

Food Supply Nutrients and Dietary Guidance, 1970-99

Shirley Gerrior
(703) 305-2563
shirley.gerrior@cnpp.usda.gov

Lisa Bente
(703) 305-2571
lisa.bente@cnpp.usda.gov

The variety and the types of food in the U.S. food supply since 1970 paralleled consumer preferences which evolved over the years due to influences such as increased ethnic diversity, more elderly consumers, and effective Federal Government nutrition policy and dietary guidance. Consumer demand for more healthful foods challenged the food industry to evolve as well. By 1999, the available food supply contained two-fifths more grain products, about one-third more fruit, about one-tenth more vegetables, and one-fourth more legumes, nuts, and soy products per capita than in 1970. The availability of lean red meat and low-fat and skim milks also increased between 1970 and 1999 (fig. 1). Such foods enhanced the health benefits of the food supply. However, despite the high interest in nutrition by Americans in the late 1980s and 1990s, and the increased supply of healthful foods, the availability of caloric sweeteners and fats and oils in the food supply also increased by one-third more per capita from 1970 to 1999 to record high amounts. A large proportion of the increase came from sugars and fats added to foods, such as soft drinks, cakes, cookies and pies, fruit

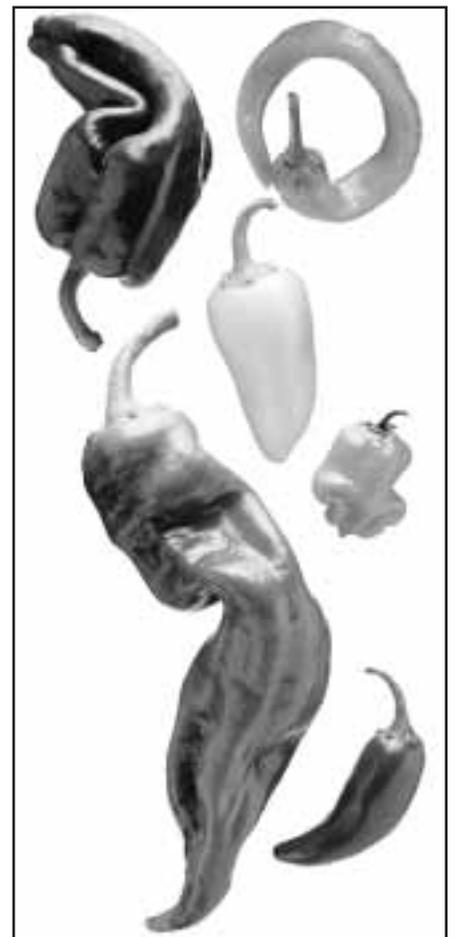
ades, salad dressings, and rich dairy desserts.

USDA Estimates Food Supply and Nutrients

USDA's Economic Research Service (ERS) annually calculates the amount of food available for consumption on a per capita basis in the United States. Food supply data measure national consumption of several hundred basic commodities. For most commodity categories, the available food supply is measured as the sum of annual production, beginning inventories, and imports minus exports, farm and nonfood uses, and end-of-the year inventories. Per capita consumption is calculated by dividing the available food supply by the total U.S. population as of July 1 each year.

Using the ERS per capita consumption data and nutrient composition information from USDA's Agricultural Research Service, USDA's Center for Nutrition Policy and Promotion calculates the nutrient content of the food supply. Per capita consumption for each commodity is multiplied by the amount of food energy and each of 27 nutrients and dietary components in the edible portion of the food. Results for each nutrient from all foods are totaled and converted to amount per capita per day (table 1). Nutrients added to certain commodities commercially through fortification

and enrichment are also included in the nutrient content of the food supply. Since food supply data represent the disappearance of food into



The increase in the types and varieties of chili peppers in the marketplace exemplifies the evolution of the U.S. food supply as it reacts to stimuli that influence consumer preference, such as increased ethnic diversity.

Credit: PhotoDisc.

The authors are nutritionists with the Center for Nutrition Policy and Promotion, USDA.

the marketing system, per capita consumption and nutrient estimates typically overstate the amount of food and nutrients people actually ingest.

Food Supply Nutrients and Dietary Guidance, 1970-99

The 2000 edition of the *Dietary Guidelines for Americans*, the most recent Federal nutrition recommendations, places greater emphasis and gives more explicit recommendations for particular nutrients and foods than previous editions. The guidelines differentiate between total fat, saturated fat, and cholesterol and recommend a diet that is low in saturated fat and cholesterol and is moderate in total fat. Other dietary recommendations include daily varieties of fruits and vegeta-

bles and grains, particularly whole grains, and foods and beverages that limit intake in sugars.

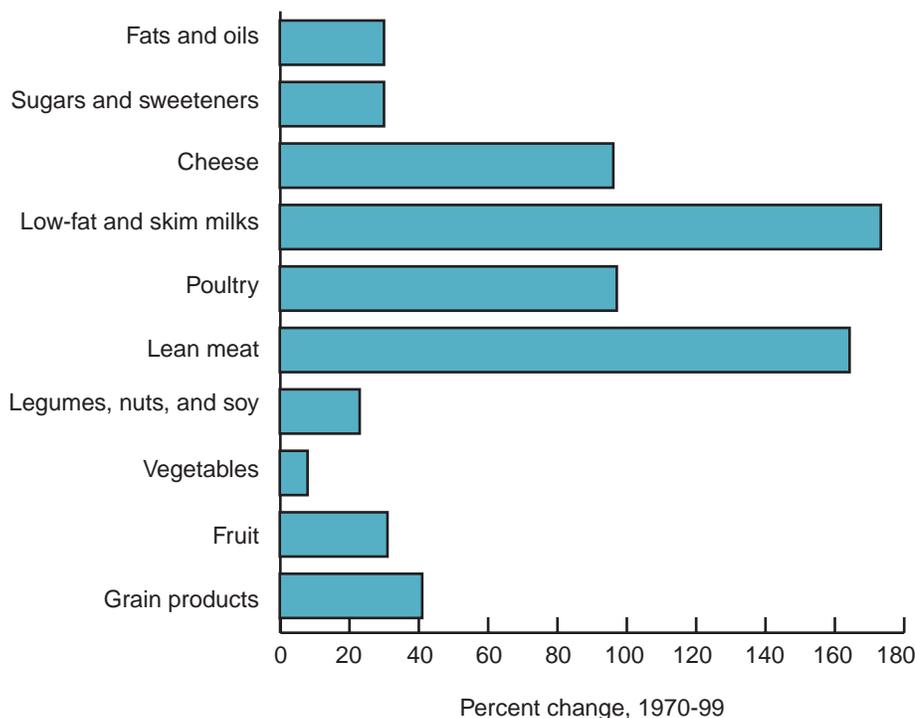
The *Dietary Guidelines for Americans* also recommends that consumers use the Food Guide Pyramid to guide food choices. Using the pyramid helps ensure that an adequate amount and mix of nutrients are consumed each day, as no single food can supply all the nutrients needed for good health. For example, good sources of calcium are milk, cheeses, dark-green leafy vegetables, and foods with added calcium, such as soy-based beverages and fruit juices. Good sources of iron include lean meats, spinach, and enriched grains.

Since 1941, the Recommended Dietary Allowances (RDA) have been recognized as the most authoritative source of information on nutrient levels for healthy people. The 10th edition of the RDAs in

1989 increased public awareness of the impact of nutrition on chronic disease. In light of new research findings and the public's heightened interest in nutrition and health, a new series of nutrient reference values, the Dietary Reference Intakes (DRI), was developed.

The DRIs replace and expand on the RDAs and thus extend the scope and application of previous guidance. The DRIs provide information on the function of each nutrient, the factors that determine each nutrient's requirements (for example, physical activity), and the relationship of each nutrient to risk of disease. Recommended values are provided for each age group—from birth through childhood, sexual maturity, midlife, and old age—as well as for pregnancy and lactation. Whereas the RDAs provided one nutrient value, the DRIs provide four values: the RDA value as well as three new types of reference values: the Estimated Average Requirement, the Adequate Intake, and the Tolerable Upper Intake Level (see box).

