Nutrient Content of the U.S. Food Supply, 1909-94: A Summary

This document is a summary of the report, *The Nutrient Content of the U.S. Food Supply, 1909-94,* published by the U.S. Department of Agriculture's Center for Nutrition Policy and Promotion. Included in this summary are methodology revisions made since the last report, updated per capita nutrient estimates for 1909 through 1994, and a summary of food and nutrient trends for selected years. A sampling of figures and a side box from the published report are provided to highlight these trends. For more information on the U.S. food supply series, contact Shirley Gerrior at (202) 606-4839.

Introduction

The U.S. food supply, a historical series measuring the amount of nutrients per capita per day available for consumption, is the only continuous source of food and nutrient availability in the United States with extended data back to 1909. Per capita food supply estimates provide unique and essential information on the amount of food and nutrients available for consumption. They are useful to assess trends in food and nutrient consumption over time, for monitoring the potential of the food supply to meet the nutritional needs of Americans, and for examining relationships between food availability and diet-health risk. Food supply nutrients are closely linked to food and nutrition policy, with prominence in areas related to nutrition monitoring, Federal dietary guidance, nutritional requirements, nutrition education, fortification policy, and food marketing strategies. As a result, the U.S. food supply series is one of the five major components of the National Nutrition Monitoring and Related Research Program (NNMRRP), mandated by the National Nutrition and Related Research Program Act of 1990.

In this update of the nutrient content of the U.S. food supply, per capita estimates are provided for food energy and the energy-yielding nutrients—protein, carbohydrate, and fat—as well as for total fat; saturated, monounsaturated, and polyunsaturated fatty acids; cholesterol; 10 vitamins; and 7 minerals. Because the conceptual basis for measuring foods has remained the same since the inception of the U.S. food supply series, trend comparisons can be made among different years in the series.

Also, the methodologies used to estimate foods and nutrients available for consumption in the United States are similar to those used by the Food and Agriculture Organization of the United Nations for other countries. Both methodologies are based on the concept of food balance sheets, which include data on the supply and utilization of food *(6)*. Thus, these data can be used to compare the U.S. diet with the diet of other countries.

Methodology

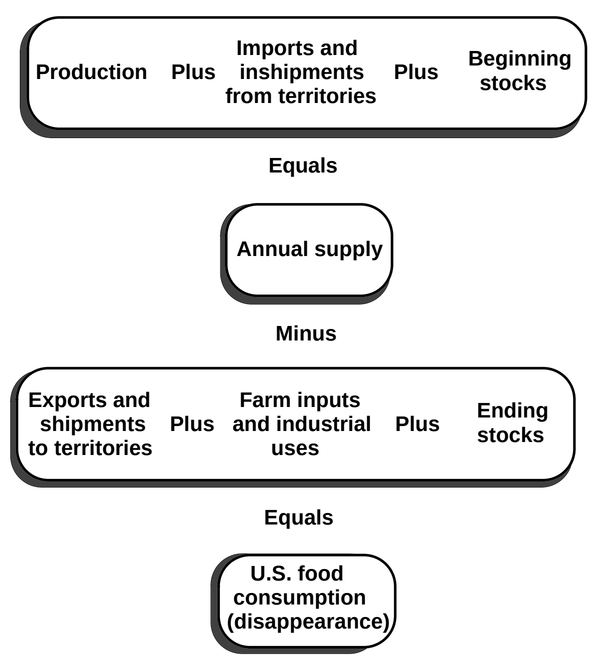
The nutrient content of the food supply is calculated using data on the amount of food available for consumption from USDA's Economic Research Service (ERS) and information on nutrients available in the food supply, from USDA's Agricultural Research Service (ARS). Estimates of per capita consumption for each commodity (in pounds per year) are multiplied by the amount of food energy and each of 24 nutrients in the edible portion of the food. The results from approximately 400 foods are then totaled for each nutrient and presented on a per day basis *(5)*.

