agents, sweeteners, colorants, preservatives, texturizers, and other substances.

  Rationale: Expanding the national food composition data to include food components, such as phytonutrients, and industrial additives will facilitate ongoing monitoring of the prevalence and trends in consumption of these bioactives and other substances in the population, and support emerging research to investigate their potential health effects.

Human Milk Composition

- Prioritize, support, and fund research to develop and improve federally available data on human milk composition from diverse population groups and across all phases of lactation.

  Rationale: The Standard Reference Legacy data for human milk in the USDA nutrient database was last analyzed and updated in 1976.[16] Human milk composition is influenced by numerous factors including characteristics of the lactating individual (parity, age, and health status), stage of lactation, environmental factors, and dietary intake. There is a need for a comprehensive, representative, systematic collection of human milk across the United States and Canada that reflects current dietary intake patterns of diverse populations and the methodological advances of current assay methods to better inform the Dietary Reference Intakes and future nutrients of public health concerns.

Dietary Reference Intakes (DRIs)

- Emphasize the importance of the Joint U.S.-Canada DRI Working Group to coordinate regular updates to existing DRIs and development of new DRIs for nutrients across the lifespan.

  Rationale: The DRIs are a set of scientifically developed reference values for nutrients that serve as a vital resource for evaluating the nutritional quality of dietary patterns consumed in the United States.[17] The Committee relies on and uses the DRIs to develop dietary patterns that meet nutrient requirements and understand how current nutrient intakes compare to recommendations. The DRIs are not required to be updated on a recurring basis. However, many nutrients have not been updated in 10 to 20 years, and new data may be available to warrant updates to nutrient values or to develop values for nutrients that have never been considered. Furthermore, the Chronic Disease Risk Reduction (CDRR) Intake model needs to be applied to all nutrients within the DRI Framework.[18]

Methodological Considerations for the Research Community

Throughout its review of the science, the Committee identified important gaps in data and identified future directions. Additional research recommendations pertaining to each scientific approach (data analysis, systematic reviews, and food pattern modeling) are included elsewhere in this report. The following recommendations span multiple scientific approaches that benefit the entire research community.

- Replicate observational studies conducted outside of the United States with prospective cohort studies among U.S. populations, while considering diversity in race and/or ethnicity, socioeconomic position, gender identity, and health disparities.

  Rationale: The Committee's reviews included many studies that were conducted in countries outside the United States. Despite having comparable human development index classification, studies conducted outside of the United States often include homogenous populations and have limited generalizability to the U.S. context due to differences in food supply and lack of participant diversity.[19-21] Nonetheless, it continues to be important to consider the entire body of evidence, including U.S. and international studies, to help evaluate potential diet-health relationships.

- Determine consistent nomenclature and components for dietary patterns.

  Rationale: The Committee had difficulty assessing some of the literature due to subjectivity in labeling and determining the food components that comprise a pattern. Further, certain patterns were population-specific and less generalizable between studies, making it challenging to reproduce and compare patterns across the body of evidence.[22]

- Develop evidence-based and consistent nomenclature for food groups and subgroups.

  Rationale: The naming and grouping of certain foods to food groups and subgroups is cultural, historical, and based on the way that foods are consumed as part of culinary practice, and not necessarily tied to botanical nomenclature. Grouping of foods and beverages into FPED categories relies on similarities in nutrient composition of foods and beverages in a food group (e.g., Red and Orange Vegetables are characteristically higher in vitamin A and carotenoids than the other Vegetables subgroups). All food groups and subgroups are defined in the FPED, a database for assessing food group and subgroup intakes and calculating the HEI scores for assessment of diet quality in the U.S. population. Consumer testing informed the naming of some food groups such as the change from "Meat, poultry, eggs, seafood, and beans" to "Protein Foods." The Vegetables and Protein Foods subgroup "Legumes" was changed to "Beans, Peas, and Lentils" to be more specific and descriptive of the food types within the subgroup. As perspectives on foods, their availability, and their use change over time, the naming of food groups and subgroups need re-evaluation. Their grouping and nomenclature may need tailoring to convey their meaning to individual groups in the U.S. population. The Committee recommends consumer testing of the current terminology is recommended for certain food groups and subgroups, specifically Beans, Peas and Lentils, Dairy and Fortified Soy Alternatives, and the term 'whole fruits', which is used to describe recommended types from the Fruits Food Group.

Summary

In closing, future Committees should identify opportunities for enhancing data representation and inclusivity. This will require expanding the life stage and subgroup analyses; working with agencies and the research community to address critical gaps in data collection, surveillance, and scientific evidence; and exploring the potential for a more robust inclusion of cultural foodways and SDOH considerations. Given the persistent gap between dietary guidance and actual dietary intakes, additional evidence-based focus is needed on behavioral sciences, health communication, and implementation research in the *Dietary Guidelines* process. Finally, robust collection of dietary and health outcome data via NHANES and other databases, along with availability of nutrient adequacy markers informed by current DRIs—as well as food composition and nutrient databases that provide comprehensive support for these resources—are critical for effectively implementing the future directions identified in this chapter. These future directions underscore the importance of inclusive and representative dietary data and expertise to inform guidelines that support health equity and address the needs of a diverse U.S. population.

References

1. USDA Nutrition Evidence Systematic Review Branch. 2025 Dietary Guidelines Advisory Committee Systematic Reviews. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review. https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews
2. Dietary Guidelines Advisory Committee. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. 2020; doi:https://doi.org/10.52570/DGAC2020
3. Cruz CM, DeSilva D, Beckman K, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Patterns of Food and Beverage Intake*. 2024; doi:https://doi.org/10.52570/DA.DGAC2025.DA01
4. Cruz CM, DeSilva D, Beckman K, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Current Intakes of Nutrients and Dietary Components*. 2024;doi:https://doi.org/10.52570/DA.DGAC2025.DA03

5. Cruz CM, DeSilva D, Beckman K, et al. *Federal Data Analysis Report for the 2025 Dietary Guidelines Advisory Committee: Prevalence of Nutrition-Related Chronic Health Conditions.* 2024; U.S. Department of Health and Human Services, Office of the Assistant Secretary for Health, Office of Disease Prevention and Health Promotion. U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion. doi:https://doi.org/10.52570/DA.DGAC2025.DA04
6. Gyawali B, Mkoma GF, Harsch S. Social Determinants Influencing Nutrition Behaviors and Cardiometabolic Health in Indigenous Populations: A Scoping Review of the Literature. *Nutrients*. Aug 17 2024;16(16) doi:https://doi.org/10.3390/nu16162750
7. U.S. Department of Agriculture, U.S. Department of Health and Human Services. Data Analysis https://www.dietaryguidelines.gov/2025-advisory-committee-report/data-analysis
8. USDA Nutrition Evidence Systematic Review Branch. USDA Nutrition Evidence Systematic Review: Methodology Manual U.S. Department of Agriculture, Food and Nutrition Service, Center for Nutrition Policy and Promotion, Nutrition Evidence Systematic Review. https://nesr.usda.gov/methodology-overview
9. Executive Office of the President, President's Council of Advisors on Science and Technology (PCAST). *Report to The President A Vision for Advancing Nutrition Science in the United State*. 2024. www.whitehouse.gov/pcast
10. White House Domestic Policy Council. *Biden-Harris National Strategy on Hunger, Nutrition and Health*. 2022. https://www.whitehouse.gov/wp-content/uploads/2022/09/White-House-National-Strategy-on-Hunger-Nutrition-and-Health-FINAL.pdf
11. U.S. Department of Agriculture, Agricultural Research Service. What We Eat in America. https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-surveys-research-group/docs/wweianhanes-overview/
12. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. National Health and Nutrition Examination Survey. https://www.cdc.gov/nchs/nhanes/index.htm
13. U.S. Department of Health and Human Services, Center for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey. Brief Overview of Sample Design, Nonresponse Bias Assessment, and Analytic Guidelines for NHANES August 2021-August 2023. https://wwwn.cdc.gov/nchs/nhanes/continuousnhanes/overviewbrief.aspx?Cycle=2021-2023
14. Ponce N, Becker T, Babey S, et al. *Improving Data Capacity for American Indian/Alaska Native (AIAN) Populations in Federal Health Surveys*. 2019; https://aspe.hhs.gov/sites/default/files/migrated_legacy_files/197431/improving-data-capacity-aian.pdf
15. U.S. Department of Agriculture, Agricultural Research Service. FoodData Central. https://fdc.nal.usda.gov/
16. Casavale KO, Anderson-Villaluz D, Ahuja JK, et al.Perspective: The Human Milk Composition Initiative - Filling Crucial Gaps in Data on and Related to Human Milk in the United States and Canada. *Adv Nutr*. Nov 2023;14(6):1253-1254. doi:https://doi.org/10.1016/j.advnut.2023.07.005
17. Institute of Medicine. *Dietary Reference Intakes: Applications in Dietary Assessment*;2000:305. doi:https://doi.org/10.17226/9956
18. National Academies of Sciences, Engineering, and Medicine. *Guiding Principles for Developing Dietary Reference Intakes Based on Chronic Disease*. 2017:334. doi:https://doi.org/10.17226/24828
19. Mertens E, Colizzi C, Penalvo JL. Ultra-processed food consumption in adults across Europe. *Eur J Nutr*. Apr 2022;61(3):1521-1539. doi:https://doi.org/10.1007/s00394-021-02733-7
20. Baraldi LG, Martinez Steele E, Canella DS, Monteiro CA. Consumption of ultra-processed foods and associated sociodemographic factors in the USA between 2007 and 2012: evidence from a nationally representative cross-sectional study. *BMJ Open*. Mar 9 2018;8(3):e020574. doi:https://doi.org/10.1136/bmjopen-2017-020574
21. Juul F, Parekh N, Martinez-Steele E, Monteiro CA, Chang VW. Ultra-processed food consumption among US adults from 2001 to 2018. *Am J Clin Nutr*. Jan 11 2022;115(1):211-221. doi:https://doi.org/10.1093/ajcn/nqab305