Figure 1
Americans Strive To Meet Food Guide Pyramid Recommendations, But Stumble Along the Way by Eating More Cheese, Sweeteners, and Fats



Source: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. *Nutrient Content of the U.S. Food Supply, 1909-99, 2001.*

Food Supply Providing More Carbohydrates, Protein, and Fat

Carbohydrates convert to glucose, the main simple sugar used by the body for energy. Grain products, fruits, and vegetables are important sources of carbohydrate in the food supply. The National Research Council suggests that 55 percent or more of calories should come from carbohydrate. In 1999, the food supply provided 500 grams of carbohydrate per capita per day, up from 389 grams in 1970. Sugars and sweeteners provided 39 percent of carbohydrates in 1999 and fruits and vegetables provided 16 percent; both amounts were similar to 1970 levels. Grains provided 38 percent of carbohydrates in 1999, compared with 35 percent in 1970. To best

Table 1

Per Capita Per Day Amounts of Most Nutrients in the U.S. Food Supply Increased During 1970-99

Nutrient	Unit	1970	1999	Change,
				1970-99 Percent
Food energy	Kcal	3,300.0	3,800.0	15
Carbohydrate	g	389.0	500.0	29
Dietary fiber	g	19.0	24.0	26
Protein	g	96.0	111.0	16
Total fat	g	151.0	164.0	9
Saturated fat	g	53.0	52.0	-2
Monounsaturated fat	g	61.0	70.0	15
Polyunsaturated fat	g	26.0	34.0	31
Cholesterol	mg	460.0	430.0	-7
Vitamin A	RE	1,460.0	1,780.0	22
Carotenes	mcg RE	480.0	800.0	67
Vitamin E	mcg aTE	13.5	17.8	32
Vitamin C	mg	104.0	132.0	27
Thiamin	mg	1.9	3.0	58
Riboflavin	mg	2.3	2.9	26
Niacin	mg	21.0	33.0	57
Vitamin B ₆	mg	1.9	2.5	32
Folate	mcg	278.0	641.0	131
Vitamin B ₁₂	mcg	9.5	8.1	-15
Calcium	mg	930.0	990.0	6
Phosphorus	mg	1,490.0	1,690.0	13
Magnesium	mg	330.0	390.0	18
Iron	mg	15.3	23.6	54
Potassium	mg	3,550.0	3,890.0	10
Zinc	mg	12.3	15.5	26
Selenium	mcg	127.0	178.0	40

Note: Kcal = kilocalories; g = grams; mg = milligrams; mcg = micrograms; RE =retinol equivalent; aTE = alpha-tocopherol equivalent.

Source: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. *Nutrient Content of the U.S. Food Supply, 1909-99, 2001.*

meet dietary recommendations for carbohydrate, consumers need to offset their intake of sugar and sweeteners with more whole grains, vegetables, and fruit.

Along with the increase in total supply of grains, vegetables, and fruits from 1970 to 1999, the amount of dietary fiber available in the food supply increased by 26 percent from 19 grams per capita per day in 1970 to 24 grams per capita per day in 1999. Dietary guidance recommends including fiber-containing foods in the diet daily and emphasizes fiber's importance to good health. Recommendations for specific levels of dietary fiber are currently under review.

Protein provides amino acids to build and maintain body tissues, form enzymes necessary for body reactions, and combine with fatty acids to transport vitamins and minerals in the body. In 1999, the food supply provided 111 grams of protein per capita per day, 16 percent more than the 96 grams provided in 1970. Over the last 30 years, total protein availability in the U.S. food supply has met the nutrient needs of Americans. During that time, the meat, poultry, fish, and meat alternatives group (eggs, nuts, and legumes) was the major contributor to total protein in the food supply, providing about 40 percent of the total.

Fats are the major source of energy storage, help to hold body organs and nerves in position, protect against injury and shock, insulate and maintain body temperature, and act in the transportation and absorption of fat-soluble vitamins. Current dietary guidance recommends a diet low in saturated fat and cholesterol and moderate in total fat. U.S. food supply fat estimates include levels for saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, and cholesterol. Total fat in the food supply increased about 8 percent between 1970 and 1999 from 151 grams to 164 grams per capita per day, providing about 40 percent of the calories for both 1970 and 1999. This level exceeds the current recommendations of 30 percent or less of total calories.

The types of fat used during this period, however, showed a trend toward decreased use of saturated fats and increased use of unsaturated fats. In 1999, saturated fat use dropped slightly and both monounsaturated and polyunsaturated fat use increased, the latter by almost one-third since 1970. The increase in polyunsaturated fats reflects increases in soybean and corn oils and nuts, whereas the increase in monounsaturated fats reflects an increase in olive, sunflower, and canola oils. Despite a drop in cholesterol levels from 460 mg in 1970 to 430 mg in 1999 (associated with a decrease in egg use), the food supply still exceeded the recommendation of 300 milligrams or less per day.

Vitamins and Minerals Found in Every Major Food Group

Dietary guidance recommends choosing a variety of grains, especially whole grains, and a variety of fruits and vegetables daily. Foods made from grains, especially those made from whole grains, and fruits

and vegetables contain vitamins and minerals that are important for good health and may protect against many chronic diseases. Other food groups provide important vitamins and minerals needed by the body for good health. Milk and milk products are the major source of calcium, and the meat, poultry, and fish group is an important contributor of zinc and iron.

Antioxidant vitamins. Many vitamins act as coenzymes or as parts of enzymes responsible for essential chemical reactions necessary for good health. For example, vitamins A, C, and E act as antioxidants that help protect healthy cells from damage by free radicals. Free radicals are substances produced by normal bodily functions, such as breathing or physical activity, and other lifestyle habits, such as smoking, that attack healthy cells, weakening them. Weakened cells are more susceptible to cardiovascular disease and certain types of cancers.

Vitamin A is a fat-soluble antioxidant vitamin essential for vision, growth, bone development, healthy skin, the immune system, and reproduction. The vitamin A found in vegetables and fruits is known as carotenoid. Good sources of carotenoids are found in deep-yellow fruits and vegetables and dark-leafy vegetables and protect the body against many diseases, including some types of cancer. Both vitamin A and carotenoids are converted to retinol in the body, and retinol equivalents (RE) are used to calculate the vitamin A value of foods. The Estimated Average Requirements (EAR) for vitamin A is 500 micrograms per day for adult females (19 years and older) and 625 micrograms per day for adult males (19 years and older). In the U.S. food supply, total vitamin A increased from 1,460 micrograms RE per capita per day in 1970 to 1,780 micrograms RE per capita per day in 1999. This change reflects an

increased use of carrots, broccoli, and cantaloup in 1999.

Vitamin C is a water-soluble antioxidant vitamin that is important in forming collagen, which gives structure to bones, cartilage, muscle, and blood vessels. Vitamin

C also helps to maintain capillaries, bones, and teeth and aids in wound healing and iron absorption. The EAR for vitamin C is 60 milligrams per day for adult females and 75 milligrams per day for adult males. In 1999, the level of vitamin C in the

New Nutrient References Under Development

Dietary Reference Intakes (DRI) represent the new approach adopted by the National Academy of Sciences, Food and Nutrition Board, Institute of Medicine to provide reference estimates of nutrient intakes to assess the adequacy of diets of both individuals and groups. The DRIs replace and expand on the Recommended Dietary Allowances (RDA), the acknowledged nutrient standards for the past 50 years. The DRIs provide Americans with guidelines to optimize health and physical functions. Rather than provide one value, DRIs provide four nutrient values: Recommended Dietary Allowances, the Estimated Average Requirement, the Adequate Intake, and the Tolerable Upper Intake Level.

- *Recommended Dietary Allowance (RDA)*

The average daily intake level that is sufficient to meet the nutrient requirement of 97-98 percent of healthy individuals in a group. RDA is used to set goals for nutrient intakes for individuals.

- *Estimated Average Requirement (EAR)*

A nutrient intake value that is estimated to meet the requirement of half the healthy individuals in a group. EAR is used to assess adequacy of intakes of population groups. For example, EAR would be used to assess the nutrient status of individuals enrolled in a large dietary survey.

- *Adequate Intake (AI)*

A recommended daily intake based on observed or experimentally determined approximations of nutrient intake by a group (or groups) of healthy people. AI is used when an RDA cannot be determined.

- *Tolerable Upper Level (UL)*

The highest level of daily nutrient intake likely to pose no risks of adverse health effects to almost all individuals in the general population.

When estimating food supply nutrients on a per capita basis, the RDAs (or other reference intakes) are not effective as a measurement value. It is unreasonable to assume equitable distribution of nutrients among the population subgroups or among individuals in the population. In the past, the most commonly used approach was to compare the per capita supply of a nutrient with its RDA, with or without a weight adjustment for demographics. This approach was inappropriate. Therefore, this article does not compare food supply per capita nutrients with either the 1989 RDAs or the current DRIs, but instead provides information on a nutrient's availability, its health importance, and food sources. To offer the reader a reference point, the EARs for the nutrients discussed in this article are provided.

food supply was 132 milligrams per person per day, a level nearly 27 percent higher than in 1970. This increase in vitamin C was due to increased use of strawberries, melons, citrus fruits, and kiwi and tropical fruits.

Vitamin E is a fat-soluble antioxidant vitamin that prevents vitamin A and essential fatty acids from breaking down (oxidizing) and protects the body from cell damage that can lead to cancer, heart disease, and cataracts. Vitamin E is found mostly in fats and oils in the food supply. The EAR for vitamin E is 12 milligrams alpha-tocopherol equivalent (aTE) per day for adult males and females. In 1999, the level of vitamin E in the food supply was up about 32 percent, from 13.5 milligrams aTE per capita per day in 1970 to 17.8 milligrams aTE per capita per day in 1999. This change reflects the increased use of soybean, corn, sunflower, olive, and canola oils in the food supply.

B vitamins. Thiamin is a water-soluble vitamin that helps the body release energy from carbohydrates. Riboflavin and niacin, also water-soluble vitamins, help the body release energy from protein, fat, and carbohydrates. The EAR for thiamin is 0.9 milligrams per day for adult males and 1.0 milligram per day for adult females. The EAR for riboflavin is 0.9 milligram per day for adult males and 1.1 milligrams per day for adult females. The EAR for niacin is 12 milligrams per day for adult males and 11 milligrams per day for adult females. Between 1970 and 1999, the food supply levels of thiamin increased from 1.9 to 3.0 milligrams per capita per day, the levels of riboflavin increased from 2.3 to 2.9 milligrams per capita per day, and the levels of niacin increased from 21 to 33 milligrams per capita per day. Enriched-grain products are good sources of these nutrients. The increases in nutrient levels in the past 30 years were

mostly due to fortified breakfast cereals.

As a coenzyme, vitamin B₆ aids in the synthesis and breakdown of amino acids, the synthesis of fatty acid, and the conversion of the amino acid tryptophan to niacin. The EAR for vitamin B₆ is 1.1 milligrams per day for females age 19-50, 1.3 milligrams per day for females age 51 and older, 1.1 milligrams per day for males age 19-50, and 1.4 milligrams per day for males age 51 and older. The level of vitamin B₆ in the food supply rose from 1.9 micrograms per capita per day in 1970 to 2.5 micrograms per capita per day in 1999. Vitamin B₆ is found mainly in fortified ready-to-eat breakfast cereals, meat, poultry, fish, potatoes, and noncitrus fruits.

Folate is a water-soluble B vitamin that reduces the risk of some serious birth defects when consumed before and during pregnancy. Studies are underway to clarify whether folate decreases risk of coronary heart disease, stroke, and certain types of cancer. The EAR for folate is 320 micrograms for both adult females and adult males. Mandated folate fortification of flours and cereals in 1998 increased folate levels in the U.S. food supply during the period 1970 to 1999. In 1999, the level of folate in the food supply was 641 micrograms per capita per day, an increase of more than 130 percent from the 1970 level of 278 per capita per day (fig. 2).

Vitamin B₁₂, another water-soluble B vitamin, aids in the formation of red blood cells and the functioning of the nervous system. The EAR for vitamin B₁₂ is 2.0 micrograms per day for both adult males and adult females. The level of vitamin B₁₂ in the food supply was lower in 1999 at 8.1 micrograms per capita per day than in 1970 at 9.5 micrograms per capita per day. Unlike the other B vitamins, B₁₂ is normally found in animal products. Vitamin B₁₂ is also found in some plant

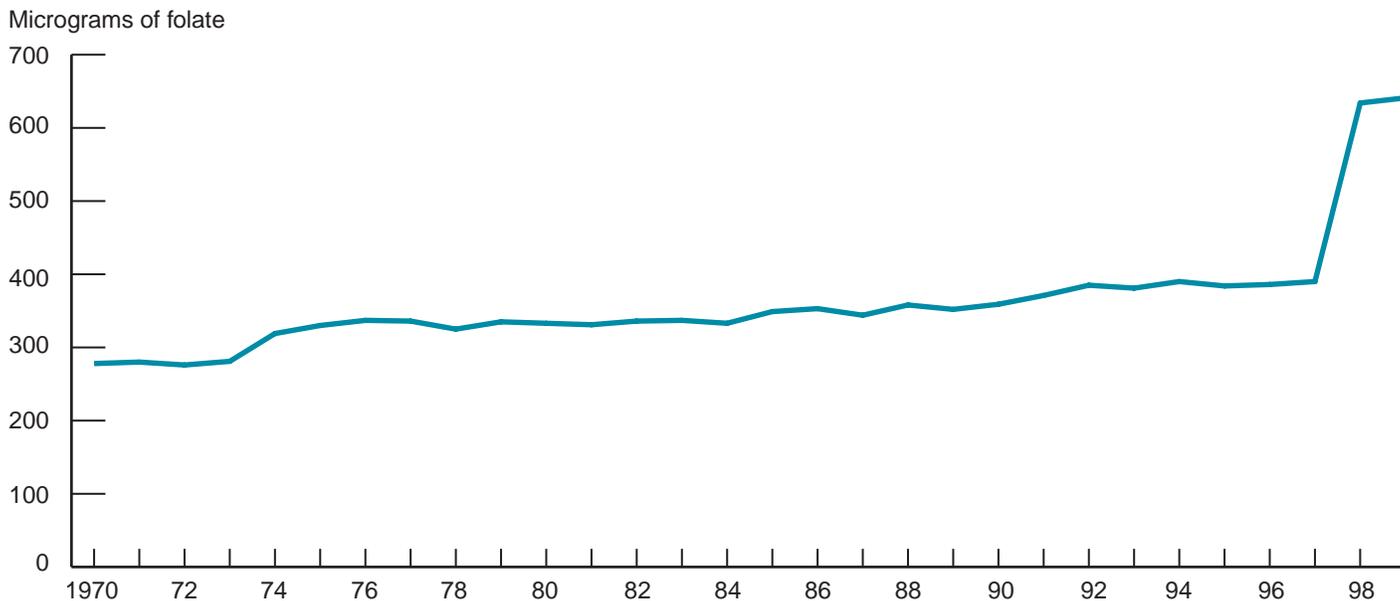
foods, such as fortified breakfast cereals. Although the use of fortified breakfast cereals, poultry, and fish increased in the food supply, the decrease of B₁₂ levels reflects the decreased use of red meat and eggs during the period 1970 to 1999.

Calcium and Iron Critical for a Healthy Body

Calcium is essential for the formation of bones and teeth, and calcium requirements increase significantly during adolescence, early adulthood, pregnancy, and lactation. The Food Guide Pyramid suggests that women who are pregnant or breastfeeding, teenagers, and young adults consume three servings of milk and milk products daily in order to meet minimum calcium needs. A serving is a cup of milk or yogurt, 1 ½ ounces of natural cheese, or 2 ounces of processed cheese. Calcium is important from a public health perspective because inadequate intake of calcium may increase the risk of osteoporosis, a condition in which decreased bone mass weakens bones.