Food Use Estimates

ERS annually calculates the amount of food available for consumption on a per capita basis in the United States *(10)*. The U.S. food supply series, which measures national consumption of several hundred basic commodities, is based on records of commodity flows from production to end uses (fig. 1). This involves the development of supply and utilization balance sheets for each major commodity from which foods are produced. Total available supply is the sum of production, beginning inventories, and imports. These

Figure 1. Estimating U.S. Food Consumption

The supply and utilization commodity



Source: Putnam, J.J. and Allshouse, J.E. 1996, Food Consumption, Prices, and Expenditures, 1996. Annual Data, 1970-94. U.S. Department of Agriculture, Economics Research Service. Statistical Bulletin No. 928.

three components are either directly measurable or are estimated by Government agencies using sampling and statistical methods.

The food available for human use reflects what is left from available supply after deducting exports, industrial uses, farm inputs, and end-of-year inventories. Human food use is not directly measured or statistically estimated. Instead it is a residual component after subtracting out other uses from the available total supply. The availability of food for human use represents disappearance of food into the marketing system, and it is often referred to as food disappearance. Food disappearance measures food supplies for consumption through all outlets—at home and away from home. Per capita food use, or consumption, is calculated by dividing the total annual food disappearance by the total U.S. population.

Estimates of consumption (disappearance) are prepared at two levels for most commodities: the basic measurement is at the primary distribution level (primary weight) and the retail-equivalent weight. Some foods, such as eggs and produce, are measured at the farm gate. However, most processed commodities are measured at the processing or manufacturing plant. Once the primary level of distribution has been selected, quantities of all other components in the balance sheet for that commodity are converted to the primary-weight basis, using appropriate conversion factors.

ERS converts food consumption from primary weight to a retail-weight equivalent, using conversion factors that allow for additional processing, trimming, shrinkage, or loss in the distribution system. Subsequent losses that occur after the retail level, such as in preparation and cooking in the home or food-service establishments, are not considered. Therefore, the amount of foods available for consumption exceeds that actually ingested by individuals.

Food Composition Data

The food composition data used to estimate the nutrients available in the food supply were obtained from the Primary Nutrient Data Set (PDS), containing approximately 3,000 foods and their nutrient profiles. The nutrient data base used for food supply determinations was developed by ARS. Food specialists developed nutrient profiles for unique items as necessary.

Nutrients added to foods commercially through fortification and enrichment are also included in the nutrient estimates. Vitamins and minerals added to foods for their functional or flavoring properties or ingested as supplements are not estimated.

Changes in Methodology

Changes in marketing practices and technological advances have occurred since 1970. These changes, along with industry's response to Federal dietary guidance and the consumer demand for healthier food choices, have influenced the U.S. food supply. Revisions were made to a number of food supply methodologies to account for these changes.

Dairy.—Since the beginning of this century, the average butterfat content of whole milk declined from 3.80 percent in 1909 to 3.25 percent in 1994. Demand by the consumer for lower levels of butterfat in milk products, Federal standards on lower minimum levels of fat in milk products, and changes in types of cows bred for milking contributed to this decline. In fact, the higher fat milk of the 1950's is almost entirely gone from the market.

To account for these changes and to be more consistent with ERS per capita consumption estimates for all fluid milk products, the butterfat content of these products has been revised *(7).* Revised butterfat data were applied to per capita consumption estimates for fluid milks (whole, lowfat, and skim milk) to separate into their respective fat and residual components. This resulted in larger quantities of the residual component and smaller quantities of the fat component for these products over the series.

Red Meat.—The red meat industry has altered a number of marketing practices in the past three decades with ramifications for the U.S. food supply series. Specifically, feeding practices, genetic and animal management practices, meat handling, and merchandising practices have been modified to improve production efficiency and to respond to consumer's health concerns about dietary fat and red meat *(8)*. Resultant changes in the quantity and quality of red meat available for consumption in the food supply required adjustments in the nutrient data bases be made beginning with the year 1955. These adjustments compensate for quantity overestimates previously reported for the mid-1950's to the present and reflect up-to-date nutrient information.

