

[FOR 2 YEARS AND OLDER] ARE CHANGES TO THE USDA FOOD PATTERNS NEEDED BASED ON THE RELATIONSHIPS IDENTIFIED [IN THE SYSTEMATIC REVIEWS]? IF SO, HOW WELL DO USDA FOOD PATTERN VARIATIONS MEET NUTRIENT RECOMMENDATIONS FOR EACH STAGE OF LIFE? IF NUTRIENT NEEDS ARE NOT MET, IS THERE EVIDENCE TO SUPPORT SUPPLEMENTATION AND/OR CONSUMPTION OF FORTIFIED FOODS TO MEET NUTRIENT ADEQUACY?: FOOD PATTERN MODELING PROTOCOL

The question “Are changes to the USDA Food Patterns needed based on the relationships identified [in the systematic reviews]?” was answered after the systematic reviews were completed. This document describes the protocol to answer the following question for 2 years and older: ...How well do USDA Food Pattern variations meet nutrient recommendations for each stage of life? If nutrient needs are not met, is there evidence to support supplementation and/or consumption of fortified foods to meet nutrient adequacy?

The 2020 Dietary Guidelines Advisory Committee, Data Analysis and Food Pattern Modeling Cross-Cutting Working Group, answered these questions with support from the federal food pattern modeling specialists of the Data Analysis Team.

Food pattern modeling methodology for answering these questions involved:

- updating nutrient profiles of food groups and subgroups using data on foods consumed by Americans from NHANES, What We Eat in America 2015-2016 and corresponding food composition data from USDA Food and Nutrient Database for Dietary Studies, USDA National Nutrient Database for Standard Reference, and the USDA Food Patterns Equivalents Database [not inclusive of nutrients from dietary supplements];
- testing changes to USDA food patterns, for example accounting for variability of eating patterns across life stages, potential role of fortified foods, and additional variations of healthy eating patterns;
- testing nutrient adequacy of healthy eating pattern variations compared to the DRIs, current Dietary Guidelines recommendations, and potential recommendations of the 2020 Dietary Guidelines Advisory Committee;
- developing conclusion statements to summarize the answer to each food pattern modeling question; and,
- making research recommendations to inform future work on this topic.

This protocol answered this question based on an update to the base pattern, the Healthy U.S. Style Pattern.

This document includes details about the methodology, as it was applied to the food pattern modeling exercises as follows:

- The [analytic framework](#) (p. 2) describes the overall scope of the question and approach used to describe how the food patterns were updated and compared to nutrient recommendations.
- The [analytic plan](#) (p. 3) details the data and methods for the food pattern modeling exercises described.

- The results (p. 7) explains how to access summarized and full documentation of the food pattern modeling analyses described in this protocol.

More information about food pattern modeling methods, which were used in implementing this food pattern modeling protocol, is available on the Dietary Guidelines for Americans website: <https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling>

ANALYTIC FRAMEWORK

The analytic framework describes the overall scope of the food pattern modeling, including the population and type of analyses and data sources identified to answer the question. It also includes the definitions of key terms.

Question: How well do USDA Food Pattern variations meet nutrient recommendations for each stage of life?

The overall food pattern modeling methodology used to develop and update the USDA Food Patterns includes: (1) identifying appropriate energy levels for the patterns, (2) identifying nutritional goals for the patterns, (3) establishing food groupings, (4) determining the amounts of nutrients that would be obtained by consuming various foods within each group, (5) evaluating nutrient levels in each pattern against nutritional goals, and (6) iteration and re-evaluation of the Patterns to align with current or potential recommendations

Population:

The patterns tested in these food pattern modeling exercises are intended to apply to the U.S. population ages 2 years and older including women who are pregnant or lactating.

Data Sources:

FNDDS 2015-2016: U.S. Department of Agriculture, Agricultural Research Service. 2018. USDA Food and Nutrient Database for Dietary Studies 2015-2016. Food Surveys Research Group Home Page, <http://www.ars.usda.gov/nea/bhnrc/fsrg>

FPED 2015-2016: Bowman SA, Clemens JC, Shimizu M, Friday JE, and Moshfegh AJ. 2018. Food Patterns Equivalents Database 2015-2016: Methodology and User Guide [Online]. Food Surveys Research Group, Beltsville Human Nutrition Research Center, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland. September 2018. Available at: <http://www.ars.usda.gov/nea/bhnrc/fsrg>

SR 28: US Department of Agriculture, Agricultural Research Service. 2016. Nutrient Data Laboratory. USDA National Nutrient Database for Standard Reference, Release 28 (Slightly revised). Version Current: May 2016. <http://www.ars.usda.gov/nea/bhnrc/mafcl>

