

Can nutrient goals be met when animal sources of foods and beverages are removed from the Healthy Vegetarian Dietary Pattern for ages 2 years and older?: Food Pattern Modeling Report

Exploratory Analysis

Christopher A. Taylor, PhD, RDN, LD, FAND,^{a,b} Sameera Talegawkar, PhD,^{a,i} 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} Deirdre Tobias, ScD,^{a,j} Meghan Adler, MS, RDN,^k Kevin Kuczynski, MS, RD,^k Verena McClain, MSc,^l Leigh Ann Richardson, MPH, PhD,^l TusaRebecca Pannucci, PhD, MPH, RD,^m

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 Food Pattern Modeling Analyst, Panum Telecom, LLC (A wholly owned subsidiary of Aretum), under contract with FNS, USDA

m Branch Chief, Nutrition and Economic Analysis Branch (NEAB); NGAD, CNPP, FNS, USDA



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Overview

Food pattern modeling (FPM) is a methodology used to

- illustrate how hypothetical changes to the amounts or types of foods and beverages in a dietary pattern might affect meeting nutrient needs
- assist in defining quantitative dietary patterns that reflect the evidence for health-promoting diets synthesized from systematic reviews, while meeting energy and nutrient needs

This report describes the results for FPM analyses conducted by the 2025 Dietary Guidelines Advisory Committee (Committee), supported by USDA's FPM team, to answer the following question: What are the implications for nutrient intakes when removing animal-source foods and beverages within the Healthy Vegetarian Dietary Pattern?

Removing animal-source foods and beverages

The removing animal-source foods and beverages analysis investigated the nutrient ramifications when foods and beverages from animal sources are hypothetically removed from the Healthy Vegetarian Dietary Pattern (H-VEG) for ages 2 years and older. The analyses of this report include food groups and subgroups that have been discussed in other FPM reports.



For information about what is included, how much, and what counts, for **Nuts and Seeds; Soy Products; Beans, Peas, and Lentils; and Eggs**, please review the Protein Foods FPM Report. For **Dairy and Fortified Soy Alternatives**, please review the Dairy and Fortified Soy Alternatives FPM Report. Both FPM Reports can be found here: <https://www.DietaryGuidelines.gov/2025-advisory-committee-report/food-pattern-modeling>

Food Pattern Modeling Analytic Process – In Brief

Below are abbreviated summaries of the methods applied to conduct these FPM analyses. For full details pertaining to how these methods were operationalized, please see the *Should foods and beverages with lower nutrient density (i.e., those with added sugars, saturated fat, and sodium) contribute to item clusters, representative foods, and therefore the nutrient profiles for each food group and subgroup used in modeling the USDA Dietary Patterns? Food Pattern Modeling Report* (which will be referenced as the **Basis Nutrient Profiles FPM Report** throughout the following report).



Before progressing in the following report, it is recommended to review the methods applied in the Basis Nutrient Profiles FPM Report, visit:

<https://www.DietaryGuidelines.gov/2025-advisory-committee-report/food-pattern-modeling>

Step 1: Establish energy levels

Dietary Reference Intakes (DRI) formulas are used to calculate Estimated Energy Requirements (EER) for each age and sex group and for three age groups specific to pregnancy and lactation (14-18 years, 19-30 years and 31-50 years)¹. Each EER calculation is based on sex, age, height, weight, level of physical activity, and life stage and, during pregnancy, gestational weeks. For individuals ages 19 years and older, the established energy levels for FPM analyses utilized the EER calculation specific to inactive individuals at the median height and a normal weight (BMI 22.5 for males, BMI 21.5 for females) for each age and sex group, rounded to the nearest 200 kcal level. For children and adolescents ages 2-18 years, median height and the 50th percentile BMI-for-age were used, with the EER rounded to the nearest 200 kcal level. The corresponding calories were then used to evaluate the patterns against nutritional goals.