Overall, closer trimming of fat and more bone removal have resulted in a lower ratio of available carcass for retailers and consumers. A conversion factor for meat is used to calculate the dressed-meat equivalent of bone-in cuts and boneless retail cuts. In the U.S. food supply series, an assumption is made that a certain percentage of carcass weight (fat, bone, connective tissue, and shrink) is removed or lost before the product reaches the retail level or consumer *(2,9,11).*

***Beef.*—**Conversion factors used to calculate beef quantity and nutrient estimates were revised to account for variations in quality and yield of the product and in marketing practices. These new factors are based on changes in animal husbandry or technology, marketing practices of fat and bone at the packer or retail level, or a combination of these events at a specific period over the series *(9,17)*. Two sets of conversion factors were revised for beef. One accounted for closer fat trim specifications by packers (carcass-to-wholesale) and the other adjusted for the closer trimming of fat and increased removal of bone by retailers (carcass-to-retail). For beef, Yield Grade was a major consideration in the adjustment in animal composition because the lower the Yield Grade, the less fatty the animal carcass *(13)*. Also, the current retail practice of fat trim replaces the 1/2-inch trim of the 1970's and 1980's with a 1/8-inch trim.

***Pork.*—**For pork, conversion factors used for carcass-to-retail calculations were adjusted downward for the series beginning in 1955 to better reflect the changing mix of lean and fat on the carcass and the smaller percentage of carcass available for fat cuts *(2)*. Two factors were revised for pork**—**one for lean cuts and the other for fat cuts. They account for the separation of wholesale pork into lean and fat cuts during processing and exclude fat cuts from the total retail carcass weight. The revised factor for fat cuts was based on bellies (primarily bacon) percentage yield from bone-in trimmed wholesale cuts *(4)*. Since the late 1960's this yield has decreased and in 1994 was about one-half that of 1965.

***Veal and Lamb.*—**Although veal and lamb have been important contributors to the total consumption of red meat by Americans over time, the consumption of these meats has been steadily declining over the last three decades, with per capita consumption in 1994 at less than 1 pound each. Fewer changes have occurred in the production and marketing of veal and lamb than of beef and pork, but since the early 1990's, many retailers have been trimming lamb products to a 1/8-inch trim. Also, carcass-to-retail conversion factors used for veal from the early 1960's have been changed and are consistent with those used by ERS. These factors are more reflective of the cattle industry and more representative of the nutrient contributions from veal to the food supply. The conversion factors for lamb were not changed; however, the PDS values used in the lamb nutrient data base are reflective of leaner cuts for more recent years.

Game Data—(See Box)

Fish.—Fish production data include fish caught by commercial fishing vessels, noncommercial sources, and aquaculture *(12,16)*. Canned and cured fish are processed from fish caught and are counted separately from those that are caught for fresh and frozen distribution**.** Beginning in 1980, aquaculture began to play a major role in fish production. Presently, aquaculture provides a significant portion of the fish in the U.S. fish supply, particularly salmon, trout, and catfish species. Estimates for some fish in the food supply are reported as broad categories that include a number of species based on lipid content. The categories include: Fatty fish**—**those

Update of Game Consumption

Food supply game consumption estimates have been updated by CNPP based on State game harvest data. Prior to 1963, ERS provided these data and per capita estimates were retained since 1963. To improve the quality of food supply game data, CNPP used individual State data because each State collects harvest game statistics. Although these data may be limited by differences in collection methods for the same species from State-to-State or across different States, they give a more representative profile of the types of game consumed and the nutrient contributions from these game than previous estimates.