22. English LK, Raghavan R, Obbagy JE, et al. Dietary Patterns and Health: Insights From NESR Systematic Reviews to Inform the Dietary Guidelines for Americans. *J Nutr Educ Behav*. Jan 2024;56(1):75-87. doi:https://doi.org/10.1016/j.jneb.2023.10.001

Part F. Appendix F-1: Glossary of Terms and Abbreviations

Terms included in this appendix are defined according to their use in the 2025 Dietary Guidelines Advisory Committee's review of the evidence and resulting Scientific Report. Terms that are included here are those that are cross-cutting (i.e., appear in multiple chapters) throughout the report, ambiguous in some contexts, and/or may have multiple definitions. This appendix also includes a list of abbreviations used in the Scientific Report.

Glossary of Terms

Added sugars: Sugars that are added during the processing of foods (such as sucrose or dextrose), foods packaged as sweeteners (such as table sugar), sugars from syrups and honey, and sugars from concentrated fruit or vegetable juices.

Beans, Peas, and Lentils: Name for the food subgroup formerly called "legumes (beans and peas)" that includes the dried edible seeds of legumes (beans and peas). This subgroup is also known as pulses. Beans, peas, and lentils have a similar nutrient profile to foods in both the Vegetable Group and the Protein Foods Group. They may be thought of as either a vegetable or a protein food when aiming to meet recommended intakes. Beans include varieties such as kidney beans, pinto beans, white beans, black beans, pinto beans, and fava beans. Also included are dried peas (e.g., chickpeas, black-eyed peas), and lentils. Edamame, the soybean in the pod, is counted in the subgroup even though it is eaten fresh and not dried. Generally, foods made from processed soybeans are a part of the Nuts, Seeds, and Soy Products subgroup of the Protein Foods Group. Green peas and green (string) beans are not counted in the subgroup because the nutrient content of these vegetables is more similar to vegetables in other subgroups.

Beverage patterns: The quantities, proportions, variety, or combination of different beverages in diets, and the frequency with which they are habitually consumed.

Body mass index (BMI): A measure that defines weight in kilograms (kg) divided by height in meters (m) squared. BMI is an indicator of deficient or excess body tissue, both fat and muscle. BMI status categories for individuals ages 2 years and older include underweight, normal weight, overweight, and obesity (normal weight is often referred to as "healthy" weight). Overweight and obesity describe ranges of weight that are greater than what is considered healthy for a given height, whereas underweight describes a weight that is lower than what is considered healthy. Because children and adolescents are growing, their BMI is plotted on growth charts for sex and age. The percentile indicates the relative position of the child's BMI among children of the same sex and age. This is generally referred to as a *BMI percentile or z-score*. Body weight categories for children, adolescents, and adults are summarized in **Table F.1.1**.

TABLE F.1.1
BODY MASS INDEX CATEGORIES FOR CHILDREN, ADOLESCENTS, AND ADULTS

Body Mass Index Category	**Children and Adolescents (Ages 2 to 19 years) (Sex-Specific BMI-for-Age Percentile Range)**	**Adults (BMI)**
Underweight	Less than the 5th percentile	Less than 18.5 kg/m^2
Normal Weight	5th percentile to less than the 85th percentile	18.5 to 24.9 kg/m^2
Overweight	85th to less than the 95th percentile	25.0 to 29.9 kg/m^2
Obesity	Equal to or greater than the 95th percentile	30.0 kg/m^2 and greater
Severe Obesity	120% of the 95th percentile or greater	40.0 kg/m^2 and greater

Carbohydrates: One of the 3 primary macronutrients that may be present in foods and beverages. Carbohydrates include sugars, starches, and fibers:

- **Sugars**: A simple carbohydrate composed of one unit (a monosaccharide, such as glucose and fructose) or two joined units (a disaccharide, such as lactose and sucrose). Sugars include white sugar, brown sugar, fruit sugar, corn syrup, molasses, and honey (see Added sugars).
- **Starches**: Many glucose units linked together. Examples of foods containing starch include vegetables, dry beans and peas, and grains (e.g., rice, oats, wheat, barley, corn).
- **Fiber**: Nondigestible carbohydrates and lignin that are intrinsic and intact in plants. Fiber consists of dietary fiber, the fiber naturally occurring in foods, and functional fiber, which are isolated, nondigestible carbohydrates that have beneficial physiological effects in humans.

Complementary feeding: The process that starts when human milk or infant formula is complemented by other foods and beverages. The complementary feeding period typically continues to age 24 months as the young child transitions to family foods.

Complementary foods and beverages (CFB): Foods and beverages (liquids, semisolids, and solids) other than human milk or infant formula provided to an infant or young child during the complementary feeding period to provide nutrients and energy.

Consistency: One of the criteria used to grade the strength of the evidence in systematic reviews conducted using Nutrition Evidence Systematic Review (NESR) methodology. Consistency considers the degree of similarity in the direction and magnitude of effect across the body of evidence. This element also considers whether differences across the results can be explained by variations in study designs and methods (see Grade).

Chronic Disease Risk Reduction (CDRR) intakes: A nutrient reference value that characterizes nutrient intakes that are expected to reduce the risk of developing chronic disease. The CDRR does not replace existing DRI categories, but changes how evidence on chronic disease risk is assessed and used in the DRI process. For individuals ages 14 and older, the CDRR recommendation is to reduce sodium intakes if above 2,300 mg per day.

The sodium CDRR for children ages 1-13 are:

- 1–3 years Reduce intakes if above 1,200 mg/day
- 4–8 years Reduce intakes if above 1,500 mg/day
- 9–13 years Reduce intakes if above 1,800 mg/day

Culture: The shared values, norms, and belief systems that collectively shape a group's attitudes, behaviors, and perceptions through their interactions with and within their environments.

Dietary pattern: The combination of foods and beverages that constitutes an individual's complete dietary intake over time. This may be a description of a customary way of eating or a description of a combination of foods recommended for consumption.

Dietary Pattern Flexibilities: The Committee operationalized the term 'Flexibilities' as narrative advice around options for meeting nutrient needs outside of quantitative pattern recommendations (e.g., flexibilities to consume more plant-based protein foods than quantified in the Pattern).

Dietary Pattern Modifications: The Committee operationalized the term 'Modifications' as any proposed change to the food group or subgroup quantities provided in the patterns included in the Dietary Guidelines for Americans, 2020-2025.

Dietary Pattern Variations: The Committee operationalized the term 'Variation' as the creation of a new dietary pattern.

Dietary Reference Intakes (DRIs): Nutrient reference values developed by the National Academies of Sciences, Engineering, and Medicine that are specific to age, sex, and life stage. The DRIs provide reference values for vitamins, minerals, and other nutrients that: 1) indicate daily intake amounts that meet the needs of most healthy people, and 2) set intake levels not to exceed to avoid harm.

Dietary supplement: A product intended to supplement the diet that contains 1 or more dietary ingredients (including vitamins, minerals, herbs or other botanicals, amino acids, and other substances) intended to be taken by mouth as a pill, capsule, tablet, or liquid, and that is labeled on the front panel as being a dietary supplement.

Directness: One of the criteria used to grade the strength of the evidence in systematic reviews conducted using NESR methodology. Directness considers the extent to which studies are designed to directly examine the relationship among the interventions/exposures, comparators, and outcome(s) of primary interest in the systematic review question (see **Grade**).

Established Nutritional Goals for Food Pattern Modeling: The established nutritional goals for food pattern modeling analyses are defined as the Estimated Energy Requirement (EER) for energy, less than 10 percent of energy from saturated fat, less than 10 percent of energy from added sugars, lower than the Chronic Disease Risk Reduction intakes (CDRR) for sodium, and 90 percent of the Recommended Dietary Allowance (RDA) or Adequate Intake (AI) when an RDA is not established.

