PART D. CHAPTER 14: USDA FOOD PATTERNS FOR INDIVIDUALS AGES 2 YEARS AND OLDER

INTRODUCTION

Understanding the benefits of a healthy dietary intake and translating this into recommendations for dietary intake includes several different steps. The 2020 Dietary Guidelines Advisory Committee pursued systematic reviews to identify combinations of foods that have been associated with lower risk of all-cause mortality and a number of important health outcomes across the lifespan (see ***Part D. Chapter 8: Dietary Patterns***). Translating this evidence into actionable guidance for the public at large means that the Committee also must determine whether combinations of foods within a pattern meet goals for nutrient adequacy.

The USDA Food Patterns represent the types and amounts of food groups that aim to provide sufficient nutrients or food components (e.g., fiber) to meet Dietary Reference Intakes (DRIs) and *Dietary Guidelines for Americans* recommendations, at various energy levels, by age-sex groups ages 2 years and older. The Food Patterns are updated every 5 years during the deliberations of the Committee and are presented to the Committee for its assessment of how well the Patterns align with the most current evidence on diet, health, and nutrient adequacy. During the Committee's deliberations, amounts recommended from each food group may be modified based on the Committee's review and/or to support nutrient adequacy to reach all or most of the specified goals.

The **Healthy U.S.-Style Pattern** is one of the 3 current USDA Food Patterns and is the base pattern for food pattern modeling analyses. This Pattern serves as the foundation for the Healthy Eating Index-2015 (HEI-2015) (see ***Part D. Chapter 1: Current Intakes of Foods, Beverages, and Nutrients)*** and is aligned with findings from the 2015 Committee's review of the evidence on dietary patterns and health outcomes.[1]

Additionally, USDA's food pattern modeling was used in 2015 to assess whether the Healthy U.S.-Style Pattern could be adapted to a vegetarian style while maintaining nutritional adequacy. The resulting pattern was the **Healthy Vegetarian Pattern**. Compared with the Healthy U.S.-Style Pattern, the Healthy Vegetarian Pattern is higher in soy products (particularly tofu and other processed soy products), legumes, nuts and seeds, and whole grains. Meat, poultry and seafood were eliminated, however, dairy and eggs were included in this lacto-ovo vegetarian pattern. The 2015 Committee also recommended a **Healthy Mediterranean-Style Pattern**, which was based on evidence from a range of dietary intake patterns described as

"Mediterranean." Common key components of these patterns include higher intakes of plant-based foods (e.g., fruit, vegetables, legumes, and whole grains), olive and other non-tropical vegetable oils, and nuts and seeds, with low to moderate intakes of eggs, meat, and seafood.[1] The Healthy Mediterranean-Style Pattern includes higher amounts of fruit and seafood and less dairy compared to the Healthy U.S.-Style Pattern. Ultimately, all 3 Patterns represent healthy approaches to eating that simultaneously address nutrient needs while promoting health and reducing risk of chronic disease.

The 2020 Committee used recommendations provided by the 2017 National Academies of Science, Engineering, and Medicine (NASEM) study on redesigning the process for establishing the *Dietary Guidelines for Americans* to guide its approach to using USDA's food pattern modeling.[2] The NASEM study recommended that food pattern modeling could be used to better account for differences in the nutritional needs of the population, going beyond the generic characterization of the "average" American. This recommendation aligned well with a broader focus of the 2020 Committee on optimizing nutrition for each discrete life stage across the lifespan. Because this Committee's report would consider birth to age 24 months as well as pregnancy and lactation, the need to apply food pattern modeling in a way that considered the needs of these unique phases of life was even more apparent. To accommodate this life-stage approach, the Committee used a new method in which the anticipated nutrient profiles were based on the proportions of foods consumed specific to each life stage, including children, adolescents, and younger, middle-aged and older adults. This chapter presents food patterns that apply to the U.S. population ages 2 years and older and ***Part D. Chapter 7: USDA Food Patterns for Children Younger than Age 24 Months*** presents, for the first time, food patterns that apply to the U.S. population from birth to age 24 months.

The results of this work should be informative at several levels. By taking a life-stage approach, the results of the USDA's food pattern modeling exercises will be specific to a given stage of life when risk of inadequacy or nutrition-related disease may vary based on age. In addition to differing risks of disease by age, nutritional needs to ensure adequacy differ, particularly during pregnancy and lactation. Women in these life stages have different estimated energy requirements as well as unique nutritional needs that affect the woman's health as well as the development and health of the infant. A specific evaluation of the USDA Food Patterns relative to these unique nutritional needs will be described. Lastly, the Committee was able to use food pattern modeling by life stage to examine opportunities to provide specific advice on improving nutritional intakes within given age-sex subgroups by examining ways to "repurpose calories" from foods with low nutrient density to foods that meet specific nutrient and food group

shortfalls specific to that age-sex group (see ***Part D. Chapter 12: Added Sugars***). Again, this approach attempts to use food pattern modeling to go beyond universal advice for adopting a healthy eating pattern to specific, tailored, and actionable advice on small but meaningful cumulative changes to typical food intake patterns common for a given life stage.

The results of the data presented from the USDA's food pattern modeling exercises have some methodologic issues that are worth considering when they are put in the context of their potential applications. Notably, the USDA Food Patterns do not account for beverages that are not constituents of food groups or subgroups. In data reviewed by the Committee, a substantial percentage of energy intake for Americans ages 2 years and older comes from sweetened beverages (including soda, fruitades, sports drinks, energy drinks, sweetened water, and sweetened coffee and tea) and alcoholic beverages. The specific beverages omitted from the Patterns generally do not contribute to intakes of food groups or nutrients in the Patterns except for any portions that are a recognized food constituent in the beverage (e.g., dairy added to coffee, or 100% juice added to a sugar-sweetened beverage or alcoholic beverage). Therefore, in spite of the contribution of beverages to energy intake and added sugars (see ***Part D. Chapter 10: Beverages***, ***Part D. Chapter 11: Alcoholic Beverages***, and ***Part D. Chapter 12: Added Sugars*** for additional information), USDA food pattern modeling does not include beverages that do not contribute to food groups in the USDA Food Patterns.

Another limitation of the food pattern modeling approach is that it does not qualitatively address cultural variations in intake patterns; this type of issue may be more appropriately addressed as a menu planning activity. Nevertheless, a strength of the Food Patterns is that it has a tremendous amount of flexibility that allows it to be tailored to an individual's cultural and taste preferences. This flexibility occurs because the resulting Patterns are only prescriptive for the larger food groups and subgroups *amounts* but not the specific *types* of foods to be consumed, permitting choices and options for the consumer. Although a representative food is used for purposes of modeling, that food is not the only available choice within a food cluster. Many food items can be used that approximate the most nutrient-dense choices for given food group and subgroups. These items also can be combined in unique ways that meet an individual's dietary preferences.

Finally, in testing the patterns for pregnancy, the Committee presumed increased energy needs throughout pregnancy based on the NASEM's report on recommended weight gain during pregnancy.[3] Excess weight gain during pregnancy has been associated with increased risk of adverse outcomes for the mother and infant.[4] However, recent analyses also suggest that pre-pregnancy body mass index (BMI) may be more important than excess gestational weight

gain in predicting adverse events during pregnancy and may be associated with higher postpartum weight retention.[5] Taken together, these data highlight the interconnected nature of the relationships between health and nutrition across life stages. USDA's food pattern modeling does not specify energy needs based on pre-pregnancy weight status and target weight gain during pregnancy. However, Patterns do support nutrient adequacy at any chosen energy level. Specific guidance on estimated energy requirements during pregnancy and lactation may require discussions with a qualified healthcare provider.

LIST OF QUESTIONS

1. 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?

METHODOLOGY

The food pattern modeling methodology used to answer these questions involved aiming to establish food patterns that incorporate goals for nutrient adequacy for energy, nutrients, and other dietary components compared to the DRIs and potential Committee recommendations (see ***Part C. Methodology*** for more information on food pattern modeling*)*. Nutrient profiles were developed from food groups and subgroups using 2015-2016 data on foods consumed by individuals ages 2 years and older, as collected by What We Eat in America (WWEIA), the dietary intake portion of the National Health and Nutrition Examination Survey (NHANES).[6] The nutrient adequacy of variations of the USDA Food Pattern were then tested by comparing their nutrient content to the DRIs and potential Committee recommendations. The Committee then developed conclusion statements to summarize the answer to each food pattern modeling question and made research recommendations to inform future work on this topic.