Based on these data, game was divided into one of five categories: Deer, big game (excluding deer), small game, land birds, and water fowl. Carcass weight of each species was determined using data provided by the States, and a weighted average was used for each category. In cases where States did not provide carcass weight data, weights were based on information from the Wildlife Management Institute in Washington, DC *(1)*. Harvest data were totaled for a particular year and adjusted based on carcass weight. These estimates were divided by the Census population data and per capita and nutrient estimates were calculated for each of the game categories from 1966 to 1994. Game data prior to 1966 were assumed to be deer and per capita data were adjusted accordingly.

The quantity of game in the food supply in 1994 was 3.5 pounds per capita per year, compared with 4.5 pounds in 1909. For both years, deer was the primary contributor, providing over two-thirds of the quantity in 1994**—**with a larger per capita consumption than veal or lamb.

containing more than 5-percent fat; lean fish—those containing 5 percent or less of fat; and ground fish *(3)*. Previously, no nutrient composite had been used for ground fish. For this update, a nutrient composite has been defined and calculated for ground fish using the same procedures as used for the fatty and lean fish composites.

Soy Flour.—Per capita values for soy flour (flour and grits) have not been determined by ERS since 1980. To avoid data gaps in the series, values prior to 1980 have been carried forward by CNPP. Since 1980, the use of soy flour by the food industry has increased as has its availability in natural food stores and some supermarkets. To account for this increase and to be more reflective of nutrient contributions from soy flour, per capita estimates were revised based on product shipment data from the *Census of Manufacturers*, an industrial series done every 5 years by the Bureau of the Census *(15)*.

Fresh Fruits and Vegetables.—In the early 1980's, USDA stopped reporting per capita values for many commercially produced fresh and processed fruits and vegetables because national production data were no longer available. However, many of these fruits and vegetables are important sources of several nutrients. To continue monitoring as many of the fresh vegetable and fruit sectors as possible, ERS commodity specialists estimated national production for a number of specific vegetables (cucumbers, fresh green beans, garlic, bell peppers, and others) and fruits (pineapple, kiwi, mangoes, and others) using data from those States that continued to collect production information *(10)*.

Canned Fruits and Juices.—Beginning with 1991 per capita estimates, ERS no longer distinguished between the final product forms of juices, such as frozen or canned orange and grapefruit juices. Since that time, per capita juice has been reported as mere juice, gallons per capita. Procedures, using ERS supply data, have been developed to distinguish between the frozen and canned forms of juices in the food supply to ensure consistency of data and to reflect nutrient contributions from these commodities *(14)*.

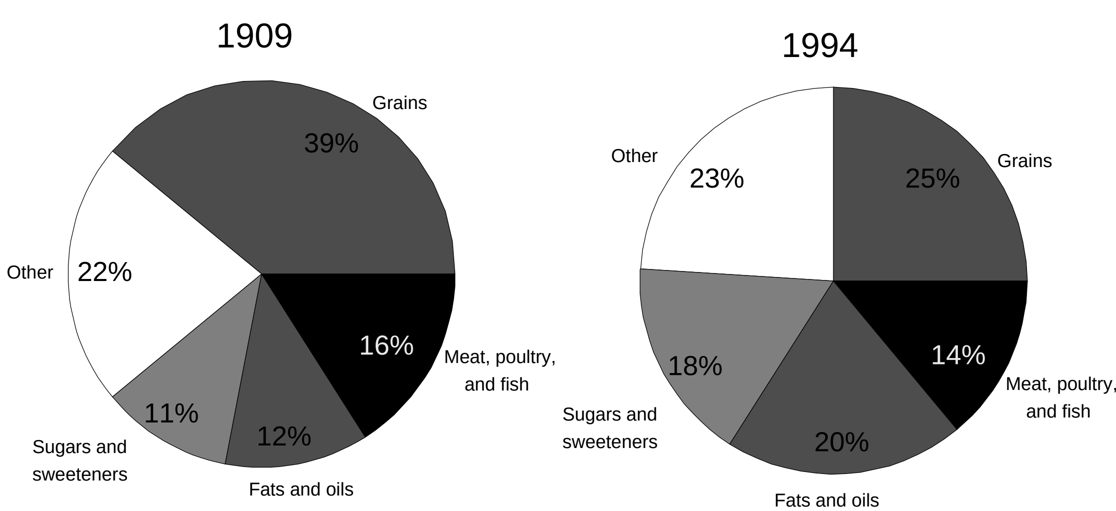
Trends in Availability of Foods, Food Energy, and Macronutrients (see table)