Evidence scan: An exploratory evidence description project in which systematic methods are used to search for and describe the volume and characteristics of evidence available on a nutrition question or topic of public health importance.

Fats: One of 3 primary macronutrients that may be present in foods and beverages.

- **Unsaturated fat**: Unsaturated fat has 1 or more double bonds between carbon atoms. Depending on the double bonds, unsaturated fats can be classified as monounsaturated fat or polyunsaturated fat:
- **Monounsaturated fat**: Monounsaturated fats have 1 double bond. They are found in both animal and plant products. Plant sources that are rich in monounsaturated fat include nuts and vegetable oils that are liquid at room temperature (e.g., canola oil, olive oil, high oleic safflower, and sunflower oils).
- **Polyunsaturated fat**: Polyunsaturated fats have 2 or more double bonds and may be 1 of 2 types, based on the position of the first double bond. Polyunsaturated fats are found in many different plants and some fish sources.
- **Saturated fat**: Saturated fats have no double bonds. Major sources include animal products, such as meat and dairy products, and plant sources higher in saturated fat (e.g., palm oil, cocoa butter, and coconut oil). In general, fats high in saturated fatty acids are solid at room temperature.

Food environments: The physical, social, and person-centered environments that play a role in what people choose to eat. Physical factors include the availability and accessibility of foods in homes, early care and education centers, preschools, schools, and community venues, with the most proximal being food in homes. Social factors include social support for making healthy food choices, role modeling, and social expectations. The person-centered factors include an individual’s perceptions of the food environment and their own relationship with food. Food environments also include macro-level factors such as food marketing, food production and distribution systems, agricultural policies, federal nutrition assistance programs, and economic price structures.

Food groups: A method of grouping similar foods for descriptive and guidance purposes. Food groups in the USDA Dietary Pattern(s) are defined as Fruits, Vegetables, Grains, Dairy and Fortified Soy Alternatives, and Protein Foods. Some of these groups are divided into subgroups, such as Dark-Green Vegetables or Whole Grains. When mixed dishes are assigned to food groups, they are disaggregated into their major component parts. For example, pizza may be disaggregated into the Grains (crust), Dairy and

Fortified Soy Alternatives (cheese), Vegetables (sauce and toppings), and Protein Foods (toppings) food groups.

Food pattern modeling: Food pattern modeling is a methodology used to illustrate how changes to the amounts or types of foods and beverages in a dietary pattern might affect meeting nutrient needs. Food pattern modeling is used to develop quantitative dietary patterns that reflect health-promoting patterns identified in systematic reviews and meet energy and nutrient needs.

Food security: A condition in which all people, at all times, have access to sufficient, safe, and nutritious food to maintain a healthy and active life.

Generalizability: One of the criteria used to grade the strength of the evidence in systematic reviews conducted using NESR methodology. Generalizability considers whether the study participants, interventions and/or exposures, comparators, and outcomes examined in the body of evidence are applicable to the U.S. population of interest for the review (see **Grade**).

Grade: A term that communicates the strength of evidence supporting a conclusion statement developed as part of systematic reviews conducted using NESR methodology. The strength of evidence is determined based on an evaluation of predefined criteria for the following grading elements: consistency, precision, risk of bias, directness, and generalizability. A conclusion statement can receive a grade of Strong, Moderate, or Limited. If insufficient or no evidence is available to answer a systematic review question, then no grade is assigned (i.e., Grade Not Assignable) (see **Consistency**; **Precision**; **Risk of bias**; **Directness**; **Generalizability**).

- **Strong**: The conclusion statement is based on a strong body of evidence as assessed by consistency, precision, risk of bias, directness, and generalizability. The level of certainty in the conclusion is strong, such that if new evidence emerges, modifications to the conclusion are unlikely to be required.
- **Moderate**: The conclusion statement is based on a moderate body of evidence as assessed by consistency, precision, risk of bias, directness, and generalizability. The level of certainty in the conclusion is moderate, such that if new evidence emerges, modifications to the conclusion may be required.
- **Limited**: The conclusion statement is based on a limited body of evidence as assessed by consistency, precision, risk of bias, directness, and generalizability. The level of certainty in the conclusion is limited, such that if new evidence emerges, modifications to the conclusion are likely to be required.
- **Grade Not Assignable**: A conclusion statement cannot be drawn due to either a lack of evidence, or evidence that has severe limitations related to consistency, precision, risk of bias, directness, and generalizability.

Growth, body composition, and risk of obesity measures include the following:

- *Growth*: includes height, length/stature-for-age, weight, weight-for-age, stunting, failure to thrive, wasting, BMI-for-age, weight-for-length/stature, body circumferences (arm, neck, thigh), head circumference;
- *Body Composition*: includes skinfold thicknesses, fat mass, ectopic fat, fat-free mass, lean mass, waist circumference, waist-to-hip ratio; and
- *Risk of Obesity*: includes BMI, underweight, healthy/normal weight, overweight, obesity, and weight gain.
- *Gestational Weight Gain*: includes the increase in weight during pregnancy (difference in weight between 1 time during pregnancy and pre-pregnancy weight or between 1 time in pregnancy and an earlier time during pregnancy);
- *Postpartum Weight Change*: includes the change in weight during the postpartum period (difference in weight between weight during postpartum and weight at delivery or between 1 time in postpartum and an earlier time during postpartum).

Health Disparities: A particular type of health difference that is closely linked with economic, social, or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater social or economic obstacles to health based on their racial or ethnic group, religion, socioeconomic status, gender, age, or mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion.

Health Equity: The state in which everyone has a fair and just opportunity to attain their highest level of health. This includes the consistent and systematic treatment of all individuals in a fair, just, and impartial manner, including individuals who belong to communities that have often been denied such treatment, such as Black, Hispanic or Latino, Indigenous and Native American, Asian American, Native Hawaiian and Pacific Islander persons, and other persons of color; members of religious minorities; women and girls; Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, and Asexual persons; persons with disabilities; persons who live in rural areas; persons who live in United States Territories; persons with stigmatized health conditions; persons otherwise adversely affected by persistent poverty or inequality; and individuals who belong to multiple such communities.

Human milk: A person's own milk provided at the breast (i.e., nursing) or expressed and fed fresh or after refrigeration or freezing.

Human milk feeding: Feeding human milk alone or in combination with infant formula and/or complementary foods and beverages.

Infant formula: A food that is represented for special dietary use solely as a food for infants by reason of its simulation of human milk or its suitability as a complete or partial substitute for human milk.

Isocaloric: Having the same energy values. For example, 2 dietary patterns that vary in macronutrient proportions but have the same energy content are isocaloric.

Item Clusters: Identified groupings of the same or similar foods or beverages that make up each food group and subgroup. Item clusters are used to calculate the weighted average consumption for use in calculating a nutrient profile for each food group and subgroup used in USDA food pattern modeling.

Lean meat: Any meat with less than 10 percent fat by weight, or less than 10 grams of fat per 100 grams, based on USDA and FDA definitions for food label use. Examples include 95 percent lean ground beef, cooked; broiled beef steak, lean only eaten; baked pork chop, lean only eaten; roasted chicken breast or leg, no skin eaten; and smoked/cured ham, lean only eaten.

Non-dairy alternatives: For the Committee's Food Pattern Modeling analyses, non-dairy alternatives are defined as foods and beverages that may be marketed to the public as milk, yogurt, or cheese alternatives originating from plant foods (e.g., almond, coconut, pea, and oat beverages; non-dairy yogurts and cheeses). For these analyses non-dairy alternatives do not include fortified soy alternatives as they are already a component of the Dairy and Fortified Soy Alternatives Food Group.

Nutrient-dense: Nutrient-dense foods and beverages provide vitamins, minerals, and other health-promoting components and have no or little added sugars, saturated fat, and sodium. Vegetables, fruits, whole grains, seafood, eggs, beans, peas, and lentils, unsalted nuts and seeds, fat-free and low-fat dairy products, and lean meats and poultry—when prepared with no or little added sugars, saturated fat, and sodium— are nutrient-dense foods.

Nutrient-dense representative foods: For purposes of USDA food pattern modeling, each item cluster is assigned a nutrient-dense representative food which are those foods or beverages that represent the forms with the least amounts of added sugars, saturated fat, and sodium. The nutrient composition of the nutrient-dense representative food is used to represent the nutrient composition of the entire item cluster when calculating the nutrient profile for a food group or subgroup.

Nutrients and food components of public health concern: Nutrients and other dietary components that are overconsumed or underconsumed (compared to Dietary Reference Intake recommendations and biological measures of the nutrient when available) and linked in the scientific literature to adverse health outcomes in the general population or in a subpopulation.

Nutrients and food components that pose special challenges: Nutrients and other dietary components for which dietary guidance to meet recommended intake levels was challenging to develop, or identification of at-risk groups was difficult due to unavailability of dietary data or biological endpoints directly linked to adverse outcomes. These nutrients and food components should continue to be monitored.

Nutrient profiles: The proportional nutrient composition from the item clusters that represent each food group and subgroup from the variety of foods in each food group in their nutrient-dense forms. The nutrient profiles are based on a weighted average of nutrient-dense forms of foods (i.e., a composite of nutrient-dense forms of foods and beverages within a food group or subgroup). The calculated weighted average considers a range of foods and beverages reported by individuals in the United States, but are modeled using nutrient-dense forms, and results in a food pattern that can be adapted to fit an individual's preferences.

Nutrition Evidence Systematic Review (NESR): NESR specializes in conducting food- and nutrition-related systematic reviews. NESR systematic reviews are research projects that answer important public health questions by using rigorous and transparent methods to search for, evaluate, analyze, and synthesize the body of scientific evidence on topics relevant to federal policy and programs.

Ounce equivalent (oz eq): The amount of a food product that is considered equal to 1 ounce from the Grains or Protein Foods food group. An oz eq for some foods may be less than a measured ounce in weight if the food is concentrated or low in water content (nuts, peanut butter, dried meats, flour) or more than a measured ounce in weight if the food contains a large amount of water (tofu, cooked beans, cooked rice or pasta).

Portion size: The amount of a food or beverage served at 1 time in 1 eating occasion and includes pre-portioned, self-served, and packaged foods and beverages.

Precision: One of the criteria used to grade the strength of the evidence in systematic reviews conducted using NESR methodology. Precision considers the degree of certainty around an effect estimate for a given outcome. This element considers measures of variability, such as the width and range of confidence intervals, the number of studies, and sample sizes, within and across studies (see Grade).

Processed meat: Meat, poultry, or seafood products preserved by smoking, curing, or salting, or addition of chemical preservatives. Examples of processed meat include bacon, sausage, hot dogs, sandwich meat, packaged ham, pepperoni, and salami.

Protein: One of 3 primary macronutrients that may be present in foods and beverages. Protein is the major functional and structural component of every animal cell. Proteins are composed of amino acids, 9 of which are essential, meaning they cannot be synthesized by humans and therefore must be obtained from the diet. The quality of dietary protein is determined by its amino acid profile relative to human requirements as determined by the body's requirements for growth, maintenance, and repair. Protein quality is determined by 2 factors: digestibility and amino acid composition.

- **Animal protein**: Protein from meat, poultry, seafood, eggs, and milk and milk products.
- **Plant-based protein**: Protein from plants such as dry beans, whole grains, fruit, nuts, and seeds.

Protocol: A plan used by the 2025 Dietary Guidelines Advisory Committee to conduct a systematic review or food pattern modeling analysis of a scientific question. Protocols were established at the beginning of a review or analysis and were posted online to provide transparency, guard against selective reporting, avoid duplication of efforts, and facilitate peer review and/or public comment.

Risk of bias: One of the criteria used to grade the strength of the evidence in systematic reviews conducted using NESR methodology. Risk of bias considers the likelihood that systematic errors resulting from the design and conduct of the studies could have impacted the accuracy of the reported results across the body of evidence. (see **Grade**)

Seafood: Marine animals that live in the sea and in freshwater lakes and rivers. Seafood includes fish such as salmon, tuna, trout, and tilapia, and shellfish such as shrimp, crab, and oysters.

Serving size: The customary or standard amount of a particular food or beverage consumed for the purpose of evaluating nutritional content or providing dietary guidance.

Simulation: Simulation is a systems science method that has been defined as "a mathematical model that describes or recreates computationally a system process." In USDA food pattern modeling, simulation was used to create computationally thousands of 7-day diets that meet the modified Healthy U.S.-Style Dietary Pattern by randomly selecting foods and beverages from a set of food and beverage items using a predefined probability of selection for each item.

Social Determinants of Health: Conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks. These are also known as non-medical drivers of health.

Socioeconomic position: An economic and sociologic measure defined by factors such as income in dollars, income as a percent of the poverty ratio, food security, eligibility for federal assistance programs, or level of education.

What We Eat in America (WWEIA) Food Categories: The What We Eat in America (WWEIA) Food Categories provide an application to analyze foods and beverages as consumed in the U.S. diet. Each of the food and beverage items that can be reported in WWEIA, National Health and Nutrition Examination Survey are placed in 1 of the mutually exclusive food categories. This is done by linking each food code contained in the Food and Nutrient Database for Dietary Studies (FNDDS) to 1 WWEIA category. The focus of this categorization system is on grouping similar foods and beverages together based on usage and nutrient content.

- This classification scheme includes approximately 172 unique categories.
- Each category is assigned a 4-digit number and description.
- Each FNDDS food code is linked to a unique category.
- Categories contain discrete food items - no disaggregation into ingredients; e.g., pizza vs. grain, cheese, tomatoes, etc. (see **Food groups**).

Abbreviations

The following table describes abbreviations and acronyms used throughout the Scientific Report of the 2025 Dietary Guidelines Advisory Committee.

TABLE F.1.2
LIST OF ABBREVIATIONS

Abbreviation	Full Name
AAP	American Academy of Pediatrics
AAPD	American Academy of Pediatric Dentistry
AHA	American Heart Association
AND	Academy of Nutrition and Dietetics
AI	Adequate Intake
AMDR	Acceptable Macronutrient Distribution Range
ARS	Agricultural Research Service
AT	alpha-tocopherol
BMI	body mass index
CACFP	Child and Adult Care Food Program
CBPR	community-based participatory research
CDC	Centers for Disease Control and Prevention
CDRR	Chronic Disease Risk Reduction Intake
CEM	continuous evidence monitoring
CFB	complementary foods and beverages
CHD	coronary heart disease
CNPP	Center for Nutrition Policy and Promotion
CONSORT	Consolidated Standards of Reporting Trials
CQA	continuous quality advancement
CVD	cardiovascular disease
DFE	dietary folate equivalent
DRI	Dietary Reference Intakes
EAR	Estimated Average Requirement
EER	Estimated Energy Requirement
ERS	Economic Research Service
FACA	Federal Advisory Committee Act

Abbreviation	Full Name
FDA	Food and Drug Administration
FFQ	food frequency questionnaire
FNDDS	Food and Nutrient Database for Dietary Studies
FNS	Food and Nutrition Service
FPED	Food Pattern Equivalents Database
FPM	food pattern modeling
FSRG	Food Surveys Research Group
GBCO	growth, body composition, and risk of obesity
GDM	gestational diabetes mellitus
GED	General Educational Development
GRAS	Generally Recognized as Safe
HDL-C	high-density lipoprotein cholesterol
HEI	Healthy Eating Index
HHS	United States Department of Health and Human Services
H-MED	Healthy Mediterranean-Style Dietary Pattern from the *Dietary Guidelines for Americans, 2020-2025*
HUSS	Healthy U.S.-Style Dietary Pattern from the *Dietary Guidelines for Americans, 2020-2025*
H-VEG	Healthy Vegetarian Dietary Pattern from the *Dietary Guidelines for Americans, 2020-2025*
ICHNR	Interagency Committee on Human Nutrition Research
IHS	Indian Health Service
LDL-C	low-density lipoprotein cholesterol
LNCSB	low- and no-calorie sweetened beverages
MUFA	monounsaturated fatty acids
NASEM	National Academies of Sciences, Engineering, and Medicine
NCI	National Cancer Institute
NCHS	National Center for Health Statistics
NESR	Nutrition Evidence Systematic Review
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey
NIH	National Institutes of Health
NIS	National Immunization Surveys
NSLP	National School Lunch Program

Abbreviation	Full Name
NVSS	National Vital Statistics System
OASH	Office of the Assistant Secretary for Health
ODPHP	Office of Disease Prevention and Health Promotion
PCAST	President's Council of Advisors on Science and Technology
RAE	retinol activity equivalents
RCT	randomized controlled trials
RDA	Recommended Dietary Allowance
P/B-24 Project	Pregnancy and Birth to 24 Months Project
PCS	prospective cohort studies
PICO	population, intervention, comparator, and outcome(s)
PIR	poverty to income ratio
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PRAMS	Pregnancy Risk Assessment Monitoring System
PUFA	polyunsaturated fatty acids
SBP	School Breakfast Program
SDOH	social determinants of health
SEER	Surveillance, Epidemiology and End Results
SEP	socioeconomic position
SFSP	Summer Food Service Program
SNAP	Supplemental Nutrition Assistance Program
SR Legacy	Standard Reference Legacy
SSB	sugar-sweetened beverages
UL	Tolerable Upper Intake Level
UPF	ultra-processed food
USDA	United States Department of Agriculture
WHO	World Health Organization
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children
WWEIA	What We Eat in America

Part F. Appendix F-2: Public Comments

Introduction

As a federal government advisory committee, the Dietary Guidelines Advisory Committee (Committee) operates under the Federal Advisory Committee Act (FACA), a law that emphasizes public participation and requires open access to meetings and operations. To engage the public and ensure input, the U.S. Departments of Health and Human Services (HHS) and Agriculture (USDA) solicited public comments throughout the 2025 Dietary Guidelines Advisory Committee process. A *Federal Register* notice published on January 19, 2023, opened the public comment period, which remained open through October 7, 2024. During this time, the public was invited to submit written comments via Regulations.gov, at Docket HHS-OASH-2022-0021-0001 (www.regulations.gov/docket/HHS-OASH-2022-0021/document). In addition, oral testimony to the Committee was accepted at its third meeting on September 12, 2023. Per FACA, all meetings of the Committee were open to the public; the meetings were made accessible by webcast. *Federal Register* notices alerted the public to the Committee's meetings, and in these notices, the public was invited and reminded to submit comments via Regulations.gov. In addition, the Departments updated the DietaryGuidelines.gov website, sent GovDelivery notices via email, and posted social media messages on a steady basis to notify the public of opportunities to engage throughout the Committee's work.

Comments submitted to the Committee covered a wide array of topics. The majority addressed topics under review by the Committee, including dairy consumption, ultra-processed foods, plant-based diets, and health equity, particularly with an emphasis on cultural diets and helping all people in the United States achieve a dietary pattern that supports a healthy and active lifestyle. Public input came from a diverse group of commenters, including industry groups, community practitioners, academia, and private citizens. A total of 9,942 comments were received from January 19, 2023, through October 7, 2024, which includes 3 submitted by postal mail and uploaded to the Federal Docket Management System (FDMS). Of these comments, a total of 9,886 were posted. Fifty-six comments were identified as duplicative, not germane, or otherwise violating commenting guidelines, and were not posted.

Following the submission of the Scientific Report of the 2025 Dietary Guidelines Advisory Committee to the Secretaries of HHS and USDA, the federal government alerted the public of its availability through a *Federal Register* notice. This notice also announced a public comment period where the public could provide comments to the federal government about the report.

Process

Comments were accepted electronically through Regulations.gov and by paper submissions through the postal mail. Comments were processed using FDMS, a centralized Docket Management system that provides the ability to search, view, download, and submit comments on federal notices and rules. Media and mail campaigns resulted in duplicate comments from individuals and organizations, and these are referred to as form letters. FDMS enabled comment de-duplication based on the detection of similarities and differences among comments within each campaign.

Information required from the public comment submitter included the text of the comment (up to 5,000 characters), attachments, if any, and first and last names. Additional information, though not required, could be provided and would be viewable on Regulations.gov, including the submitter's city, state, and country, and organization type and name, if applicable. Street address, zip code, e-mail address, and telephone and fax numbers also could be provided, but would not be viewable on Regulations.gov except if included in attachments.

All comment submissions were reviewed by a third-party consultant (ICF International, Inc.) and after being posted were viewable on Regulations.gov. The content of public comments was not edited, but in some cases, certain types of personally identifiable information, such as an individual's street address or email address, were redacted. Several comments were withdrawn after notice was given to staff by the commenter that an incomplete comment had been submitted in error. Comments that contained vulgar language or inappropriate comments were not posted.

ICF summarized each submitted comment. Committee members were regularly sent comment summaries organized by topic area. The summary included the commenter's name and/or affiliation, the comment number, and the hyperlink to the comment on Regulations.gov. Additionally, Committee members were given instructions for searching and reading the full comments on Regulations.gov. When requested, federal staff also provided Committee members with copies of original public comment submissions and any corresponding attachments. Public comments were discussed and considered by the Committee at Subcommittee and full Committee meetings.

Written Comments to the Advisory Committee

Written public comments to the Committee were continuously submitted from January 19, 2023, through October 7, 2024. Collection was announced in Federal Register Notice 88 FR 3423, published on January 19, 2023, and comments were collected in Docket HHS-OASH-2022-0021-0001. All comments will remain on Regulations.gov and can be accessed and read at any future time by searching for the Docket number noted above.

For each question, a specific protocol, or plan, was developed to describe how the Committee would apply a methodology, such as the Nutrition Evidence Systematic Review (NESR) methodology, to answer the scientific question. During the second, third, fourth, and fifth Committee meetings, the Chair asked the public to provide comments on the protocols specifically discussed at those meetings. Staff compiled all comments on the protocols and provided them to Committee members, along with directions on accessing and reading comments on Regulations.gov.

Oral Comments to the Advisory Committee

The opportunity to provide oral comments in person at a full Committee meeting was announced in the Federal Register Notice 88 FR 46170, published on July 19, 2023. Commenters were given the option to either submit a pre-recorded video comment to be played to the Committee or to present their comments live via webinar on September 12, 2023. A total of 82 people provided virtual oral comments on September 12, 2023—56 submitted pre-recorded videos that were presented to the Committee, and 26 provided comments live via webinar. One hundred people were on the list to provide oral comments (including 80 confirmed and 20 standby commenters). One confirmed speaker did not attend; 3 speakers from the standby list provided comments.

Registration to provide oral comments was completed online and registrants were accepted on a first come, first served basis. Registration was further limited to 1 person per organization. Individuals submitted a brief outline of their oral comments upon registering and were allowed up to 2 minutes to deliver their comments to the Committee. Some individuals also submitted written copies of their oral comments through Regulations.gov.

Additional Comment Collections

In addition to soliciting public comments throughout the period of the Committee's work, HHS and USDA asked for public comments at 2 other times. Before the Committee was established, HHS and USDA asked for public comments on the proposed topics and questions to be examined by the Committee. These topics and questions remain available at DietaryGuidelines.gov.

Comments were accepted April 15, 2022, through May 16, 2022; a total of 1,443 public comments were received. Of those, 674 were unique submissions, and 747 submissions comprising 4 distinct form letter campaigns were identified. The remaining 22 comments were identified as duplicative or not germane.

The public also was asked to submit nominations of individuals to serve on the Committee. Nominations, including self-nominations, were collected from June 15, 2022, through July 15, 2022 (see **Part C. Methodology** for additional details on the process to identify scientific questions and appoint the Committee).

A final round of public comments directed to HHS and USDA on the Committee's Scientific Report was received in Docket HHS-OASH-2024-0017 on Regulations.gov following the Committee's submission of its report to the Secretaries of HHS and USDA. The Committee's report is publicly available on DietaryGuidelines.gov. This round of public comments encompassed written comments on the Committee's report, as well as an opportunity to provide pre-recorded or live oral comments via webinar to the Departments at a virtual meeting on January 16, 2025.

Summary

The oral and written comments provided by the public were valuable in that they helped the Committee gather background information and understand public and professional perceptions on diet and health topics included in its review of the evidence. Comments from the public brought new issues to light as well as new approaches to examining current issues and emerging evidence. They also highlighted and ensured consideration of topics deemed to be important by the submitters, who represented a variety of backgrounds and focus areas.

For 22 months, HHS and USDA sought written and oral public comments throughout the Committee's deliberations. The Committee reviewed the comments and greatly appreciated the time, effort, and thought that individuals and organizations put into their submissions. Public involvement is critical to making the *Dietary Guidelines* development process open and transparent.

Part F. Appendix F-3: Biographical Sketches of the 2025 Dietary Guidelines Advisory Committee

Below is brief biographical information for each member of the 2025 Dietary Guidelines Advisory Committee as it relates to the Committee's scope and charge.

Sarah Booth, PhD (Chair), is Director of the USDA Human Nutrition Research Center on Aging (HNRCA) at Tufts University and Senior Scientist. She has led HNRCA, one of the largest research centers focused on nutrition and healthy aging, since 2016. She is also Professor at the Friedman School of Nutrition Science and Policy at Tufts University. Dr. Booth is an international leader in vitamin K research and her current research investigates the roles of vitamins D and K in risk for Alzheimer's disease and dementia. She has also studied novel roles for vitamin K in calcification disorders and kidney disease and discovered a previously undescribed form of vitamin K in the human diet. She developed the methodology for measuring vitamin K forms in a variety of food matrices and her team continues to generate vitamin K food composition data for national nutrient databases. Dr. Booth is President of the American Society for Nutrition (ASN). She earned a PhD in Human Nutrition from McGill University in Montreal, Canada.

Angela Odoms-Young, PhD, MS (Vice Chair) is an Associate Professor and Director of the Food and Nutrition Education in Communities Program and New York State Expanded Food and Nutrition Education Program in the Division of Nutritional Sciences at Cornell University. Dr. Odoms-Young's research explores the social and structural determinants of dietary behaviors and related health outcomes in low-income populations and in populations that are Black, Indigenous, and people of color. Her work centers on developing culturally responsive programs and policies that promote health equity, food justice, and community resilience. She has served on numerous advisory committees and boards, including the National Academies of Sciences, Engineering, and Medicine (NASEM) Food and Nutrition Board and NASEM's respective committees that provided recommendations to update nutrition standards for school meals and to re-evaluate the food packages provided in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Dr. Odoms-Young received a PhD in Community Nutrition from Cornell University and completed a Family Research Consortium Postdoctoral Fellowship at the Pennsylvania State University and the University of Illinois at Urbana-Champaign.

Steven Abrams, MD, is a board-certified pediatrician and practicing neonatologist. He is Professor of Pediatrics at Dell Medical School (DMS) at the University of Texas. He was previously Chair of the Department of Pediatrics at DMS. His research and clinical expertise relate to the nutritional needs, particularly for minerals, of infants and young children. He also conducts ongoing research that examines food insecurity among young children, including effects of the COVID-19 pandemic. He served as a member of the 2015 Dietary Guidelines Advisory Committee and as a member and later Chair of the American Academy of Pediatrics (AAP) Committee on Nutrition. He is co-editor of the AAP's Nutrition Handbook, 9th Edition and an editor for pediatric nutrition topics for UpToDate. He is the recipient of the Fomon Award for outstanding research in pediatric nutrition from the AAP and is a fellow of the American Society for Nutrition and a fellow of the American Institute for Medical and Biological Engineering. Dr. Abrams earned an MD at The Ohio State University.

Cheryl Anderson, PhD, MPH, MS, is a Professor and Founding Dean of the Herbert Wertheim School of Public Health and Human Longevity Science at the University of California San Diego (UCSD). Dr. Anderson is also Director of the UCSD Center of Excellence in Health Promotion and Equity. Her research focuses on nutrition and chronic disease prevention in underserved populations using observational epidemiologic study designs, randomized clinical trials, and implementation science. She is a member of the National Academy of Medicine’s Health and Medicine Division Board on Global Health and serves on the American Heart Association's (AHA) Board of Directors (member), its Council Operations Committee (chair), and its Epidemiology Leadership Committee (member). Dr. Anderson was also a member of the 2015 Dietary Guidelines Advisory Committee. She received a PhD and an MS, both in Epidemiology, from the University of Washington, and an MPH in Health Behavior from the University of North Carolina at Chapel Hill.

Aline Andres, PhD, RD, is a Professor of Pediatrics at University of Arkansas for Medical Sciences and Associate Director of the Arkansas Children’s Nutrition Center. Her research examines the effects of prenatal and postnatal nutrition on offspring growth, body composition, metabolism, development, and health. Her investigations have enhanced understanding of the effects of maternal excessive weight on offspring metabolism and of the impact of early infant feeding on childhood growth and development by leveraging existing longitudinal cohorts, designing and implementing new longitudinal cohorts, and leading randomized controlled trials. Dr. Andres served on the Integration and Application Working Group for the National Institutes of Health (NIH) Breastmilk Ecology project and is a prior chair of The Obesity Society Membership Committee. She completed a PhD in Nutritional Sciences at the University of Illinois at Urbana-Champaign and is a registered dietitian.

Carol Byrd-Bredbenner, PhD, RD, FAND, is Distinguished Professor of Nutrition and Director of the Nutritional Sciences Graduate Program at Rutgers, The State University of New Jersey. Her research aims to elucidate the role of cognitive and environmental factors on nutrition behaviors and health outcomes, and the development and application of health behavior change theory. She also develops recommendations and guidance for nutrition communication and implementation science aspects of health promotion interventions. Currently, she is leading the innovative National Institute of Food and Agriculture (NIFA)- and NIH-funded childhood obesity and cardiometabolic disease prevention program, HomeStyles, that aims to motivate families to make quick, easy, evidence-based modifications to their home environment and lifestyle practices. She received the Helen Denning Ullrich Award for Lifetime Excellence in Nutrition

Education from the Society for Nutrition Education and Behavior and the Excellence in Nutrition Education Award from the American Society for Nutrition. Dr. Byrd-Bredbenner earned a PhD at The Pennsylvania State University and is a registered dietitian.

Andrea Deierlein, PhD, MPH, MS, is an Associate Professor of Epidemiology and Director of Public Health Nutrition at New York University School of Global Public Health. She is a nutritional epidemiologist who studies how dietary, behavioral, and environmental factors contribute to perinatal health outcomes and chronic disease development across the life course. Her research has examined predictors and outcomes of maternal metabolic health-related conditions during pregnancy and postpartum, such as excessive gestational weight gain, hyperglycemia, and obesity. She has also conducted studies on exposures to environmental endocrine-disrupting chemicals and cardiometabolic health outcomes among children and pregnant persons. Recently, Dr. Deierlein expanded her research to include reproductive and perinatal health outcomes among persons with disabilities. She received a PhD in Nutrition Epidemiology at the University of North Carolina at Chapel Hill and an MPH in Epidemiology and an MS in Human Nutrition at Columbia University.

Heather Eicher-Miller, PhD, is a Professor in the Department of Nutrition Science at Purdue University. She is a nutrition epidemiologist experienced in dietary data analysis and patterning, assessment techniques and inference, with a focus on low-resource populations. Many of her studies are aimed to improve food insecurity through evaluation of nutrition education and food assistance programs and their impacts on dietary intake and health. She also leads interventions focused on promoting healthful food environment in food pantries, improving client diets and access to resources. Dr. Eicher-Miller also leads a team to create new techniques for integrating the timing of dietary intake, physical activity, and other lifestyle patterns and evaluating their relationship to health indicators. She has held various member leadership roles in the American Society of Nutrition and the Society for Nutrition Education and Behavior and is also a member of the Board of Editors for the Journal of the Academy of Nutrition and Dietetics and Advances in Nutrition. Dr. Eicher-Miller was recently selected as the 2023-2024 Danone International Prize for Alimentation Laurate. She received a PhD and completed post-doctoral research in Foods and Nutrition/Nutrition Science from Purdue University.

Jennifer Orlet Fisher, PhD, is a Professor in the Department of Social and Behavioral Sciences and Associate Director of the Center for Obesity Research and Education at Temple University. Dr. Fisher's research seeks to understand influences on the development of eating behaviors and weight outcomes during early childhood. Her work examines the role of the family as a first and fundamental context in which eating habits develop. She has conducted basic and applied research to understand socioenvironmental influences on appetite self-regulation and obesity among young children, including studies of food-motivated eating behaviors and food parenting influences. Her work has focused on racial and ethnic minority families with low incomes who experience disproportionate diet- and obesity-related burdens. Her current research investigates sweet preferences, food motivated behaviors, and executive functioning around eating during early childhood. Dr. Fisher was Chair of a Robert Wood Johnson Foundation-funded Healthy Eating Research expert panel examining promotion of healthy dietary behaviors for children ages 2-8 years and serves on several journal editorial boards. She earned a PhD in Nutrition from The Pennsylvania State University.

Teresa Fung, ScD, RD, is a Professor of Nutrition at Simmons University and Adjunct Professor of Nutrition at the Harvard T.H. Chan School of Public Health. Her expertise is in developing diet quality measures and examining corresponding disease risk. As a nutritional epidemiologist, she has examined the associations between the Alternate Mediterranean Diet Score, the Dietary Approaches to Stop Hypertension score, and the Alternate Healthy Eating Index and health outcomes including diabetes, cardiovascular disease, cancer, weight change, geriatric fractures, and frailty. From 2018-2020, she led the U.S. module to develop the Global Diet Quality Score to measure diet quality and predict chronic disease risk in different worldwide settings. She is Associate Editor for the Journal of Nutrition and a member of the editorial board for the Journal of the Academy of Nutrition and Dietetics. She received the 2022 Elaine R. Monsen Award for Outstanding Research Literature from the Academy of Nutrition and Dietetics. Dr. Fung earned a dual ScD in Epidemiology and Nutrition at Harvard and is a Registered Dietitian.

Christopher Gardner, PhD, is the Rehnborg Farquhar Professor of Medicine at Stanford University, where he has been conducting epidemiological and human intervention trials for 30+ years. His research investigates the potential health benefits of various dietary components and food patterns. This includes intervention studies on the relationships between diet and weight management, blood lipids and lipoproteins, inflammatory markers, insulin, blood pressure, body composition, and the microbiome. He is the principal investigator and lead author of two landmark weight loss diet trials, Diet Intervention Examining the Factors Interacting with Treatment Success (DIETFITS) and the A TO Z Weight Loss Study. He has participated in Scientific Statements of diet-disease relationships through his work with the American Heart Association (AHA) and the American Diabetes Association (ADA), including his contributions as a panel member and co-author of the ADA's update on Nutritional Therapy for Diabetes, and the writing chair for the 2023 AHA Scientific Statement on: Popular Dietary Pattern: Alignment With American Heart Association 2021 Dietary Guidance. He was the chair of the AHA's Nutrition Committee from 2022-2024 and co-chaired the expert committee that produced the 2022 AHA Policy Statement, Strengthening U.S. Food Policies and Programs to Promote Equity in Nutrition Security. Professor Gardner co-founded the Menus of Change University Research Collaborative. He earned a PhD in Nutrition Science from the University of California, Berkeley.

