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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?: Food Pattern Modeling Protocol

Christopher A. Taylor, PhD, RDN, LD, FAND,[a,b] Steven A. Abrams, MD,[a,c] Sarah L. Booth, PhD,[a,d] Carol Byrd-Bredbenner, PhD, RD, FAND,[a,e] Heather A. Eicher-Miller, PhD,[a,f] Teresa Fung, ScD, RD,[a,g] Valarie Blue Bird Jernigan, DrPH, MPH,[a,h] Sameera Talegawkar, PhD,[a,i] Deirdre Tobias, ScD,[a,j] Meghan Adler, MS, RDN,[k] Colleen M. Cruz, MPH, RDN,[k] Janet de Jesus, MS, RD,[l] Dana DeSilva, PhD, RD,[m] Laural Kelly English, PhD,[n] Stephenie Fu,[o] Hazel Hiza, PhD,[k] Kevin Kuczynski, MS, RD,[k] Verena McClain, MSc,[p] TusaRebecca Pannucci, PhD, MPH, RD,[q] Ramkripa Raghavan, DrPH, MPH, MSc,[n] Kelley Scanlon, PhD, RD,[r] Eve Stoody, PhD[s]

[a] Food Pattern Modeling and Data Analysis Subcommittee, 2025 Dietary Guidelines Advisory Committee
[b] The Ohio State University, Subcommittee Chair, Food Pattern Modeling
[c] University of Texas at Austin
[d] Tufts University, Committee Chair
[e] Rutgers, The State University of New Jersey
[f] Purdue University, Subcommittee Chair, Data Analysis
[g] Simmons University
[h] Oklahoma State University
[i] The George Washington University
[j] Harvard University
[k] Food Pattern Modeling Analyst; Nutrition Guidance and Analysis Division (NGAD), Center for Nutrition Policy and Promotion (CNPP), Food and Nutrition Service (FNS), U.S. Department of Agriculture (USDA)
[l] Designated Federal Officer and Nutrition Advisor, Office of Disease Prevention and Health Promotion (ODPHP); Office of the Assistant Secretary for Health (OASH), U.S. Department of Health and Human Services (HHS)
[m] Food Pattern Modeling Analyst, ODPHP; OASH, HHS
[n] Systematic Review Analyst, Nutrition Evidence Systematic Review (NESR) Branch; NGAD, CNPP, FNS, USDA
[o] Senior Policy Advisor; Deputy Administrator's Office; CNPP, FNS, USDA
[p] Food Pattern Modeling Analyst, Panum Telecom, under contract with FNS, USDA
[q] Branch Chief, Nutrition and Economic Analysis Branch (NEAB); NGAD, CNPP, FNS, USDA
[r] Senior Analytical Advisor; CNPP, FNS, USDA
[s] Director, NGAD; CNPP, FNS, USDA

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Rationale

Food pattern modeling (FPM) is a methodology 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.

The Protein Foods group is comprised of a variety of foods from plant and animal sources. The Protein Foods group includes foods such as meats, poultry, eggs, seafood, nuts, seeds, and soy products. Beans, peas, and lentils can also be included as part of the Protein Foods group because these foods may contain comparable amounts of nutrients including protein, iron, and zinc, as well as others such as B vitamins, choline, and magnesium. Dietary protein and iron are underconsumed from food sources by the U.S. population during certain life stages—for example, dietary protein in adolescent females and older adults, and iron in infants ages 6 to 11 months who are primarily fed human milk, adolescent females, and during pregnancy.[1,2] The 2020 Healthy U.S.-Style (HUSS) Dietary Pattern recommends 5 to 7 ounce equivalents (oz eq) of Protein Foods per day for individuals ages 9 years and older, with reduced quantities recommended for children under 9 years of age because they have lower energy and nutrient requirements.[2] Fifty-seven percent of individuals in the U.S. meet or exceed these daily recommendations for the total Protein Foods group, but most do not align with subgroup recommendations for Meats, Poultry, and Eggs (54% exceeding recommendation); Seafood (88.4% below recommendation); Nuts and Seeds (62% below recommendation); and Beans, Peas, and Lentils (83% below recommendation).[3] Intakes of Meats, Poultry, and Eggs exceed recommendations while intakes of Beans, Peas, and Lentils, Nuts, Seeds, and Soy Products, and Seafood fall short of recommendations.[2] About 50% percent of Protein Foods consumed in the U.S. include foods higher in saturated fat and sodium (e.g., deli or cured meats or poultry) and mixed dishes (e.g., burgers, sandwiches, tacos, casseroles, pasta dishes), which also include higher amounts of saturated fats, sodium, and sugars added during preparation.[2,4]

These FPM analyses are supported by public interest and the wide spectrum of Protein Foods preferences, dietary needs, budget considerations, and cultural or religious norms across the population, which modify proportions of animal and plant Protein Foods sources. Within population subgroups, preferences for Protein Foods can vary by individual, age, life stage, geographic location, and acculturation, as well as other factors. Within cultures or religions, greater quantities of some Protein Foods subgroups and lesser quantities of other Protein Foods subgroups may be consumed in contrast with the U.S. average intakes, due to food traditions, customs, or practices. In addition, many major food allergens are associated with the Protein Foods group,[5] and dietary patterns with relatively higher intakes of red and processed meats have been linked to higher risk of all-cause mortality and certain chronic diseases.[6-10] To understand the health implications of these Protein Foods adaptations, it is important to first understand the contribution of the complete nutrient profile to nutrient intakes when Protein Foods group and subgroup quantities are modified, including lower quantities of animal-based Protein Foods and greater quantities of plant-based Protein Foods than are currently recommended in the *Dietary Guidelines for Americans, 2020-2025*.[2] Requests from public comments to the 2025 Dietary Guidelines Advisory Committee (Committee) also emphasize the need for action on patterns that more equitably represent the diverse scope of population subgroup norms, preferences, and needs.[11] Thus, this protocol will assess the implications for macronutrient and micronutrient content with changes to the dietary pattern that change the quantities of Protein Foods, reduce or minimize consumption of saturated fat, and/or alter the contribution of animal-based or plant-based Protein Foods.

The following FPM analyses are proposed to examine hypothetical modifications and implications on the nutritional composition and contributions of the 2020 HUSS or Healthy Vegetarian (H-VEG) Dietary Patterns when: 1) the Protein Foods group and subgroups quantities are modified from a range of 0 to the current quantities in the recommended Dietary Pattern, and 2) the proportions of animal-based Protein Foods subgroups are reduced and the proportions of plant-based Protein Foods subgroups are increased. These

analyses will examine hypothetical modifications and the implications on meeting nutritional goals across the lifespan. Separate protocols propose food group and subgroup modifications within the other food groups and will address any unmet nutritional goals identified in the Protein Foods analyses. Results from each of these analyses will be synthesized with the results from all other FPM analyses of the Committee, along with related data analysis findings and systematic review evidence, before determining if the final advice to the Departments will include suggested changes to the USDA Dietary Patterns or if new dietary patterns are recommended.

Introduction

To prepare for the development of the *Dietary Guidelines for Americans, 2025-2030*, the U.S. Departments of Health and Human Services (HHS) and Agriculture (USDA) identified a proposed list of scientific questions based on relevance, importance, potential impact to federal programs, and avoiding duplication, which were posted for public comment.[2,11] The Departments appointed the 2025 Dietary Guidelines Advisory Committee (Committee) in January 2023 to review evidence on the scientific questions. Their review forms the basis of their independent, science-based advice and recommendations to HHS and USDA, which is considered as the Departments develop the next edition of the Dietary Guidelines. These questions were refined and prioritized by the Committee for consideration in their review of the evidence.