Food Energy

The level of food energy in the food supply increased from 3,500 kilocalories in 1909 to 3,800 kilocalories per capita per day in 1994. The lowest food energy calorie level, 3,000 kilocalories, occurred in the late 1950's. The proportion of kilocalories from carbohydrate decreased from 57 percent in 1909 to 52 percent in 1994. The contribution from fat has increased from 32 to 38 percent, and protein levels in the food supply have consistently accounted for about 12 percent of total kilocalories or food energy from 1909 to 1994.

Although various food groups have fluctuated in their contribution to the food energy in the food supply, grain products have clearly provided a major share since 1909. However, during this time, sugars and sweeteners and fats and oils appreciably increased their food energy contributions to

Figure 2. Sources of Food Energy in the U.S. Food Supply



Nutrients Per Capita Per Day for Selected Years

Nutrient	1909	1945/46	1965	1970	1980	1994
Food energy (kcal)	3,500	3,300/3,300	3,100	3,300	3,300	3,800
Carbohydrate (gm)	500	424/417	373	386	406	491
Protein (gm)	101	102/101	91	95	96	110
Total fat (gm)	123	137/141	142	154	153	159
Saturated fat (gm)	57	60/62	54	54	52	52
Monounsaturated fat (gm)	49	55/57	57	63	60	65
Polyunsaturated fat (gm)	13	17/17	21	236	30	31
Cholesterol (mg)	454	530/520	460	470	430	410
Vitamin A (μg)	1,240	1,530/1,470	1,250	1,500	1,520	1,520
Carotene (μg)	440	580/580	390	510	600	660
Vitamin E (mg α-TE)	7.3	10.6/10.6	12.4	13.7	14.6	16.9
Vitamin C (mg)	98	121/119	89	107	112	124
Thiamin (mg)	1.7	2.1/2.2	1.8	2.0	2.3	2.7
Riboflavin (mg)	1.9	2.6/2.6	2.2	2.3	2.4	2.6
Niacin (mg)	19	22/22	22	22	25	29
Vitamin B_6 (mg)	2.3	2.0/2.1	2.0	2.0	2.0	2.3
Folate (μg)	322	345/333	266	279	292	331
Vitamin B_{12} (μg)	8.5	9.2/9.0	8.7	9.5	8.4	8.1
Calcium (mg)	760	1,070/1,080	900	890	870	960
Phosphorus (mg)	1,500	1,650/1,670	1,420	1,460	1,460	1,680
Magnesium (mg)	390	400/380	320	320	320	380
Iron (mg)	14.2	16.0/16.0	14.0	15.4	16.0	21.2
Zinc (mg)	13.7	12.9/12.8	11.5	12.2	11.8	13.2
Copper (mg)	2.1	1.9/1.9	1.5	1.6	1.7	1.9
Potassium (mg)	4,070	4,240/4,220	3,400	3,510	3,440	3,780

the food supply. Contributions from sugars and sweeteners increased from 11 to 18 percent, while those from fats and oils increased from 12 to 20 percent. As a result, food energy contributions from grain products decreased from 39 to 25 percent between 1909 and 1994. Despite this decrease, grain products continued to be the major contributor of food energy in the food supply in 1994. Fats and oils ranked second as a source of food energy in 1994 (fig. 2).