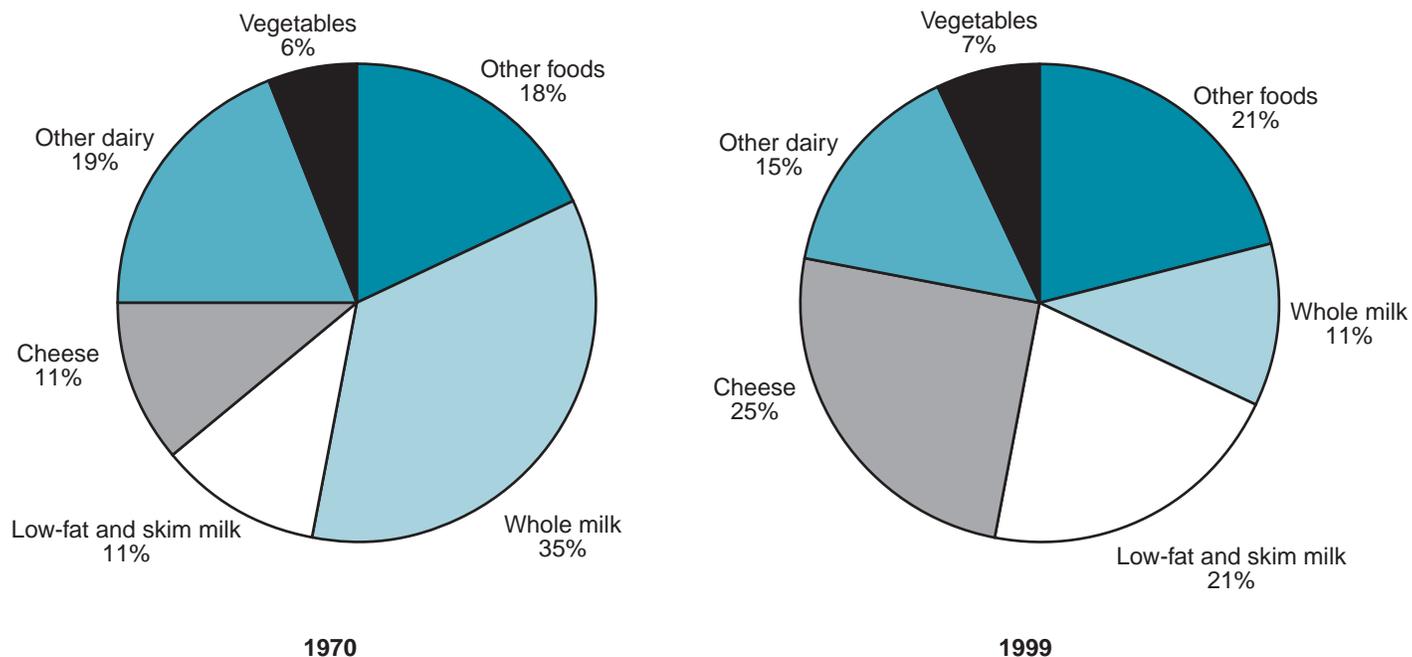
Dairy foods, especially milk and yogurt, are good sources of calcium. Calcium has no established EAR. Calcium levels have generally increased in the food supply, from 930 milligrams in 1970 to 990 milligrams per capita per day in 1999. In 1999, the use of whole milk decreased, but low-fat milk, yogurt, and cheese increased from 1970 amounts (fig. 3). This shift in percent contributions from whole milk to low-fat milk supports dietary guidance that recommends diets low in saturated fats. However, decreased use of fluid milk made it difficult for some individuals to follow pyramid serving recommendations for milk and milk products overall, particularly teenage girls, pregnant women, and breastfeeding mothers, whose calcium needs are higher than other groups.

Figure 2
Per Capita Per Day Levels of Folate Spiked in 1998



Source: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. *Nutrient Content of the U.S. Food Supply, 1909-99, 2001.*

Figure 3
Whole Milk Decreased But Low-Fat and Skim Milk Increased as Sources of Calcium in the U.S. Food Supply in 1970-99



Source: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. *Nutrient Content of the U.S. Food Supply, 1909-99, 2001.*

Iron is found in all body cells. As a component of hemoglobin in the blood and myoglobin in the muscles, iron carries oxygen. Iron-deficiency anemia is the most common nutritional deficiency in the United States; symptoms include decreased exercise tolerance, fatigue, and decreased immunity to illnesses and, particularly in children, abnormal growth and cognitive development. Infants, adolescents, and women of childbearing age have the highest risk of developing anemia. These individuals have greater needs for iron due to rapid growth or excessive blood loss during menstruation, and these needs usually cannot be compensated by dietary intake alone.

The EAR for iron increases with age for children and teens, from 3.0 milligrams per day for children age 1-3 to 7.7 milligrams for males age 14-18 and 7.9 milligrams for females age 14-18. For adults, the EAR for