The Committee will be asked to answer the following question using FPM analyses:

> **Considering each life stage, should changes be made to the USDA Dietary Patterns (Healthy U.S.-Style, Healthy Mediterranean-Style, and/or Healthy Vegetarian); should additional Dietary Patterns be developed/proposed based on:**
>
> - **Findings from systematic reviews, data analysis, and/or FPM analyses; and**
> - **Population norms (e.g., starchy vegetables are often consumed interchangeably with grains), preferences (e.g., emphasis on one staple grain versus another), or needs (e.g., lactose intolerance) of the diverse communities and cultural foodways within the U.S. population?**

Changes to USDA Dietary Patterns may include modification to the amounts of food groups/subgroups and/or recategorization of food groups/subgroups, as well as subsequent changes to energy available for other uses, including for added sugars.

As part of that process and to address the overarching FPM question, the following questions for analysis have been identified:

> **What are the implications for nutrient intakes when modifying the Protein Foods group and subgroup quantities (i.e., Meats, Poultry, and Eggs; Seafood; Nuts, Seeds, and Soy Products; Beans, Peas, and Lentils) within the Healthy U.S.-Style (HUSS) Dietary Pattern or Healthy Vegetarian (H-VEG) 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?**

The Committee will use FPM analyses to address this question, with support from USDA's FPM methods team. This protocol will establish the methods to model hypothetical modifications of Protein Foods group and subgroup quantities within the current HUSS Dietary Pattern or H-VEG Dietary Pattern and implications on meeting nutritional goals.

Historical perspectives

The 2020 USDA Dietary Patterns are designed to reflect health promoting dietary patterns and meet the known nutrient needs of the age-sex groups for which they are targeted, within calorie constraints. The Patterns include recommended amounts to eat from five major food groups, one of which is the Protein Foods group. The Protein Foods group includes subgroups for Meats, Poultry, and Eggs; Seafood; and Nuts, Seeds, and Soy Products. Beans, Peas, and Lentils can also be included as part of the Protein Foods group. Dietary protein as a nutrient is also found in foods from other food groups, such as Dairy and Fortified Soy Alternatives. The USDA Food Pattern Equivalents Database (FPED) can be used to estimate the contribution of various foods and beverages to 37 food pattern components, including the Protein Foods group and subcomponents (e.g., meat, poultry, cured meat, seafood low in *n-3* fatty acids, seafood high in *n-3* fatty acids, organ meat, eggs, nuts and seeds, soy products, beans, peas, and lentils (legumes).[12]

The 2020 HUSS Dietary Pattern recommends 5 to 7 oz eq of Protein Foods per day for individuals ages 9 years and older, 2 to 4 oz eq per day for children ages 2 to 8 years, and 2 oz eq per day for young children 12 through 23 months who are no longer receiving human milk or infant formula.[2] Weekly recommendations are provided for Protein Foods subgroups, with the highest quantities of oz eq recommended for the Meats, Poultry, and Eggs subgroup among ages 2 years and older and for the Meats and Poultry subgroup among ages 12 through 23 months. For example, on a weekly basis, individuals ages 9 years and older are recommended to consume 23 to 33 oz eq of Meats, Poultry, and Eggs; 8 to 10 oz eq of Seafood; and 4 to 6 oz eq of Nuts, Seeds, and Soy Products. For this Pattern, the Beans, Peas, and Lentils subgroup contributes to the Vegetables food group and is recommended at 1 to 3 cup equivalents (cup eq) per week.

The *Dietary Guidelines for Americans, 2020-2025* also provides the H-VEG Dietary Pattern, a lacto-ovo vegetarian diet which incorporates protein foods from plants, dairy, and eggs and excludes meats, poultry, and seafood.[2] The H-VEG Dietary Pattern is higher in Soy Products; Beans, Peas, and Lentils; Nuts and Seeds; and Whole Grains compared to the HUSS Dietary Pattern.

The FPM analyses in this protocol expand and complement the work of the 2010 and 2020 Committees. In the 2010 Committee's Vegetarian Food Patterns: Food Pattern Modeling Analysis (Appendix E-3.3), a scenario was modeled for plant-based patterns, defined as providing "more than 50% of all protein from plant sources," along with scenarios for lacto-ovo vegetarian and vegan patterns.[13] Data from What We Eat in America (WWEIA), National Health and Nutrition Examination Survey (NHANES) 1999-2004 found that individuals who self-identified as vegetarian consumed a wide variety of foods, with some participants reporting intakes of animal-based foods such as meat, poultry, fish, and eggs.[14] As there were a spectrum of definitions for "vegetarian" diets, the data was insufficient to develop separate plant-based patterns based on actual intake, and the 2010 Committee's scenarios modelled modifications in the base USDA Food Pattern. The plant-based analyses involved decreasing amounts of meats and poultry and increasing amounts of processed soy products, cooked dry beans and peas, and nuts to compensate, while maintaining the overall Protein Foods group amount. The plant-based pattern met almost all nutrient goals (≥ 90% of the Recommended Dietary Allowance [RDA] or Adequate Intake [AI]) at 12 calorie levels, except for vitamin E, potassium, and choline. Of note, the AI for potassium decreased after these analyses were completed—for example, the AI for females ages 19 to 30 years decreased from 4,700 mg to 2,600 mg.[15] WWEIA, NHANES last included a question on self-reported vegetarian status in 2009-2010,[16] meaning that current dietary intakes for vegetarians can no longer be identified from this national data source.

In alignment with the FPM analyses on vegetarian patterns, the 2010 Committee completed dietary protein-focused systematic reviews which examined the relationship between health outcomes and the intakes of animal protein products, vegetable proteins, soy proteins, and cooked dry beans and peas, and how the health

outcomes of a vegetarian diet compared to diets that included animal products.[17] Limited evidence was found for most of these questions, with exceptions being moderate evidence for an association between intake of vegetable protein and lower blood pressure, an association between intake of soy protein and small effects on total and low-density lipoprotein cholesterol, an association between intake of certain animal protein products and colorectal cancer, no unique benefit of soy protein intake on body weight, and no clear association between intake of animal protein products and blood pressure.[17]

The 2010 Committee also published a systematic review and FPM analysis on seafood intake, with a focus on omega-3 fatty acids. The systematic review found moderate evidence showing the consumption of two, 4-oz servings of seafood (8 oz total) per week, which provide an average of 250 mg per day of long-chain omega-3 fatty acids, is associated with reduced cardiac mortality from coronary heart disease or sudden death in persons with cardiovascular disease.[18] FPM examined the impact on nutrient adequacy when the quantity of seafood is increased in the base USDA Food Patterns, and the Committee concluded that seafood could be increased to 8 oz per week without a negative impact on nutrient adequacy.[19] Based on the FPM and systematic review findings, and as advised by the 2010 Committee, the *2010 Dietary Guidelines for Americans* added a recommendation to consume about 8 oz of a variety of seafood per week, with an emphasis on choices lower in methylmercury. This recommendation has been carried forward into subsequent editions of the *Dietary Guidelines for Americans* through the current 2020-2025 edition.[2,20,21] Building upon the work of the 2010 Committee, systematic reviews from the 2020 Committee found moderate evidence that seafood intake during pregnancy was favorably associated with cognitive development in young children.[22] However, there was insufficient evidence on the relationship between seafood consumption during childhood and adolescence and two health outcomes (i.e., neurocognitive development and risk of cardiovascular disease).[23]

As part of a dietary pattern, certain Protein Foods were found to be associated with several health outcomes in adults and older adults in systematic reviews by the 2020 Committee. Based on strong or moderate evidence, the Committee concluded that dietary patterns relatively higher in red and/or processed meats were associated with a higher risk of all-cause mortality,[24] cardiovascular disease,[7] overweight and obesity,[24] type 2 diabetes,[10] and colorectal cancer.[9] Moderate evidence also showed an association between dietary patterns lower in meats, particularly processed meats, and favorable bone health.[10] Strong or moderate evidence indicated that dietary patterns higher in legumes and fish and/or seafood were associated with more favorable bone health[8] and lower risk of all-cause mortality,[24] cardiovascular disease,[7] overweight and obesity,[9] and colorectal cancer.[8] Dietary patterns higher in legumes and fish and/or seafood had a limited association with preterm birth during pregnancy[25] and gestational weight gain.[26]