Carbohydrate

The level of carbohydrate steadily decreased from 500 grams per capita per day in 1909 to 373 grams per capita per day between 1963 and 1965. The drop in use of grain products and white potatoes was chiefly responsible for the decline. Since 1965, carbohydrate levels have increased. Grain products and sugars and sweeteners have been the major sources of carbohydrate throughout the years. In 1909, grain products provided about 57 percent of the carbohydrate in the food supply, followed by sugars and sweeteners with 21 percent.

During the mid-1960's when grain consumption was low, sugars and sweeteners provided more carbohydrate than any other food group at 38 percent. By 1994, grains increased their carbohydrate contribution to 41 percent, while sugars and sweeteners remained at a level similar to that of the mid-1960's. These trends are consistent with dietary guidance to choose a diet with plenty of grain products and high in complex carbohydrates.

Protein

The level of protein in the food supply was higher in 1994 than in 1909, 110 grams compared with 101 grams per capita per day. The protein level was lowest, 86 grams per capita per day, during the mid-1930's. Just after World War II, protein in the food supply spiked to amounts similar to those in 1909. However, by 1950, levels declined and remained low throughout the 1960's. Since 1970, they have primarily increased, peaking in 1994.

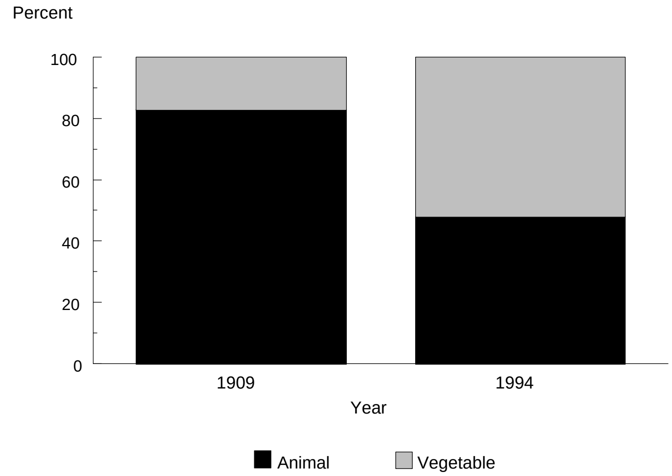
Considerable change has occurred in protein sources since 1909. In 1994, animal sources contributed about 62 percent of the total protein, whereas in the beginning of the century, animal and plant sources contributed about equal shares. Since the 1940's, the meat, poultry, and fish group has been the primary source of protein in the food supply. In 1994, this group contributed 39 percent of the protein in the food supply.

Historically, dairy products have supplied a significant percentage of protein in the U.S. food supply. The largest contribution, 23 percent, from this group occurred during the 1950's. Since then, contributions from dairy products have declined due to a decrease in the use of fluid milks and the changing trends for individual milk and milk products. Whole milk remained a relatively stable source of protein from 1909 through the 1960's; then its use began to decline. The use of lowfat milk, yogurt, and hard cheese began to increase and continues to do so in the 1990's.

Total Fat and Fatty Acids

Fat.—Estimates of the fat content of the food supply include visible fats, such as lard, margarine, and oils, and invisible fats found in dairy foods, meats, and baked goods. Total fats and oils have increased from 41 pounds in 1909 to 70 pounds per capita in 1994. However, a shift has occurred from animal to vegetable sources (fig. 3), with a decline in the use of butter and lard and an increase in use of vegetable oils. Total fat contributions from red meat have generally declined throughout the series. In the early years, red meat contributed about one-third of the fat, but by 1994, its contribution decreased by almost one-half. However, contributions from salad oils were ten times higher in 1994 than in 1909.

Figure 3. Types of Fat in the U.S. Food Supply



The increase in total fats and oils, especially in the past 25 years, probably results from expanded use of fried foods by the fastfood industry *(10)*. In the 1990's, many fastfood chains began to change from solid and partially hydrogenated vegetable frying fats to liquid vegetable fats and oils. Use of these foods helps to reduce the intake of dietary fats higher in saturated fat and cholesterol. These changes are consistent with dietary guidance: choose a diet low in total fat, saturated fat, and cholesterol.