Key Definitions:

Food Groups and Subgroups: USDA Food Patterns provide amounts of five major food groups and subgroups including:

- Fruits
- Vegetables: Dark-green, red/orange, beans and peas, starchy, and other
- Dairy, including calcium fortified soy beverage
- Grains: Whole grains and refined grains
- Protein Foods: Meats, poultry, and eggs; seafood; nuts, seeds, and soy products

*For the purpose of this protocol beans and peas will only be modeled in the vegetable group

Nutrient Profiles: the anticipated nutrient content for each food group and subgroup that could be obtained by eating a variety of foods in each food group in nutrient dense forms. The nutrient profiles are based on a weighted average of nutrient dense forms of foods. The weighted average calculation considers a range of American food choices, but in nutrient dense forms and results in a food pattern that can be adapted to fit an individual's preferences.

Nutrient Dense Representative Foods: for the purpose of USDA's food pattern modeling, nutrient dense representative foods are those within each item cluster in forms with the least amounts of added sugars, sodium, and solid fats.

Added sugars: Added sugars that are either added during the processing of foods, or are packaged as such (e.g., a bag of 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 (FDA, 2016). Naturally occurring sugars, such as those in fruit or milk, are not 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.

ANALYTIC PLAN

Each step used to test the development and/or update to the patterns is described here.

1. Establish energy levels

Dietary Reference Intakes (DRI) formulas were used to calculate Estimated Energy Requirements (EER) for each age-sex group, with three age groups specific to pregnancy and

lactation - women 14-18 years, 19-30 years and 31-50 yearsⁱ. EER was based on sex, age, height, weight, and physical activity level. Median body height and weight for normal body mass index (BMI) were used to calculate appropriate energy levels for each age-sex group represented in the patterns. The EERs for pregnancy accounted for additional energy expenditure and deposition that included the products of conception and accretion of maternal tissues, those for lactation accounted for energy expenditure associated with human milk output and weight loss.

The food patterns included 12 energy levels from 1000 to 3200 calories at 200 calorie “step” intervals intended to cover energy needs for the majority of the population ages 2 years and older.

2. Establish nutritional goals

Specific nutritional goals for each food intake pattern (i.e., by calorie level) were selected based on the age/sex group(s) for which the pattern was appropriate. If a food intake pattern at a calorie level aimed to meet the needs for more than one age/sex group, the pattern was evaluated against the nutrient goals for all those groups. Goals for energy, 3 macronutrients, 3 fatty acids, cholesterol, 12 vitamins, 9 minerals, and fiber were based on DRI reports released between 1997 and 2018 and on quantitative recommendations in the current 2015-2020 Dietary Guidelines. Because the Food Patterns were designed as plans for individuals to follow, the goals were the RDA amounts for nutrients having an RDA. The AI was used when an RDA was not published.

The lowest energy level (for sedentary individuals, determined in step 1), rounded to the nearest calorie pattern was determined for each age/sex group and used in evaluating the patterns against nutritional goals.

3. Establish food groupings and amounts

Existing food groups and subgroups in the USDA Food Patterns published in the 2015-2020 *Dietary Guidelines for Americans* were used in this exerciseⁱⁱ.

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

We used a “composite” system to determine the anticipated nutrient content, or Nutrient Profile, of each food group as described below.

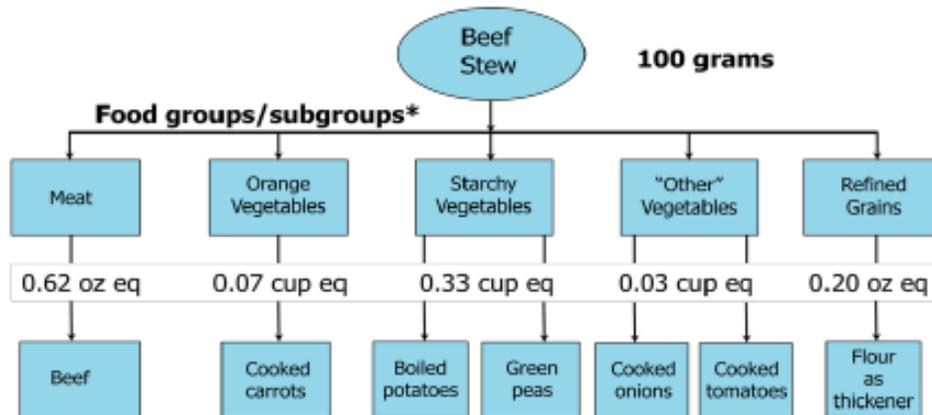
- a) To create Nutrient Profiles, all foods reported by individuals ages 2 years and older as part of What We Eat in America NHANES 2015-2016 were disaggregated into their ingredients.