Step 2: Establish nutritional goals

Specific nutritional goal quantities for a dietary pattern are set according to energy level and based on the DRI specific to the age and sex group(s) for which the pattern is designed. For individual FPM analyses, the assigned energy level for each age and sex group and life stage will be tested against the established nutritional goals (hereafter referred to as 'goals') for that age and sex group or life stage. Dietary patterns are evaluated against 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 *Dietary Guidelines for Americans, 2020-2025*.

Step 3: Establish food groupings and amounts

Existing food groups and subgroups in the USDA H-VEG Dietary Pattern for ages 2 years and older (published in the *Dietary Guidelines for Americans, 2020-2025*) were used in these analyses. The 2020 H-VEG served two purposes in the following analyses: (1) as a reference and/or (2) as the starting point in analyses that investigate implications to nutritional goals when quantities of food groups and/or subgroups are removed.

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

A composite system is used to calculate the anticipated energy and nutrient content, or nutrient profile, of each food group or subgroup as described below. All foods reported by individuals ages 1 year and older as part of What We Eat in America, National Health and Nutrition Examination Survey 2017-2018 (WWEIA, NHANES 2017-2018) are disaggregated into their ingredients. Some foods and beverages that are lower in nutrient density are excluded from the set of foods used to calculate nutrient profiles. Similar ingredients are aggregated into food item clusters. A

nutrient-dense form of the food is selected as the representative food for each item cluster. The proportional intake of each item cluster within each food group or subgroup is calculated and used to compute a weighted average of nutrient-dense forms of foods representing each food item cluster.

Step 5: Evaluate the implications for meeting nutritional goals when modifying animal sources of foods and beverages within the Healthy Vegetarian Dietary Pattern

The removing animal sources analysis investigated the nutrient implications when foods and beverages from animal sources are removed from the 2020 H-VEG for ages 2 years and older. First, the nutrient profiles for Nuts and Seeds; Soy Products; and Beans, Peas, and Lentils were compared. Then, the nutritional contribution of the two animal-source food groups, Eggs and Dairy and Fortified Soy Alternatives, in the 2020 H-VEG was identified. In the first analysis the Eggs food group and the Dairy and Fortified Soy Alternatives food group were removed from the 2020 H-VEG. In the second analysis, the Dairy and Fortified Soy Alternatives food group was modified to represent only the plant-based component (i.e. soy milk) of the nutrient profile. Nutrient implications were assessed when the plant-based nutrient profile for the Dairy and Fortified Soy Alternatives food group was included, and the Eggs subgroup was removed from the 2020 H-VEG.



For additional details about the rationale how these analyses contribute to the synthesis statements, visit:

[Removing Animal-Source Foods FPM Protocol:](https://www.dietaryguidelines.gov/sites/default/files/2024-06/2025_DGAC_FPM_Q2_Protocol_RemovingAnimalBasedFoods_v2_508c.pdf)

[https://www.dietaryguidelines.gov/sites/default/files/2024-](https://www.dietaryguidelines.gov/sites/default/files/2024-06/2025_DGAC_FPM_Q2_Protocol_RemovingAnimalBasedFoods_v2_508c.pdf)

[06/2025_DGAC_FPM_Q2_Protocol_RemovingAnimalBasedFoods_v2_508c.pdf](https://www.dietaryguidelines.gov/sites/default/files/2024-06/2025_DGAC_FPM_Q2_Protocol_RemovingAnimalBasedFoods_v2_508c.pdf)

Step 6: Iteration and re-evaluation of the patterns to align with current or potential recommendations

Step 6 is not applicable to this exploratory analysis. The results presented here were not used in the development of dietary pattern(s) but were conducted to be responsive to public comment/interest in assessing the nutrient implications of a diet in which animal-sources are removed.

Removing Animal-Source Foods and Beverages Methods and Results

Questions

Can nutrient goals be met when animal sources of foods and beverages are removed from the Healthy Vegetarian Dietary Pattern for ages 2 years and older?

Objectives

The following report contains the FPM objectives, methods, and results for these analyses.

The analysis focused on 2 objectives:

- **Objective 1:** Compare the nutrient profiles for the plant-source Protein Foods subgroups (Nuts and Seeds; Soy Products; Beans, Peas, and Lentils) to identify their nutritional contribution in the 2020 H-VEG Dietary Pattern. Nutrient profiles may be modified or combined for subsequent analyses in the protocol based on these results.
- **Objective 2:** Evaluate the implications on meeting nutritional goals by removing the Eggs subgroup and Dairy and Fortified Soy Alternatives group from each calorie level of the 2020 H-VEG Dietary Pattern. The nutritional composition of the Dietary Pattern will be examined.



All data and results presented in this report can be found in the **Removing Animal-Source Foods FPM Analyses** at the following link:

<https://www.dietaryguidelines.gov/2025-advisory-committee-report/food-pattern-modeling>

Introduction to Analyses

Originally, the Committee planned to explore analysis of the 2020 H-VEG that eliminated all animal-source foods and beverages and replaced them with plant-based alternatives. However, the Committee encountered challenges related to the availability of data. The marketplace for plant-based alternatives for foods such as dairy products and meats is rapidly evolving and up-to-date data for these types of foods is not yet available in the database applied in the analyses. Protocol amendments were noted in June 2024.

For example, as part of the Dairy and Fortified Soy Alternatives protocol, the Committee planned to develop a nutrient profile for the Dairy and Fortified Soy Alternatives food group that consisted entirely of plant-based foods and beverages that are commonly used to replace dairy products such as plant-based milks (e.g., oat milk, almond milk, or coconut milk), plant-based yogurts, and non-dairy cheese. After evaluating the available data, the Committee decided not to pursue this option for several reasons. For one, not all types of commonly consumed plant-based dairy alternatives were available in FNDDS 2017-18, which would be needed to develop the nutrient profiles. Of the plant-based milk alternatives, only soy milk has been established as nutritionally equivalent to dairy

milk and therefore, only for soy milk is there an FPED contribution to the Dairy and Fortified Soy Alternatives food group. To calculate a nutrient profile that includes other plant-based alternatives using the established FPM methodology, an FPED contribution for those food codes to the Dairy and Fortified Soy Alternatives food group would be required. In addition, for plant-based dairy alternatives that are not available in the database, no consumption data is available from NHANES 2017-18. This is another required component of the existing FPM methodology. As a result, the Committee would have had to rely on conjecture to determine which foods in which proportions should contribute to such a plant-based dairy alternatives food group.

Similarly, there are no current nationally representative data that would allow the Committee to assess which foods and beverages are commonly chosen by individuals who avoid animal products and in which proportions. Individuals may avoid animal products for various reasons and the resulting diets vary in composition. Because of these limitations around the data on dietary intakes and the potential variation in resultant replacement of foods and beverages among those who avoid animal products, the objectives and corresponding results described in this FPM report do not include analyses in which any food groups or subgroup quantities are modified to achieve the energy target or to develop a new dietary pattern.

Therefore, the proposed FPM analyses aim to model potential nutritional gaps that may result from the removal of food groups from animal sources that are recommended as part of the 2020 H-VEG, without making other dietary substitutions. Results from these analyses may be used to discuss the degree to which nutritional goals might be met after the removal of food groups from animal sources, and to help inform future directions, such as nutritional composition priorities for replacement foods.

Objective 1 and Objective 2 Methods:

First, the nutrient profiles for the plant-source Protein Foods subgroups (Nuts and Seeds; Soy Products; Beans, Peas, and Lentils) were compared to identify their nutritional contribution in the 2020 H-VEG. Second, the Eggs subgroup and Dairy and Fortified Soy Alternatives food group were removed from each calorie level of the 2020 H-VEG Dietary Pattern. The nutritional composition of the Dietary Pattern and resulting implications on meeting nutritional goals were evaluated.

As described in the **Basis Nutrient Profiles FPM Report**, the nutrient profile for the Dairy and Fortified Soy Alternatives food group is a weighted average of dairy milk, cheese, and yogurt, and fortified soy milk. In addition to removing both the Eggs subgroup and the Dairy and Fortified Soy Alternatives food group entirely, another scenario was developed in which the Eggs subgroup was removed but the nutrient profile for the Dairy and Fortified Soy Alternatives food group was modified to be represented only by the plant-based component (i.e. soy milk) of the nutrient profile.

Objective 1 and 2 Results:

Results reflect the assumptions underlying the nutrient profiles for each food group and subgroup. For consistency, all results are presented to the nearest decimal.

Nutrient Profiles for Plant-based Protein Food Subgroups

Table 1. Nutrient profiles for plant-based Protein Food subgroups (Beans, Peas, and Lentils; Soy Products; Nuts and Seeds).

Food Group	Bean, Peas, and Lentils (oz eq)	Soy Products (oz eq)	Nuts and Seeds (oz eq)
Energy (kcal)	59.75	46.35	85.30
Carbohydrate (g)	10.66	0.09	3.12
Added Sugars (g)	0.00	0.00	0.00
Fiber (g)	3.59	0.02	1.22
Protein (g)	3.94	11.53	3.01
Fat (g)	0.34	0.71	7.41
Saturated Fatty Acids (g)	0.06	0.09	1.00
Linoleic acid (18:2) (g)	0.09	0.32	1.99
Linolenic acid (18:3) (g)	0.05	0.04	0.14
Vitamin A (mcg RAE)	0.06	0.00	10.39
Vitamin C (mg)	0.30	0.02	0.04
Vitamin D (IU)	0.00	0.00	4.58
Vitamin E (mg AT)	0.29	0.00	1.44
Vitamin K (mcg)	1.85	0.16	0.75
Thiamin (mg)	0.07	0.03	0.03
Riboflavin (mg)	0.02	0.02	0.05
Niacin (mg)	0.18	0.22	1.26
Vitamin B6 (mg)	0.06	0.02	0.06
Folate (mcg DFE)	60.69	25.28	12.72
Vitamin B12 (mcg)	0.00	0.00	0.00
Choline (mg)	14.99	25.84	8.43
Calcium (mg)	19.86	30.73	34.50
Copper (mg)	0.11	0.21	0.13
Iron (mg)	1.15	1.89	0.42
Magnesium (mg)	22.90	6.94	28.79
Phosphorus (mg)	62.30	103.54	62.30
Potassium (mg)	186.01	19.37	95.76
Sodium (mg)	1.09	125.48	9.65
Zinc (mg)	0.49	0.55	0.47

Healthy Vegetarian Dietary Pattern

This section describes which nutrients fall short of established nutritional goals in the 2020 H-VEG before any food groups are removed. Not all nutrient shortfalls are unique to the H-VEG pattern. The Healthy U.S.-Style pattern also falls short of established nutrient goals for vitamin D and vitamin E for nearly all age-sex groups and life stages, and for other nutrients such as vitamin A, iron, choline, and folate for some age-sex groups and life stages. For full details on the nutrient content of the HUSS pattern, see the **Basis Nutrient Profiles FPM Report**.

For all age and sex groups and life stages:

- The amount of vitamin D in the H-VEG pattern is below goals ranging from 26 to 33 percent of the RDA.
- The amount of vitamin E in the H-VEG pattern is below goals ranging from 50 to 88 percent of the RDA.
- The amount of choline is below goals (except for children ages 2 through 3 years), ranging from 50 to 78 percent of the AI.

For **children ages 4 through 8 years**, the amount of iron is below goals at 88 percent of the RDA and the amount of potassium is below goals at 86 percent of the RDA.

For **females ages 31 through 50 years**, the amount of iron is below goals at 86 percent of the RDA.

For **males ages 51 years and older**, the amount of magnesium is below goals at 87 percent of the RDA.

For **pregnant individuals ages 14 through 50 years**, the amount of iron is below goals at 60 percent of the RDA.

For **lactating individuals ages 14 through 50 years**, the amount of vitamin A is below goals ranging from 71 to 78 percent of the RDA.

Removing the Eggs Subgroup and Dairy and Fortified Soy Alternatives Food Group

The following section describes which nutrients fall below goals for each age and sex group and life stage, when removing Eggs and Dairy and Fortified Soy Alternatives from the H-VEG pattern without replacing them with other food groups or subgroups.

Energy

For **children ages 2 through 8 years (1,200 kcal)**, the amount of energy is reduced to 805 kcal, leaving 395 kcal before reaching the EER of 1,200 kcal.

For **females ages 51 years and older (1,600 kcal)**, the amount of energy is reduced to 1,149 kcal, leaving 451 kcal before reaching the EER of 1,600 kcal.

For **females ages 9 through 13 years, females ages 31 through 50 years, and males ages 51 and older (1,800 kcal)**, the amount of energy is reduced to 1,340 kcal, leaving 460 kcal before reaching the EER of 1,800 kcal.

For **females ages 14 through 30 years, individuals who are pregnant ages 14 through 50 years, and males ages 9 through 13 (2,000 kcal)**, the amount of energy is reduced to 1,440 kcal, leaving 560 kcal before reaching the EER of 2,000 kcal.

For **males ages 31 through 50 years and lactating individuals ages 31 through 50 years (2,200 kcal)**, the amount of energy is reduced to 1,600 kcal, leaving 600 kcal before reaching the EER of 2,200.

For **males ages 14 through 30 years (2,600 kcal)**, the amount of energy is reduced to 1,936 kcal, leaving 664 kcal before reaching the EER of 2,600 kcal.

For **lactating individuals ages 14 through 30 years (2,400 kcal)**, the amount of energy is reduced to 1,739 kcal, leaving 661 kcal before reaching the EER of 2,400 kcal.

Macronutrients

Protein

For **males and females ages 51 years and older**, and **pregnant and lactating individuals ages 14 through 50 years**, the amount of protein is below goals, ranging from 70-86 percent of the RDA.

Vitamins

For **all age and sex groups and life stages**:

- The amount of vitamin D in the pattern falls further below the RDA, ranging from 2 to 6 percent of the RDA.
- The amount of vitamin E is below goals, ranging from 48 to 83 percent of the RDA.
- The amount of vitamin B12 is below goals, ranging from 33 to 62 percent of the RDA.
- The amount of choline is below goals, ranging from 27 to 44 percent of the AI.
- The amount of vitamin A is below goals for most groups, ranging from 74 to 82 percent of the RDA, except for patterns for children ages 2 through 3 years and females and males ages 9 through 13 years exceeding goals.
- The amount of riboflavin is below goals for most groups, ranging from 57 to 85 percent of the RDA, except for patterns for children ages 2 through 3 years and males ages 9 through 13 years exceeding goals.

For **females ages 51 years and older** and **pregnant individuals ages 14 through 50 years**, the amount of niacin is below goals, ranging from 83 to 86 percent of the RDA.

For **females and males ages 51 years and older** and **pregnant individuals ages 14 through 50 years**, the amount of vitamin B6 is below goals, ranging from 83 to 89 percent of the RDA.

Minerals

The amount of calcium is below goals for **all age and sex groups and life stages**, ranging from 24 to 61 percent of the RDA.

For **children ages 4 through 8 years**, **females ages 19 through 50 years**, and **pregnant individuals ages 14 through 50 years**, the amount of iron is below goals, ranging from 58 to 87 percent of the RDA.

For **females ages 14 through 18 years**, **females ages 51 years and older**, **males ages 31 years and older**, and **pregnant individuals ages 14 through 50 years**, the amount of magnesium is below goals, ranging from 69 to 88 percent of the RDA.

For **females ages 9 through 18 years**, **males ages 9 through 13 years**, **males ages 31 years and older**, and **pregnant individuals ages 14 through 18 years**, the amount of phosphorus is below goals, ranging from 69 to 73 percent of the RDA.