Fatty acids.—Per capita levels saturated fatty acids decreased from 57 grams in 1909 to 52 grams in 1994. Levels for monounsaturated and polyunsaturated fatty acids increased from 49 to 65 grams per capita per day and 13 to 31 grams per capita per day, respectively, from 1909 to 1994. The fats and oils and meat, poultry, and fish groups have been the major contributors of fatty acids over the series. In 1994, the fats and oils group was the major source of the three fatty acids in the food supply. This food group provided 41 percent of the saturated fat, 56 percent of the monounsaturated fat, and 69 percent of the polyunsaturated fat to the food supply.

From 1909 to 1994, saturated fatty acids contributions from the meat, poultry, and fish group steadily declined by 10 percent. This coincided with increased monounsaturated fat contributions from the fats and oils group, reflecting the greater use of vegetable fats. Also, the share of polyunsaturated fatty acids provided by the fats and oils group steadily increased, more than doubling the level of 1909 in 1994, while polyunsaturated fatty acid contributions from the meat, poultry, and fish group decreased by more than one-half during this period.

Cholesterol

Dietary cholesterol decreased 10 percent between 1909 and 1994, from 454 to 410 mg per capita per day. The peak level of 530 mg occurred at the end of World War II when use of eggs and dairy products was high. Eggs and the meat, poultry, and fish group provided similar shares of cholesterol in 1909, 36 and 34 percent, respectively. However, eggs ranked as the primary source of cholesterol, especially during the 1950's when its share peaked at 44 percent. Since then, the share of cholesterol from eggs has generally declined with a low point of 34 percent in 1994. The cholesterol share from the meat, poultry, and fish group continued to increase from the 1970's and in 1994 was 44 percent. Cholesterol contributions from dairy products has remained relatively stable at 16 percent from 1909 to 1994; however, shifts have occurred in product use within the dairy group.

Trends in Availability of Vitamins (see table)

Food supply vitamin data include per capita nutrient estimates for vitamins A, C, and E, thiamin, riboflavin, niacin, vitamins B_6 and B_{12}, and folate. In general, per capita levels of these nutrients exceed the RDA for a healthful diet by a generous margin.

Vitamin A, Carotenes.—Vitamin A is essential for vision, growth, bone development, maintenance of of epithelial tissue, the integrity of the immune system, and reproduction. In the early part of this century, the meat, fish, and poultry group was the leading source of vitamin A, with organ meats accounting for most of the vitamin A from this group. In the early 1970's, with the decline in human use of organ meats and the increase in contribution of carotenes from dark-green and deep-yellow vegetables, the vegetable group became the leading source of vitamin A. The increase in carotenes is attributed to both the development of carotene-rich varieties of deep-yellow vegetables in the mid-1960's and the increased availability of broccoli and green peppers. Fortification of margarine with vitamin A since 1944-45 has also contributed to higher levels of vitamin A.

Vitamin E.— Vitamin E acts as an antioxidant at the cellular level to prevent the peroxidation of polyunsaturated fatty acids. The level of vitamin E increased from 1909 to 1994, with the peak level, 17.6 mg alpha TE per capita per day, occurring in 1993. Higher levels reflect the increased use of vegetable oils for salads and cooking, and to a lesser extent, the use of margarine and shortening. The fats and oils are by far the largest contributor to vitamin E in the food supply, contributing 68 percent in 1994.