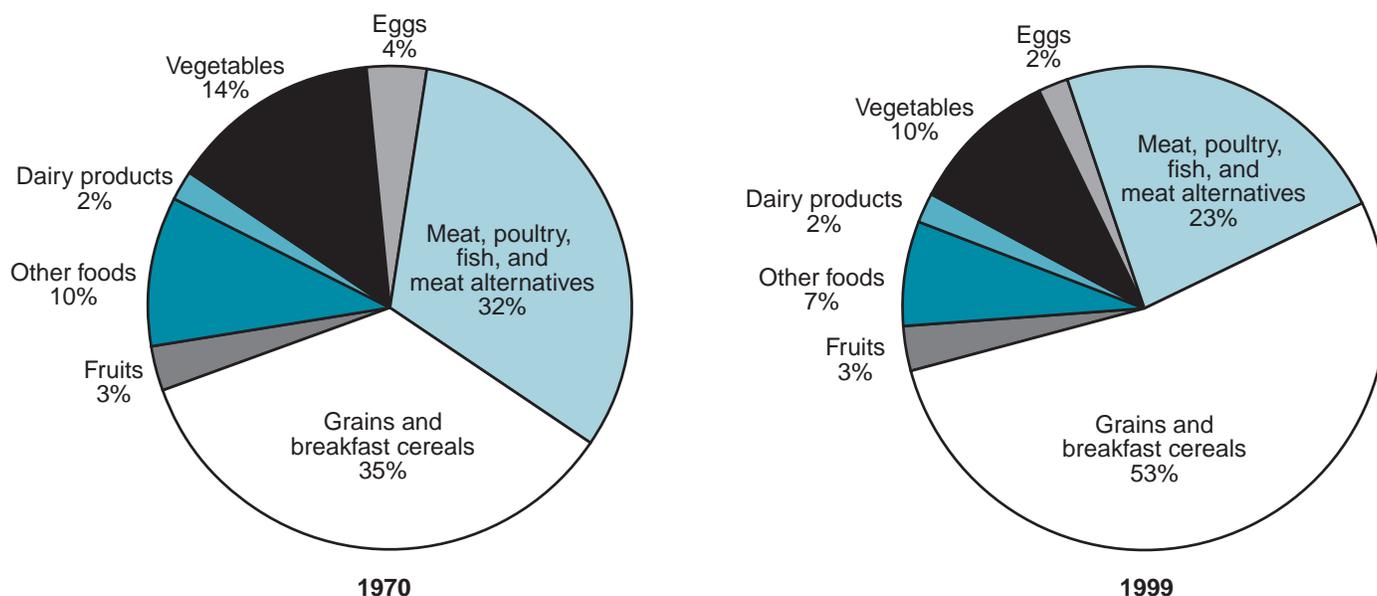
iron is 8.1 milligrams for women age 19-50, 5.5 milligrams for women age 51 and older, and 6 milligrams per day for men age 19 and older. Iron levels in the food supply increased from 15.3 milligrams per person per day in 1970 to 23.6 milligrams per person per day in 1999. Red meat and fortified grains are the primary sources of iron in the food supply. Although use of red meat decreased from 1970 to 1999, the increased use of enriched grains and the fortification of ready-to-eat breakfast cereals more than made up for the decreased iron contributions from meat (fig. 4).

In 1999, the food and nutrients of the U.S. food supply supported dietary guidance for minimum recommended servings of grains, vegetables, and meats and meat alternatives and associated nutrients but fell short of this guidance for whole grains, fruit, and milk and milk products. Also, the industry's

response to consumer demand for more cheese and beverages and foods with added sugar and added fat offset some of the positive changes made in the U.S. food supply over the past 30 years. To better balance their diet and health, Americans need to take advantage of the myriad foods available to them in the U.S. food supply and try less familiar, but nutritious, foods to increase variety. For example, the marketplace has seen an increase in the variety of soy products, such as soy milk drinks, soyburgers and tofu, an increase in the variety of tropical fruits, such as mangoes, golden pineapples, and kiwi, and an increase in the variety and types of peppers, especially orange, red, and chili peppers.

Better placement of healthful foods in schools, grocery stores, and restaurants could encourage more nutritious food choices. Recently, some schools have replaced the soft

Figure 4
Fortified Breakfast Cereals and Grains Supplied More Than One-Third of Iron in the U.S. Food Supply in 1970 and More Than One-Half in 1999



Source: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. *Nutrient Content of the U.S. Food Supply, 1909-99, 2001.*

drinks offered in vending machines with milk and milk-based products. In grocery stores and supermarkets, purchases of more healthful foods might benefit from placement at strategic points throughout the store, such as at the ends of aisles, at eye level, and near fruits and vegetables. Recipe suggestions for healthful menus using these foods would benefit the consumer as well as possibly increase sales of these items. More Americans are eating away from home, and the nutrient value of meals is not keeping pace with the nutritional improvements in home-prepared meals. Some restaurants use menus that feature logos to alert customers of healthful or low-fat menu items; other restaurants respond to customer requests for baked items or salad dressing served on the side. To best serve the nutritional needs of customers, restaurants need to focus more on the nutritional value of the meals and food items offered and less on

large food portions, keeping in mind the importance of taste and appearance.

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The Interactive Food Supply, an on-line version of the U.S. Food Supply, allows Internet access to food supply quantity and nutrient information. The user can quickly calculate quantity and nutrient estimates for 350 food commodities and 26 nutrients for a specific year or range of years, fortification estimates, and Food Guide Pyramid serving estimates.

Available at www.cnpp.usda.gov