Current perspectives

According to the WWEIA, NHANES 2017-2018, individuals ages 2 to 19 years consumed 4.27 oz eq of Protein Foods (excluding legumes) in a day, and individuals ages 20 years and older consumed 6.33 oz eq in a day.[27] For both age groups, animal-based Protein Foods sources were consumed as a larger proportion of total Protein Foods than plant-based Protein Foods sources. Most of the U.S. population meets the Dietary Reference Intakes (DRIs) recommendation for dietary protein, with 94% consuming above the Estimated Average Requirement (EAR) based on WWEIA, NHANES 2015-2018 data. However, certain life stages and subpopulations, including adolescent females and older adults, were less likely to meet their dietary protein needs.[1,28-30] The Protein Foods group also contributes substantively to intakes of nutrients, including iron, zinc, B vitamins, choline, and magnesium. Meat, poultry, and seafood are sources of iron, a nutrient that is under-consumed by infants ages 6 to 11 months who are primarily fed human milk, adolescent females, and during pregnancy.[1,2] Beans, Peas, and Lentils also provide iron, along with dietary fiber and potassium. The Committee will use the data analysis scientific approach to examine the current consumption of these and other nutrients and dietary fiber in the U.S population.[31]

The source of Protein Foods has implications on nutrient content and the bioavailability of nutrients for digestion and absorption. Plant-based Protein Foods contain non-heme iron, which is less bioavailable than heme iron—meaning absorbed less efficiently.[32] Non-heme iron may interact with other dietary components in plant-based foods, such as phytates and some polyphenols, to further reduce its bioavailability. As a result, the requirement for iron is 1.8 times higher in vegetarians than in non-vegetarians.[32] Vitamin B12, which is found primarily in animal protein sources and also some fortified foods, may be a concern for persons who do not consume animal-based proteins and persons with vitamin B12 malabsorption.[33] The Committee will evaluate the nutritional contribution of the Protein Foods group and subgroups using USDA's FPM methods, which rely on the DRIs and *Dietary Guidelines for Americans, 2020-2025* recommendations. However, considerations regarding differences in bioavailability of nutrients will be needed in the interpretation of these findings.

There is interest from the public and research communities in modifying proportions of animal and plant Protein Foods sources to accommodate representation of cultural or religious norms (e.g., kosher or halal diets), dietary preferences (e.g., "flexitarian" or pescatarian dietary patterns), budgetary considerations (e.g., food prices), food market/innovation trends (e.g., plant-based meat alternatives), and other dietary restrictions (e.g., food allergies). Seven of the nine major food allergens (i.e., eggs, fish, crustacean shellfish, tree nuts, peanuts, soybeans, and sesame) recognized by the Food and Drug Administration are part of the Protein Foods group.[5]

In addition, the amount of plant-based Protein Foods, such as plant-based meat alternatives, in retail market and food service settings has increased in recent years due to consumer demand and product innovation. A national consumer survey found that 12% of adults reported following a plant-based diet, with Gen Z (born between 1998 and 2005) being the most likely to purchase products labeled as "plant-based."[34] Further, respondents reported consuming more protein from whole-plant sources (31% increase) and plant-based meat or seafood alternatives (22% increase) in 2022 compared to 2021. Purdue University's Consumer Food Insights survey (January 2022-May 2023) also found that 25% of respondents 'always or often' and 22% 'sometimes' chose plant-based proteins over animal proteins when shopping or eating in the last 30 days.[35] Due to their growing popularity, alternative dietary protein sources, including plant-based sources, were recently examined by the scientific community in a 2022 Food Forum workshop by the National Academies of Sciences, Engineering, and Medicine with a focus on nutrition, diet quality, sustainability, affordability, and accessibility.[36]

This protocol describes a multi-phased approach for understanding if nutritional goals can be achieved when Protein Foods group and subgroup quantities are 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 H-VEG Dietary Patterns. Results from these analyses will be collectively synthesized by the Committee along with all other FPM analyses, including those modeling modifications of other food group and subgroup quantities to address intake variability at the food group and subgroup levels. As part of a separate protocol following these analyses, diet simulations will be used to examine intake variability at the individual food level. As part of the iterative FPM process, findings from these and other analyses may prompt the development of subsequent protocols to address any identified nutrient inadequacies and answer the overarching FPM question. The conclusions drawn by the Committee will inform their recommendations for the 2025 USDA Dietary Patterns in their scientific report to the Secretaries of HHS and USDA.

Methods

This section presents an overview of the methods, or the process, that will be used by the Committee to answer the questions:

What are the implications for nutrient intakes when modifying the Protein Foods group and subgroup quantities (i.e., Meats, Poultry, and Eggs; Seafood; Nuts, Seeds, and Soy Products; Beans, Peas, and Lentils) within the Healthy U.S.-Style (HUSS) Dietary Pattern or Healthy Vegetarian (H-VEG) Dietary Pattern?

What are the implications for nutrient intakes when the proportions of animal-based Protein Foods subgroups are reduced and the proportions of plant-based Protein Foods subgroups are increased?

Develop a protocol

A FPM protocol is the plan for how USDA's FPM methodology will be used to conduct specific FPM analyses. The protocol is established by the Committee before the analysis is conducted. The protocol describes the components of the FPM process, including the analytic framework, analytic plan, analysis synthesis, conclusion development, and future research recommendations. It is developed through Committee discussion of the strengths and limitations for various analysis types and exercises to identify the most appropriate and relevant methods to answer each FPM question. FPM is an iterative process; thus, results from initial analyses may inform refinement of this or subsequent protocols.

When reviewing questions or topics addressed by prior Committees, the Committee uses the previous analytic framework, plan, and protocol to inform and refine their current approaches. Any changes to this protocol will be described in **Table 7. Protocol amendments**.

Develop an analytic framework

An analytic framework represents the overall scope of the FPM analyses, including the population, types of analyses, and data sources identified to answer the questions. It also includes the definitions of key terms.

Questions:

What are the implications for nutrient intakes when modifying the Protein Foods group and subgroup quantities (i.e., Meats, Poultry, and Eggs; Seafood; Nuts, Seeds, and Soy Products; Beans, Peas, and Lentils) within the Healthy U.S.-Style (HUSS) Dietary Pattern or Healthy Vegetarian (V-VEG) Dietary Pattern?

What are the implications for nutrient intakes when the proportions of animal-based Protein Foods subgroups are reduced and the proportions of plant-based Protein Foods subgroups are increased?

Population:

The nutrient profiles modeled in these FPM analyses are based on dietary intake data among the U.S. population ages 12 months and older. The contribution of complimentary foods and beverages consumed by infants less than 12 months will not be included in the calculation of nutrient profiles.

The nutrient profiles examined in these FPM analyses will be applied to the 2020 HUSS or H-VEG Dietary Patterns published for ages 12 through 23 months who are no longer consuming human milk or infant formula, and for ages 2 and older.[2] Around 12 months, a dietary pattern that no longer includes infant or toddler formula or human milk may be established; however, consumption of human milk in the second year of life is common. The USDA Dietary Patterns are tailored for children ages 12 through 23 months who are no longer receiving infant formula or human milk.

Types of analyses:

The overall FPM methodology used to develop and update the USDA Dietary Patterns includes six steps: **(1)** identifying appropriate energy levels for the patterns; **(2)** identifying nutritional goals for the patterns; **(3)** establishing food groupings and food group amounts; **(4)** determining the amounts of energy and nutrients that would be provided by consuming various foods within each food group or subgroup; **(5)** evaluating nutrient levels in each pattern against nutritional goals; and **(6)** adjusting and re-evaluating the patterns to align with current or potential recommendations.