ⁱ Institute of Medicine 2005. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington, DC: The National Academies Press. <https://doi.org/10.17226/10490>

ⁱⁱ U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015–2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at <http://health.gov/dietaryguidelines/2015/guidelines/>.

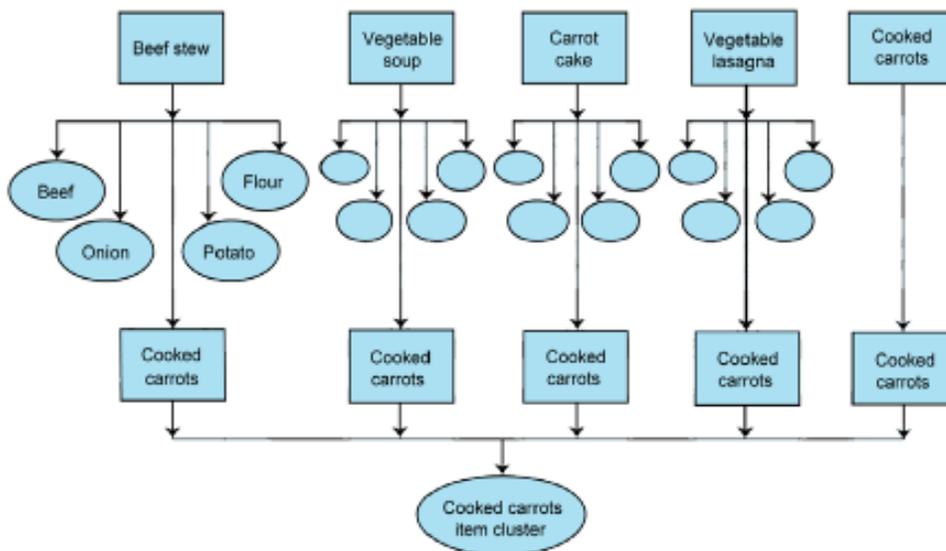
- b) Similar ingredients were aggregated into food item clusters (see Figures 1 and 2).
- c) A nutrient-dense form of the food was selected as the representative food for each cluster.
- d) The proportional intake of each item cluster within each food group or subgroup was calculated and used to compute a weighted average of nutrient dense forms of foods representing each food item cluster.
- The proportional intake was calculated for ages 2 plus as has been done in previous updates.
 - To account for variation in eating patterns across different age groups, a new approach was considered by the committee. Proportions by life stage were calculated for ages 2-3, 4-18 (children), 19-70 (adults), and 71 years and older (older adults).
- e) Using the nutrients in each representative food and the item cluster's proportional intake using the life-stage approach, a nutrient profile was calculated for each food group or subgroup. Thus, creating a nutrient profile specific to each life stage used to estimate the anticipated nutrients in the patterns. Nutrient profiles were also calculated for oils and solid fats using food supply data to determine proportional intakes.

Figure 1. Example of disaggregation of a mixed food into item clusters



*Also identify amounts of oil, solid fat, added sugars, and alcohol

Figure 2. Example of aggregation of an item cluster from various foods



Figures 1 and 2 adapted from Marcoe et al, 2006.

5. Evaluate nutrient level in each pattern against nutritional goals

Using the updated nutrient profiles that apply to ages 2 years and older and for each life stage, the nutrients provided by amounts recommended in the 2015-2020 Dietary Guidelines from each food group (and oils) were compared to the age, gender, and life stage-specific goals (usually at least 90% of the RDA or AI).

6. 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 food patterns were identified and potential health impacts were considered by the Dietary Guidelines Advisory

Committee. Food group amounts were modified based on a judgment of which food groups could most reasonably provide the nutrients when goals were not met. A new food group subgroup was also tested to aim towards achieving a potential recommendation reflected in the systematic reviews. All necessary increases to a food group or subgroup were balanced with energy compensating decreases in other food groups. To reduce possible bias in modifying food group amounts, food group and subgroup amounts in the patterns were 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 and oils, termed “essential calories,” were then summed and the remaining calories up to the calorie limit for the pattern were used to set a limit for calories from solid fats and added sugars.

RESULTS

The Advisory Committee’s findings are summarized within Part D, Chapter 14 of the Scientific Report of the 2020 Dietary Guidelines Advisory Committee:

<https://www.dietaryguidelines.gov/2020-advisory-committee-report>

In addition, an online-only supplement was prepared by the food pattern modeling team for the 2020 Dietary Guidelines Advisory Committee to support its review of the scientific evidence:

<https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling>