

Development of Food Intake Patterns for the MyPyramid Food Guidance System

Patricia Britten, PhD¹; Kristin Marcoe, MBA, RD¹; Sedigheh Yamini, PhD, RD²; Carole Davis, MS, RD¹

ABSTRACT

Objective: The purpose of this research was to design food intake patterns based on typical American food selections that would meet Dietary Guidelines and Dietary Reference Intake recommendations.

Design: Analytic process to identify appropriate amounts from each food group that together will meet nutritional goals for various age/gender groups.

Variables Measured: Projected intake of energy, 9 vitamins, 8 minerals, 8 macronutrients, and dietary fiber in each food intake pattern.

Analysis: Iterative comparison of nutrients in each food intake pattern to Dietary Reference Intakes and Dietary Guidelines recommendations set as goals for that pattern.

Results: Food intake patterns were established that met almost all nutrient goals within estimated energy needs. Intakes of vitamin E at all energy levels, potassium at lower energy levels, and sodium at higher energy levels did not meet goals.

Conclusions and Implications: The food intake patterns provide a foundation of food choices that will meet nutritional recommendations. They form the scientific basis for the MyPyramid Food Guidance System and can also be used as a starting point for developing other educational programs or materials.

Key Words: MyPyramid, food guides, food intake patterns, dietary guidance

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INTRODUCTION

Dietary patterns describe the types and amounts of food to consume. Providing information about dietary patterns that will meet current recommendations for nutritional health has been a major focus of the United States Department of Agriculture's (USDA) food guidance to consumers over the past century. USDA has developed a number of different food guides to identify patterns of eating that would meet known nutrient needs and balance intake from various food groups.^{1,2} As noted by Welsh et al,¹ "A food guide . . . provides a conceptual framework for selecting the kinds and amounts of

foods of various types which together provide a nutritionally satisfactory diet. A food guide translates recommendations on nutrient intake into recommendations on food intake."

Many of the earlier food guides developed by USDA focused on nutrient adequacy only and were designed to meet known nutrient needs. Beginning in the 1970s, with the issuance of national nutritional recommendations that urged moderation to help prevent chronic disease, a need was recognized for a food guide that made food intake suggestions for a "total diet" rather than a "foundation diet."² The goal of designing total diet recommendations differed from previous food guides that were only concerned with adequacy and presented as foundations to which other foods could be added.

The first USDA food intake patterns that represented a "total diet" approach to food guides were developed in the mid-1980s through an extensive technical research process that has been well documented.^{1,3,4} These food intake patterns were first presented to consumers as a Food Wheel that was part of a joint American Red Cross-USDA nutrition course in 1984.² Later, the food intake patterns were presented in tabular form as "A Pattern for Daily Food Choices" in USDA publications that focused on how to use the Dietary Guide-

¹USDA Center for Nutrition Policy and Promotion, Alexandria, VA

²FDA Center for Food Safety and Applied Nutrition, formerly with USDA Center for Nutrition Policy and Promotion, Alexandria, VA

Address for correspondence: Patricia Britten, PhD, USDA Center for Nutrition Policy and Promotion, 3101 Park Center Drive, Room 1034, Alexandria, VA 22302; Phone: (703) 305-7600; Fax: (703) 305-3300; E-mail: Patricia.Britten@cnpp.usda.gov.

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lines for Americans. Development of a new graphic approach to presenting these food intake patterns resulted in the original Food Guide Pyramid, released in 1992.^{3,4}

The original Pyramid's food patterns were designed to help Americans make daily food choices that were *adequate* in meeting nutritional standards but *moderate* in energy level and in food components often consumed in excess. The adequacy and moderation of these patterns were assessed by comparing nutrients in the patterns to nutritional goals from the 1980 Recommended Dietary Allowances (RDA), the 1980 Dietary Guidelines for Americans, and other standards that were current at the time.² They were later assessed in comparison to the 1989 RDAs and the 1985 and 1990 Dietary Guidelines.⁴ They have also been reevaluated based on updated food consumption information from national surveys.⁵ Revisions of the food intake patterns were based on the same guiding principles that were used to develop the original Pyramid,⁴ including the principles to represent a total diet that is both *adequate* and *moderate*, as well as to reflect current food consumption choices in determining nutrient sources.

This article presents the methods used to reassess and revise the food intake patterns and the evaluation of the updated patterns in comparison to new nutritional goals. The objective in revising the food intake patterns was to meet current nutritional standards for adequacy and moderation, as determined by recommendations from established authoritative bodies, expert panels such as the Dietary Guidelines Advisory Committee (DGAC), and the National Academy of Sciences' Institute of Medicine (IOM) Dietary Reference Intakes Committee.⁶⁻¹²

METHODS

The overall iterative process used to develop the updated food intake patterns was similar to the process used in the 1980s to create intake patterns for the original Food Guide Pyramid.² This method included identifying appropriate energy levels for the patterns, identifying nutritional goals for the patterns, establishing food groupings, determining the amounts of nutrients that would be obtained by consuming various combinations of foods, and evaluating nutrient levels in each pattern against nutritional goals. These steps are summarized in Figure 1, and each step is detailed in this section.

Establishing Energy Levels

As an initial step in the process of developing potential new food intake patterns, appropriate energy levels were identified for them. The IOM Dietary Reference Intakes Committee provided formulas for calculating Estimated Energy Requirements (EER) based on gender, age, height, weight, and physical activity level.¹¹ These formulas, shown in Table 1, were used to generate estimates of the energy needs for various age/gender groups within the population.

For the energy level calculations, reference heights and

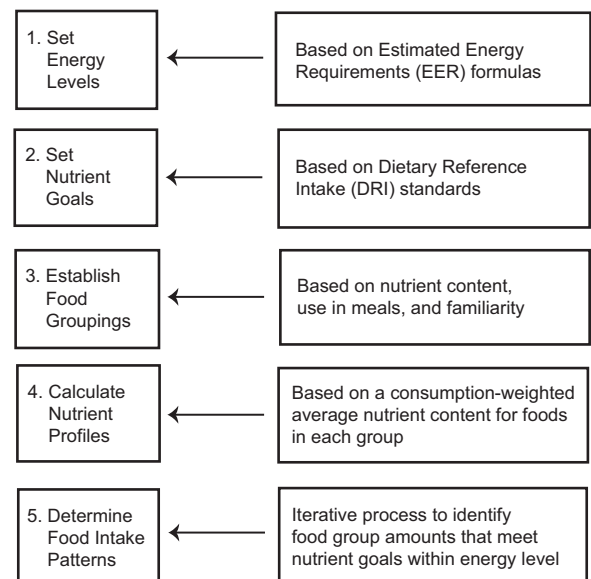


Figure 1. Process Used for Development of MyPyramid Food Intake Patterns

weights as defined by the IOM report on macronutrients were used.¹¹ Reference heights are the median heights for each age/gender group. Reference weights are weights that should approximate “ideal” weights based on low risk of chronic disease for adults and adequate growth for children. For adult males, the median height is 1.77 meters (about 5' 9") and an “ideal” Body Mass Index (BMI) is 22.5, according to the IOM, which results in a weight of 70 kilograms (about 154 pounds). For adult females, the median height is 1.63 meters (about 5' 4") and an “ideal” BMI is 21.5, which results in a weight of 57 kilograms (about 125 pounds). For adults, the reference weights used are lower than the median weights for each age/gender group. For children, the reference heights and weights are the median heights and weights for each age group.

We held discussions among groups of nutritionists from various agencies in both the USDA and the Department of Health and Human Services to identify assumptions that should be made in determining proposed energy levels for the intake patterns. These assumptions and proposed energy levels for the patterns were then published in the Federal Register in September 2003 for comment by professionals and the public at large.¹³ We also discussed the proposal with the DGAC as it began deliberations for the 2005 Dietary Guidelines. The final energy levels established for the food intake patterns were based on the EER equations and took into account the suggestions of these groups and the comments in response to the Federal Register notice.¹⁴

Establishing Nutritional Goals

The next step in developing new food intake patterns was to identify appropriate nutritional goals for each potential

Table 1. Estimated Energy Requirement (EER) Equations

Age/Gender Group	Equation		
Males and females 13–35 months	$EER = (89 * WT^a - 100) + 20$		
Males 3-8 years	$EER = 88.5 - (61.9 * AGE^b) + PA^c * (26.7 * WT + 903 * HT^d) + 20$		
Females 3-8 years	$EER = 135.3 - (30.8 * AGE) + PA * (10 * WT + 934 * HT) + 20$		
Males 9-18 years	$EER = 88.5 - (61.9 * AGE) + PA * (26.7 * WT + 903 * HT) + 25$		
Females 9-18 years	$EER = 135.3 - (30.8 * AGE) + PA * (10 * WT + 934 * HT) + 25$		
Adult males (19 years and older)	$EER = 662 - (9.53 * AGE) + PA * (15.91 * WT + 539.6 * HT)$		
Adult females (19 years and older)	$EER = 354 - (6.91 * AGE) + PA * (9.36 * WT + 726 * HT)$		

Physical Activity Coefficients (PA):	Sedentary ^e	Low Active ^f	Active ^g
Males			
3-18 years old	1.00	1.13	1.26
Adults 19 years and older	1.00	1.11	1.25
Females			
3-18 years old	1.00	1.16	1.31
Adults 19 years and older	1.00	1.12	1.27

From the Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington, DC: National Academies Press; 2002.

^aWT: Weight in kilograms (pounds/2.2)

^bAGE: Age in years

^cPA: Physical Activity Coefficient (See below)

^dHT: Height in meters (Inches/39.37)

^eSEDENTARY means a lifestyle that includes only the physical activity of independent living.

^fLOW ACTIVE means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living.

^gACTIVE means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living.

pattern. As with the original Pyramid, the nutritional goals for the potential new food intake patterns were based on the most current nutritional recommendations available at the time. We identified proposed goals for each age/gender group and published them in the Federal Register in September 2003 for comment by professionals and the public at large.¹³ We also discussed the proposed nutritional goals with the DGAC as it began deliberations for the 2005 Dietary Guidelines. Some nutritional goals were updated as new standards became available during the developmental process. Nutritional goals for the patterns were selected only for nutrients for which a quantified standard had been established by the IOM or the Dietary Guidelines for Americans.

Establishing Food Groupings

The food groups developed for the original Pyramid were examined to identify where changes might be needed to help consumers select healthy diets that would reflect potential guidance from the 2005 Dietary Guidelines. The original Pyramid's food groups were: fruits; vegetables; meat, poultry, fish, dry beans, eggs, and nuts; milk, yogurt, and cheese; bread, cereal, rice, and pasta; and fats, oils, and sweets. Some subgroups had also been used in the development of food intake patterns for the original Pyramid, such

as whole and enriched grains and the 5 vegetable subgroups (dark-green vegetables, orange vegetables, dry beans and peas, starchy vegetables, other vegetables). However, these subgroupings had not been translated into consumer guidance in a quantified manner.

In addition, based on scientific reports that were summarized by the DGAC,⁶ we identified a need to distinguish between fats that are primarily sources of saturated fatty acids and those that are primarily sources of monounsaturated or polyunsaturated fatty acids. To accomplish this differentiation, we investigated separating fats into subgroups of solid fats and oils and designating oils as an essential component of the food patterns. We also explored the potential for including subgroups for fish and nuts in the patterns, in light of the DGAC's interest in possible guidance related to these foods.⁶ These analyses are described in an accompanying article.¹⁵

The DGAC identified a new concept of "discretionary calories" as calories that can be used flexibly once nutrient needs are fulfilled.⁶ The DGAC defined the discretionary calorie allowance as the difference between total energy requirements and the energy consumed to meet recommended nutrient needs. Using this definition, the authors calculated a discretionary calorie allowance for each food intake pattern to replace the allowances in the preliminary

food patterns for solid fats and added sugars. Based on the DGAC definition of discretionary calories, calories from alcohol were also included in this category.

Identifying Nutrient Contributions From Each Food Group

The specific process used to identify the nutrients that could be expected from consuming a given amount of each food group is detailed in an accompanying article.¹⁶ To summarize the research process, the expected nutrients from each food group, or the nutrient profiles, were calculated based on a weighted average of the nutrient contributions of each food in the group or subgroup. The weights were assigned based on relative consumption of each food item, determined from national food consumption surveys. These nutrient profiles for each food group and subgroup were used in assessing the extent to which a proposed food intake pattern met its nutrient goals.

Determining Recommended Amounts From Each Food Group

Shaw et al¹⁷ outlined a framework for making decisions about food guide modifications to make sure that they continue to meet their nutritional objectives. The framework consisted of identifying the changes in nutritional standards; quantifying the extent to which current diets and/or food patterns met the new standards; identifying potential changes to food pattern recommendations to meet the new standards and assessing the consistency of these changes with overall goals; and documenting where the revised food patterns do not reliably meet the new

standards. We followed this process to identify new food intake patterns.

The development of new food intake patterns for each calorie level began with an assessment of the original Food Guide Pyramid patterns at the 1600, 2200, and 2800 calorie levels (Table 2). In addition, trial patterns at additional energy levels were created by making stepped alterations to the amounts in the original patterns. For example, trial patterns at the 1800 and 2000 calorie levels were established with food amounts in steps between the amounts in the original 1600-calorie and 2200-calorie patterns. Using the new nutrient profiles for each food group, these original and trial patterns were compared to the new nutritional goals.

After comparing the nutrients provided in each trial pattern to its goals, iterative changes were made to food group amounts when needed until the pattern achieved its nutritional goals or came within a reasonable range. Food group amounts were changed based on a judgment of which food groups could most reasonably provide the nutrients when goals were not met. Reasonableness included a determination of the amount of the nutrient(s) provided by the food group and amounts typically consumed from the food group.

For example, the IOM report on water and electrolytes¹² included a substantial increase in the recommendation for potassium intake, which necessitated an increase in the amount of potassium in the food patterns. We examined nutrient profiles of each food group to identify the groups where an increased recommendation would have the largest impact on levels of potassium in the overall pattern. Fruits, vegetables, and milk all contain substantial amounts of potassium.¹⁶ Recommended intakes of all 3 food groups

Table 2. Original Food Guide Pyramid Intake Patterns, Listing the Number of Servings Recommended Daily from Each Food Group at Three Calorie Levels (As presented in the 2000 Dietary Guidelines for Americans, with minor updates)

Energy Level	1600 calories	2200 calories	2800 calories
Age groups for whom pattern is recommended	Children ages 2 to 6 years, women, some older adults	Older children, teen girls, active women, most men	Teen boys, active men
Food Group	Number of servings and amounts translated into cups or ounce equivalents (oz eq) for comparison with current patterns		
Bread, cereal, rice, and pasta group (Grain group)	6 (6 oz eq)	9 (9 oz eq)	11 (11 oz eq)
Vegetable group	3 (1½ cups)	4 (2 cups)	5 (2½ cups)
Fruit group	2 (1 cup)	3 (1½ cups)	4 (2 cups)
Milk, yogurt, and cheese group (Milk group)	2 or 3 ^a (2 or 3 cups)	2 or 3 ^a (2 or 3 cups)	2 or 3 ^a (2 or 3 cups)
Meat, poultry, fish, dry beans, eggs, and nuts group (Meat and Beans group)	2 (5 oz eq)	2 (6 oz eq)	3 (7 oz eq)

Source: Nutrition and Your Health: Dietary Guidelines for Americans, 5th ed. USDA and HHS, 2000.

^aThe number of servings depends on age. Older children and teenagers (ages 9 to 18 years) and adults age 50 years and older need 3 servings daily. Others need 2 servings daily.

were increased in most patterns. However, within the vegetable group the increased intake was assigned, in large part, to increases in “other” vegetables and starchy vegetables, rather than dark-green and orange vegetables or dry beans. Because of their high nutrient density, recommended intakes for dark-green vegetables, orange vegetables, and dry beans were already much higher than typical consumption levels in order to meet other nutritional goals within the calorie limits of the patterns.

In accordance with the guiding principles from the original Pyramid, we attempted to make the intake patterns as realistic as possible by keeping recommendations reasonably close to current consumption levels while still meeting nutritional goals. Consideration was also given to maintaining a reasonable progression from pattern to pattern in the amounts recommended from each food group, to make the patterns logical from an educational standpoint. Therefore, some adjustments were made to the stepped increases in amounts recommended so that changes were more even across calorie levels. In addition, there was concern that each intake pattern should be an understandable tool for consumers to use; therefore, the amounts recommended from each food group were kept to whole or half cups or ounce equivalents.

RESULTS

Energy Levels Selected for Food Intake Patterns

To meet a wide range of calorie needs of various age/gender groups, we determined that food patterns were needed at energy levels ranging from 1000 to 3200 calories. To meet many differing needs, 12 energy levels in 200-calorie increments within this range were selected for the development of food intake patterns. To facilitate comparison of the resulting patterns with nutritional goals, ages were grouped into the categories used by the IOM in setting Dietary Reference Intakes (DRI)⁷⁻¹² and assigned one target energy level for each age/gender group. Food intake patterns at these target energy levels were those used to determine nutrient adequacy of the pattern for each age/gender group. For adults, a target energy level for each age/gender group at a relatively low energy level was selected that would be appropriate for a reference-sized, sedentary individual. For children through the age of 18, a target energy level for a reference-sized, sedentary child was selected at the middle of each age range. Sedentary individuals were targeted to avoid an overestimation of the energy allowance within which nutrient needs would be met. EERs and the target energy levels for patterns used for comparison to nutritional goals are shown in Table 3. Based on the EERs, the intake energy levels at 1000, 1200, and 1400 calories were identified as appropriate for children 2 to 8 years of age. Intake energy levels at 1600 calories and above were identified as appropriate for various age/gender groups from 9 years of age through adulthood.

In addition to the target energy levels, we also identified food intake patterns at higher energy levels for individuals in each age/gender group who are more physically active. Food pattern energy levels at 3 levels of physical activity are shown in Table 4. These additional patterns for each age/gender group allow additional flexibility in food choices for those who are physically active.

Nutritional Goals Selected

The nutritional goals selected for each food intake pattern include targets for 9 vitamins, 8 minerals, and 6 macronutrients and acceptable intake ranges for 5 macronutrients for various age/gender groups. The nutritional goals and their sources are identified in Table 5. These goals were set based on DRI reports, released by the IOM from 1997 to 2004,⁷⁻¹² for various nutrients and on quantitative recommendations in the year 2005 Dietary Guidelines.¹⁸ We identified specific goals for each food intake pattern, based on the age/gender group(s) for which each pattern was targeted. If a food intake pattern was targeted for more than one age/gender group, the pattern was evaluated against the nutrient goals for all those groups.

Most goals for nutrient *adequacy* were based on the RDA or Adequate Intake (AI) set by the IOM in recent Dietary Reference Intakes reports. RDAs, rather than Estimated Average Requirements (EAR), also set by the IOM, were used as the criteria for the nutritional goals because the food intake patterns are designed for use by individuals in planning their diets rather than for planning group intakes.¹⁹ RDAs are designed to cover the nutrient needs of 98% of the population, whereas EARs are designed to cover the nutrient needs of only 50%.¹⁹ The goal for each pattern was to have an intake at the RDA or AI level or higher, but small deviations below the target of 100% of the RDA were considered acceptable. Because of the way nutrients are distributed in foods, it was expected that levels of some nutrients in the food patterns (protein and vitamin C, for example) would exceed recommended quantities, whereas the pattern would provide just the recommended quantities of other nutrients (calcium and magnesium, for example). Amounts of a nutrient in excess of the RDA or AI were considered acceptable as long as they did not exceed the Tolerable Upper Intake Level (UL) for that nutrient.

For total fiber, the nutritional goal was set at 14 grams total fiber per 1000 calories, the value used by the IOM as the basis for setting AI levels. The IOM established AI levels for each age/gender group, using this standard, at the median energy intake for each age/gender group.¹¹ Since the food intake patterns are planned to meet nutrient needs at lower energy levels—for sedentary, reference-sized individuals—the AIs were not considered to be appropriate goals. An additional adjustment converted the amount of “dietary” fiber, which is available in food composition tables, to “total” fiber. The IOM report suggests that the amount of total fiber in an average diet, about 2000 calories, may be approximately 5.1 grams

Table 3. Estimated Energy Requirements (EER) for Reference-sized Sedentary Individuals and Target Food Intake Patterns Assigned to Age/Gender Groups

Males			Females		
Age ^a	EER ^b	Target Pattern ^c	Age ^a	EER ^b	Target Pattern ^c
2	1050	1000	2	997	1000
3	1162		3	1080	
4	1215	1400	4	1133	1200
5	1275		5	1189	
6	1328		6	1247	
7	1394		7	1298	
8	1453		8	1360	
9	1530	1800	9	1415	1600
10	1601		10	1470	
11	1691		11	1538	
12	1798		12	1617	
13	1935		13	1684	
14	2090	2200	14	1718	1800
15	2223		15	1731	
16	2320		16	1729	
17	2366		17	1710	
18	2383		18	1690	
20	2540	2400	20	1933	2000
25	2493		25	1898	
30	2445		30	1864	
35	2397	2200	35	1829	1800
40	2350		40	1795	
45	2302		45	1760	
50	2254		50	1725	
55	2207	2000	55	1691	1600
60	2159		60	1656	
65	2111		65	1622	
70	2064		70	1587	
75	2016	2000	75	1553	1600
80	1968		80	1518	

^aAges are grouped according to age groups used by the IOM for setting Dietary Reference Intakes.

^bEER were calculated using the equations shown in Table 1 for reference-sized, sedentary individuals. They are shown for each year from 2 to 18, and at 5-year intervals for adults.

^cTarget patterns were established to identify food intake patterns that would be used for comparison to nutritional goals for specific age/gender groups.

more than the amount of dietary fiber.¹¹ Therefore, to convert the dietary fiber amounts from food composition data to estimates of total fiber, we added 2.5 grams to the calculated amount of dietary fiber for each 1000 calories in the food intake pattern.

For *moderation goals*, the standards used were the Acceptable Macronutrient Distribution Ranges (AMDR) from the IOM macronutrients report or quantitative recommendations from the 2005 Dietary Guidelines.^{11,18} In the case of the AMDRs, the goals were for nutrient levels to be within the range specified. The IOM did not establish quantified moderation goals for saturated fatty acids, cholesterol, or *trans* fatty acids, but it recommended that intakes be “as low as possible.”¹¹ The 2005 Dietary Guidelines, however, included a recommendation for maximum daily intakes of saturated fat (<10% of calories) and cholesterol (<300

milligrams).¹⁸ These goals were selected for the food intake patterns. An intake goal for *trans* fats was not set because no quantified standard was provided by the IOM or the Dietary Guidelines. In addition, data on the current amount of *trans* fats in many food items are not available. However, major sources of saturated and *trans* fatty acids are included in the composite and nutrient profile developed for solid fat, and the food patterns indirectly limit consumption of solid fat, because solid fat is always part of the discretionary calorie allowance.

For sodium, the 2005 Dietary Guidelines recommends a daily intake of less than the UL of 2300 milligrams for the general population, but the document notes that certain subpopulation groups would benefit from further reductions.¹⁸ The DGAC also stated that there was no advantage in sodium intakes above the AI level.⁶ However, given the high current

Table 4. Energy Levels Used for Assignment of Individuals to MyPyramid Food Intake Patterns. This table shows suggested energy intake for each age/gender group at three levels of physical activity. Energy intake levels are provided for each year of childhood, from 2-18 years, and for adults in 5-year increments.

MALES				FEMALES			
AGE	Sedentary ^a	Moderately Active ^b	Active ^c	AGE	Sedentary ^a	Moderately Active ^b	Active ^c
2	1000	1000	1000	2	1000	1000	1000
3	1200	1400	1400	3	1000	1200	1400
4	1200	1400	1600	4	1200	1400	1400
5	1200	1400	1600	5	1200	1400	1600
6	1400	1600	1800	6	1200	1400	1600
7	1400	1600	1800	7	1200	1600	1800
8	1400	1600	2000	8	1400	1600	1800
9	1600	1800	2000	9	1400	1600	1800
10	1600	1800	2200	10	1400	1800	2000
11	1800	2000	2200	11	1600	1800	2000
12	1800	2200	2400	12	1600	2000	2200
13	2000	2200	2600	13	1600	2000	2200
14	2000	2400	2800	14	1800	2000	2400
15	2200	2600	3000	15	1800	2000	2400
16	2400	2800	3200	16	1800	2000	2400
17	2400	2800	3200	17	1800	2000	2400
18	2400	2800	3200	18	1800	2000	2400
19-20	2600	2800	3000	19-20	2000	2200	2400
21-25	2400	2800	3000	21-25	2000	2200	2400
26-30	2400	2600	3000	26-30	1800	2000	2400
31-35	2400	2600	3000	31-35	1800	2000	2200
36-40	2400	2600	2800	36-40	1800	2000	2200
41-45	2200	2600	2800	41-45	1800	2000	2200
46-50	2200	2400	2800	46-50	1800	2000	2200
51-55	2200	2400	2800	51-55	1600	1800	2200
56-60	2200	2400	2600	56-60	1600	1800	2200
61-65	2000	2400	2600	61-65	1600	1800	2000
66-70	2000	2200	2600	66-70	1600	1800	2000
71-75	2000	2200	2600	71-75	1600	1800	2000
76 and up	2000	2200	2400	76 and up	1600	1800	2000

^aSedentary means a lifestyle that includes only the physical activity of independent living.

^bModerately Active means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living.

^cActive means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living.

intakes in the population, and the preponderance of dietary sodium that comes from food processing, the DGAC and the Dietary Guidelines identified the UL as a more achievable goal.^{6,18} Therefore, the moderation goal for sodium in the food intake patterns was set as less than the UL.

Food Groupings

The 5 major food groups were retained from the original Food Guide Pyramid: Fruits; Vegetables; Bread, Cereal, Rice, and Pasta; Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts; and Milk, Yogurt, and Cheese. The 2000 Dietary Guidelines included the shorthand names of "Grains," "Meat and Beans," and "Milk" for the latter 3 food groups,

respectively.²⁰ We adopted these shortened names for most communications, but used the longer versions when appropriate to identify the variety of foods that are components of the groups.

The subgroups within the Grain and Vegetable groups were also retained and were emphasized to convey the Dietary Guidelines recommendations to consume whole grains and vegetables from each subgroup.¹⁸ For the Grains group, the subgroups are whole grains and refined grains. For the Vegetables group, the subgroups are dark-green vegetables, orange vegetables, dry beans and peas, starchy vegetables, and other vegetables. The names of some subgroups were slightly modified to better reflect the foods in the subgroup and to be understandable to consumers. For

Table 5. Nutritional Goals Selected for Each Food Intake Pattern, Based on the Age/Gender Group(s) Assigned to That Pattern

Energy level of pattern ^a		1000	1200	1400	1600	1600	1800	1800	1800	2000	2000	2200	2200	2400
		Age gender groups												
Source of Goal		Child 1-3	Female 4-8	Male 4-8	Female 9-13	Female 51+	Male 9-13	Female 14-18	Female 31-50	Male 51+	Female 19-30	Male 14-18	Male 31-50	Male 19-30
Vitamin A (μg RAE)	RDA ^b	300	400	400	600	700	600	700	700	900	700	900	900	900
Vitamin E (mg AT)	RDA	6	7	7	11	15	11	15	15	15	15	15	15	15
Vitamin C (mg)	RDA	15	25	25	45	75	45	65	75	90	75	75	90	90
Thiamin (mg)	RDA	0.5	0.6	0.6	0.9	1.1	0.9	1	1.1	1.2	1.1	1.2	1.2	1.2
Riboflavin (mg)	RDA	0.5	0.6	0.6	0.9	1.1	0.9	1	1.1	1.3	1.1	1.3	1.3	1.3
Niacin (mg)	RDA	6	8	8	12	14	12	14	14	16	14	16	16	16
Vitamin B ₆ (mg)	RDA	0.5	0.6	0.6	1	1.5	1	1.2	1.3	1.7	1.3	1.3	1.3	1.3
Folate (μg)	RDA	150	200	200	300	400	300	400	400	400	400	400	400	400
Vitamin B ₁₂ (μg)	RDA	0.9	1.2	1.2	1.8	2.4	1.8	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Calcium (mg)	AI ^c	500	800	800	1300	1200	1300	1300	1000	1200	1000	1300	1000	1000
Phosphorus (mg)	RDA	460	500	500	1250	700	1250	1250	700	700	700	1250	700	700
Magnesium (mg)	RDA	80	130	130	240	320	240	360	320	420	310	410	420	400
Iron (mg)	RDA	7	10	10	8	8	8	15	18	8	18	11	8	8
Zinc (mg)	RDA	3	5	5	8	8	8	9	8	11	8	11	11	11
Copper (μg)	RDA	340	440	440	700	900	700	890	900	900	900	890	900	900
Sodium (mg)	UL ^d	<1500	<1900	<1900	<2200	<2300	<2200	<2300	<2300	<2300	<2300	<2300	<2300	<2300
Potassium (mg)	AI	3000	3800	3800	4500	4700	4500	4700	4700	4700	4700	4700	4700	4700
Protein (g)	RDA	13	19	19	34	46	34	46	46	56	46	52	56	56
(% of calories)	AMDR ^e	5-20	10-30	10-30	10-30	10-35	10-30	10-30	10-35	10-35	10-35	10-30	10-35	10-35
Carbohydrate (g)	RDA	130	130	130	130	130	130	130	130	130	130	130	130	130
(% of calories)	AMDR	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65	45-65
Total Fiber (g)	14g/1000 kcal ^f	14	17	20	22	22	25	25	25	28	28	31	31	34
Total Fat (% of calories)	AMDR	30-40	25-35	25-35	25-35	20-35	25-35	25-35	20-35	20-35	20-35	25-35	20-35	20-35
Saturated Fat (% of calories)	DG ^g	<10%	<10%	<10%	<10%	<10%	<10%	<10%	<10%	<10%	<10%	<10%	<10%	<10%
Cholesterol (mg)	DG	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
Linoleic Acid (g)	AI	7	10	10	10	11	12	11	12	14	12	16	17	17
(% of calories)	AMDR	5-10	5-10	5-10	5-10	5-10	5-10	5-10	5-10	5-10	5-10	5-10	5-10	5-10
α -Linolenic Acid (g)	AI	0.7	0.9	0.9	1	1.1	1.2	1.1	1.1	1.6	1.1	1.6	1.6	1.6
(% of calories)	AMDR	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2	0.6-1.2

^aFood intake patterns at 2600, 2800, 3000, and 3200 calories were designed to meet the needs of males 14 to 18 and 19 to 30. Their nutritional goals are the same as for the patterns at 2200 and 2400 calories.

^bRecommended Dietary Allowance, IOM⁷⁻¹²

^cAdequate Intake, IOM⁷⁻¹²

^dTolerable Upper Intake Level, IOM⁷⁻¹²

^eAcceptable Macronutrient Distribution Range, IOM⁷⁻¹²

^f14 grams per 1000 calories, based on AI calculations, see text

^gDietary Guidelines recommendation

example, dark-green vegetables were originally called dark-green leafy vegetables, but the largest single food in this subgroup is now broccoli, which is not “leafy.”¹⁶ In addition, the term “legumes” was replaced by “dry beans and peas” for this subgroup, because few consumers understand the term “legumes.”^{21,22}

More detailed composites were developed for fish and for nuts and seeds, to provide additional information about these foods to the DGAC as they deliberated.^{15,16} However, no quantified guidance for the general public on these foods was included in the Dietary Guidelines, so no subgroups were established for them in the final food intake patterns. Fish, nuts, and seeds were maintained as part of the “Meat and Beans” group, and intake of a variety of foods within this group is suggested. Fish, nuts, and seeds are also recommended in the Dietary Guidelines as sources of mono-unsaturated and polyunsaturated fats.¹⁸

The original Pyramid food intake patterns had included an allowance for “added fats” that could be consumed in addition to the amounts of fat in lean or low-fat versions of foods in each food group.² We separated this added fat allowance into solid fats and oils and soft margarines; the method and results are described in an accompanying article.¹⁶ An allowance for oils and soft margarines was included in the food intake patterns because these foods were identified as the primary sources of essential fatty acids and vitamin E for Americans.⁶ After being separated from oils, solid fats were not a major source of any nutrients and were therefore not considered essential in the food patterns. The allowance for solid fats was integrated into the discretionary calories allowance.

Final Food Intake Patterns and Assessment In Relation To Nutritional Goals

The final food intake patterns met as many of the nutritional goals as possible, within the energy limits of each pattern. Table 6 presents the food intake patterns, which identify daily or weekly amounts to eat from each food group and subgroup. As noted in the Dietary Guidelines, these daily and weekly amounts are intended as averages to be met over time.¹⁸ The total amount of food eaten and amounts from each group may vary from day to day. The amounts recommended within each food group were expressed as daily total amounts in cups or ounce equivalents rather than in servings. The rationale for this change is described in an accompanying article.²³

The amount from the milk group in patterns identified for individuals 9 years of age and older is 3 cups per day. The amount in the patterns for children 2 to 8 is 2 cups per day, which meets their lower calcium needs. If physically active children 8 or younger need to consume 1600 or more calories per day, they will still meet their calcium intake goal with 2 cups per day of milk.

Recommended amounts from the foods groups that provide dietary fiber—fruits, vegetables, and grains—

continue to increase with increased calorie intake to meet the per-1000-calorie goal for fiber. The increase in recommended amounts of fruits and vegetables at higher calorie levels also helps to meet the potassium requirement.

We quantified the discretionary calories allowance, which had been identified conceptually by the DGAC, for each food pattern. The number of calories considered essential was calculated by summing the calories in recommended intakes from each food group and oils. These essential calories were then subtracted from the caloric goal for the pattern. Minor adjustments were made in the remainder so that sample amounts of solid fats and added sugars could be presented as whole numbers. For example, in the 1800 calorie pattern, the essential calories totaled 1609, which left 191 calories that could be considered “discretionary.” This number was adjusted to 195 calories, so that it could be represented by 15 grams of solid fats and 20 grams of added sugars. In consumer communications, the number of discretionary calories is rounded to the nearest 5 calories.

Table 7 presents the resulting nutrients in each food intake pattern, and Table 8 shows how these compare to the nutritional goals for that pattern. Almost all of the nutritional goals were met. The exceptions were vitamin E, sodium at energy levels above 2400 calories, and potassium at energy levels below 2600 calories. Amounts of calcium, magnesium, and iron were marginal for 1 or more age/gender groups.

DISCUSSION

The final food intake patterns provide a recommended daily selection of foods that is generally adequate in essential nutrients and moderate in food components often consumed in excess. These patterns are based on commonly consumed foods, but the amounts have been altered from typical consumption levels, and most foods would need to be selected or prepared in low-fat and low-added-sugars forms. Added sugars and discretionary solid fats, as well as calories from alcohol, are considered part of the discretionary calorie allowance.

In comparison to food intake patterns for the original Food Guide Pyramid, the new patterns include recommendations for an increased amount from the fruit and vegetable groups for all age groups, and an increased amount from the milk group for some age groups. To partially compensate for the calories in these increased amounts, somewhat lower amounts from the grains group were recommended. The amount of whole grains recommended, however, has increased. The original Pyramid suggested “several servings a day” of whole grains, whereas the new patterns specify amounts of whole grains that are at least half of the total recommended amount for the group.

MyPyramid’s food intake patterns demonstrate how Americans can modify their diets to meet nutritional goals. Comparisons between the food group recommendations

Table 6. MyPyramid Food Intake Patterns

Food Group	Energy Level of Pattern ^a											
	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200
	Daily Amount^b of Food from Each Group (vegetable subgroup amounts are per week)											
Fruits	1 c	1 c	1½ c	1½ c	1½ c	2 c	2 c	2 c	2 c	2½ c	2½ c	2½ c
Vegetables	1 c	1½ c	1½ c	2 c	2½ c	2½ c	3 c	3 c	3½ c	3½ c	4 c	4 c
Dark-green vegetables	1 c/wk	1½ c/wk	1½ c/wk	2 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk
Orange vegetables	½ c/wk	1 c/wk	1 c/wk	1½ c/wk	2 c/wk	2 c/wk	2 c/wk	2 c/wk	2½ c/wk	2½ c/wk	2½ c/wk	2½ c/wk
Dry beans and peas	½ c/wk	1 c/wk	1 c/wk	2½ c/wk	3 c/wk	3 c/wk	3 c/wk	3 c/wk	3½ c/wk	3½ c/wk	3½ c/wk	3½ c/wk
Starchy vegetables	1½ c/wk	2½ c/wk	2½ c/wk	2½ c/wk	3 c/wk	3 c/wk	6 c/wk	6 c/wk	7 c/wk	7 c/wk	9 c/wk	9 c/wk
Other vegetables	4 c/wk	4½ c/wk	4½ c/wk	5½ c/wk	6½ c/wk	6½ c/wk	7 c/wk	7 c/wk	8½ c/wk	8½ c/wk	10 c/wk	10 c/wk
Grains	3 oz eq	4 oz eq	5 oz eq	5 oz eq	6 oz eq	6 oz eq	7 oz eq	8 oz eq	9 oz eq	10 oz eq	10 oz eq	10 oz eq
Whole grains	1½ oz eq	2 oz eq	2½ oz eq	3 oz eq	3 oz eq	3 oz eq	3½ oz eq	4 oz eq	4½ oz eq	5 oz eq	5 oz eq	5 oz eq
Refined grains	1½ oz eq	2 oz eq	2½ oz eq	2 oz eq	3 oz eq	3 oz eq	3½ oz eq	4 oz eq	4½ oz eq	5 oz eq	5 oz eq	5 oz eq
Meat and Beans	2 oz eq	3 oz eq	4 oz eq	5 oz eq	5 oz eq	5½ oz eq	6 oz eq	6½ oz eq	6½ oz eq	7 oz eq	7 oz eq	7 oz eq
Milk	2 c	2 c	2 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c
Oils	15 g	17 g	17 g	22 g	24 g	27 g	29 g	31 g	34 g	36 g	44 g	51 g
Discretionary calorie allowance	165	171	171	132	195	267	290	362	410	426	512	648

^aFood intake patterns at 1000, 1200, and 1400 calories are designed to meet the nutritional needs of 2 to 8 year-old children. Patterns from 1600 to 3200 calories are designed to meet the nutritional needs of children 9 and older and adults. If a child 2 to 8 years of age needs more calories and, therefore, is following a pattern at 1600 calories or more, their recommended amount from the milk group can be 2 cups per day. Children 9 and older and adults should not use the 1000, 1200, or 1400 calorie patterns.

^bFood group amounts shown in cups (c) or ounce equivalents (oz eq). Oils are shown in grams (g). Quantity equivalents for each food group are:

- Grains, 1 ounce equivalent is: 1/2 cup cooked rice, pasta, or cooked cereal; 1 ounce dry pasta or rice; 1 slice bread; 1 small muffin (1 oz); 1 cup ready-to-eat cereal flakes.
- Fruits and vegetables, 1 cup equivalent is: 1 cup raw or cooked fruit or vegetable, 1 cup fruit or vegetable juice, 2 cups leafy salad greens.
- Meat and beans, 1 ounce equivalent is: 1 ounce lean meat, poultry, or fish; 1 egg; ¼ cup cooked dry beans or tofu; 1 Tbsp peanut butter; ½ ounce nuts or seeds.
- Milk, 1 cup equivalent is: 1 cup milk or yogurt, 1½ ounces natural cheese such as Cheddar cheese, or 2 ounces of processed cheese.

Table 7. Calculated Nutrient Content of Each Food Intake Pattern

		Energy Level of Food Intake Pattern											
		1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200
Macronutrients													
Calories	kcal	999	1207	1400	1598	1804	1987	2199	2395	2597	2796	2999	3193
Protein	g	42	54	64	83	87	91	99	105	109	116	117	117
Carbohydrate	g	139	161	192	211	243	271	306	334	369	404	427	453
Total fiber	g	13	18	21	26	29	31	35	37	41	44	46	46
Cholesterol	mg	94	133	168	204	210	230	250	271	274	292	298	303
Total fat	g	33.3	41.8	45.7	51.2	57.9	64.8	70.1	77.0	82.9	87.4	99.4	110.3
Sat. fat	g	9.1	11.5	12.6	13.4	15.4	17.3	18.6	20.6	22.0	22.9	25.9	28.7
Mono. fat	g	12.1	15.2	16.7	18.6	21.0	23.5	25.5	28.0	30.0	31.6	35.9	39.8
Poly. fat	g	10.2	12.4	13.2	15.8	17.6	19.6	21.2	23.0	25.1	26.6	30.8	34.4
Linoleic acid	g	9.3	11.2	12.0	14.3	15.9	17.7	19.2	20.9	22.8	24.1	27.9	31.3
α -Linolenic acid	g	0.9	1.1	1.1	1.4	1.6	1.7	1.9	2.0	2.2	2.3	2.7	3.0
Vitamins													
Vitamin A	μ g RAE	455	614	663	855	1011	1052	1086	1126	1238	1280	1317	1347
Vitamin E	mg AT	4.5	5.7	6.1	7.6	8.6	9.5	10.1	10.7	11.6	12.3	13.8	15.0
Vitamin C	mg	73	83	109	117	130	155	163	163	170	196	203	203
Thiamin	mg	1.0	1.2	1.5	1.7	1.9	2.0	2.3	2.4	2.6	2.9	2.9	2.9
Riboflavin	mg	1.5	1.8	2.0	2.5	2.7	2.8	2.9	3.1	3.2	3.4	3.5	3.5
Niacin	mg	9.7	13.3	16.6	18.9	20.8	21.9	25.1	27.3	29.4	31.9	32.8	32.8
Vitamin B ₆	mg	1.1	1.5	1.7	2.1	2.3	2.4	2.8	2.9	3.1	3.4	3.5	4.0
Folate	DFE	306	403	486	561	668	695	765	822	904	984	998	998
Vitamin B ₁₂	μ g	4.3	5.1	5.9	7.9	8.0	8.3	8.8	9.2	9.4	9.9	9.9	9.9
Minerals													
Calcium	mg	782	843	888	1238	1302	1316	1357	1388	1439	1481	1495	1497
Phosphorus	mg	905	1072	1212	1612	1691	1740	1870	1961	2063	2171	2205	2206
Magnesium	mg	180	225	263	335	363	380	418	440	474	508	523	523
Iron	mg	7.6	10.4	12.7	14.9	17.0	17.5	19.7	21.5	23.7	25.8	26.2	26.3
Zinc	mg	6.6	8.5	10.2	13.1	13.7	14.3	15.6	16.7	17.6	18.8	19.0	19.0
Copper	mg	0.7	0.9	1.1	1.3	1.4	1.5	1.7	1.8	2.0	2.1	2.2	2.3
Sodium	mg	869	1119	1334	1526	1721	1779	1962	2136	2296	2467	2514	2531
Potassium	mg	1988	2386	2750	3514	3784	4044	4416	4523	4817	5136	5371	5372

and current consumption levels have been described elsewhere.^{18,24} These comparisons demonstrate that to meet recommendations, fruit group consumption would need to at least double for adults, milk group consumption would need to double for adult women and increase by more than 50% for adult men, and vegetable group consumption would need to increase by about 50%. Decreases from current consumption of solid fats and added sugars of 50% or more would also be needed for adults to meet recommendations. In addition to these recommended changes, changes in the types of foods selected from the Grain and Vegetable groups would be needed to meet recommendations. These changes are illustrated in Figures 2 and 3, using data for adult females 31 to 50 years of age as an example. Figure 2 shows that the proportion of whole grains consumed would need to increase from about 13% to at least 50% of all grains eaten. Figure 3 shows that the proportion of vegetables eaten from the dark-green, orange, and dry

beans subgroups would need to increase from about 22% to about 45% of all vegetables eaten.

Energy Levels

For most adults, the reference weight used in the EER calculations represents a weight that is less than their actual weight. Use of average weights in the calculations would have increased estimated energy requirements, because higher weights in the EER equations result in higher EERs. Average weights for adults are above the healthy range in the United States; their use for determining food pattern energy levels, then, could have promoted consumption of food energy at levels that would increase weight or maintain weight above the healthy range. The use of reference heights and weights was considered to be the more appropriate choice, since they would result in energy intake

Table 8. Comparison of Nutrient Content of Each Food Intake Pattern to Nutritional Goals for That Pattern

Age/gender group for comparison		Energy Level of Food Intake Pattern																
		1000	1200	1400	1600	1600	1800	1800	1800	2000	2000	2200	2200	2400	2600	2800	3000	3200
		Child 1-3	M/F 4-8	M/F 4-8	M/F 9-13	F 51-70	F 31-50	M/F 9-13	F 14-18	F 19-30	M 51-70	M 31-50	M 14-18	M 19-30	M 19-30	M 14-18	M 19-30	M 14-18
Macronutrients																		
Calories	% goal	100	101	100	100	100	100	100	99	99	100	100	100	100	100	100	100	
Protein	% RDA	324	282	335	243	180	190	257	190	199	163	177	190	187	195	222	209	
Protein	% kcal	17	18	18	21	21	19	19	19	18	18	18	18	17	17	17	16	
Carbohydrate	% RDA	107	124	147	162	162	187	187	187	208	208	235	235	257	284	310	329	
Carbohydrate	% kcal	55	53	55	53	53	54	54	54	55	55	56	56	56	57	58	57	
Total fiber	% AI	94	104	106	114	114	116	116	116	110	110	112	112	109	112	112	109	
Total fat	% kcal	30	31	29	29	29	29	29	29	29	29	29	29	29	29	28	30	
Sat. fat	% kcal	8.2	8.6	8.1	7.5	7.5	7.7	7.7	7.7	7.8	7.8	7.6	7.6	7.7	7.6	7.4	7.8	
Mono. fat	% kcal	10.9	11.4	10.7	10.5	10.5	10.5	10.5	10.5	10.7	10.7	10.4	10.4	10.5	10.4	10.2	10.8	
Poly. fat	% kcal	9.2	9.2	8.5	8.9	8.9	8.8	8.8	8.8	8.9	8.9	8.7	8.7	8.7	8.7	8.6	9.2	
Linoleic acid	% AI	132	112	120	119	130	133	133	145	147	126	113	120	123	134	151	164	
Linoleic acid	% kcal	8.3	8.4	7.7	8.0	8.0	7.9	7.9	7.9	8.0	8.0	7.9	7.9	7.8	7.9	7.8	8.4	
α-Linolenic acid	% AI	127	121	127	114	124	142	130	142	158	108	117	117	126	138	145	168	
α-Linolenic acid	% kcal	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	
Cholesterol	% DV	31	44	56	68	68	70	70	70	77	77	83	83	90	91	97	99	
Vitamins																		
Vitamin A	% RDA	152	154	166	143	122	144	168	144	150	117	121	121	125	138	142	146	
Vitamin E	% RDA	75	81	88	69	50	58	79	58	63	63	67	67	71	77	82	92	
Vitamin C	% RDA	488	333	435	260	156	173	289	200	207	173	181	217	181	189	261	226	
Thiamin	% RDA	194	206	248	193	158	176	216	194	184	169	189	189	203	220	238	244	
Riboflavin	% RDA	305	292	328	282	231	245	300	270	252	213	227	227	238	249	263	266	
Niacin	% RDA	161	166	208	157	135	149	173	149	157	137	157	157	171	184	199	205	
Vitamin B ₆	% RDA	222	242	292	209	139	175	228	190	186	143	213	213	224	242	261	273	
Folate	% RDA	204	201	243	187	140	167	223	167	174	174	191	191	206	226	246	250	
Vitamin B ₁₂	% RDA	482	426	491	437	328	332	443	332	345	345	365	365	385	392	412	412	
Minerals																		
Calcium	% AI	156	105	111	95	103	130	100	100	132	110	136	104	139	144	114	150	
Phosphorus	% RDA	197	214	242	129	230	242	135	135	249	249	267	150	280	295	174	315	
Magnesium	% RDA	225	173	202	140	105	113	151	101	122	90	100	102	110	119	124	131	
Iron	% RDA	109	104	127	186	186	94	212	113	97	219	246	179	269	297	234	328	
Zinc	% RDA	219	170	204	164	164	171	171	152	179	130	142	142	152	160	171	173	
Copper	% RDA	195	200	240	181	141	158	203	160	168	168	191	194	202	221	241	250	
Sodium	% UL	58	59	70	69	66	75	78	75	77	77	85	85	93	100	107	109	
Potassium	% AI	66	63	72	78	75	81	84	81	86	86	94	94	96	102	109	114	

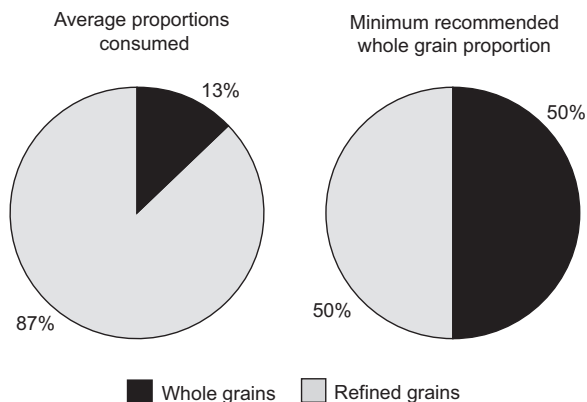


Figure 2. Proportions of Whole and Refined Grains Recommended in Comparison to Proportions Consumed, on Average, by Females 31 to 50 Years of Age, Based on Intake Data from NHANES 2001–2002

recommendations appropriate for achieving or maintaining a healthy body weight.

In addition, the food intake patterns used as the target patterns for comparison to nutrient adequacy goals (Table 3) were those designed for sedentary individuals in each age/gender group. This determination was made so that the patterns would meet nutrient goals within the energy needs of sedentary individuals of a given age and gender. The alternative would be to plan food intake patterns that met nutrient needs only when consuming the higher energy levels needed by a physically active person. Given the sedentary lifestyles of many Americans, it was considered preferable not to assume any specific level of physical activity and not to suggest energy intake levels that might encourage overconsumption of calories by those with lower energy needs. The majority of comments received in response to the Federal Register notice on the food intake patterns were in agreement with the proposal that the energy levels for the patterns should be set to meet nutrient needs within the calorie recommendations for a sedentary, reference-sized individual.¹⁴

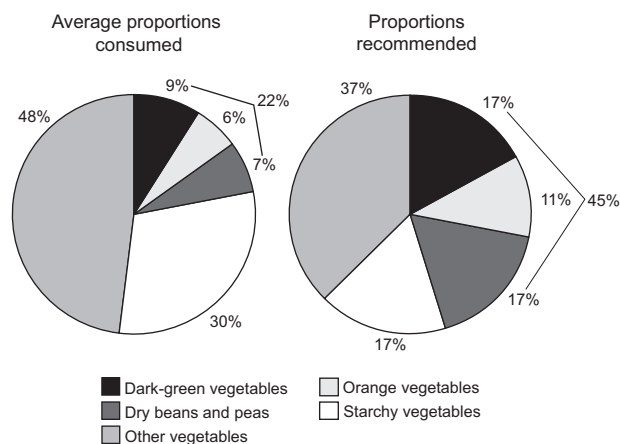
Therefore, these patterns were designed according to a strict criterion of meeting all nutrient recommendations within a relatively low energy “budget.” This was considered to be a conservative approach that would ensure nutrient adequacy not only for individuals with higher energy needs, but also for those with lower energy needs due to their smaller size and/or lack of physical activity.

Nutrients for Which Goals Were Not Met

Intake goals were not met for vitamin E in all food patterns except at the highest energy level, for sodium in patterns at higher energy levels, and for potassium in patterns at lower energy levels (see Table 8). In the 2000 IOM report,⁹ intake standards for vitamin E increased substantially over the 1989 RDAs.²⁵ Typical intakes of vitamin E, as measured in food consumption surveys, are far less than these new intake standards. Mean usual intakes for adult females are

6.3 mg alpha tocopherol (AT), and for adult males, 8.2 mg AT.²⁶ Meeting the new RDA of 15 mg for adults,⁹ especially at lower energy intakes, would have required substantial changes from typical food intake patterns and would also require the regular intake of foods not commonly consumed. We did not consider this change to be consistent with the guiding principle for the food guidance system of being realistic and practical. Although they did not reach the RDA, vitamin E levels in the revised food intake patterns are higher than current consumption, with 7.6 to 9.5 mg of vitamin E in patterns targeted for adult females who are sedentary (1600, 1800, and 2000 calories) and 9.5 to 10.7 mg in those for adult males who are sedentary (2000, 2200, and 2400 calories). The vitamin E content of all intake patterns is shown in Table 7.

The major sources of vitamin E in American diets are fats and oils, which account for over 70% of all vitamin E in the food supply.²⁶ Sunflower and safflower oils are especially rich in vitamin E, but the majority of vitamin E from fats and oils in American diets comes from soybean oil, which is much more widely consumed. The proposed daily food intake patterns include higher levels of dark-green vegetables, dry beans, and oils and soft margarines (replacing some solid fats) than the original Pyramid. Specifying the use of nuts and seeds to meet the vitamin E RDA was not considered to be feasible, since they contribute only about 5% of the total vitamin E in the American food supply.²⁷ In addition, peanuts and peanut butter, which together represent about 80% of all nut consumption,¹⁶ are not especially rich sources of vitamin E in comparison to other nuts. Foods that are good sources of vitamin E were listed as an appendix to the Dietary Guidelines, and con-



*Examples of items in each vegetable subgroup include:
 Dark-green vegetables: Spinach, broccoli, romaine lettuce, kale, collard greens
 Orange vegetables: Carrots, sweet potatoes, butternut squash
 Dry beans and peas: Kidney beans, pinto beans, lentils, garbanzo beans, split peas, black-eyed peas
 Starchy vegetables: Potatoes, sweet corn, garden peas
 Other vegetables: Tomatoes, lettuce, onions, green beans, cabbage

Figure 3. Proportions of Intake from Each Vegetable Subgroup* Recommended in Comparison to Proportions Consumed, on Average, by Females 31 to 50 Years of Age, Based on Intake Data from NHANES 2001–2002

sumers were encouraged to select some of these foods to increase their vitamin E consumption.¹⁸

The food intake patterns provide less than the UL for sodium at energy levels less than 2600 calories, but more than the UL at higher energy levels. As the DGAC noted, about 75% of sodium consumed comes from food processing, making it challenging for many individuals to substantially reduce intake levels without changes in food manufacturing practices.⁶ In addition, sodium content of diets is closely tied to energy content, making it more difficult to achieve intakes below the UL at higher energy intakes. Lower sodium intakes at higher energy levels can be accomplished when following the food intake patterns by selecting processed food products such as bread with lower sodium levels and foods labeled as low sodium. The Dietary Guidelines also recommend selection of more fresh and less-processed items, less sodium-dense food, and reducing salt in food preparation.¹⁸

The food intake patterns provide less than the AI for potassium of 4700 mg for adults¹² at energy levels less than 2600 calories, but more than the AI at higher energy levels (Table 8). All of the patterns identified for adults and children over the age of 9 include at least 75% of the AI, and all patterns represent substantial increases in potassium compared to typical intakes. For example, mean usual intakes of potassium for adult males are 3141 mg and for adult females 2341 mg per day.²⁶ In comparison, the food intake patterns targeted for adult males contain from 4044 to 5372 mg, and the patterns targeted for adult females contain 3514 to 4044 mg of potassium per day. As with vitamin E, the Dietary Guidelines identify a list of potassium sources that can help consumers to increase their potassium consumption.¹⁸

The marginal amounts of calcium, magnesium, and iron in several food patterns was considered to be acceptable given the imprecise nature of the datasets used. None of the resulting amounts for calcium, magnesium, and iron was below 90% of the standard for any group.

IMPLICATIONS FOR RESEARCH AND PRACTICE

These food intake patterns were designed to illustrate how nutritional recommendations can be translated into a pattern of recommended food choices. Future research is needed to test the usefulness of these food intake patterns to help Americans improve their diets. In addition, researchers can apply the same methods to develop food intake patterns for other population groups, based on their typical intakes and recommendations for their needs. For example, food intake patterns for children 2 to 6 years of age were developed by USDA using the original Food Guide Pyramid patterns as a basis.²⁸ This procedure can again be followed to identify patterns for specific age groups or for those with different nutritional needs, such as pregnant and lactating women.

Educators can use the food intake patterns as the basis for developing programs and materials for their specific audiences. The patterns provide a foundation of food choices that will meet nutritional recommendations. Adapting the way in which the patterns are presented and the examples used will make them useful in many educational settings and with varied audiences. In particular, there is a need for educational programming to help consumers understand and apply the concept of a discretionary calorie allowance when making food choices. Additionally, understanding how these patterns were developed can help educators determine how to apply them in appropriate ways with their clientele. They were designed to provide adequate nutrient intake using a wide variety of food selections in each group. Since these varied selections are based on typical choices, messages can be conveyed about varying food choices within a group and examples provided of how this goal can be accomplished in different situations. For example, consumers may not recognize that recommendations for dark-green vegetables can be met by choosing salads that contain broccoli, romaine lettuce, or raw spinach.

Educators may also help consumers meet recommended intakes for vitamin E and potassium by selecting foods that are rich sources. Using the Dietary Guidelines table of vitamin E sources,¹⁸ for example, one consumer may choose to consume almonds to increase the vitamin E in his or her diet, another may use sunflower or safflower oil, and yet another may select a vitamin-E fortified breakfast cereal. The list of potassium sources in the Dietary Guidelines includes foods from all food groups except grains. Although some of these foods are widely consumed, such as white potatoes and bananas, many, like beet greens, white beans, clams, and prune juice, are not. This approach to meeting needs for vitamins E and potassium allows the flexibility that the food guidance system encourages, so that individuals can choose foods that they prefer. In addition to frequently choosing from these lists of better sources, another way for consumers to increase intake of many nutrients including vitamin E and potassium is to become more active and be able to consume a higher calorie diet.

The food intake patterns form the scientific basis for the MyPyramid Food Guidance System. They can also be used as a starting point for developing targeted teaching materials, specific educational messages, or other educational programs.

All of the figures in this article have also been compiled into an online slideshow. See www.JNEB.org, under supplementary material for this article.

SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.jneb.2006.08.007](https://doi.org/10.1016/j.jneb.2006.08.007).

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