This analysis question will focus on step 3 (establishing food groupings and food group amounts) and assess the implications of changes to step 3 throughout subsequent steps 4, 5, and 6. Initial analyses will use existing food groups and subgroups identified in the 2020 USDA Dietary Patterns, published in the *Dietary Guidelines for Americans, 2020-2025*.[2] Nutrient profiles that underlie those patterns will be updated based on the 2025 Committee's analyses in answering the question: "*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?* View the protocol developed by the 2025 Committee to answer that question.[37]

Subsequent analyses will model the implications of food group and subgroup modifications, including for Protein Foods. Specifically, analyses will examine hypothetical modifications to the Protein Foods group and subgroups, including reduced proportions of animal-based Protein Foods subgroups and increased proportions of plant-based Protein Foods subgroups, and the implications on meeting nutritional goals across the lifespan.

FPM analyses planned to answer this question include:

- Identifying the nutritional composition and contribution of the Protein Foods group and subgroups to current dietary intakes, relative to the 2020 HUSS Dietary Pattern goals.
- Evaluating implications on meeting nutritional goals when the Protein Foods subgroup quantities in the 2020 HUSS Dietary Pattern are reduced by ½ oz eq increments for the 700 to 1,400 calorie levels and by 1 oz eq increments for the 1,600 to 3,200 calorie levels, starting with the current quantity for a given calorie level in the Dietary Pattern and reducing to 0. The process will be completed for each subgroup while holding the other subgroup quantities constant. The nutritional composition and contributions of the Protein Foods group in the Dietary Pattern will be examined.
- Evaluating implications on meeting nutritional goals when the proportions of animal-based Protein Foods subgroups (i.e., Meats, Poultry, and Eggs and Seafood) in the 2020 HUSS Dietary Pattern are reduced by ½ or 1 oz eq increments and the proportions of plant-based Protein Foods subgroups (i.e., Beans, Peas, and Lentils and Nuts, Seeds, and Soy Products) are increased by ½ or 1 oz eq increments. Increments of ½ oz eq will be used for the 700 to 1,400 calorie levels and increments of 1 oz eq will be used for the 1,600 to 3,200 calorie levels. The process will model various subgroup proportions to represent potential levels of consumption. The nutritional composition and contributions of the Protein Foods group in the Dietary Pattern will be examined.
- Evaluating implications on meeting nutritional goals when the proportions of Protein Foods subgroups are modified to include animal-based Protein Foods from Seafood and Eggs only or from Seafood only, while maintaining the plant-based Protein Foods subgroups (i.e., Beans, Peas, and Lentils; Nuts, Seeds, and Soy Products) quantities in each calorie level of a modified 2020 H-VEG Dietary Pattern. These analyses will model two scenarios of subgroup proportions to represent potential levels of consumption in a pescatarian diet. The nutritional composition and contributions of the Protein Foods group in the Dietary Pattern will be examined.

Results from these analyses will contribute to the evidence that will be used to answer the overarching FPM question: 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?

This process will include:

- Synthesizing the above analyses with all other food group and subgroup modification analyses to determine if changes should be made to the USDA Dietary Patterns or if additional dietary patterns should be proposed based on population norms, preferences, and needs.
- Examining modified or new dietary patterns for meeting nutritional goals compared to the DRIs, current *2020-2025 Dietary Guidelines* recommendations, potential recommendations of the 2025 Committee, and simulated diet analyses.
- Developing conclusion statements based on all FPM analyses informing the overarching FPM question, and in consideration of related systematic review conclusions and data analysis findings.
- Making research recommendations to inform future work on this topic.

Data sources:

- What We Eat in America, NHANES 2017-2018, individuals 1 years and over, days 1 and 2, weighted to produce nationally representative estimates. Available: ars.usda.gov/nea/bhnrc/fsrg

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Key definitions:

Key definitions in this protocol include existing definitions used by the 2020 Dietary Guidelines Advisory Committee and/or published in the *Dietary Guidelines for Americans, 2020-2025*, such as definitions operationalized in the HUSS and H-VEG Dietary Patterns.[2,38] The 2025 Committee will continue to consider terminology and implications of terms related to representation of population subgroups and/or communication to the public. Future revisions to existing definitions and new working definitions for 2025 will be noted.

Food groups and subgroups in the Healthy U.S.-Style (HUSS) Dietary Pattern: USDA's HUSS Dietary Pattern for ages 2 years and older provides amounts of five major food groups and *subgroups* including:

- Fruits
- Vegetables:
  - *Dark-Green; Red and Orange; Beans, Peas, and Lentils [a]; Starchy; and Other*
    - [a.] Beans, Peas, and Lentils are typically modeled as Vegetables in the HUSS Dietary Pattern but can also be counted toward the Protein Foods group. For the analyses in this protocol using the HUSS Dietary Pattern, Beans, Peas, and Lentils will only be modeled in the Protein Foods group.
- Dairy and Fortified Soy Alternatives
- Grains:
  - *Whole Grains; Refined Grains*
- Protein Foods:
  - *Meats, Poultry, and Eggs [b]; Seafood; Nuts, Seeds, and Soy Products*; *Beans, Peas, and Lentils [a]*
    - [a.] Beans, Peas, and Lentils are typically modeled as Vegetables in the HUSS Dietary Pattern but can also be counted toward the Protein Foods group. For the analyses in this protocol using the HUSS Dietary Pattern, Beans, Peas, and Lentils will only be modeled in the Protein Foods group.
    - [b.] For the HUSS Dietary Pattern for ages 12 through 23 months, there are separate subgroups for 1) Meats and Poultry and 2) Eggs.

Food groups and subgroups in the Healthy Vegetarian (H-VEG) Dietary Pattern: USDA's H-VEG Dietary Pattern for ages 2 years and older provides amounts of five major food groups and *subgroups* including:

- Fruits
- Vegetables:
  - *Dark-Green; Red and Orange; Beans, Peas, and Lentils [a.]; Starchy; and Other*
    - [a.] For the analyses in this protocol using the H-VEG Dietary Pattern, Beans, Peas, and Lentils will be modeled in both the Vegetables and Protein Foods groups.
- Dairy and Fortified Soy Alternatives
- Grains:
  - *Whole Grains; Refined Grains*
- Protein Foods:
  - *Eggs; Beans, Peas, and Lentils [a.]; Soy Products [b]; Nuts and Seeds [b]*
    - [a.] For the analyses in this protocol using the H-VEG Dietary Pattern, Beans, Peas, and Lentils will be modeled in both the Vegetables and Protein Foods groups.

- [b.] For the H-VEG Dietary Pattern for ages 12 through 23 months, there is one subgroup for Nuts, Seeds, and Soy Products combined.

Oils: Oils are sources of essential fatty acids and include canola, corn, olive, peanut, safflower, soybean, and sunflower oils. Oils also are naturally present in nuts, seeds, seafood, olives, and avocados. The fat in some tropical plants, such as coconut oil, palm kernel oil, and palm oil, are not included in the oils category because they contain a higher percentage of saturated fat than do other oils.

Added sugars: Added sugars are either added during the processing of foods or are packaged as sweeteners (e.g., a bag of table sugar). Added sugars include sugars (free, mono- and disaccharides), sugars from syrups and honey, and sugars from concentrated fruit or vegetables juices that are in excess of what would be expected from the same volume of 100 percent fruit or vegetable juice of the same type.[39] Naturally occurring sugars, such as those in fruit or milk, are not defined as added sugars. Specific examples of added sugars that can be listed as an ingredient include brown sugar, corn sweetener, corn syrup, dextrose, fructose, glucose, high-fructose corn syrup, honey, invert sugar, lactose, malt syrup, maltose, molasses, raw sugar, sucrose, trehalose, and turbinado sugar.