Analytic Framework

The Committee developed a food pattern modeling protocol. The protocol included an analytic framework that described the scope of the food pattern modeling exercises. The

analytic framework also described the population, data sources, and key terms used to answer this question. The exercises relied on data from the U.S. Department of Agriculture Food and Nutrient Database for Dietary Studies (FNDDS) 2015-2016.[7] The Food Patterns Equivalents Database (FPED) 2015-2016 and the National Nutrient Database for Standard Reference (SR), Release 28 (2016 version) provided supporting data.[7,8] The U.S. population ages 2 years and older, including women who are pregnant or lactating, was considered. The following are key definitions for the food pattern modeling exercises:

- **Food Groups and Subgroups:** USDA Food Patterns provide amounts from the 5 major food groups and subgroups, including:
  - Fruits
  - Vegetables: Dark green, red and orange, beans and peas, starchy, and other
  - Dairy, including calcium-fortified soy beverages
  - Grains: Whole grains and refined grains
  - Protein Foods: Meats, poultry, and eggs; seafood; nuts, seeds, and soy products
- **Food Pattern Components:** Oils, solid fats, added sugars
- **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 tailored to fit an individual's preferences.
- **Item Cluster:** Identified groupings of the same or similar foods within each food group and subgroup. Item clusters are used to calculate the composite nutrient profile for each food group and subgroup used to define the USDA Food Pattern.
- **Nutrient-Dense Representative Food**: The food within an item cluster with the least amount of added sugars, sodium, and solid fats. For some item clusters, the nutrient dense representative food contains some added sugars, solid fats, and/or sodium.
- **Typical Choice Representative Food:** The most frequently consumed food within an item cluster of foods and inclusive of any added sugars, solid fats, and/or sodium
- **Essential Calories:** The energy associated with the foods and beverages ingested to meet nutritional goals through choices that align with the USDA Food Patterns in forms with the least amounts of saturated fat, added sugars and sodium.
- **Solid fats:** The food category called "solid fat" includes a variety of fats, but predominantly saturated fat and to a small extent, *trans* fat. This category includes the

saturated fats naturally found in animal products (e.g., meats, dairy) as well as vegetable sources with high saturated fat content, like tropical oils, e.g., coconut oil and hydrogenated vegetable shortenings

- **Added Sugars:** Sugars that are added during the processing of foods (such as sucrose or dextrose), foods packaged as sweeteners (such as table sugar), sugars from syrups and honey, and sugars from concentrated fruit or vegetable juices. They do not include naturally occurring sugars that are found in milk, fruits, and vegetables (see ***Part F. Appendix F-1: Glossary***).

General Process for Developing and Updating the USDA Food Patterns

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 based on sex and life stage, (3) establishing food groups and food group amounts, (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) adjusting and re-evaluating the Patterns to align with current or potential recommendations.

1. Establish Energy Levels

The DRIs use formulas to calculate Estimated Energy Requirements (EER) for each age-sex group, with 3 age groups specific to pregnancy and lactation: women ages 14 to 18 years, 19 to 30 years, and 31 to 50 years.[9] EER is based on sex, age, height, weight, and physical activity level. Median body height and weight for normal BMI are used to calculate appropriate energy levels for each age-sex group to be represented in the Patterns. The EERs for pregnancy account for additional energy expenditure and deposition that includes the products of conception and accretion of maternal tissues.[9] The EERs specific to lactation were used to estimate appropriate energy levels for women in this life stage.[9]

The USDA Food Patterns include 12 energy levels from 1,000 to 3,200 kilocalories (kcal) at 200 kcal “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., energy level) were selected based on the age-sex group(s) for which the pattern is appropriate. If a food intake pattern at a energy level aims to meet the nutritional needs of more than 1 age-sex group, the pattern is evaluated against the nutrient goals for all those groups. Goals for energy, 3 macronutrients, 3 fatty acids, dietary cholesterol, 12 vitamins, 9 minerals, and fiber are based on DRI reports released between 1997 and 2019 and on quantitative recommendations in the current *2015-2020 Dietary Guidelines for Americans*. When evaluating the dietary intakes of a group, the Estimated Average Requirement (EAR) is used as a benchmark for meeting the needs of at least 50 percent of the population. Because the USDA Food Patterns are designed as plans for individuals to follow, the goals were the Recommended Dietary Allowance (RDA) amounts for nutrients having an RDA, which are notably higher than the EAR (i.e., 2 standard deviations above the EAR, meeting the needs of 98% of a population). The Adequate Intake (AI) was used when an RDA is not published.

The lowest energy level (for sedentary individuals, determined in Step 1), rounded to the nearest energy level is determined for each age-sex group and used in evaluating the patterns against nutritional goals.

3. Establish Food Groupings and Food Group Amounts

Existing food groups and subgroups in the USDA Food Patterns published in the *2015-2020 Dietary Guidelines for Americans* were used in this exercise. The food groups and subgroups included in the Healthy U.S.-Style Eating Pattern, the Healthy Mediterranean-Style Eating Pattern, and the Healthy Vegetarian Eating Pattern were applied.[10]

4. Determine the Amounts of Nutrients That Would be Obtained by Consuming Various Foods Within Each Group

A “composite” system was used to determine the anticipated energy and nutrient content, or nutrient profile, of each food group, as described below. To create nutrient profiles, all foods reported by individuals ages 2 years and older as part of WWEIA, NHANES 2015-2016 were disaggregated into their ingredients. Similar ingredients were aggregated into food item clusters (see online Food Pattern Modeling report: https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older). A nutrient-dense form of the food was selected as the representative food for each cluster. The proportional intake of each item

cluster within each food group or subgroup was calculated and used to compute a weighted average of nutrient-dense forms of foods representing each food item cluster. The proportional intake was calculated based on intakes for ages 2 years and older, as had been done in previous updates.

To account for variation in eating patterns across different age groups, the Committee employed a new approach. Proportions by life stage were calculated for ages 2 to 3 years, 4 to 18 years, 19 to 70 years, and 71 years and older. 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, a nutrient profile specific to each life stage was developed and then used to estimate the anticipated nutrients and other food components in the patterns. Nutrient profiles also were calculated for oils and solid fats using food supply data to determine proportional intakes because NHANES does not specify the type of oil or solid fat for most foods, and therefore those data cannot be used to determine proportional consumption.

5. Evaluate Nutrient Level in Each Pattern Against Nutritional Goals

The estimated nutrient composition of the Healthy U.S.-Style Pattern was calculated using the nutrient profiles for ages 2 years and older as well the nutrient profiles for specific life stages (2 to 3 years, 4 to 18 years, 19 to 30 years, 31 to 70 years, pregnant or lactating women, 71 years and older). For the Healthy Vegetarian and Healthy Mediterranean-Style Patterns, only the nutrient profiles for ages 2 years and older were used to calculate estimated nutrient composition.

Using the updated nutrient profiles that apply to ages 2 years and older and for each life stage, the nutrients provided in the Patterns were compared to the Pattern's goals, which in most cases aimed to meet at least 90 percent of the RDA or AI.

6. Adjust and Re-evaluate the Patterns to Align with Current or Potential Recommendations

After identifying any nutrient goals that were not met in the resulting Food Patterns, the Committee considered if additional adjustments in the Patterns were needed based on its systematic reviews. Four modifiable elements were available to further refine the Patterns: (1) food group amounts could be increased or decreased, (2) goals and constraints could be adjusted, (3) food group nutrient profiles could be adjusted through selection of different

representative foods or categorization of item clusters, and (4) certain foods could be included or excluded. If changes were needed, an iterative series of adjustments and evaluations to achieve patterns that aligned with recommendations could be applied. The Committee determined no modifications in the Patterns were needed based on its systematic reviews.

All necessary increases to a food group or subgroup were balanced with energy compensating decreases in other food groups. To maintain feasible dietary patterns for the population, the Patterns were compared with current usual intake distributions from NHANES data 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.

After all adjustments were complete, energy from all food groups and oils, termed "essential calories," were summed and the remaining energy (kcal) up to the energy limit for the pattern were calculated. The uses for any remaining energy were discussed, particularly in relation to limits on added sugars (see ***Part D. Chapter 12: Added Sugars***).

REVIEW OF THE SCIENCE

1. 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?

Approach to Answering Question: Food Pattern Modeling

Conclusion Statements

Are Changes to the USDA Food Patterns Needed Based on the Relationships Identified in the Systematic Reviews?

No major changes to the 3 USDA Food Patterns were needed based on the relationships identified in the systematic reviews conducted by the Committee. The 3 patterns published as part of the *2015-2020 Dietary Guidelines for Americans* include the Healthy U.S.-Style Eating Pattern, Healthy Vegetarian Eating Pattern, and Healthy Mediterranean-Style Eating Pattern. The Healthy U.S.-Style serves as a basis of the Healthy Eating Index (HEI). No additional patterns were identified in systematic reviews that provided both a clearly defined food pattern and were consistently associated with the health outcomes across life stages.

The Committee adapted the nutrient profiles of the 2015 USDA Food Patterns to facilitate the life-stage approach review of the evidence. Nutrient profiles for food groups and subgroups within the Patterns were developed for specific age groups (ages 2 to 3 years, 4 to 18 years, ages 19 to 30 years, ages 31 to 70 years, and ages 71 years and older) and life stages (i.e., women who are pregnant or lactating) to capture variation in the population by age. Life-stage dietary preferences inform the nutrient profiles, and provide a better estimate how patterns fulfill nutritional goals.

If So, How Well Do USDA Food Pattern Variations Meet Nutrient Recommendations for Each Stage of Life?

The 3 USDA Food Patterns meet the Recommended Dietary Allowance or Adequate Intake goals and stay within limits for the Tolerable Upper Intake Level or the Chronic Disease Risk Reduction target for the majority of nutritional goals for ages 2 years and older, including women who are pregnant or lactating. This applies both when using a general nutrient profile for the total population or a nutrient profile specific to an age group.

Nutrients that do not meet Recommended Dietary Allowance or Adequate Intake goals include the following. Iron: The patterns provide less than 90 percent of the Recommended Dietary Allowance for females ages 4 to 8 years, 19 to 30 years, 31 to 50 years, and less than 75 percent for women who are pregnant. Vitamin D: The patterns achieve 30 to 45 percent of the Recommended Dietary Allowance for children younger than age 8 years and approximately 55 to 70 percent the Recommended Dietary Allowance for the rest of the population. Vitamin E: The patterns generally provide less than 80 percent of the Recommended Dietary Allowance for Vitamin E, except for children younger than age 8 years, where 82 to 94 percent of the Recommended Dietary Allowance is achieved. Choline: The patterns generally provide less than 85 percent of the Adequate Intake for choline. Folate: The patterns provide approximately 85 percent of Recommended Dietary Allowance for folate at the 1,800 and 2,000 energy-levels during the first trimester for women who are pregnant.

If Nutrient Needs Are Not Met, Is There Evidence to Support Supplementation and/or Consumption of Fortified Foods to Meet Nutrient Adequacy?

Current evidence supports supplementation or targeted efforts to increase iron intakes through dietary choices and fortification for women who are pregnant or who are planning to become pregnant. Careful choices of foods high in iron, including fortified foods, should be considered by females, especially during adolescence and pregnancy, to meet the increased iron

requirements. Some women may need an iron supplement and should consult with a health care provider.

Vitamin D, an identified nutrient of public health concern for all age-sex groups, requires that individuals pay careful attention to dietary sources (both natural sources and fortified foods) even when taking into account an average level of UV exposure. Supplementation may be advised by a health care provider. (See 2015 Dietary Guidelines Advisory Committee Report,[1] Appendix E-3.3 Meeting Vitamin D Recommended Intakes in USDA Food Patterns.)

Folic acid intakes are critical in the first trimester of pregnancy to reduce the risk of neural tube defects therefore the Committee supports folic acid supplementation as the standard of care before and during pregnancy. Dietary intakes of folate are generally low and folate status may be compromised in some groups of women. Efforts to encourage inclusion of fortified foods or dietary supplements among women with low intakes are warranted.

Summary of the Evidence

Are Changes to the USDA Food Patterns Needed Based on the Relationships Identified in the Systematic Reviews?

No major changes to the 3 USDA Food Patterns were needed based on the relationships identified in the systematic reviews by the Committee. The Committee adapted the nutrient profiles of the 2015 USDA Food Patterns to facilitate the life-stage approach review of the evidence. The Patterns were developed for specific age groups (ages 2 to 3 years, ages 4 to 18 years, ages 19 to 30 years, ages 31 to 70 years, and ages 71 years and older) and life stages (i.e., women who are pregnant or lactating). The nutrient profiles for food groups and subgroups that were developed for specific age groups reflect variation in dietary intake within the population. The Committee reviewed the similarities and differences between nutrient profiles of specific age groups to consider how best to fulfill nutrient needs across all the life stages. Food Patterns for infants and young children (or toddlers) are addressed in ***Chapter 7: USDA Food Patterns for Children Younger than Age 24 Months***.

The nutrient profiles specific to each age group were calculated as described above in Methodology. Notably, the nutrient-dense representative foods remained the same for each age group. A description of these nutrient profiles is available in the online Food Pattern Modeling Report (https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older). The online report provides the proportions of consumption for each item cluster within each food group or subgroup, the representative foods for each item cluster

for the population ages 2 years and older, and the proportions of consumption for each item cluster within each food group and subgroup by life stage (https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older).

The proportions of consumption of the item clusters were similar across age groups for many food groups and subgroups with variations of only a few percentages. However, there were some notable exceptions. For example, apples contributed 36.5 percent to whole fruit consumption for those ages 4 to 18 years, but decreased to 17.6 percent for those ages 71 years and older. Apple juice was reported as almost 42 percent of fruit juice consumption among those ages 4 to 18 years, while only 17 percent among those ages 19 to 70 years and 14 percent for those ages 71 years and older. Conversely, orange juice contributed 62 percent to fruit juice consumption for those ages 71 years and older, 53 percent for ages 19 to 70 years, and 36 percent for ages 4 to 18 years. The proportion of broccoli in the dark green vegetable subgroup was highest among ages 4 to 18 years at nearly 48 percent of the subgroup, and lowest among those ages 71 years and older at 25 percent of the dark green vegetable subgroup. For those ages 71 years and older, only about 5 percent of the proportion of all starchy vegetable consumption were french fries, compared to 19 percent of starchy vegetables for ages 4 to 18 years. Whole grain bread accounted for 25 percent of whole grains among ages 4 to 18 years and 41 percent for those ages 71 years and older. More than 54 percent of the proportion of nuts and seeds profile among ages 4 to 18 years was from peanut butter and decreased to 23 percent of nuts and seeds for those ages 71 and older. Thus, modifications were made in the nutrient profiles to accommodate these observed changes in food choice based on life stage.

Food group and subgroup amounts modeled as part of the 2015 Committee's work and the 2020 Committee's work were the same.

If So, How Well Do USDA Food Pattern Variations Meet Nutrient Recommendations for Each Stage of Life?

The USDA Food Patterns at energy levels appropriate to life stages meet the RDA or AI and stay within limits for the Tolerable Upper Intake Level (UL) and Chronic Disease Risk Reduction (CDRR) for the majority of nutritional goals for ages 2 years and older, including women who are pregnant or lactating. For detailed results, including a summary of the nutrients provided by the patterns in comparison to nutrient goals, levels of all nutrients provided by each pattern, and a comparison of the nutrients in all patterns to all nutrient goals, see the online Food Pattern

Modeling Report (https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older).

Each age-sex group was assigned an intake pattern at a specific energy level that should meet their energy needs to maintain current body weight, assuming an average height and weight and physical activity within the healthy weight range. Each pattern was compared to the nutrient goals for that age-sex group, from the most recent DRIs or in some cases the *2015-2020 Dietary Guidelines for Americans*. Within the online Food Pattern Modeling report, the specific nutrient goals for each pattern and the age-sex group(s) for which the pattern was assigned is listed. For this evaluation, the pattern selected was at an energy level appropriate for sedentary (less active) individuals within the age-sex group. If this pattern met nutrient goals for adequacy, patterns at higher energy levels (for more physically active individuals) also would meet those goals. The DRI values are assigned to life-stage groups that correspond to various periods of the human lifespan. Therefore, when comparing the Patterns at the same energy levels for different age-sex groups, it is important to note that the RDA for a nutrient may be different between the age-sex groups. For example, Table D14.1 shows the Healthy U.S.-Style Pattern at 2,000 kcal for both women ages 19 to 30 years and men ages 51 and older. The 2,000-kcal Pattern meets 78 percent of the iron RDA for females ages 19 to 30 years, but 175 percent of the iron RDA for males ages 51 years and older. Other differences within the table are due to different DRI values for specific age-sex groups.

All foods are assumed to be in nutrient-dense forms, lean or lower-fat, and prepared with minimal added fats, sugars, refined starches, or sodium. The sum of energy from the food groups in nutrient-dense form and oils was considered “essential calories,” and any remaining energy calculated by subtracting essential energy from the energy goal for the pattern were considered remaining energy for other uses. Compared with the 2015 food pattern modeling exercise, the available remaining energy for other uses for the 2020 Patterns is slightly less because of updates to the nutrient profiles identified above. Further details on how the remaining energy for other uses were applied and analyzed is discussed in Chapter 12 (see ***Part D. Chapter 12: Added Sugars***).

Healthy U.S.-Style Pattern

The Healthy U.S.-Style Food Pattern provides macronutrients within the Acceptable Macronutrient Distribution Range (AMDRs) as recommended by the National Academies of Science, Engineering, and Medicine.[9] For all age groups, the percentage of energy from macronutrients varies slightly depending upon the energy level, but even at the lowest level, the

macronutrients are well within the AMDR. The 1 exception is at the 3,200 kcal level where 36 percent of energy come from fat, which is 1 percent above the AMDR (i.e., 25 to 35 percent of energy from fat). As mentioned above, it is important to note that the USDA Food Patterns do not account for energy, nutrients, or food components from beverages including sweetened or alcoholic beverages.

As shown in Table D14.1, for many nutrients, the amount provided by the Patterns is well above the RDA or AI but within limits for the UL and CDRR. Nutrients provided in amounts higher than 100 percent of RDA or AI for all age-sex groups include: protein, phosphorus, zinc, copper, selenium, manganese, vitamin C, thiamin, riboflavin, niacin, vitamin K, folate, vitamin B_6, and vitamin B_{12}. Even though provided in high amounts (e.g., 200 to 300 percent of RDA), these amounts are less than the UL, and thus likely to pose no risk of adverse health effects. These nutrients are found in many foods, and therefore, it is relatively easy to meet or exceed the RDA or AI when trying to meet goals for other nutrients that are not as plentiful. If amounts of some of the more common nutrients were to be reduced, it would result in not meeting recommendations for several key nutrients.

Some nutrients are slightly above the RDA or AI, or marginally below (i.e., 90 to 100 percent) the goal amounts for several age-sex groups. For example, amounts of calcium in the patterns range from 93 to 98 percent of the RDA for girls ages 4 to 18 years. Amounts of iron are marginally low for girls ages 4 to 8 years (89 percent of RDA). Magnesium is 94 percent of the RDA for girls ages 14 to 18 years, and 96 to 97 percent of the RDA for males ages 14 to 50 years and 87 percent of the RDA for men ages 51 years and older. It is important to note that the percentages of the RDA described are calculated for the lowest energy level assigned to these age-sex groups—the level applicable for a sedentary or less active physical activity level. In comparison to EARs, which are the appropriate targets for assessment of adequate intakes in populations, amounts in all patterns meet the EARs for calcium, iron, and magnesium.

The nutrients for which adequacy goals are not met in almost all patterns are vitamin D, vitamin E, and choline. Additionally, iron goals are not met for young girls ages 4 to 8 years (89 percent RDA), women of reproductive age, specifically adult women ages 19 to 50 years (75 to 78 percent RDA), and women who are pregnant (approximately 50 to 70 percent RDA). Vitamin D amounts in the patterns range from 38 to 75 percent of the RDA. Vitamin E amounts are low, ranging between 62 to 82 percent RDA for most age-sex groups except for boys ages 4 to 8 years where Vitamin E amounts are closer to the RDA goal. Choline amounts range from 69 percent to 89 percent of the AI for all age-sex groups except for females 31 to 50 (84 percent AI) and boys ages 4 to 8 years where choline goals are met (104% AI). Unlike when the 2015

Committee examined the patterns, potassium levels are generally above 90 percent of the AI in the patterns due to the 2019 update of the DRI for potassium, which lowered the AI for the age groups examined in this chapter.[11] The sodium DRI was changed from a UL to a CDRR value in the 2019 DRI update.

The patterns also meet nearly all of the nutrient goals for moderation. The patterns at the 3 highest energy levels (2,800 to 3,200 kcal) provide sodium in amounts approaching the CDRR of 2,300 mg (2,237 to 2,288 mg) but less than mean intakes from data collected using 24-hour dietary recalls (4,107 mg for males ages 20 years and older for whom these energy-levels would apply). Saturated fat ranges from 7 percent to 8 percent of energy, with most patterns providing 7percent of energy from saturated fat including the solid fats available as “remaining calories for other uses.” For analysis and discussion related to added sugars see ***Part D. Chapter 12: Added Sugars***.

Table D14.1. Healthy U.S.-Style Food Pattern: Comparison of select nutrients to nutrient goals for select energy levels per age-sex groups[1]

Energy Level		**1,000**	**1,200**	**1,400**	**1,600**	**1,600**	**1,800**	**1,800**	**1,800**	**2,000**	**2,000**	**2,200**	**2,200**	**2,400**
Age-sex group for comparison		M/F 1 to 3	F 4 to 8	M 4 to 8	F 9 to 13	F 51+	M 9 to 13	F 14 to 18	F 31 to 50	F 19 to 30	M 51+	M 14 to 18	M 31 to 50	M 19 to 30
Macronutrients														
Protein	%RDA	331%	307%	359%	241%	181%	254%	188%	191%	199%	164%	189%	179%	190%
Protein	%kcal	17%	19%	19%	20%	21%	19%	19%	20%	18%	18%	18%	18%	18%
Carbohydrate	%RDA	104%	122%	146%	159%	159%	183%	183%	183%	201%	201%	224%	223%	242%
Carbohydrate	%kcal	54%	53%	54%	52%	51%	53%	53%	53%	52%	52%	53%	53%	52%
Fiber, total dietary	14g/ 1000kcal	99%	103%	105%	109%	109%	111%	111%	111%	106%	106%	111%	111%	108%
Total lipid (fat)	%kcal	31%	30%	29%	30%	30%	30%	30%	30%	32%	32%	31%	31%	32%
Saturated fat	%kcal	8%	7%	7%	7%	7%	7%	7%	7%	8%	8%	8%	7%	8%
Cholesterol	%DG	28%	40%	51%	63%	61%	64%	64%	62%	70%	70%	77%	75%	82%
Minerals														
Calcium	%RDA	110%	98%	102%	93%	100%	96%	96%	125%	126%	105%	102%	132%	135%
Iron	%RDA	105%	89%	108%	154%	149%	176%	94%	75%	78%	175%	152%	202%	220%
Magnesium	%RDA	224%	174%	202%	130%	101%	141%	94%	109%	117%	87%	96%	97%	107%
Potassium	%AI	88%	95%	107%	128%	121%	130%	141%	132%	140%	107%	126%	117%	120%
Sodium	%CDRR	65%	77%	88%	83%	55%	91%	71%	61%	63%	63%	80%	69%	75%
Vitamins														
Vitamin E	%RDA	82%	84%	94%	75%	56%	82%	60%	62%	70%	70%	75%	77%	83%
Vitamin D	%RDA	38%	40%	44%	53%	66%	54%	54%	67%	68%	68%	57%	70%	72%
Choline	%AI	87%	89%	104%	85%	81%	89%	83%	84%	90%	69%	71%	75%	79%

1: Energy and macronutrients are displayed along with nutrients or food components that were identified as shortfall or nutrients of public health concern or special challenges in any age-sex group. See online Food Pattern Modeling Report (hhttps://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older) for complete list of nutrients and energy levels.

Women Who Are Pregnant or Lactating

The Healthy U.S.-Style Food Pattern is expected to meet nutrient needs for women who are pregnant or lactating, with the exception of iron during pregnancy, vitamin A during lactation, and vitamin E, vitamin D, and choline for both life stages. Estimated energy needs and the total anticipated nutrient composition of the patterns for women who are pregnant or lactating are described in the online Food Pattern Modeling report (https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older). The Food Patterns at energy levels estimated for women who are pregnant or lactating meet or exceed nutrient needs for most nutrients, as shown in Table D14.2A, B and C. For women who have higher estimated energy requirements, higher energy Patterns may come closer to providing the RDA or AI for nutrients through dietary sources.

The anticipated nutrient composition of the patterns provides between 50 and 72 percent of the RDA for iron for women who are pregnant. The RDA for iron assumes 75 percent of iron is from heme iron sources. The iron requirement for women consuming a vegetarian diet with non-heme iron sources is approximately twice that of women consuming a non-vegetarian diet. Careful choices of foods high in iron should be considered during pregnancy to meet a larger proportion of iron from dietary sources. Some women may need an iron supplement and should consult with their health care provider. Iron needs are in general lower during lactation than during non-pregnant or pregnant women if menstruation has not resumed, which varies based on exclusivity of breast-feeding. Women who resume menstruation sooner may have higher iron needs than reflected in the DRI for women who are lactating.

The anticipated nutrient profile of the patterns contributes between 78 and 82 percent of RDA for Vitamin A for women who are lactating. The anticipated nutrient composition of the patterns generally falls in the range of 71 to 79 percent of the AI for choline during lactation and 74 to 101 percent of the AI during pregnancy. The patterns modeled for the third trimester and generally those at higher energy levels during pregnancy, provide approximately 90 percent or more of the AI for choline.

Dietary supplements used by women who are pregnant or lactating contribute towards most of these nutrients, except choline that is not present in high amounts in prenatal supplements. For that reason, careful choices of choline-rich foods (e.g. eggs and legumes) may be warranted during pregnancy and lactation to help achieve nutrient goals.

Table D14.2A U.S. Healthy-Style Pattern comparison to goals for women who are pregnant or lactating, ages 14 to 18 years

Age Group		14 to 18 years				
Energy Level		**1,800**	**2,200**	**2,400**	**2,200**	**2,200**
Life stage group for comparison		pregnant (1st trimester) 14 to 18	pregnant (2nd trimester) 14 to 18	pregnant (3rd trimester) 14 to 18	lactating (0-6 mo post part) 14 to 18	lactating (7-12 mo post part) 14 to 18
Macronutrients						
Protein	%RDA	122%	139%	147%	139%	139%
Protein	%kcal	19%	18%	17%	18%	18%
Carbohydrate	%RDA	136%	166%	180%	139%	139%
Carbohydrate	%kcal	53%	53%	53%	53%	53%
Fiber, total dietary	14g/ 1000kcal	111%	114%	115%	114%	111%
Total lipid (fat)	%kcal	30%	31%	32%	31%	31%
Minerals						
Calcium	%RDA	96%	102%	104%	102%	102%
Iron	%RDA	52%	62%	68%	167%	167%
Magnesium	%RDA	85%	98%	103%	109%	109%
Potassium	%AI	125%	145%	149%	151%	151%
Sodium	%CDRR	71%	80%	86%	80%	80%
Vitamins						
Vitamin A	%RDA	117%	131%	135%	82%	82%
Vitamin E	%RDA	60%	75%	80%	59%	59%
Vitamin D	%RDA	54%	57%	60%	57%	57%
Choline	%AI	74%	86%	91%	71%	71%
Folate, DFE	% RDA	84%	101%	109%	121%	121%

Table D14.2B U.S. Healthy-Style pattern comparison to goals for women who are pregnant or lactating, ages 19 to 30 years

Age Group		19 to 30 years				
Energy Level		**2,000**	**2,400**	**2,600**	**2,400** lactating (0-6 mo post part)	**2,400** lactating (7-12 mo post part)
Life stage group for comparison		pregnant (1st trimester) 19 to 30	pregnant (2nd trimester) 19 to 30	pregnant (3rd trimester) 19 to 30	19 to 30	19 to 30
Macronutrients						
Protein	%RDA	129%	150%	157%	150%	150%
Protein	%kcal	18%	18%	17%	18%	18%
Carbohydrate	%RDA	149%	180%	197%	150%	150%
Carbohydrate	%kcal	52%	52%	53%	52%	52%
Fiber, total dietary	14g/ 1000kcal	106%	111%	118%	111%	108%
Total lipid (fat)	%kcal	32%	32%	32%	32%	32%
Minerals						
Calcium	%RDA	126%	135%	140%	135%	135%
Iron	%RDA	52%	65%	72%	195%	195%
Magnesium	%RDA	104%	123%	133%	139%	139%
Potassium	%AI	125%	141%	152%	146%	146%
Sodium	%CDRR	63%	75%	80%	75%	75%
Vitamins						
Vitamin A	%RDA	122%	136%	148%	81%	81%
Vitamin E	%RDA	70%	83%	91%	66%	66%
Vitamin D	%RDA	68%	72%	73%	72%	72%
Choline	%AI	85%	97%	101%	79%	79%
Folate, DFE	% RDA	86%	108%	121%	129%	129%

Table D14.2C U.S. Healthy-Style Pattern comparison to goals for women who are pregnant or lactating, ages 31 to 50 years

Age Group		31 to 50 years				
Energy Level		1,800	2,200	2,400	2,200	2,200
Life stage group for comparison		pregnant (1st trimester) 31 to 50	pregnant (2nd trimester) 31 to 50	pregnant (3rd trimester) 31 to 50	lactating (0-6 mo post part) 31 to 50	lactating (7-12 mo post part) 31 to 50
Macronutrients						
Protein	%RDA	124%	141%	150%	141%	141%
Protein	%kcal	20%	18%	18%	18%	18%
Carbohydrate	%RDA	136%	166%	180%	138%	138%
Carbohydrate	%kcal	53%	53%	52%	53%	53%
Fiber, total dietary	14g/ 1000kcal	111%	114%	115%	115%	111%
Total lipid (fat)	%kcal	30%	31%	32%	31%	31%
Minerals						
Calcium	%RDA	125%	132%	135%	132%	132%
Iron	%RDA	50%	60%	65%	179%	179%
Magnesium	%RDA	97%	113%	119%	127%	127%
Potassium	%AI	119%	137%	141%	142%	142%
Sodium	%CDRR	61%	69%	75%	69%	69%
Vitamins						
Vitamin A	%RDA	119%	132%	136%	78%	78%
Vitamin E	%RDA	62%	77%	83%	61%	61%
Vitamin D	%RDA	67%	70%	72%	70%	70%
Choline	%AI	80%	92%	97%	75%	75%
Folate, DFE	% RDA	83%	100%	108%	120%	120%

Pattern Variations

The Food Pattern variations included as part of the 2015 Committee's review included Healthy Vegetarian and Healthy Mediterranean-Style Patterns. The development of these patterns is described in detail in Appendix E-3-7 of the 2015 report.[10] These patterns were adopted by the 2020 Committee and updated using the nutrient profiles for the population ages 2 and older described previously in this chapter. Table D14.3 provides a comparison of the food groups and subgroups of the 3 updated USDA Food Patterns at the 2,000-kcal level. Table D14.4 provides a comparison to nutrient goals at the 2,000-kcal level using females ages 19 to 30 years as an example. The online Food Pattern Modeling report provides food groups and comparison to goals for all age-groups and energy levels

(https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older).

Table D14.3. Comparison of food groups and subgroups between the 3 USDA Food Patterns at the 2,000-kcal level

FOOD GROUP[1] (units)[2]	Healthy U.S.-Style 2,000	Vegetarian 2,000	Mediterranean-Style 2,000
FRUITS (cup eq/day)	2	2	2.5
VEGETABLES (cup eq/day)	2.5	2.5	2.5
Subgroups	Vegetable Subgroup Amounts in Cup Eq per Week		
Dark green (cup eq/week)	1.5	1.5	1.5
Red Orange (cup eq/week)	5.5	5.5	5.5
Legumes (cup eq/week)	1.5	1.5	1.5
Starchy (cup eq/week)	5	5	5
Other (cup eq/week)	4	4	4
GRAINS (oz eq/day)			
Whole grains (oz eq/ day)[3]	3	3.5	3
Refined grains (oz eq/ day)	3	3	3
PROTEIN FOODS (oz eq/day)	5.5	3.5	6.5
Subgroups	Protein Foods Subgroup Amounts in Oz Eq per Week		
Meats and Poultry (oz eq/week)	23		23
Eggs (oz eq/week)	3	3	3
Seafood (oz eq/week)	8		15
Legumes as protein (Vegetarian) (oz eq/week)		6	
Nuts, Seeds and Soy (oz eq/week)	5	15	4.5
DAIRY[4] (cup eq/day)	3	3	2
OILS (grams/day)	27	27	27
Remaining Calories for Other Uses (kcal) [5],[6]	243	252	240

[1] Foods in each group and subgroup are:
Vegetables
• Dark-green vegetables: All fresh, frozen, and canned dark-green leafy vegetables and broccoli, cooked or raw: for example, broccoli; spinach; romaine; kale; collard, turnip, and mustard greens.
• Red and orange vegetables: All fresh, frozen, and canned red and orange vegetables or juice, cooked or raw: for example, tomatoes, tomato juice, red peppers, carrots, sweet potatoes, winter squash, and pumpkin.

• Legumes (beans and peas): All cooked from dry or canned beans and peas: for example, kidney beans, white beans, black beans, lentils, chickpeas, pinto beans, split peas, and edamame (green soybeans). Does not include green beans or green peas.
• Starchy vegetables: All fresh, frozen, and canned starchy vegetables: for example, white potatoes, corn, green peas, green lima beans, plantains, and cassava.
• Other vegetables: All other fresh, frozen, and canned vegetables, cooked or raw: for example, iceberg lettuce, green beans, onions, cucumbers, cabbage, celery, zucchini, mushrooms, and green peppers.
Fruits
• All fresh, frozen, canned, and dried fruits and fruit juices: for example, oranges and orange juice, apples and apple juice, bananas, grapes, melons, berries, and raisins.
Grains
• Whole grains: All whole-grain products and whole grains used as ingredients: for example, whole-wheat bread, whole-grain cereals and crackers, oatmeal, quinoa, popcorn, and brown rice.
• Refined grains: All refined-grain products and refined grains used as ingredients: for example, white breads, refined grain cereals and crackers, pasta, and white rice. Refined grain choices should be enriched.
Dairy
• All milk, including lactose-free and lactose-reduced products and fortified soy beverages (soymilk), yogurt, frozen yogurt, dairy desserts, and cheeses. Most choices should be fat-free or low-fat. Cream, sour cream, and cream cheese are not included due to their low calcium content.
Protein Foods
• All seafood, meats, poultry, eggs, soy products, nuts, and seeds. Meats and poultry should be lean or low-fat and nuts should be unsalted. Legumes (beans and peas) can be considered part of this group as well as the vegetable group, but should be counted in 1 group only.

[2] Food group amounts shown in cup-(c) or ounce-equivalents (oz-eq). Oils are shown in grams (g). Quantity equivalents for each food group are:
• Vegetables and fruits, 1 cup-equivalent is: 1 cup raw or cooked vegetable or fruit, 1 cup vegetable or fruit juice, 2 cups leafy salad greens, ½ cup dried fruit or vegetable.
• Grains, 1 ounce-equivalent is: ½ cup cooked rice, pasta, or cereal; 1 ounce dry pasta or rice; 1 medium (1 ounce) slice bread; 1 ounce of ready-to-eat cereal (about 1 cup of flaked cereal).
• Dairy, 1 cup-equivalent is: 1 cup milk, yogurt, or fortified soymilk; 1½ ounces natural cheese such as cheddar cheese or 2 ounces of processed cheese.
• Protein Foods, 1 ounce-equivalent is: 1 ounce lean meat, poultry, or seafood; 1 egg; ¼ cup cooked beans or tofu; 1 Tbsp peanut butter; ½ ounce nuts or seeds.

[3] Amounts of whole grains in the Patterns for children are less than the minimum of 3 oz-eq in all Patterns recommended for adults.

[4] Regardless of energy level, the Dairy Food group (inclusive of calcium-fortified soy beverages) is 2 cup-eq for children ages 2 to 3 years, 2.5 cup-eq for children ages 4 to 8 years, and 3 cup-eq for children ages 9 to 18 years.

[5] All foods are assumed to be in nutrient-dense forms, lean or low-fat and prepared without added fats, sugars, refined starches, or salt. If all food choices to meet food group recommendations are in nutrient-dense forms, a small number of kcals remain within the overall energy limit of the Pattern (i.e., limit on kcals for other uses). The number of these kcals depends on the overall energy limit in the Pattern and the amounts of food from each food group required to meet nutritional goals.

[6] Values are rounded.

Table D14.4. Comparison to goals between the 3 USDA Food Patterns at the 2,000-kcal level

Energy Level Age-sex group for comparison		**Healthy US-Style 2,000[1]** Female 19 to 30 yr	**Vegetarian 2,000[1]** Female 19 to 30 yr	**Mediterranean-Style 2,000[2]** Female 19 to 30 yr
Macronutrients				
Protein	%RDA	200%	174%	196%
Protein	%kcal	18%	16%	19%
Carbohydrate	%RDA	199%	214%	193%
Carbohydrate	%kcal	52%	56%	53%
Fiber, total dietary	14g/1000kcal	107%	125%	110%
Total lipid (fat)	%kcal	32%	31%	31%
Saturated fat	%kcal	8%	8%	7%
Cholesterol	%DG	75%	39%	75%
Minerals				
Calcium	%RDA	128%	134%	99%
Iron	%RDA	79%	91% (51%[3])	80%
Magnesium	%RDA	115%	123%	113%
Phosphorus	%RDA	236%	230%	217%
Potassium	%AI	130%	126%	130%
Sodium	%CDRR	72%	65%	67%
Vitamins				
Vitamin E	%RDA	69%	73%	70%
Vitamin D	%RDA	50%	37%	50%
Vitamin B-12	%RDA	260%	164%	266%
Choline	%AI	83%	71%	83%

1: Includes 3 cup eq Dairy; 2: Includes 2 cup eq Dairy.
3: RDA assumes 75% of iron from heme sources. The RDA is 1.8 higher for vegetarians because they obtain iron predominantly from non-heme sources. The percent of the RDA foriron provided by the Vegetarian Pattern using the RDA (i.e., 91%) and 1.8 times the RDA (i.e., 51%).
See online food pattern modeling report (https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older) for complete list of nutrients.

Healthy Vegetarian Pattern

Although vegetarian dietary patterns are associated with positive health outcomes, their description in the literature often focuses on foods that are not consumed, rather than on the foods that represent the pattern. For the 2015 Committee's process, the USDA Healthy Vegetarian Pattern was informed by reported dietary intakes of self-identified vegetarians using NHANES 2007-2010. Self-identified vegetarian status is not collected in more recent NHANES survey years, so this analysis was not undertaken by the 2020 Committee. In previous analyses, more than 90 percent of self-identified vegetarians consumed dairy products on the

day of the NHANES survey, and 65 percent consumed eggs.[12] Thus, the Healthy Vegetarian Pattern was modeled as a lacto-ovo vegetarian pattern. Nutrient adequacy of the Healthy Vegetarian Patterns aims to meet the same nutrient standards met by the Healthy U.S.-Style Patterns.

The updated Healthy Vegetarian Pattern generally meets nutrient needs (https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older). Like the Healthy U.S.-Style, the Healthy Vegetarian Pattern does not meet intake recommendations for vitamin E, vitamin D, and choline for adult women and young men, and iron for women ages 14 and older. Bioavailability of iron from non-heme sources found in vegetarian diets is lower than that from heme sources (i.e., animal products). The RDA for iron assumes 75 percent of iron is from heme iron sources, which is unlikely in a typical vegetarian diet. The iron requirement for individuals consuming a vegetarian diet is 1.8 times higher that of individuals consuming a non-vegetarian diet. The Committee did not specifically address the iron bioavailability for any of the Patterns, as absorption rates are known to differ based on intake of calcium, zinc, and phytates in the diet.

The Healthy Vegetarian Pattern contains some differences in food group amounts compared to the Healthy U.S.-Style Pattern. The major difference is the lack of meat, poultry, or seafood subgroups in the Healthy Vegetarian Pattern. Using the 2,000 kcal level as reference, the Healthy Vegetarian Pattern is higher in soy products (particularly tofu and other processed soy products), legumes, nuts and seeds, and whole grains compared to the Healthy U.S.-Style Pattern. The remaining food group components match that of the Healthy U.S.-Style Pattern.

The 2,000 kcal Healthy Vegetarian Pattern provides less protein (12 g), less fat (1 g), less dietary cholesterol (96 mg), more carbohydrate (19 g), and more dietary fiber (5 g), than the 2,000 kcal Healthy U.S.-Style Pattern. For micronutrients, the Healthy Vegetarian Pattern provides less potassium, vitamin A, vitamin D, sodium, and choline than the Healthy U.S.-Style Pattern. Amounts of fiber, magnesium, and folate are higher in the Healthy Vegetarian Pattern, primarily due to the increased quantity of legumes and nuts and seeds. Calcium also is slightly higher in the Healthy Vegetarian Pattern due to the higher quantity of processed soy products, including tofu, which often contains a calcium salt, as well as the calcium from dairy and other food groups.

The 2,000-kcal Healthy Vegetarian Pattern meets goals and recommendations for most nutrients, although some gaps remain. For women ages 19 to 30 years, the Healthy Vegetarian Pattern provides 91 percent of RDA for iron through an increase of legumes, whole grains, and soy products, compared with 79 percent of RDA in the Healthy U.S.-Style Pattern; however,

given the lower bioavailability of iron from non-heme sources this likely reflects an overestimation of how much iron the Vegetarian pattern provides. Both the Healthy Vegetarian Pattern and the Healthy U.S.-Style Pattern exceed the RDA for magnesium and AI for potassium. Similar to the Healthy U.S.-Style Pattern, the Healthy Vegetarian Pattern does not provide adequate amounts of vitamin E, vitamin D, and choline to meet the RDA and AI. At the 2,000-kcal level, the Healthy Vegetarian Pattern provides 73 percent of RDA for vitamin E, 37 percent of RDA for vitamin D, and 71 percent of AI for choline.

Healthy Mediterranean Style

The Healthy Mediterranean-Style Eating Pattern was developed as part of the 2015 Committee's review and is characterized by food group amounts similar to the diets characterized by research as "Mediterranean," particularly Mediterranean-diet (Med-diet) indexes. It was adapted from the Healthy U.S.-Style pattern to include food categories associated with positive health outcomes vs focusing on meeting specific nutrient goals. The major difference between the 2 patterns is that the Healthy Mediterranean-Style Pattern contains more fruits and seafood and less dairy. Although the development of the pattern was focused on health outcomes vs nutrient adequacy, the adequacy of the Healthy Mediterranean-Style pattern has been compared to the same nutrient standards as the Healthy U.S.-Style Pattern.

The updated Healthy Mediterranean-Style Pattern meets most RDA and AI goals, nearly matching the Healthy U.S.-Style Pattern. The food group and subgroup amounts for this Pattern are described in the online Food Pattern Modeling report (https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older). The Healthy Mediterranean-Style Pattern provides calcium, vitamin A, and sodium in lower amounts than the Healthy U.S.-Style Pattern. This reflects the lower amount of dairy in the Healthy Mediterranean-Style Pattern for adults: 2 cup-equivalents (cup-eq) compared to 3 cup-eq in the Healthy U.S.-Style Pattern. Calcium is a nutrient of public health concern and thus, the amounts of dairy included in the pattern for children are intended to provide adequate calcium to meet the RDA. Regardless of energy level, the Dairy Food group (inclusive of calcium-fortified soy beverages) is 2 cup-eq for children ages 2 to 3 years, 2.5 cup-eq for children ages 4 to 8 years, and 3 cup-eq for children ages 9 to 18 years.

Using the 2,000-kcal level as reference, the Healthy Mediterranean-Style Pattern includes more fruits (2.5 vs 2.0 cup-eq) and protein foods (6.5 vs 5.5 ounce-equivalents [oz-eq]) compared to the Healthy U.S.-Style Pattern. The higher amount of protein foods comes directly

from an increase in seafood (15vs. 8 oz-eq per week) in the Healthy Mediterranean-Style Pattern. The remaining food group components match that of the Healthy U.S.-Style Pattern. The 2,000-kcal Healthy Mediterranean-Style Pattern (using 2 cup-eq of dairy) provides less calcium (-289 mg), less phosphorous (-135 mg), less sodium (-121 mg) and more omega-3 eicosapentaenoic acid (EPA) (+52 mg) and more omega-3 docosahexaenoic acid (DHA) (+107 mg) than the 2,000-kcal Healthy U.S.-Style Pattern (using 3 cup-eq of dairy).

If Nutrient Needs Are Not Met, Is There Evidence to Support Supplementation and/or Consumption of Fortified Foods to Meet Nutrient Adequacy?

The USDA Food Patterns are designed to meet most or all nutrient recommendations. However, in cases where natural sources of the nutrient are limited (e.g., vitamin D) or when the reference value is above what can be accommodated within an energy range (e.g., iron during pregnancy), fortified foods are recommended and dietary supplements may need to be considered**.** Fortification, as defined by the U.S. Food and Drug Administration (FDA), is the deliberate addition of 1 or more essential nutrients to a food, whether or not it is normally contained in the food. Fortified foods, such as ready-to-eat cereals, are included in food pattern modeling in proportion to their consumption in that age group. However, no special emphasis is placed on fortified foods within the food pattern modeling exercises.

Vitamin D presents a unique case for the USDA Food Patterns because it is not present in most foods commonly consumed by Americans. The majority of vitamin D intake comes from fortified foods and supplements. To meet vitamin D recommendations while following the food group recommendations of the USDA Food Patterns, careful selection of specific foods within each food group would be needed, to include natural sources of and foods fortified with vitamin D (see 2015 Dietary Guidelines Advisory Committee Report,[1] Appendix E-3.3 Meeting Vitamin D Recommended Intakes in USDA Food Patterns).

Women of reproductive age should carefully consider choices of foods high in iron, especially during pregnancy, so as to obtain a larger proportion of iron from dietary sources given the higher bioavailability. Prenatal dietary supplements provide iron in amounts sufficient to meet needs of most women during pregnancy, and should be discussed with a healthcare provider.

During the periconceptual time period, folic acid has been shown to reduce the risk for the occurrence or reoccurrence of neural tube defects.[13,14] It also may reduce other poor pregnancy outcomes among women of reproductive age (see ***Part D. Chapter 2: Food, Beverage, and Nutrient Consumption During Pregnancy***). Efforts to encourage inclusion of folic acid in the diet from fortified foods or dietary supplements among women with low intakes are warranted.

Folic acid intakes are critical in the first trimester of pregnancy to reduce the risk of neural tube defects therefore the Committee supports folic acid supplementation as the standard of care before and during pregnancy.

Choline also is a challenge because an RDA is not established, which makes it difficult to determine whether it is a nutrient of public health concern and therefore developing guidance is problematic. Choline is not currently part of most dietary supplements that Americans typically consume,[15] nor is it fortified in any products known to the Committee. More research is needed, particularly for women of reproductive age, around the health consequences of low levels of choline intake.

Vitamin E has consistently been identified as a shortfall nutrient in the American diet but it is not considered a nutrient of public health concern based on biomarker information from previous NHANES cycles that did not indicate low vitamin E status. Thus, the Committee did not consider evaluating whether fortification or supplementation is warranted.

For additional details on this body of evidence, visit:
https://www.dietaryguidelines.gov/2020-advisory-committee-report/food-pattern-modeling/FPM-2-and-older

DISCUSSION

Since the 2015 review of food patterns, when the Healthy U.S.-Style, Healthy Vegetarian, and Healthy Mediterranean-Style Patterns were developed and tested for provision of nutrient recommendations, the literature related to healthy dietary intake patterns and a range of associated outcomes has significantly expanded as demonstrated by the systematic reviews completed by the Committee (see ***Part D. Chapter 8: Dietary Patterns***). The growth in this field of research (and subsequent literature base) reinforces the conclusion that for now, the primary Healthy U.S.-Style pattern and its variations are generally representative of high-quality dietary intakes that meet nutrient recommendations; “high-quality” refers to the most nutrient-dense form of a food with the least amount of added sugars, sodium, and saturated fat. A general consensus has emerged from the Committee based on systematic review about the core components to encourage and those to limit. Therefore, the goal going forward is to help the public achieve these healthy dietary intakes more consistently over the lifespan.

The 3 USDA Food Patterns provide an adequate amount of most nutrients while minimizing amounts of sodium, solid fats, and added sugars—all of which increase the risk of chronic

disease. Furthermore, the recommended patterns provide the combinations of foods to meet nutrient recommendations while maintaining an appropriate energy intake based on life stage, sex, and physical activity level. However, this work demonstrates that careful choices must be made to consume nutrient-dense forms of foods, lower in foods with sodium, added sugars, and saturated fat within a given energy level. Similarly, the modeling exercises also demonstrates that choosing less nutrient-dense foods (i.e. typical choices) will fail to meet the nutrient adequacy targets, while potentially providing higher-than-needed energy intake. This type of pattern is, unfortunately, typical of a significant proportion of Americans' current intake, as shown on Healthy Eating Index scores, which reflect alignment with the Healthy U.S.-Style Pattern (see ***Part D. Chapter 1: Current Intakes of Foods, Beverages, and Nutrients***). None of the work of this Committee evaluated the cost of these proposed patterns; however, the USDA routinely publishes such data within its USDA Food Plans.[16]

As highlighted in the *2015-2020 Dietary Guidelines for Americans*, most Americans would benefit from shifting current food choices to healthy, nutrient-dense foods and beverages across and within all food groups.[10] The need for the shifts are demonstrated by the under- and overconsumption of certain food components identified in this report (see ***Part D. Chapter 1***), together with high rates of overweight and obesity suggesting excess energy intakes and or low physical activity. Some shifts that are needed are minor—primarily requiring a different type of food choice or food preparation. For example, choosing a more nutrient-dense snack option of nuts or seeds rather than potato chips or pretzels would provide similar amounts of energy based on serving size, but would help to increase intake of a broad range of nutrients. Baking rather than frying, or alternating food preparation techniques may be considered a small shift that would be beneficial over time. However, other changes or shifts in the diet are likely to require a concerted effort to include foods that may be underconsumed and/or displacing foods and beverages that are overconsumed. One example of this is increasing daily vegetable intake even if the taste of vegetables is not preferred by an individual.

Opportunities for improving the dietary quality of Americans can be gleaned by analyzing intake patterns across life stages. As noted in ***Chapter 1***, dietary quality is highest in the youngest populations, with notably lower quality in adolescents and early to middle-aged adults. In this instance, the opportunity for improvement centers on retaining dietary quality from one life stage to the next, while continuing to make incremental improvements along the way. Although the Committee acknowledges that NHANES data are not longitudinal in nature, it is still relevant to highlight some differences in intake by life stage that may be actionable. For example, maintaining the intake of dairy in the form of fluid milk or calcium-fortified soy

beverages, rather than replacing these choices with sweetened beverages as children age could be a key focus for improving dietary quality while also aiding in the development of peak bone mass. [17] Retaining diet and nutrient quality may become increasingly important as dietary guidance emphasizes building health-promoting eating patterns early in life.

Even though the recommended Food Patterns have not appreciably changed with the 2020 Committee's review, the results of food pattern modeling point to some important conclusions and lessons learned. Some of these findings are a result of the life-stage approach used to achieve a focused assessment of dietary intakes and nutrient needs by age-sex subgroups. Updating the food item clusters with relevant intakes of foods by life stage revealed some interesting observations that may provide insight on strategies that might help influence Americans to continue improving dietary quality. For example, it is notable that certain forms of foods appear in differing proportions across age groups. The differences in intake proportions and food groups by life stage suggest that these differences could be driven by the lifestyle and socialization patterns for each age group.[18,19] School aged-children may be structurally exposed to different food options than working adults or older, retired adults. These differences in socialization and lifestyle patterns may become evident in the food choices and preferences at various stages in life. A better understanding of the influence of these lifestyle patterns that are common to a given life stage may provide the opportunity to better support and promote healthy dietary intake. This points to the need for considering a systems science approach to expand food pattern modeling,[2] incorporating factors that influence food choice and result in more actionable recommendations that would lower the risk of obesity and other nutrition-related chronic health conditions (see ***Part D. Chapter 1*** and Lee et al.[20]).

Diet quality is a central theme for the Committee as a result of reviewing data from a variety of sources, including the results of the food pattern modeling analyses. Food pattern modeling highlights the impact of diet quality on the risk of nutrient inadequacy. The USDA Food Patterns consist of high-quality food choices and achieving the nutrient intake targets is dependent on those choices. When diet quality is poor, as indicated by lower intakes of nutrient-dense foods like vegetables, fruit, legumes, or whole grains, then it is unlikely that individuals will achieve the targeted nutrient intakes from foods. When nutrient-dense foods account for a low proportion of the total energy intake, it follows that nutrient-poor but energy-rich foods, such as refined grains and foods and beverages with added sugars and saturated fats, contribute a higher proportion of energy intake, thereby contributing to a higher risk of overweight and obesity and a range of related chronic diseases.

In addition to ensuring high dietary quality, the USDA Food Patterns allow individuals to meet nutrient needs at a target energy level. This ensures that no matter what an individual's energy needs are, total energy does not have to be exceeded to ensure nutrient adequacy. For many Americans, the issue of energy balance is critical because of the high prevalence of overweight and obesity—consuming a poor-quality, energy-dense diet increases the risk of excess weight gain and associated complications. It should be noted that nutrient adequacy can be achieved if one consumes less-than-ideal food choices, but this will typically come at the expense of consuming excess energy. For example, foods that help meet nutrient needs but include significant amounts of added sugars or solid fats, such as fruits canned in heavy syrup, or higher fat meats, provide more energy than comparable foods with lower amounts of added sugars and solid fats. While added sugars and solid fats may enhance palatability and therefore increase intake of some nutrients or food groups that have typically been under consumed, Americans should be aware of how these additions may affect energy balance. Managing energy intake from all foods and beverages is fundamental to maintaining energy balance, and routine behaviors related to food quality have a significant impact on that energy balance. For analysis and discussion related to added sugars see ***Part D. Chapter 12: Added Sugars***.

Achieving energy balance and nutrient adequacy are important for promoting optimal health. This is particularly true when considering growth, development, and healthy aging. Early in life, energy intake increases as infants grow and mature. In general, energy intakes should peak for men and women in the young adult stage: ages 19 to 30 years. From there, energy requirements typically decline in middle age and older adults as changes in lean muscle reduce energy needs. These trajectories in terms of energy and associated nutrients are intended to help achieve peak body composition, muscle stores, and bone mass by early adulthood.[9] For women who are pregnant or lactating, adjustments in energy and associated nutrients are intended to help support growth and development of the offspring while maintaining the health of the mother. In older ages, achieving nutrient intake adequacy can be particularly challenging in circumstances where food intake is inconsistent due to age-related factors or changes in preferences. Shifting energy intake down with older age often requires paying even more attention to portions, dietary quality, and energy density of food choices. Older adults require less food to meet their lower energy needs. Therefore, it is crucial that the foods consumed be nutrient-dense in order to avoid nutrient shortfalls.

Other life stages of note when considering diet quality and nutrient adequacy are pregnancy and lactation. The existing 2015-2020 USDA Healthy U.S-Style Patterns are expected to meet nutrient needs for women who are pregnant or lactating, with the exception of iron during

pregnancy, vitamin A during lactation, and vitamin E, vitamin D, and choline for both life stages. For women who have higher estimated energy requirements, higher energy patterns may come closer to providing the RDA or AI for nutrients through dietary sources. The considerations for diet quality during pregnancy and lactation have implications for the health of the mother and the offspring. This includes ensuring appropriate growth and development of the fetus, avoidance of maternal-fetal complications during pregnancy, and normal growth and development of the infant. The longer-term implications for the mother are notable as well because retention of weight gain after pregnancy or a history of gestational diabetes or hypertensive disorders of pregnancy also increase the risk of chronic diseases. To achieve healthy outcomes, women should follow a nutrient-dense dietary pattern, such as the Healthy U.S.-Style Pattern, during pregnancy and lactation along with guidance from a healthcare provider on appropriate use of dietary supplements to meet nutrient needs not expected to be covered by dietary intake alone, especially iron, iodine, and folic acid. Folic acid should be consumed preconception and at least through the first trimester.

The food pattern modeling review has several important implications for the development of the *2020-2025 Dietary Guidelines for Americans*. The Committee's food pattern modeling work also offers a few key caveats. Most notably, the food pattern modeling process does not include beverages that are not contributors to the USDA food groups or subgroups, meaning that many of the commonly consumed beverages, such as sweetened beverages and alcoholic beverages, are not included in the patterns presented. Therefore, if individuals choose to include these types of energy-containing beverages in excess of the remaining energy allotted in a pattern on a routine basis, then they would need to account for that energy by reducing intakes of other foods and beverages to ensure energy balance without sacrificing the nutrient adequacy that the Healthy U.S.-Style Pattern provides (see ***Part D. Chapter 12: Added Sugars***). Future work is needed to understand how to incorporate beverages into the food pattern modeling process.

As alluded to previously, one consideration with food pattern modeling is that it can identify gaps in nutrient intake and options to meet those needs, but this process does not specify how to change food intake behaviors. It would be valuable to continue food pattern modeling analyses by life stage as well as to employ the socio-ecological model systems approach, such as that identified by the *2015-2020 Dietary Guidelines for Americans*, to identify strategies that promote and advance broad public health change engaging multiple sectors, as delineated by the Socioecological Framework.[10,19]

Another aspect of food pattern modeling that this Committee discussed is how to apply DRI recommendations for individuals more broadly at the population level. To advance this goal, the food pattern modeling approach would need to be adjusted appropriately and subsequently evaluated against the EAR, not the RDA that is used for individual planning. As noted in the 2017 NASEM report,[2] techniques such as linear programming or stochastic modeling may be useful in food pattern modeling as applied to food preferences, geographic or cultural factors, as well as nutrient recommendations as model parameters.[21]

Lastly, food pattern modeling identifies the food groups and subgroups needed to meet nutritional goals. It does not specify the specific foods to be consumed, as menu planning would. However, food pattern modeling does provide the framework to build menu planning and then allows individuals to tailor the recommended USDA Food Patterns to specific tastes and preferences. Ultimately, individuals who would benefit from guidance need support to help them make ideal food choices within their own personal dietary preferences to ensure that nutritional goals are met with high-quality foods.

SUMMARY

The recommended USDA Food Patterns for Americans, which achieve healthy dietary intake and meet nutritional goals and energy balance, include the Healthy U.S.-Style, the Healthy Vegetarian, and the Healthy Mediterranean-Style Patterns. No additional food patterns were developed during the work of this Committee, confirming the guidance on Patterns issued from this and previous Committees (see ***Part D. Chapter 8: Dietary Patterns***). Although these 3 Food Patterns have some key differences that allow for tailoring to individual preferences, they share some core components, including obtaining the majority of energy from plant-based foods, such as fruits, vegetables, legumes, whole grains, nuts and seeds, and obtaining protein and fats from nutrient-rich food sources, while limiting intakes of added sugars, solid fats, and sodium.

The 2020 Committee looked at ways to implement recommendations from the 2017 NASEM report on updating the process for the *Dietary Guidelines for Americans*.[2] Food pattern modeling was one tool identified by the NASEM report. The Committee sought to use food pattern modeling across life stages to increase the applicability of food pattern modeling for individuals. The focus on life stages has provided interesting insights into opportunities for tailoring recommendations for food intake to meet nutrient needs across the life course. Future Committees should be encouraged to expand upon this tailored approach, where more refined

dietary guidance for each life stage may be developed to promote optimal health and aging within and across each life stage.

Food pattern modeling helps to affirm the recommended dietary patterns by demonstrating their impact on nutrient adequacy. Food pattern modeling highlights the impact that diet composition and quality have on nutrient intakes. Consumption of the optimal balance of energy and nutrients has always been a key concern of the Committee because under- and overconsumption of certain nutrients and food components are associated with an increased risk of chronic disease. Indeed, food components of public health concern have been identified by the Committee based on inadequate intakes of key nutrients that have biomarkers that indicate increased disease risk (see ***Part D Chapter 1***). Food pattern modeling provides a means to transition from a nutrient level focus to a dietary pattern level of focus, whereby the individual can address nutrient needs within a food plan. By evaluating how diet composition and quality affect nutrient intakes, food pattern modeling provides an important understanding of how to consume combinations of foods to address those shortfalls or excesses. This moves the focus from nutrient intakes to foods and dietary patterns over a period of time. Ultimately, the negative health risks of a low-quality dietary pattern can be mitigated or largely avoided when one of the recommended USDA Food Patterns is consumed at the energy level to maintain a healthy weight.

Strong evidence shows the types of foods individuals should primarily be consuming, and this has been reaffirmed by the work of this Committee (see ***Part D. Chapter 8: Dietary Patterns*** and ***Chapter 12: Added Sugars***). Additionally, general consensus exists around what types of foods should be limited, as they contribute high amounts of energy with minimal contribution to the nutrients needed to promote optimal health and avoid chronic disease. Even though some needs have important variations across life stages, the foods that individuals should eat over the lifespan are remarkably consistent. If healthy eating patterns can be established early in life and sustained thereafter, the impact on the prevalence of chronic disease could be significant (see ***Part D. Chapter 7: USDA Food Patterns for Children Younger than Age 24 Months***). Because the risk of chronic disease begins early in life, taking steps to apply the best understanding of healthy dietary intakes in the earliest days of life can support lifelong chronic disease risk reduction and improved quality of life.

Food pattern modeling begins to illustrate some opportunities for engagement with the public in continuing to shift dietary intakes in healthy directions. Identifying subtle changes in intakes and preferences over the life course signals opportunities to help maintain healthy intakes early in life and build on those behaviors over time. It is also possible to identify life

stage transition points when the potential for changes are likely to be detrimental or lead to higher risk dietary patterns. If these “at risk” periods are anticipated over the life course, public health strategies can be considered that may help to decrease the adoption of poor dietary habits that may become engrained into lifestyle patterns over the long term. The Committee strongly recommends the Departments of Agriculture and of Health and Human Services make it a priority to direct Federal resources and research toward implementing effective behavior change strategies to achieve the recommendations outlined in this report. As explored by the 2015 Committee and recommended by the *2015-2020 Dietary Guidelines for Americans*, employing a systems-based approach and the Socioecological Model may lead to behavior change strategies that can be used to favorably affect a range of health-related outcomes and to enhance the effectiveness of interventions.

To facilitate shifting American dietary intakes toward healthier directions, access to healthy food options is critical. The Committee recognizes that several barriers and facilitators affect access and influence consumers’ dietary behaviors beyond nutritional considerations, including food costs and food security status. The Committee recommends that the Departments of Agriculture and of Health and Human Services continue to assess how food costs and food security status influence food intake and resulting nutritional status in the American public. The Departments have done a significant amount of work on understanding the cost of the recommended Food Plans. The Healthy U.S.-Style Pattern described in this chapter will serve as the foundation for updating the USDA Food Plans that calculate market basket costs of a healthy eating pattern at 4 levels: the Thrifty Food Plan (i.e., minimal cost), Low Cost, Moderate Cost, and Liberal Food Plans. These Food Plans demonstrate that healthy eating does not need to be cost-prohibitive. However, little information exists on how food insecurity, which is the limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways, affects food purchasing behaviors. Approximately 11 percent of U.S. households experienced food insecurity in 2018.[22] Future research is needed to understand how food security status interacts with food costs to shape dietary behaviors.

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