Edward Giovannucci, MD, ScD, is a Professor in the Departments of Nutrition and Epidemiology at the Harvard T.H. Chan School of Public Health. He is also an American Cancer Society Clinical Research Professor. During the past several decades, Dr. Giovannucci's work has been based largely in the Nurses' Health Study I & II and the Health Professionals Follow-Up Study. His research focuses on how nutritional, environmental, and lifestyle factors relate to various malignancies, especially those of the colorectum, other gastrointestinal cancers, and prostate cancer. In 2019, he received the American Association of Cancer Research-American Cancer Society Scientific Achievement Award for research excellence in cancer epidemiology and prevention. A specific interest has been understanding etiologic mechanisms underlying the relationships between nutritional factors and cancer. Dr. Giovannucci has extensive experience evaluating research to formulate cancer prevention recommendations for nutrition, physical activity, and body weight from his work with the World Cancer Research Fund/American Institute for Cancer Research Expert Panel. A major focus of his work is how diet interacts with physical activity and body weight to influence processes such as inflammation and insulin resistance to affect risk of multiple chronic diseases including cardiovascular disease, diabetes and cancer. He received an MD from the University of Pittsburgh and completed his residency in Anatomic Pathology at the University of Connecticut. Dr. Giovannucci then earned an ScD in Epidemiology from the Harvard T.H. Chan School of Public Health.

Deanna Hoelscher, PhD, RDN, LD, CNS, FISBNPA, is the John P. McGovern Professor in Health Promotion, founding Director of the Michael & Susan Dell Center for Healthy Living, and Regional Dean of the University of Texas Health Science Center at Houston (UTHealth Houston) School of Public Health in Austin. Her research interests are empowering children and their families to engage in healthier dietary and physical activity behaviors to prevent chronic disease, with an emphasis on addressing health disparities in diverse, historically underserved populations. She is the principal investigator of several studies funded by NIH, the Texas Department of State Health Services, and the Michael & Susan Dell Foundation, which focus on community-based participatory research, child obesity surveillance, maternal and child health, and the use of research evidence in health policy. Dr. Hoelscher has held several leadership positions in obesity- and nutrition-focused professional societies, including the International Society of Behavioral Nutrition and Physical Activity (ISBNPA), the Academy of Nutrition and Dietetics, and The Obesity Society. She is an ISBNPA Fellow and received the Oded Bar-Or Award for Excellence in Pediatric Obesity Research from The Obesity Society in 2024. She earned a PhD in Biological Sciences from the University of Texas at Austin and is a registered dietitian nutritionist.

Valarie Blue Bird Jernigan, DrPH, MPH, is a Professor of Medicine and Director of the Center for Indigenous Health Research and Policy at Oklahoma State University Center for Health Sciences. Dr. Jernigan has led or co-led trials to improve food systems and health in Indigenous communities. She led the THRIVE study, the first randomized trial of healthy makeovers in tribally owned convenience stores; the FRESH study, a farm-to-school intervention to support healthy eating patterns among Native American children; and a tribal community-supported agriculture study to promote sustainable changes to the food environment and health. Dr. Jernigan also leads the Center for Indigenous Innovation and Health Equity—an initiative coordinated by the HHS Office of Minority Health through cooperative agreements with Oklahoma State University and the University of Hawaii—which supports community-based initiatives to restore traditional food systems and practices in American Indian, Alaska Native, Native Hawaiian, and Pacific Islander communities. Dr. Jernigan is an enrolled citizen of the Choctaw Nation of Oklahoma. She received a DrPH from the University of California, Berkeley, and completed a postdoctoral fellowship in cardiovascular disease prevention at Stanford University Prevention Research Center.

Cristina Palacios, PhD, MSc, is a Professor and Chair in the Department of Dietetics and Nutrition at Florida International University (FIU). She has conducted several clinical trials in children, adolescents, and pregnant women, including Hispanic populations, to determine the effects of dietary supplements and dietary interventions on bone and body composition. She has developed and validated food frequency questionnaires in infants and children to evaluate dietary patterns. She also designed and tested interventions using technology for preventing excessive weight gain in Hispanic infants and pregnant women. Several of her studies have been conducted in collaboration with the WIC program, particularly among Hispanic families. She has completed extensive consultation for the World Health Organization and Pan-American Health Organization on developing various dietary guidelines for infants, children, and pregnant women and in establishing infant nutrient requirements. She is a fellow in the Robert Wood Johnson Foundation's Interdisciplinary Research Leaders program and was the previous chair of the Diversity and Inclusion Task Force at FIU. She earned a PhD and MSc in Nutrition from Purdue University.

Hollie Raynor, PhD, RD, LDN, is a Professor in the Department of Nutrition and Executive Associate Dean of Research and Operations in the College of Education, Health, and Human Sciences at the University of Tennessee. She conducts research in lifestyle interventions for pediatric and adult obesity care. Her research interests are identifying the best methods to implement dietary behaviors that improve outcomes in obesity care (e.g., limiting variety, reducing energy density, shifting distribution of energy intake earlier in the day), and translating lifestyle interventions into practice-based settings (i.e., integrated primary care). She served as a member of the National Committee for Clinical Guidelines for Obesity for the American Psychological Association and as a member of the Prediabetes and Adult Obesity Treatment Evidence Analysis Library Committee for the Academy of Nutrition and Dietetics. Dr. Raynor earned a PhD in Clinical Psychology at State University of New York at Buffalo and an MS in Public Health Nutrition at the University of Tennessee Knoxville and is a registered dietitian.

Fatima Cody Stanford, MD, MPH, MPA, MBA, MACP, FAAP, FAHA, FAMWA, FTOS, is an Associate Professor of Medicine and Pediatrics and practices and teaches at Massachusetts General Hospital/Harvard Medical School as one of the first fellowship-trained obesity medicine physicians. Her work in obesity medicine bridges the intersection of medicine, public health, policy, and disparities. She received the Gold Congressional Award in 2001 and was chosen as The Obesity Society Clinician of the Year in 2020. In 2021, she was awarded the Massachusetts Medical Society Grant Rodkey Award for her dedication to medical students and the American Medical Association's Dr. Edmond and Rima Cabbabe Dedication to the Profession Award for her commitment to expanding knowledge through teaching, conducting research, and publishing. She also received the Emory Rollins School of Public Health Distinguished Alumni Award and was selected by the National Academy of Medicine as a Scholar in Diagnostic Excellence. In 2024, she received the National Medical Association Meritorious Award and was selected for Mastership by the

American College of Physicians. Dr. Stanford received an MPH from Emory University as an MLK Scholar, an MD from the Medical College of Georgia School of Medicine as a Stoney Scholar, an MPA from the Harvard Kennedy School of Government as a Zuckerman Fellow in the Harvard Center for Public Leadership, and an executive MBA from the Quantic School of Business and Technology.

Sameera Talegawkar, PhD, is a Professor in the Department of Exercise and Nutrition Sciences at the Milken Institute School of Public Health at the George Washington University. A nutrition scientist and epidemiologist by training, she has expertise in nutritional assessment in diverse populations. Her research program focuses on better understanding the role of dietary patterns on age-related changes in physical function, including frailty, mobility limitations, and disability among older individuals. Dr. Talegawkar also studies the role of diet on health disparities experienced by underserved population groups. She is co-chair of the Jackson Heart Study Diet and Physical Activity Working Group. Dr. Talegawkar earned a PhD in Nutrition from the Friedman School of Nutrition Science and Policy at Tufts University.

Christopher Taylor, PhD, RDN, LD, FAND, is a Professor of Medical Dietetics and Family Medicine in the College of Medicine at The Ohio State University in Columbus, Ohio. His research examines how lifestyle factors impact obesity and chronic diseases, with a specific focus on food patterning, the influence of personal factors on lifestyle behavior choice, and factors that influence behavior change. His current research uses technology to more efficiently assess diet and refer primary care patients to resources such as registered dietitians to improve community health outcomes. Dr. Taylor serves as Associate Editor for the Journal of Nutrition Education and Behavior and has had several roles within the Academy of Nutrition and Dietetics, being recognized as a Fellow, served as Chair of the Research Dietetic Practice Group, and was also appointed as Chair of the Academy's 2020 Dietary Guidelines Collaborative. In 2024, he was recognized with the Academy's Medallion Award, to honor members who have shown dedication to the high standards of the nutrition and dietetics profession through active participation, leadership, and devotion to serving others in nutrition and dietetics. He received a PhD in Human Environmental Science from Oklahoma State University, an MS in Family Resources and Human Development at Arizona State University, BS in Dietetics from Bowling Green State University and is a registered dietitian nutritionist.

