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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 Protocol

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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 Vegetables group includes five vegetable subgroups—Dark-Green; Red and Orange; Beans, Peas, and Lentils; Starchy; and Other. These include all fresh, frozen, canned and dried options in cooked or raw forms, including 100% vegetable juices. Vegetables in their nutrient-dense forms have limited additions such as salt, butter, or creamy sauces. The 2020 Healthy U.S.-Style (HUSS) Dietary Pattern recommends 1 to 4 cup equivalents (cup eq) of Vegetables per day across the 1000 to 3200 calorie patterns for individuals ages 2 years and older.[1] Recommended quantities are less for children under 2 years who have lower energy needs.

Vegetables are sources of various nutrients some of which are dietary components of public health concern including dietary fiber, potassium, and folate for individuals who are pregnant or lactating. Contributing to low intakes of these dietary components are the low intakes of vegetables in the population. Nearly 90 percent of the U.S. population does not meet the current daily recommendations for the Vegetables food group.[1] In addition, with few exceptions, the U.S. population does not meet intake recommendations for any of the vegetable subgroups. Intakes of Red and Orange Vegetables, Dark-Green Vegetables, and Beans, Peas, and Lentils are particularly low among all age-sex groups, when compared to recommended quantities.[2] When consumed, less than half of vegetables are consumed as a discrete food item; 40 percent are consumed as part of mixed dishes, which may have other ingredients that are sources of saturated fat and/or sodium[2, 3]; and the remainder are consumed as a part of snack foods and condiments.

The following food pattern modeling analyses are proposed to examine hypothetical modifications and implications for meeting nutrient goals using the HUSS Dietary Pattern when: 1) quantities of the Vegetables group are modified from a range of 0 to the current quantities recommended in the HUSS Dietary Pattern (which ranges from ⅔ to 4 cup eq per day), 2) proportions of Vegetable subgroups are modified within the recommended total amount. The nutrient intake implications of these modifications will be examined across age groups and life stages. The nutritional implications of foods from the Beans, Peas, and Lentils subgroup contributing to Protein Foods intake will be examined in a separate food pattern modeling protocol.[4] The nutritional implications of foods from Vegetable subgroups contributing to staple carbohydrate intake will also be examined in a separate food pattern modeling protocol.[5]

The rationale for evaluating hypothetical reductions and/or modifications to this food group is supported by public interest and the wide spectrum of vegetable preferences, dietary needs, budget considerations, and cultural or religious norms across the population. These analyses consider a more equitable representation of the range of population subgroup norms, preferences, and needs. 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.[1, 6] 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 Food Pattern Modeling (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 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 Vegetables food group and subgroup quantities within the Healthy U.S.-Style Dietary Pattern?**

The Committee will use FPM analyses to address these questions, with support from USDA's FPM methods team. This protocol will establish the methods to model hypothetical modifications of the Vegetables group within the current HUSS 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 Dietary Patterns include recommended amounts to eat from five major food groups, one of which is the Vegetables group. The Vegetables group includes subgroups for Dark-Green; Red and Orange; Beans, Peas, and Lentils; Starchy; and Other.

A recommendation to consume vegetables has always been a core component of the Dietary Patterns; however, the subgroupings of the Vegetables group have evolved over time. In the 1980s, three subgroupings of vegetables (Dark Green/Deep Yellow, Starchy/Legumes, and Other) were identified for dietary patterns. Later, with the publication of the Food Guide Pyramid in 1992,[7] Dark Green/Deep Yellow was split to form five Vegetable subgroups: Dry Beans and Peas (legumes), Starchy Vegetables, Dark Green Vegetables, Orange Vegetables, and Other Vegetables.

The 1980 *Dietary Guidelines for Americans* included a recommendation for vegetable intake to "include all types regularly; use dark-green leafy vegetables and dry beans and peas several times a week."[8] This recommendation was then operationalized into specific amounts for analysis of dietary patterns, resulting in a recommendation of 3 cup eq servings of dark green vegetables per week; 4 cup eq servings of orange (deep yellow) vegetables per week, 3 cup eq servings of dry beans and peas per week, 4 cup eq servings of starchy vegetables per week, and 3.5 cup servings of other vegetables per week.[9] These amounts were modified in 2003 to meet the new Dietary Reference Intake (DRI) recommendations and updated in the 2005 *Dietary*

Guidelines for Americans to a recommendation of 2 ½ cups of total vegetables per day for the 2,000-calorie dietary pattern.[10]

The 2010 Committee explored revisions to the vegetable subgroups to 1) decrease the wide discrepancy between the number of vegetables included in and amounts consumed from Other Vegetables subgroup and other subgroups (including Orange Vegetables), and 2) encourage increased vegetable consumption with recommendations that, where possible, were within the range of current consumption at the time. These changes resulted in the Committee identifying tomatoes and red peppers as vegetables to be moved to the Orange vegetables group, creating the new Red and Orange vegetables subgroup.[11]

New recommended intake quantities for Total Vegetables and vegetable subgroups were developed based on the revised subgroups. To make these recommended amounts from each subgroup more achievable based on consumption in the U.S. population, proportional consumption amounts among the proposed subgroups were used as the basis for the new recommended intakes. The proposed distribution of the subgroups was set at 5.9% Dry Beans and Peas (legumes), 29.0% Starchy Vegetables, 6% Dark Green Vegetables, 26.2% Red and Orange Vegetables, and 32.9% Other Vegetables. The new recommendations were found to be more likely than previous recommendations to be within the 95th percentile of the usual intake distribution, and overall nutrient content of the former and updated patterns were similar.[11]

In 2020, the Dry Beans and Peas (legumes) subgroup was renamed to “Beans, Peas, and Lentils” to more accurately reflect the category of foods included in this subgroup.[1] The actual foods included in the subgroup and the recommendations for intake remained unchanged.

Past Committees examining the relationship between dietary patterns and health outcomes across the lifespan found consistent evidence that dietary patterns associated with beneficial outcomes include higher intakes of **vegetables**, fruits, legumes, whole grains, low- or non-fat dairy, lean meat and poultry, seafood, nuts, and unsaturated vegetable oils and lower intakes of red and processed meats, sugar-sweetened foods and drinks, and refined grains.[12-18]

Current perspectives

The 2020 HUSS Dietary Pattern recommends 1 to 4 cup eq of Vegetables per day for individuals ages 2 years and older.[1] Weekly recommendations are provided for Vegetable subgroups, with the highest quantities of cup eq recommended for the Red and Orange Vegetables subgroup. For example, the 2020 HUSS Dietary Pattern for ages 2 years and older recommended weekly consumption of between ½ to 2 ½ cup eq of Dark Green Vegetables, 2 ½ to 7 ½ cup eq of Red and Orange Vegetables, ½ to 3 cup eq of Beans, Peas, and Lentils; 2 to 8 cup eq of Starchy Vegetables, and 1 ½ to 7 cups of Other Vegetables, depending on calorie level. For individuals 12-23 months old, the 2020 HUSS Dietary Pattern recommends ⅔ to 1 cup eq of Vegetables per day, with weekly consumption of between ½ to 1 cup eq of Dark Green Vegetables, 1 to 2 ½ cup eq of Red and Orange Vegetables, ½ to ¾ cup eq of Beans, Peas, and Lentils; 1 to 2 cup eq of Starchy Vegetables, and ¾ to 1 ½ cups of Other Vegetables, depending on calorie level.

The *Dietary Guidelines for Americans, 2020-2025*, highlighted the concern around the underconsumption of the Vegetables food group, noting that about 90% of individuals in the U.S. did not meet recommendations.[1] Vegetables are consumed at levels below recommendations as early as 6 months of age and are evident across the life stages. In addition, with few exceptions, the U.S. population does not meet intake recommendations for any of the vegetable subgroups.[2, 3]

Furthermore, the foods generally consumed from this group were in forms with higher amounts of sodium and saturated fat, and most vegetables were not consumed as a distinct food. For individuals 2 years and older, the

top three food subcategories that contributed 10% or more to vegetable intake for all age groups were non-starchy and starchy vegetables; burgers and sandwiches; and rice, pasta, and other grain-based dishes.[1] In the diets of children, more than 10% of vegetable intake were obtained from chips, crackers, and savory snacks. Data analysis used to support the development of the 2020-2025 edition showed average intakes of the food group was about 1.49 cup eq per day for those 1 year and older.[3] Intake of Dark-Green vegetables and Red and Orange vegetables is especially low, with usual intakes at 0.98 and 2.45 cup eq per week, respectively.

The Vegetables food group is a major source of vitamin A, vitamin B6, potassium, copper, and dietary fiber, and a substantial contributor to calcium, iron, magnesium, vitamin C, and folate in the diet. Many individuals have intakes of calcium, potassium, and dietary fiber below the Estimated Average Requirement (EAR) or AI for these dietary components of public health concern in the United States. There are notable differences in calcium and potassium intakes among race and/or ethnic groups and across various socioeconomic positions.[19-26] The Vegetables subgroup for Beans, Peas, and Lentils also contains sources of dietary protein and can contribute to the Protein Foods group. While most individuals meet protein needs, there are certain life stages (e.g., older adults and adolescents) when low protein intakes are a concern. The analyses in this protocol will be based on the established nutritional content of foods in the Vegetables food group.

This protocol describes a multi-phased approach to understand the implications on nutrient goals if different amounts of the Vegetables group are consumed compared to what is currently recommended, or if individuals make different choices than the proportional intake of subgroups currently included in the Vegetables group.

Given that current intakes of the Vegetables group fall below recommendations for all life stages, it is important to understand the implications on nutrient goals. Therefore, one of the analyses prioritized in this protocol will assess the impact on nutrient goals using the HUSS Dietary Pattern if the quantitative recommendations for the Vegetables group are incrementally reduced or if no foods are consumed from this food group—especially for dietary components of public health concern, such as calcium, dietary fiber, and potassium. Although similar analyses were conducted by the 2010 Committee, there is support for updating these analyses with newer data due to population dietary intake changes, FPM methodological changes, food composition database updates, and revisions to the Dietary Reference Intakes in 2011 for calcium and vitamin D, 2019 for sodium and potassium, and 2023 for energy.

The 2025 Committee is also continuing to examine dietary patterns and health outcomes across the lifespan and will also be examining vegetable consumption during the complementary feeding period from birth to 24 months of age. These systematic review results will be considered when the Committee synthesizes the full body of evidence to determine their overall advice on potential dietary pattern changes and/or newly recommended dietary patterns.

This protocol describes a multi-phased approach for understanding if nutritional goals can be achieved when the Vegetables food group quantities are hypothetically modified, including nutritional implications of reducing the quantity of the food group lower than what is currently recommended in the 2020 HUSS Dietary Pattern and when differing proportional amounts of the Vegetables subgroups are included in the pattern. 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 Vegetables food group and quantities within the Healthy U.S.-Style Dietary Pattern?

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 protocol or subsequent protocols for other research questions.

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, type of analyses, and data sources identified to answer the question. It also includes the definitions of key terms.

Questions:

What are the implications for nutrient intakes when modifying the Vegetables food group and subgroup quantities within the Healthy U.S.-Style (HUSS) Dietary Pattern?

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 published for ages 12 through 23 months who are no longer consuming human milk or infant formula, and for ages 2 and older.[1] 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 and recommended by the American Academy of Pediatrics and the World Health Organization. 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; and **(5)** evaluating nutrient

levels in each pattern against nutritional goals. Finally, **(6)** adjust and re-evaluate the patterns to align with current or potential recommendations.

These analysis questions 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 HUSS Dietary Pattern published in the *Dietary Guidelines for Americans, 2020-2025*. Nutrient profiles that underlie those patterns will be updated based on the 2025 Dietary Guidelines Advisory Committees 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.

Subsequent analyses will model the implications of modifications to the Vegetables food group. Specifically, analyses will examine hypothetical modifications to the Vegetables group and subgroups, including reduced proportions of each of the Vegetables subgroups, and the implications on meeting nutritional goals across the lifespan.

FPM analyses planned to answer these questions include:

- Identifying the nutritional composition and contribution of the Vegetables group in current dietary intakes, relative to the 2020 HUSS Dietary Pattern goals.
- Evaluating nutrient intake implications when the quantity of the Vegetables food group in the pattern is reduced by ¼ cup eq increments, starting with the current maximum quantity at calorie levels of the 2020 HUSS Patterns for ages 12 through 23 months and ages 2 years and older.
- Evaluating implications on meeting nutritional goals by modifying the proportions of food subgroups contributing to the food group nutrient profile by modeling various proportions of subgroups (i.e., dark green; red and orange; beans, peas, and lentils; starchy; and other) within the Vegetables group. The process will model various subgroup proportions to represent potential levels of consumption. The nutritional composition and contributions of the Vegetables group in the HUSS Dietary Pattern will be examined.
- Identifying and documenting potential implications on the nutritional composition and contributions of the above analyses.

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 *Dietary Guidelines for Americans, 2020-2025* 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
- FNDDS 2017-2018: U.S. Department of Agriculture, Agricultural Research Service. 2020. *USDA Food and Nutrient Database for Dietary Studies 2017-2018*. Available: ars.usda.gov/nea/bhnrc/fsrg
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Key definitions:

Note: 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 Dietary Pattern.[1, 2] The 2025 Dietary Guidelines Advisory Committee will continue to consider terminology and implications of terms related to health equity 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 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 Vegetables food group.
- Dairy and Fortified Soy Alternatives
- Grains:
  - *Whole Grains and Refined Grains*
- Protein Foods:
  - *Meats, Poultry, and Eggs [b]; Seafood; Nuts, Seeds, and Soy Products*
    - [b.] For the HUSS Dietary Pattern for ages 12 through 23 months, there are separate subgroups for 1) Meats and Poultry and 2) Eggs.

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.[27] 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 Pattern):[1, 2] 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.

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).[28] (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.[1]

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.[1] 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.[29, 30] 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.[31, 32] 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.[32, 33] 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.[28, 34] 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.[28]

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).[1, 28, 35-38] 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 energy)
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 for ages 1 years and older (published in the *Dietary Guidelines for Americans, 2020-2025)* will be used in these analyses, along with the Vegetable group and subgroup modifications outlined below, to examine their impacts on nutritional composition and contribution within the Vegetables group and meeting nutritional goals across the HUSS Dietary Patterns.[1]

Analysis on the nutritional contribution of the Vegetables food group and subgroups:

- Objective 1: Identify the nutritional composition and contribution of the Vegetables food group and subgroups in current dietary intakes, relative to the 2020 Healthy U.S.-Style Dietary Pattern goals for ages 12 months and older.
- Objective 2: Evaluate nutrient intake implications when the quantity of the Vegetables food group in the patterns is reduced by ¼ cup equivalents (cup eq) for lower calorie levels in the Dietary Patterns for ages 12 months 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 cup eq will be used for the higher calorie levels in the Dietary Pattern intended for ages 2 years and older (1,600–3,200 calories).

Analyses modifying food group quantities and proportions:

- Objective 3: Evaluate implications on meeting nutritional goals when the proportions of vegetable subgroups are incrementally modified in each calorie level of the 2020 Healthy U.S.-Style Dietary Pattern.

Table 3. Cup equivalents (cup eq) per week of Vegetables to be modeled with incremental reductions of all subgroups while keeping subgroup proportions constant, within the 2,000-calorie level of the 2020 Healthy U.S.-Style (HUSS) Dietary Pattern[a]

Scenario	Vegetables (cup eq)	Dark Green Vegetables (cup eq)	Dark Green Vegetables (% of Total Vegetables)	Red and Orange Vegetables (cup eq)	Red and Orange Vegetables (% of Total Vegetables)	Beans, Peas, and Lentils (cup eq)	Beans, Peas, and Lentils (% of Total Vegetables)	Starchy Vegetables (cup eq)	Starchy Vegetables (% of total Vegetables)	Other Vegetables (cup eq)	Other Vegetables (% of Total Vegetables)
Current Pattern (Reference)	17.5	1.5	9%	5.5	31%	1.5	8%	5	29%	4	23%
Veg-1	16.5	1.485	9%	5.115	31%	1.32	8%	4.785	29%	3.795	23%
Veg-2	15.5	1.395	9%	4.805	31%	1.24	8%	4.495	29%	3.565	23%
Veg-3	14.5	1.305	9%	4.495	31%	1.16	8%	4.205	29%	3.335	23%
Veg-4	13.5	1.215	9%	4.185	31%	1.08	8%	3.915	29%	3.105	23%
Veg-5	12.5	1.125	9%	3.875	31%	1	8%	3.625	29%	2.875	23%
Veg-6	11.5	1.035	9%	3.565	31%	0.92	8%	3.335	29%	2.645	23%
Veg-7	10.5	0.945	9%	3.255	31%	0.84	8%	3.045	29%	2.415	23%
Veg-8	9.5	0.855	9%	2.945	31%	0.76	8%	2.755	29%	2.185	23%
Veg-9	8.5	0.765	9%	2.635	31%	0.68	8%	2.465	29%	1.955	23%
Veg-10	7.5	0.675	9%	2.325	31%	0.6	8%	2.175	29%	1.725	23%
Veg-11	6.5	0.585	9%	2.015	31%	0.52	8%	1.885	29%	1.495	23%
Veg-12	5.5	0.495	9%	1.705	31%	0.44	8%	1.595	29%	1.265	23%
Veg-13	4.5	0.405	9%	1.395	31%	0.36	8%	1.305	29%	1.035	23%
Veg-14	3.5	0.315	9%	1.085	31%	0.28	8%	1.015	29%	0.805	23%
Veg-15	2.5	0.225	9%	0.775	31%	0.2	8%	0.725	29%	0.575	23%
Veg-16	1.5	0.135	9%	0.465	31%	0.12	8%	0.435	29%	0.345	23%
Veg-17	0.5	0.045	9%	0.155	31%	0.04	8%	0.145	29%	0.115	23%
Veg-18	0	0	9%	0	31%	0	8%	0	29%	0	23%

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

Table 4. Cup equivalents (cup eq) per week of Vegetables to be modeled with incremental reductions of the Red and Orange Vegetables (ROV) subgroup within the 2,000-calorie level of the 2020 Healthy U.S.-Style (HUSS) Dietary Pattern[a]

Scenario	Vegetables (cup eq)	Dark Green Vegetables (cup eq)	Dark Green Vegetables (% of Total Vegetables)	Red and Orange Vegetables (cup eq)	Red and Orange Vegetables (% of Total Vegetables)	Beans, Peas, and Lentils (cup eq)	Beans, Peas, and Lentils (% of Total Vegetables)	Starchy Vegetables (cup eq)	Starchy Vegetables (% of total Vegetables)	Other Vegetables (cup eq)	Other Vegetables (% of Total Vegetables)
Current Pattern (Reference)	17.5	1.5	9%	5.5	31%	1.5	8%	5	29%	4	23%
ROV-1	17	1.5	9%	5	29%	1.5	9%	5	29%	4	24%
ROV-2	16.5	1.5	9%	4.5	27%	1.5	9%	5	30%	4	24%
ROV-3	16	1.5	9%	4	25%	1.5	9%	5	31%	4	25%
ROV-4	15.5	1.5	10%	3.5	23%	1.5	10%	5	32%	4	26%
ROV-5	15	1.5	10%	3	20%	1.5	10%	5	33%	4	27%
ROV-6	14.5	1.5	10%	2.5	17%	1.5	10%	5	34%	4	28%
ROV-7	14	1.5	11%	2	14%	1.5	11%	5	36%	4	29%
ROV-8	13.5	1.5	11%	1.5	11%	1.5	11%	5	37%	4	30%
ROV-9	13	1.5	12%	1	8%	1.5	12%	5	38%	4	31%
ROV-10	12.5	1.5	12%	0.5	4%	1.5	12%	5	40%	4	32%
ROV-11	12	1.5	13%	0	0%	1.5	13%	5	42%	4	33%

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

Table 5. Cup equivalents (cup eq) per week of Vegetables to be modeled holding all subgroup proportions equal, within the 2,000-calorie level of the 2020 Healthy U.S.-Style (HUSS) Dietary Pattern[a]

Scenario	Vegetables (cup eq)	Dark Green Vegetables (cup eq)	Dark Green Vegetables (% of Total Vegetables)	Red and Orange Vegetables (cup eq)	Red and Orange Vegetables (% of Total Vegetables)	Beans, Peas, and Lentils (cup eq)	Beans, Peas, and Lentils (% of Total Vegetables)	Starchy Vegetables (cup eq)	Starchy Vegetables (% of total Vegetables)	Other Vegetables (cup eq)	Other Vegetables (% of Total Vegetables)
Current Pattern (Reference)	17.5	1.5	9%	5.5	31%	1.5	8%	5	29%	4	23%
Veg-Equal	17.5	3.5	20%	3.5	20%	3.5	20%	3.5	20%	3.5	20%

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

Table 6. Cup equivalents (cup eq) per day of Vegetables to be modeled with total vegetable consumption from one subgroup, holding all other subgroups at zero, within the 2,000-calorie level of the 2020 Healthy U.S.-Style (HUSS) Dietary Pattern[a]

Scenario	Vegetables (cup eq)	Dark Green Vegetables (cup eq)	Dark Green Vegetables (% of Total Vegetables)	Red and Orange Vegetables (cup eq)	Red and Orange Vegetables (% of Total Vegetables)	Beans, Peas, and Lentils (cup eq)	Beans, Peas, and Lentils (% of Total Vegetables)	Starchy Vegetables (cup eq)	Starchy Vegetables (% of total Vegetables)	Other Vegetables (cup eq)	Other Vegetables (% of Total Vegetables)
Current Pattern (Reference)	2.5	0.23	9%	0.78	31%	0.2	8%	0.73	29%	0.58	23%
Dark-Green	2.5	2.5	100%	0	0%	0	0%	0	0%	0	0%
Red and Orange	2.5	0	0%	2.5	100%	0	0%	0	0%	0	0%
Beans, Peas, and Lentils	2.5	0	0%	0	0%	2.5	100%	0	0%	0	0%
Starchy	2.5	0	0%	0	0%	0	0%	2.5	100%	0	0%
Other	2.5	0	0%	0	0%	0	0%	0	0%	2.5	100%

[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 and posted on DietaryGuidelines.gov.[39]

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 nutrient 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 groups 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 these FPM questions. 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 related to 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 food pattern modeling 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 test and develop healthy dietary patterns. Rationales for the necessity of additional or stronger research may also be provided with the research recommendations.

Protocol amendments

No amendments to the protocol have been made at this time. Any future amendments will be documented below in **Table 7**.

Table 7. Protocol amendments

Date	Protocol change	Description
N/A	N/A	N/A

References

1. 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.
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The Committee members are involved in: establishing all aspects of the protocol, which presents the plan for how they are planning to examine the scientific evidence, including the development of an analytic framework and analytic plan; synthesizing analysis results; and writing conclusion statements. The analytic framework and plan provide details about the types of analyses that will be conducted, synthesized, and from which conclusions will be drawn to inform subsequent FPM questions and the Committee's advice on the development or refinement of healthy dietary patterns. The FPM Methods Team, with assistance from Federal Liaisons and Project Leadership, supports the Committee by facilitating, executing, and documenting the work necessary.

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