Limits on calories for other uses (as defined in the HUSS Dietary Pattern)[2,38]: Foods are assumed to be in nutrient-dense forms, which are lean or low-fat and prepared with minimal added saturated fat, added sugars, refined starches, or sodium. If all food choices to meet food group recommendations are in nutrient-dense forms, a small number of calories remain within the overall limit of the pattern (i.e., limit on calories for other uses). The amount of calories depends on the total calorie level of the pattern and the amounts of food from each food group required to meet nutritional goals. Calories up to the specified limit can be used for added sugars, refined starches, saturated fat, and/or alcohol (for nonpregnant adults of legal drinking age only), or to eat more than the recommended amount of food in a food group.

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-dense representative foods: For the purpose 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, sodium, and saturated fats. 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.

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 weighted average calculation considers a range of food choices in the United States, but in nutrient-dense forms, and results in a food pattern that can be adapted to fit an individual's preferences.

Animal-based Protein Foods (new for 2025): For the purposes of these analyses, animal-based Protein Foods are defined as foods originating from animal sources that count toward the Protein Foods group in the 2020 USDA Dietary Patterns (e.g., meat, poultry, eggs, and seafood).

Plant-based Protein Foods (new for 2025): For the purposes of these analyses, plant-based Protein Foods are defined as foods originating from plant sources that count toward the Protein Foods group in the 2020 USDA Dietary Patterns (e.g., beans, peas, lentils, nuts, seeds, and soy products).

Soy Products (new for 2025): Soy Products are foods made from soybeans that contribute to the Protein Foods group as a subgroup. Soy Products include tofu, tempeh, texturized vegetable protein (TVP), and

processed soy products. Cooked soybeans or immature soybeans (i.e., edamame) are counted in the Beans, Peas, Lentils subgroup and do not contribute to the Nuts, Seeds, and Soy Products subgroup.

Pescatarian diet (new for 2025): A pescatarian diet is defined in the dictionary as a diet that includes fish but no other meat. For the purposes of these analyses, a pescatarian diet includes foods from all major food groups but only certain Protein Foods subgroups. Pescatarians typically consume all plant-based Protein Foods subgroups (i.e., Beans, Peas, and Lentils; Nuts, Seeds, and Soy Products), Seafood, and sometimes Eggs, while excluding intake of Meat and Poultry.

Develop an analytic plan

Establish energy levels:

Dietary Reference Intakes (DRI) formulas are used to calculate Estimated Energy Requirements (EER) for each age-sex group and for three age groups specific to pregnancy and lactation (14-18 years, 19-30 years and 31-50 years).[40] (See **Table 1**.) EER is based on sex, age, height, weight, level of physical activity, and life stage and, during pregnancy, gestational weeks. The EERs for pregnancy account for the energy cost of tissue accretion and deposition based on pre-pregnancy BMI category and IOM recommended rates of gestational weight gain. The EERs for lactation account for the energy cost of human milk production and mobilization of postpartum tissue stores for gradual weight loss.[2]

Computed weight for a body mass index (BMI) of 22.5 kg/m^2 for adult males and 21.5 kg/m^2 for adult females (ages 19+ years) and median height are used to calculate reference energy levels for each age-sex group.[2] The computed weight based on the corresponding BMI is obtained using the following equation.

$$\text{BMI } 22.5 \text{ or } 21.5 \times (\text{median height in m})^2 = \text{computed weight in kg}$$

These BMIs correspond to the 50th percentile (median) for reference weight among 19-year old males and females based on the 2005 DRI for energy and the 2000 CDC Growth Charts.[41,42] The EER calculations for adults follow the 2020 Committee's approach to base reference weight on a BMI of 18.5 to <25 kg/m^2 but are enhanced to incorporate median heights for each age-sex group using updated NHANES data instead of using one median height for all adult males and one median height for all adult females.[43,44] For children and adolescents ages 2-18 years, median height and the 50th percentile BMI-for-age are obtained using NHANES anthropometric data and the CDC Growth Charts.[44,45] For young children ages 12 through 23 months, EERs from the DRI report using NHANES median weight and length are used, as these result in similar calorie levels as WHO Growth Chart data.[40,46] These weight, height/length, and BMI assumptions for estimating energy levels in FPM align with those being used in the Committee's data analysis work. The use of median height/length also aligns with the DRI for energy report.[40]

A lower energy level (for inactive individuals) rounded to the nearest 200 calorie level and its associated pattern are determined for each age-sex group and used in evaluating the patterns against nutritional goals. (See step 2: **Establish nutritional goals**.) The 2020 USDA Dietary Patterns for ages 12 through 23 months are established to meet the EER for those ages. For ages 2 years and older, the 2020 Dietary Patterns generally are not age- or sex- specific. However, the 2020 Dietary Patterns at 1,000, 1,200, and 1,400 calorie levels are designed to meet the nutritional needs of children ages 2 through 8 years. Patterns from 1,600 to 3,200 calories are designed to meet the nutritional needs of children 9 years and older and adults. The 1,000 and 1,200 calorie level patterns are not intended for children 9 years and older or adults, and the 1,400-calorie level is not intended for children ages 10 years and older or adults. Individuals may require a calorie level that is higher or lower than the calorie level associated with each population-level age-sex group.

Table 1. Age-sex groups for which nutritional goals are examined in analyses

Children (Male/Female)	Males	Females	Pregnancy (Per 1st, 2nd, and 3rd Trimesters)	Lactation (Per 0-6 and 7-12 months postpartum)
1-3 years				
	4-8 years	4-8 years		
	9-13 years	9-13 years		
	14-18 years	14-18 years	14-18 years	14-18 years
	19-30 years	19-30 years	19-30 years	19-30 years
	31-50 years	31-50 years	31-50 years	31-50 years
	51+ years	51+ years		

Establish nutritional goals:

Specific nutritional goal quantities for a dietary intake pattern are set according to energy intake level and based on the DRI age-sex group(s) for which the pattern is designed. Goals for total energy, fat, protein, carbohydrates, 3 fatty acids, 12 vitamins, 8 minerals, added sugars, and fiber are based on DRI reports released between 1997 and 2023 and on quantitative recommendations in the current *Dietary Guidelines for Americans, 2020-2025* (DGA).[2,15,32,33,40,47] The macronutrients, fatty acids, vitamins, and minerals that are considered nutritional goals for these analyses are specified in **Table 2**. Because the dietary patterns are designed as a framework for achieving a healthy dietary pattern, the goals are the Recommended Dietary Allowance (RDA) amounts for nutrients having an RDA. The Adequate Intake (AI) is used as the nutrient goal when an RDA is not established.

Table 2. Nutritional goals for analyses

Food Component	Specific Nutrients (and Source of Goal [a])
Energy	Energy (EER)
Macronutrients	Carbohydrate (AMDR/RDA), Protein (AMDR/RDA), Total Fat (AMDR)
Fatty Acids	Saturated Fatty Acids (DGA 2020-2025, <10% of total energy), 18:2 Linoleic Acid (AI), 18:3 Linolenic Acid (AI)
Vitamins	Vitamin A (RDA), Vitamin C (RDA), Vitamin D (RDA), Vitamin E (RDA), Vitamin K (AI), Thiamin (RDA), Riboflavin (RDA), Niacin (RDA), Vitamin B6 (RDA), Folate (RDA), Vitamin B12 (RDA), Choline (AI)
Minerals	Calcium (RDA), Copper (RDA), Iron (RDA), Magnesium (RDA), Phosphorus (RDA), Potassium (AI), Sodium (CDRR), Zinc (RDA)
Added Sugars	Added Sugars (DGA 2020-2025, <10% of total energy)
Dietary Fiber	Total Dietary Fiber (AI, 14g/1,000 calories)

[a] AI = Adequate Intake, AMDR = Acceptable Macronutrient Distribution Range, CDRR = Chronic Disease Risk Reduction Level, DGA 2020-2025 = *Dietary Guidelines for Americans, 2020-2025*, RDA = Recommended Dietary Allowance

Establish food groupings and amounts:

Food groups and subgroups in the USDA HUSS Dietary Patterns or H-VEG Dietary Patterns for ages 12 through 23 months and ages 2 years and older (published in the *Dietary Guidelines for Americans, 2020-2025*) will be used in these analyses, along with the Protein Foods modifications outlined below, to examine their impacts on the nutritional composition and contribution within the Protein Foods group and meeting nutritional goals across the Dietary Patterns.[2]

Analysis on the nutritional contribution of the Protein Foods group and subgroups:

- Objective 1: Identify the nutritional composition and contribution of the Protein Foods group and subgroups in current dietary intakes, relative to the 2020 HUSS Dietary Pattern goals for ages 12 months and older.
    - Calculate the current intake amounts and proportions of animal-based (i.e., Meats, Poultry, and Eggs; and Seafood) and plant-based (i.e., Beans, Peas, and Lentils; and Nuts, Seeds, and Soy Products) Protein Foods subgroups (mean oz eq/week and percent of total Protein Foods) as reported in WWEIA, NHANES 2017-2018. NOTE: Convert the Beans, Peas, and Lentils quantities from cup equivalents (cup eq) (Vegetables group unit of intake) to oz eq (Protein Foods group unit of intake) by multiplying the quantity by four and changing the unit. For example, 1 cup eq of Beans, Peas, and Lentils as Vegetables is equivalent to 4 oz eq of Beans, Peas, and Lentils as Protein Foods.

Analysis modifying quantities and proportions of the Protein Foods group and subgroups:

- Objective 2: Estimate the implications on meeting nutritional goals for each ½ or 1 oz eq increment shift of Protein Foods subgroup quantities, from 0 to the current quantity for a given calorie level in the 2020 HUSS Dietary Pattern. Determine whether the projected quantities impact the nutritional composition and contribution of the Protein Foods group in the Dietary Pattern.
    - Each Protein Foods subgroup will be modified individually, starting with one subgroup's current quantity and incrementally reducing it until a quantity of 0 is reached while holding the other subgroups constant, then repeating for each remaining subgroup. Thus, the Meats, Poultry, and Eggs subgroup in the Pattern for ages 2 years and older would be reduced from the current quantities until 0, before the same process would be repeated three additional times for each the Seafood; Beans, Peas, and Lentils; and Nuts, Seeds, and Soy Products subgroups. In the Dietary Pattern for ages 12 through 23 months, Meats and Poultry and Eggs are two separate subgroups and will also be modeled as such in this analysis.
    - Increments of ½ oz eq will be used for the lower calorie levels in the Dietary Patterns for ages 12 month to 23 months (700, 800, 900, and 1,000 calories) and ages 2 years and older (1,000, 1,200, and 1,400 calories). Increments of 1 oz eq will be used for the higher calorie levels in the Dietary Pattern intended for ages 2 years and older (1,600 to 3,200 calories). **Table 3** provides an example of the oz eq intervals to be modeled when examining the Seafood subgroup in this approach, based on the 2020 HUSS Dietary Pattern's 2,000-calorie level.

Table 3. Ounce equivalents (oz eq) per week of Protein Foods subgroups to be modeled with incremental reductions of the Seafood subgroup within the 2,000-calorie level of the 2020 Healthy U.S.-Style (HUSS) Dietary Pattern (Objective 2) [a]

Scenario	Meats, Poultry, and Eggs (oz eq)	Meats, Poultry, and Eggs (% of Total	Seafood (oz eq)	Seafood (% of Total Protein Foods)	Nuts, Seeds, and Soy Products (oz eq)	Nuts, Seeds, and Soy Products (% of Total	Beans, Peas, and Lentils (oz eq)	Beans, Peas, and Lentils (% of Total

		Protein Foods)				Protein Foods)		Protein Foods)
Current Pattern (Reference)	26	58%	8	18%	5	11%	6	13%
Seafood -1	26	59%	7	16%	5	11%	6	14%
Seafood -2	26	60%	6	14%	5	12%	6	14%
Seafood -3	26	62%	5	12%	5	12%	6	14%
Seafood -4	26	63%	4	10%	5	12%	6	15%
Seafood -5	26	65%	3	8%	5	13%	6	15%
Seafood -6	26	67%	2	5%	5	13%	6	15%
Seafood -7	26	68%	1	3%	5	13%	6	16%
Seafood -8	26	70%	0	0%	5	14%	6	16%

[a] This table shows just one example of several scenarios that will be modeled.

Analysis modifying quantities and proportions of animal-based vs. plant-based Protein Foods subgroups:

- Objective 3: Evaluate implications on meeting nutritional goals when the proportions of animal-based Protein Foods subgroups (i.e., Meats, Poultry, and Eggs; and Seafood) are reduced by ½ or 1 oz eq increments and the proportions of plant-based Protein Foods subgroups (i.e., Beans, Peas, and Lentils; and Nuts, Seeds, and Soy Products) are increased by ½ or 1 oz eq increments in each calorie level of the 2020 HUSS Dietary Pattern. Determine whether the projected quantities affect the nutritional composition and contribution of the Protein Foods group in the Dietary Pattern.
    - The animal-based Protein Foods subgroups and the plant-based Protein Foods subgroups will be examined simultaneously to model various proportions of subgroup quantities which represent potential levels of consumption. The analysis for the Dietary Pattern for ages 2 years and older will start with the Meats, Poultry, and Eggs and Seafood subgroups' current quantities in the Dietary Pattern and incrementally reduce their collective quantity while maintaining their baseline proportions (approximately a 3:1 ratio of Meats, Poultry, and Eggs to Seafood) until zero is reached. Thus, for every 1 oz eq interval, there will be a ¾ oz eq decrease in Meats, Poultry, and Eggs and a ¼ oz eq decrease in Seafood. At the same time as each incremental reduction in the animal-based Protein Foods subgroups, the collective quantity of the Beans, Peas, and Lentils and Nuts, Seeds, and Soy Products subgroups will incrementally increase while maintaining their baseline proportions to one another (approximately a 1:1 ratio of Beans, Peas, and Lentils to Nuts, Seeds, and Soy Products). Therefore, for every 1 oz eq interval, there will be a ½ oz eq increase in Beans, Peas, and Lentils and a ½ oz eq increase in Nuts, Seeds, and Soy Products. This same process will be applied to the analysis for the Dietary Pattern for ages 12 through 23 months, while accounting for its subgroup and proportional differences. NOTE: These changes may have an impact on iron bioavailability. However, USDA's FPM methods do not adjust for potential effects on iron absorption that result from the differences in iron bioavailability between plant-based Protein Foods and animal-based Protein Foods.
    - Increments of ½ oz eq will be used for the lower calorie levels in the Dietary Patterns for ages 12 month to 23 months (700, 800, 900, and 1,000 calories) and ages 2 years and older (1,000, 1,200, and 1,400 calories). Increments of 1 oz eq will be used for the higher calorie levels in the Pattern intended for ages 2 years and older (1,600 to 3,200 calories). The subgroups within each Dietary Pattern will be included in the analysis of the Dietary Pattern. While most subgroups are applied across both Dietary Patterns, the Dietary Pattern for ages 2 years and older uses a subgroup for Meats, Poultry, and Eggs, and the Dietary Pattern for ages 12 through 23 months uses separate subgroups for 1) Meats and Poultry and 2) Eggs.

- The scenarios to be modeled using the 2020 HUSS Dietary Pattern's 2,000 calorie level as an example, along with the percent proportions of animal-based Protein Foods and plant-based Protein Foods in each scenario, are described in **Table 4**.

Table 4. Ounce equivalents (oz eq) per week of plant-based and animal-based Protein Foods subgroups to be modeled within the 2,000-calorie level of the 2020 Healthy U.S.-Style (HUSS) Dietary Pattern (Objective 3) [a]

Scenario	Meats, Poultry, and Eggs (Animal-based)	Seafood (Animal-based)	Nuts, Seeds, and Soy Products (Plant-based)	Beans, Peas, and Lentils (Plant-based)	Proportion from Animal-Based Protein Foods Subgroups	Proportion from Plant-Based Protein Foods Subgroups
Current Pattern (Reference)	26	8	5	6	76%	24%
Animal -1/Plant +1	25.25	7.75	5.5	6.5	73%	27%
Animal -2/Plant +2	24.5	7.5	6	7	71%	29%
Animal -3/Plant +3	23.75	7.25	6.5	7.5	69%	31%
Animal -4/Plant +4	23	7	7	8	67%	33%
Animal -5/Plant +5	22.25	6.75	7.5	8.5	64%	36%
Animal -6/Plant +6	21.5	6.5	8	9	62%	38%
Animal -7/Plant +7	20.75	6.25	8.5	9.5	60%	40%
Animal -8/Plant +8	20	6	9	10	58%	42%
Animal -9/Plant +9	19.25	5.75	9.5	10.5	56%	44%
Animal -10/Plant +10	18.5	5.5	10	11	53%	47%
Animal -11/Plant +11	17.75	5.25	10.5	11.5	51%	49%
Animal -12/Plant +12	17	5	11	12	49%	51%
Animal -13/Plant +13	16.25	4.75	11.5	12.5	47%	53%
Animal -14/Plant +14	15.5	4.5	12	13	44%	56%
Animal -15/Plant +15	14.75	4.25	12.5	13.5	42%	58%
Animal -16/Plant +16	14	4	13	14	40%	60%
Animal -17/Plant +17	13.25	3.75	13.5	14.5	38%	62%
Animal -18/Plant +18	12.5	3.5	14	15	36%	64%
Animal -19/Plant +19	11.75	3.25	14.5	15.5	33%	67%
Animal -20/Plant +20	11	3	15	16	31%	69%
Animal -21/Plant +21	10.25	2.75	15.5	16.5	29%	71%
Animal -22/Plant +22	9.5	2.5	16	17	27%	73%
Animal -23/Plant +23	8.75	2.25	16.5	17.5	24%	76%
Animal -24/Plant +24	8	2	17	18	22%	78%
Animal -25/Plant +25	7.25	1.75	17.5	18.5	20%	80%
Animal -26/Plant +26	6.5	1.5	18	19	18%	82%
Animal -27/Plant +27	5.75	1.25	18.5	19.5	16%	84%
Animal -28/Plant +28	5	1	19	20	13%	87%
Animal -29/Plant +29	4.25	0.75	19.5	20.5	11%	89%
Animal -30/Plant +30	3.5	0.5	20	21	9%	91%
Animal -31/Plant +31	2.75	0.25	20.5	21.5	7%	93%
Animal -32/Plant +32	2	0	21	22	4%	96%

Animal -33/Plant +33	1.25	0	21.5	22.5	3%	97%
Animal -34/Plant +34	0.5	0	22	23	1%	99%
Animal -35/Plant +35	0	0	22.5	23.5	0%	100%

[a] This table shows just one example of several scenarios that will be modeled.

- Objective 4: Evaluate implications on meeting nutritional goals when the proportions of animal-based Protein Foods subgroups (i.e., Meats, Poultry, and Eggs; and Seafood) are reduced by ½ or 1 oz eq increments and the proportions of plant-based Protein Foods subgroups (i.e., Beans, Peas, and Lentils; and Nuts, Seeds, and Soy Products) are increased by ½ or 1 oz eq increments in each calorie level of the 2020 HUSS Dietary Pattern. Seafood will remain constant for the calorie levels in which 8 oz or less is recommended per week and will not be reduced below 8 oz for the calorie levels in which greater than 8 oz is recommended per week. Determine whether the projected quantities affect the nutritional composition and contribution of the Protein Foods group in the Pattern.
    - The Meats, Poultry, and Eggs subgroup and the plant-based Protein Foods subgroups will be examined simultaneously to model various proportions of subgroup quantities that represent potential levels of consumption. Seafood quantities will remain constant at calorie levels ≤2,000 (which recommend 8 oz eq/week or less) and undergo an incremental decrease at calorie levels >2,000 (which recommend >8 oz eq/week) until 8 oz eq is reached. Thereby, the analysis will uphold the Seafood intake recommendations (about 8 oz eq per week) in the current *Dietary Guidelines for Americans, 2020-2025*, which are not being achieved by most individuals. The **Introduction** provides more information about this recommendation.
    - The analysis for the Dietary Pattern for ages 2 years and older will start with the Meats, Poultry, and Eggs subgroup's current quantities in the 2020 Dietary Pattern and incrementally reduce their quantities until zero is reached. At the same time as each incremental reduction in the Meats, Poultry, and Eggs subgroup, the collective quantity of the Beans, Peas, and Lentils and Nuts, Seeds, and Soy Products subgroups will incrementally increase while maintaining their baseline proportions to one another (approximately a 1:1 ratio of Beans, Peas, and Lentils to Nuts, Seeds, and Soy Products). Thus, for every 1 oz eq interval, there will be a 1 oz eq decrease in Meats, Poultry, and Eggs, ½ oz eq increase in Beans, Peas, and Lentils, and ½ oz eq increase in Nuts, Seeds, and Soy Products. This same process, as described for the Dietary Pattern for ages 2 years and older, will be applied to the analysis for the Dietary Pattern for ages 12 through 23 months, while accounting for its subgroup and proportional differences. NOTE: These changes may have an impact on iron bioavailability. However, USDA's FPM methods do not adjust for potential effects on iron absorption that result from the differences in iron bioavailability between plant-based Protein Foods and animal-based Protein Foods.
    - Increments of ½ oz eq will be used for the lower calorie levels in the Dietary Patterns for ages 12 through 23 months (700, 800, 900, and 1,000 calories) and ages 2 years and older (1,000, 1,200, and 1,400 calories). Increments of 1 oz eq will be used for the higher calorie levels in the Pattern intended for ages 2 years and older (1,600 to 3,200 calories). The subgroups within each Dietary Pattern will be included in the analysis of the Dietary Pattern. While most subgroups are applied across both Dietary Patterns, the Dietary Pattern for ages 2 years and older uses a subgroup for Meats, Poultry, and Eggs, and the Dietary Pattern for ages 12 through 23 months uses separate subgroups for 1) Meats and Poultry and 2) Eggs.
    - The scenarios to be modeled using the 2020 Dietary Pattern's 2,000 calorie level as an example, along with the percent proportions of animal-based Protein Foods and plant-based Protein Foods in each scenario, are described in **Table 5**.

Table 5. Ounce equivalents (oz eq) per week of plant-based and animal-based Protein Foods subgroups to be modeled within the 2,000-calorie level of the 2020 Healthy U.S.-Style (HUSS) Dietary Pattern (Objective 4) [a]

Scenario	Meats, Poultry, and Eggs (Animal-based)	Seafood (Animal-based)	Nuts, Seeds, and Soy Products (Plant-based)	Beans, Peas, and Lentils (Plant-based)	Proportion from Animal-Based Protein Foods Subgroups	Proportion from Plant-Based Protein Foods Subgroups
Current Pattern (Reference)	26	8	5	6	76%	24%
Animal -1/Plant +1	25	8	5.5	6.5	73%	27%
Animal -2/Plant +2	24	8	6	7	71%	29%
Animal -3/Plant +3	23	8	6.5	7.5	69%	31%
Animal -4/Plant +4	22	8	7	8	67%	33%
Animal -5/Plant +5	21	8	7.5	8.5	64%	36%
Animal -6/Plant +6	20	8	8	9	62%	38%
Animal -7/Plant +7	19	8	8.5	9.5	60%	40%
Animal -8/Plant +8	18	8	9	10	58%	42%
Animal -9/Plant +9	17	8	9.5	10.5	56%	44%
Animal -10/Plant +10	16	8	10	11	53%	47%
Animal -11/Plant +11	15	8	10.5	11.5	51%	49%
Animal -12/Plant +12	14	8	11	12	49%	51%
Animal -13/Plant +13	13	8	11.5	12.5	47%	53%
Animal -14/Plant +14	12	8	12	13	44%	56%
Animal -15/Plant +15	11	8	12.5	13.5	42%	58%
Animal -16/Plant +16	10	8	13	14	40%	60%
Animal -17/Plant +17	9	8	13.5	14.5	38%	62%
Animal -18/Plant +18	8	8	14	15	36%	64%
Animal -19/Plant +19	7	8	14.5	15.5	33%	67%
Animal -20/Plant +20	6	8	15	16	31%	69%
Animal -21/Plant +21	5	8	15.5	16.5	29%	71%
Animal -22/Plant +22	4	8	16	17	27%	73%
Animal -23/Plant +23	3	8	16.5	17.5	24%	76%
Animal -24/Plant +24	2	8	17	18	22%	78%
Animal -25/Plant +25	1	8	17.5	18.5	20%	80%
Animal -26/Plant +26	0	8	18	19	18%	82%

[a] This table shows just one example of several scenarios that will be modeled.