Deirdre Tobias, ScD, is a nutrition and obesity epidemiologist at Brigham and Women's Hospital and Harvard Medical School in Boston, MA. She is also an Assistant Professor at the Harvard T.H. Chan School of Public Health. Her research focuses on identifying lifestyle risk factors for obesity and related chronic diseases, including type 2 diabetes, heart disease, and cancer. Her work aims to improve understanding of overall dietary patterns and the biological mechanisms underlying their relationship with long-term health outcomes. Dr. Tobias is passionate about improving the validity and rigor of nutrition science research, particularly as it relates to optimizing systematic reviews and meta-analysis, and in conducting and interpreting large-scale longitudinal cohort studies. Dr. Tobias serves as principal investigator for NIH-funded research, including a randomized dietary intervention weight loss trial and observational cohort analyses to investigate multi-'omics of obesity, diet, and chronic disease. Dr. Tobias also serves as

Academic Editor for the American Journal of Clinical Nutrition. She received an BA from the College of the Holy Cross and MS and ScD from the Harvard T.H. Chan School of Public Health in Nutritional Epidemiology.

Part F. Appendix F-4: Membership of the Dietary Guidelines Advisory Committee Subcommittees and Working Group

Subcommittee and Working Group Structure

The 2025 Dietary Guidelines Advisory Committee included 4 Subcommittees and 2 cross-cutting Working Groups. The purpose of the Subcommittees and Working Groups was to review evidence for the topics and questions proposed by the Departments of Health and Human Services and of Agriculture. Each group conducted its work between the Committee's meetings and reported on its work to the full Committee at its meetings, all of which were held publicly. At these public meetings, the full Committee discussed and made decisions regarding the Subcommittees' and the Working Groups' scientific reviews. The conclusions and advice included in the Committee's report were reached with consensus across the full Committee.

Dietary Patterns and Specific Dietary Pattern Components Across Life Stages

Deanna Hoelscher[a] (Subcommittee Chair)

Sarah Booth[a] (Committee Chair)

Cheryl Anderson[a]

Andrea Deierlein

Teresa Fung

Christopher Gardner

Edward Giovannucci

Hollie Raynor[a]

Fatima Cody Stanford

Sameera Talegawkar[a]

Chris Taylor

Deirdre Tobias

Diet in Pregnancy and Birth Through Adolescence

Jennifer Orlet Fisher[a] (Subcommittee Chair)

Angela Odoms-Young[a] (Committee Vice-Chair)

Steve Abrams

Aline Andres

Carol Byrd-Bredbenner

Andrea Deierlein

Heather Eicher-Miller[a]

Cristina Palacios

[a]Denotes a member of the cross-cutting Health Equity Working Group

Food Pattern Modeling and Data Analysis

Chris Taylor (Food Pattern Modeling Chair)

Heath Eicher-Miller[a] (Data Analysis Chair)

Sarah Booth[a] (Committee Chair)

Steve Abrams

Carol Byrd-Bredbenner

Teresa Fung

Valarie Blue Bird Jernigan[a]

Sameera Talegawkar[a]

Deirdre Tobias

Strategies for Individuals and Families Related to Diet Quality and Weight Management

Cristina Palacios (Subcommittee Chair)

Angela Odoms-Young[a] (Committee Vice-Chair)

Cheryl Anderson[a]

Aline Andres

Jennifer Orlet Fisher[a]

Christopher Gardner

Edward Giovannucci

Deanna Hoelscher[a]

Valarie Blue Bird Jernigan[a]

Hollie Raynor[a]

Fatima Cody Stanford

Health Equity Working Group

Sameera Talegawkar (Working Group Chair)

Sarah Booth (Committee Chair)

Angela Odoms-Young (Committee Vice-Chair)

Cheryl Anderson

Heather Eicher-Miller

Jennifer Orlet Fisher

Deanna Hoelscher

Valarie Blue Bird Jernigan

Hollie Raynor

Meta-Analysis Working Group

Aline Andres

Carol Byrd-Bredbenner

Andrea Deierlein

Jennifer Orlet Fisher[a]

Teresa Fung

Cristina Palacios

Dierdre Tobias

[a]Denotes a member of the cross-cutting Health Equity Working Group

Part F. Appendix F-5: Acknowledgements

Federal Interagency Data Analysis Collaborations

USDA Agricultural Research Service

- Joseph Goldman, MA
- Alanna Moshfegh, MS, RD
- Pamela Pehrsson, PhD
- Donna Rhodes, MS, RD
- Rhonda Sebastian, MA

HHS Centers for Disease Control and Prevention

- Joseph Afful, MS (Contractor, Peraton)
- Nicholas Ansai, MPH
- Margaret Carroll, MSPH
- Cheryl Fryar, MSPH
- Heather Hamner, PhD, MS, MPH
- Cynthia Ogden, PhD, MRP
- Bryan Stierman, MD, MPH
- Anne Williams, PhD, MPH

HHS National Institutes of Health

- Kevin Dodd, PhD
- Audrey Goldbaum, PhD, MPH
- Kirsten Herrick, PhD, MSc
- Lisa Kahle, BA
- Jill Reedy, PhD, MPH, RDN
- Edwina Wambogo, PhD, MPH, RDN
- Amelia Willits-Smith, PhD

Federal Expert Reviewers of Data Analysis Reports

The following federal data analysis collaborators conducted expert review of the data analysis reports:

- Sara Crawford, PhD
- Cheryl Fryar, MSPH
- Audrey Goldbaum, PhD, MPH
- Kirsten Herrick, PhD, MSc
- Alanna Moshfegh, MS, RD
- Cynthia Ogden, PhD, MRP
- Jill Reedy, PhD, MPH, RDN
- Edwina Wambogo, PhD, MPH, RDN
- Anne Williams, PhD, MPH

Peer Reviewers of NESR Systematic Reviews and Food Pattern Modeling Reports

Thank you to staff from the National Institutes of Health for coordinating the peer review process:

- Samantha Adas, MS, RDN
- Kimberlea Gibbs, MPH, RDN, CHES
- Ashley Vargas, PhD, MPH, RDN

The following scientists from U.S. colleges and universities conducted independent peer review of the NESR systematic reviews:

- Mary Story, PhD, RD
- Regan Bailey, PhD, MPH, RD
- Sharon Donovan, PhD, RD
- Teresa Davis, PhD, MS
- Rachel Novotny, PhD, RDN, LD
- Jamie Stang, PhD, MPH, RD
- Mark R. Corkin, MD, CNSC, FASPEN, AGAF, FAAP
- Kelly Martin DCN, RDN, CDN
- Margaret O. Murphy, PhD, RD, LD
- Lauren Coheley Spain, PhD, RDN, LD, CDE, FAND, E-RYT
- Kristi M. Crowe-White, PhD, RD
- Christine Ferguson, PhD
- Kim S. Stote, PhD, MPH, RDN
- Jennifer T. Smilowitz, PhD
- Kathleen J. Melanson, PhD, RD, LDN
- Douglas Kalman, PhD, RD
- Marybeth Mitcham, PhD, MPH
- Sibylle Kranz, PhD, RND, FTOS
- Sarah Ardanuy Johnson, PhD, RDN
- Lauren E. O'Connor, PhD, MPH
- Virginia Uhley, PhD, RD
- Vijaya Juturu, PhD, FAND, FACN
- Dariush Mozaffarian, MD, DrPH
- Emily Johnston, PhD, MPH
- Ligia Reyes, PhD, MPH

The following scientists from U.S. colleges and universities and scientific consulting firms conducted independent peer review of the food pattern modeling reports:

- Virginia Uhley, PhD, RD
- Kelly Higgins, PhD
- Marybeth Mitcham, PhD, MPH
- Mark R. Corkin, MD, CNSC, FASPEN, AGAF, FAAP
- Valerie Sullivan, PhD
- Maya Vadiveloo, PhD, RD
- Mary Murphy, RD

OASH Tower Conference Center

- William Foster

NIH Events Management

- Joy Farrar
- Michael Burnham
- Evan Cavil
- Bob Hamer
- Jeffery Cozart

NIH Office of Research Services

- Ken Ryland
- Rodney Hall
- Jami Davis
- Rena Hicks

Invited Expert Speaker and/or Consultation

Federal

National Institute of Mental Health

- Anna Ordonez, MD
- Mary Rooney, PhD, ABPP

Substance Abuse and Mental Health Services Administration

- Jason Luisi, MPH
- Traci Pole, MBA, MS
- Bilina Shaw, MD, MPH, FAPA
- Charles Smith, PhD

Contract and/or Technical Support

- Lumina Corps
- Urban Emu
- Mathematica