For **children ages 2 through 8 years, females ages 51 years and older, males ages 31 years and older, and pregnant individuals ages 19 through 50 years**, the amount of potassium is below goals, ranging from 60 to 88 percent of the AI.

The amount of zinc is below goals for **most groups**, ranging from 61 to 88 percent of the RDA. Exceptions include **children ages 2 through 3 years, males ages 9 through 30 years, and females ages 19 through 30 years** who meet or exceed nutritional goals for zinc.

Removing the Eggs Subgroup and replacing the Dairy and Fortified Soy Alternatives Food Group with Soy Milk

Energy

For **children ages 2 through 8 years (1,200 kcal)**, the amount of energy is reduced to 988 kcal, leaving 212 kcal before reaching the EER of 1,200 kcal.

For **females ages 51 years and older (1,600 kcal)**, the amount of energy is reduced to 1,368 kcal, leaving 232 kcal before reaching the EER of 1,600 kcal.

For **females ages 9 through 13 years, females ages 31 through 50 years, and males ages 51 and older (1,800 kcal)**, the amount of energy is reduced to 1,560 kcal, leaving 240 kcal before reaching the EER of 1,800 kcal.

For **females ages 14 through 30 years, males ages 9 through 13, pregnant individuals ages 14 through 50 years (2,000 kcal)**, the amount of energy is reduced to 1,659 kcal, leaving 341 kcal before reaching the EER of 2,000 kcal.

For **males ages 14 through 30 years (2,600 kcal)**, the amount of energy is reduced to 2,156 kcal, leaving 444 kcal before reaching the EER of 2,600 kcal.

For **males ages 31 through 50 years and lactating individuals ages 31 through 50 years (2,200 kcal)**, the amount of energy is reduced to 1,820 kcal, leaving 380 kcal before reaching the EER of 2,200.

For **lactating individuals ages 14 through 30 years (2,400 kcal)**, the amount of energy is reduced to 1,959 kcal, leaving 441 kcal before reaching the EER of 2,400 kcal.

Vitamins

For **all age and sex groups and life stages**:

- The amount of vitamin D in the pattern is below the RDA, ranging from 51 to 64 percent of the RDA.
- The amount of vitamin E is below goals, ranging from 51 to 89 percent of the RDA.
- The amount of choline is below goals, ranging from 44 to 79 percent of the AI.

For **pregnant individuals ages 14 through 50 years**, the amount of vitamin B6 is below goals at 89 percent of the RDA.

For **lactating individuals ages 19 through 30 years and 31 through 50 years**, the amount of vitamin A is below goals at 84 and 83 percent of the RDA, respectively.

Minerals

For **pregnant individuals ages 14 through 50 years**, the amount of iron is below goals at 70 percent of the RDA.

For **males ages 51 and older, pregnant individuals ages 14 through 50 years, and lactating individuals ages 14 through 18 years, and 31 through 50 years**, the amount of zinc is below goals, ranging from 75 to 84 percent of the RDA.

Summary Statement

Summary Statement 1:

Several nutrient gaps are introduced when all animal sources of foods and beverages are removed from the 2020 Healthy Vegetarian Dietary Pattern for ages 2 years and older. Specific nutrients that decrease from this removal include protein, vitamin A, vitamin D, vitamin E, riboflavin, niacin, vitamin B6, vitamin B12, choline, calcium, iron, magnesium, potassium, and zinc. Exclusion of animal foods such as milk, yogurt, and cheese are often accompanied by replacement with alternative products such as fortified soy alternatives which is currently included in the Dairy and Fortified Soy Alternatives food group. While this may ameliorate the limitations for several nutrients, some nutrient gaps persist. In conclusion, the Committee, cautions against excluding all animal source foods and food groups without carefully planning for nutrient adequacy from other dietary sources that may meet the nutrient gaps.

References

1. National Academies of Sciences, Engineering, and Medicine. *Dietary Reference Intakes for Energy*. Washington, DC: The National Academies Press; 2023. <https://doi.org/10.17226/26818>

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