- Objective 5: Evaluate implications on meeting nutritional goals when the proportions of Protein Foods subgroups are modified to include animal-based Protein Foods from Seafood and Eggs subgroups only or Seafood only (i.e., no Meat or Poultry), while maintaining the plant-based Protein Foods subgroups (i.e., Beans, Peas, and Lentils; Nuts and Seeds; Soy Products) in each calorie level of a modified version of the 2020 H-VEG Dietary Pattern. Determine whether the projected quantities affect the nutritional composition and contribution of the Protein Foods group in the Dietary Pattern.
    - These analyses will model two defined scenarios to represent potential levels of consumption within hypothetical pescatarian diets, where the Protein Foods group is composed of (1) Eggs; Seafood; Nuts and Seeds; Soy Products; and Beans, Peas, and Lentils subgroups, or (2)

Seafood; Nuts and Seeds; Soy Products; and Beans, Peas, and Lentils subgroups. For each calorie level in the modified H-VEG Dietary Pattern, the Seafood subgroup will be added at the oz eq quantities included in the HUSS Pattern at the same calorie level. The quantities for the other Protein Foods subgroups (i.e., Nuts and Seeds; Soy Products; Beans, Peas, and Lentils; and Eggs, if included) will be proportionally reduced to maintain the current proportion of total Protein Foods within the H-VEG Dietary Pattern.

- The subgroups within each Dietary Pattern will be included in the analysis of the Dietary Pattern. While most subgroups are applied across both Dietary Patterns, the Dietary Pattern for ages 2 years and older uses two subgroups for 1) Nuts and Seeds and 2) Soy Products, and the Dietary Pattern for ages 12 through 23 months uses one subgroup for Nuts, Seeds, and Soy Products combined. The scenarios to be modeled using the 2020 Dietary Pattern's 2,000 calorie level as an example, along with the percent proportions of animal-based Protein Foods and plant-based Protein Foods in each scenario, are described in **Table 6**.

Table 6. Ounce equivalents (oz eq) per week of plant-based and animal-based Protein Foods subgroups to be modeled within the 2,000-calorie level of the modified 2020 Healthy Vegetarian (H-VEG) Dietary Pattern (Objective 5) [a]

Scenario	Eggs (Animal-based)	Seafood (Animal-based)	Soy Products (Plant-based)	Nuts and Seeds (Plant-based)	Beans, Peas, and Lentils (Plant-based)	Total Protein Foods (All Subgroups)	Proportion from Animal-Based Protein Foods Subgroups	Proportion from Plant-Based Protein Foods Subgroups
Current Pattern (Reference)	3	0	8	7	6	24	12.5%	87.5%
Pescatarian 1 (Seafood, Eggs, & Plant-Based Protein Foods)	3	8	5	4.5	3.5	24	45.8%	54.2%
Pescatarian 2 (Seafood & Plant-Based Protein Foods)	0	8	6	5.5	4.5	24	33.3%	66.7%

[a] This table shows just one example of several scenarios that will be modeled.

Determine the amounts of nutrients that would be obtained by consuming various foods within each group:

The anticipated energy and nutrient content, or nutrient profile, of each food group and subgroup will be determined based on the synthesis of results of the planned 2025 analyses to answer the question:

> *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?*

The results of those analyses will determine if a "composite" system will be used to determine the nutrient profiles, or if a revised approach will be used which removes foods and beverages lower in nutrient density from contributing to the development of healthy dietary patterns.

For more information on the work planned for this question, view the protocol developed by the 2025 Committee on DietaryGuidelines.gov.[37]

Evaluate nutrient level in each pattern against nutritional goals:

Using the revised nutrient profiles that apply to young children less than 2 years and the population 2 years and older, the nutrients provided by amounts recommended in the *Dietary Guidelines for Americans, 2020-2025* from each food group (and oils) are compared to the age, sex, and life stage-specific goals (usually at least 90% of the RDA or AI).

Iteration and re-evaluation of the patterns to align with current or potential recommendations:

Any nutritional goals that were not feasible to meet within the structure of the dietary patterns will be identified and potential health impacts will be considered by the Committee. Food group amounts and modifications will be based on expert judgement of which food groups could most reasonably provide the nutrients when goals were not met. New food groups and subgroups may be modeled to aim towards achieving a potential recommendation reflected in the systematic reviews. All modifications to food groups or subgroups will be balanced within energy constraints. To reduce possible bias in modifying food group amounts, food group and subgroup amounts in the patterns will be evaluated against usual intake distributions and limited to amounts between median and 95th percentiles of usual intakes, or in the case of overconsumed components, between the median and the 5th percentiles of usual intake. Calories from all food groups, subgroups, and oils, termed “essential calories,” will then be summed, and the remaining calories up to the calorie limit for the pattern will be used to set limits on calories for other uses.

Conduct analyses

The USDA FPM methods team, in collaboration with the Committee, will use the analytic framework and analytic plan as a guide for conducting analyses and preparing tables and reports describing the analytic results for each analysis.

The first level of analysis will be by population, with results described for each age-sex group and life stage (e.g., pregnancy and lactation). Depending on the available data, subsequent analyses may be based on population subgroups, race and/or ethnicity, and/or socioeconomic position.

Synthesize analyses

The Committee will describe, compare, and combine the evidence from all FPM analyses conducted to answer this FPM question. Synthesis of the analyses will involve summarizing results with particular emphasis on implications for each life stage: infants, children, adolescents, adults, older adults, and individuals who are pregnant or lactating. Implications for each of the existing USDA Dietary Patterns or rationale for new pattern development, including energy levels, will also be included.

The analyses from each individual protocol, along with the results of simulated diet analyses, related systematic review evidence, and related data analysis findings, will be considered together in answering the primary question.

Develop conclusion

The Committee will review and discuss the synthesis of the analyses to develop conclusion statements for each FPM question. Conclusions from this protocol will be used along with conclusions from all other FPM

protocols, the graded conclusions of any related systematic review, and related data analysis findings to collectively inform the Committee's advice on the development or refinement of healthy dietary patterns.

Recommend future research

The Committee will identify and document research gaps and methodological limitations throughout the FPM process. These gaps and limitations will be used to develop research recommendations that describe the research, data, and methodological advances that are needed to strengthen the process to model and develop healthy dietary patterns. Rationales for the necessity of additional or stronger research may also be provided with the research recommendations.

Protocol amendments

The first version of this protocol was published in October 2023. This revised version was published in February 2024. Amendments listing protocol changes are documented below in **Table 7**.

Table 7. Protocol amendments

Date	Protocol change	Description
February 2024	Analytic Plan	The analytic plan was revised to establish energy levels based on the updated Estimated Energy Requirements (EER) equations from the Dietary Reference Intakes for Energy report published by the National Academies of Sciences, Engineering, and Medicine in 2023.[40]

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