Vitamin C.—Vitamin C has a number of functions, but it is best known as the antiscorbutic vitamin. It is also important in immune response, wound healing, and allergic reactions. The vitamin C level was highest—at 124 mg per capita per day—in 1994. In the mid-1940's, vitamin C levels were also high at 120 mg, due to the popularity of homegrown vegetables during World War II. Levels declined from the mid-1940's until the mid-1960's with the lowest level, 87 mg per capita per day, in 1964. This low level resulted from decreases in the overall use of fruits and vegetables, especially citrus fruits. Vitamin C availability has increased since the mid-1960's because of the better quality, increased variety, and year-round availability of many fresh fruits and vegetables. The fruit and vegetable share of vitamin C in the food supply has ranged from 89 to 94 percent over the years.

Thiamin, Riboflavin, Niacin.—These vitamins are components of essential enzyme systems of energy metabolism. Levels of each of these vitamins were considerably higher in 1994 than in 1909 primarily because of the enrichment of flour beginning in the early 1940's. Between 1909 and 1994, thiamin increased from 1.7 to 2.7 mg; riboflavin from 1.9 to 2.6 mg; and niacin from 19 to 29 mg per capita per day. These higher levels virtually assure that these vitamins pose no public health problems to most Americans. Although the enrichment of grain products is primarily responsible for the higher levels of these three vitamins, grain products have been the leading source only since the early 1940's. Before enrichment, the meat, poultry, and fish group was the primary source for thiamin, and grains ranked second. Dairy products has been the leading source of riboflavin over time. Riboflavin levels peaked in the mid-1940's at 2.1 mg per capita per day, reflecting the increased use of dairy products during World War II and the introduction of enriched flour. In the 1990's, riboflavin levels approached those in the war years due to the increased percentage of flour, enriched. Prior to 1990, the meat, poultry, and fish group, was the largest source of niacin followed by the grain and vegetable groups. In 1994, grain products contributed the largest share of niacin in the food supply, followed by the meat, poultry, and fish group and the vegetable group.

Vitamin B_6.—As a coenzyme, vitamin B_6 aids in the synthesis and breakdown of amino acids, fatty acid synthesis, and the conversion of tryptophan to niacin. The level of vitamin B_6 in 1994 was the same as in 1909, 2.3 mg per capita per day. Although levels varied only slightly over the series, shifts in sources have occurred. From 1909 through the 1930's, the vegetable group was the leading source of vitamin B_6 in the food supply. Over the years, the share of vitamin B_6 from vegetables declined, yet vegetables continued to remain an important source, providing 23 percent of the total vitamin B_6 in 1994. Since the early 1940's, the meat, poultry, and fish group has been the primary source of vitamin B_6 in the food supply, reflecting a greater use of beef and poultry. In 1994, the meat, poultry, and fish group provided 36 percent of the total vitamin B_6, while grain products, dairy products, and fruits each provided a similar share, around 10 percent.

Folate.—Folate functions as a coenzyme and is essential for the biosynthesis of nucleic acids and normal maturation of red blood cells. The level of folate was slightly higher in 1994 at 331 μg per capita per day than in 1909 at 322 μg per capita per day. The lowest level, 266 μg per capita per day, in 1965-66 was due to a decreased use of grain products and vegetables, mostly potatoes. The highest level, 345 μg per capita per day, in 1945 was due to the increased use of produce from home gardens at the end of World War II. The contribution from fruits tripled between 1909 to 1994, from 4 to 12 percent, reflecting the increased use of fresh and processed citrus commodities.

Vitamin B_{12}.—Vitamin B_{12} is essential for normal cell metabolism, especially for the cells in the gastrointestinal tract, bone marrow, and nervous tissue and is involved with folate metabolism. In nature it occurs only in animal foods. Vitamin B_{12} levels were lower in 1994 at 8.1 μg per capita per day than in 1909 at 8.5 μg per capita per day. This lower level was mainly due to decreased use of organ meats. Levels were the highest in the 1970's, a period of high beef, pork, and organ meats usage. In contrast, levels were the lowest in the mid-1930's, reflecting a lower use of meat, poultry, and fish group foods during the depression years. Dairy products and eggs have also been important sources of vitamin B_{12} in the food supply over the years.

Trends in Availability of Minerals (see table)

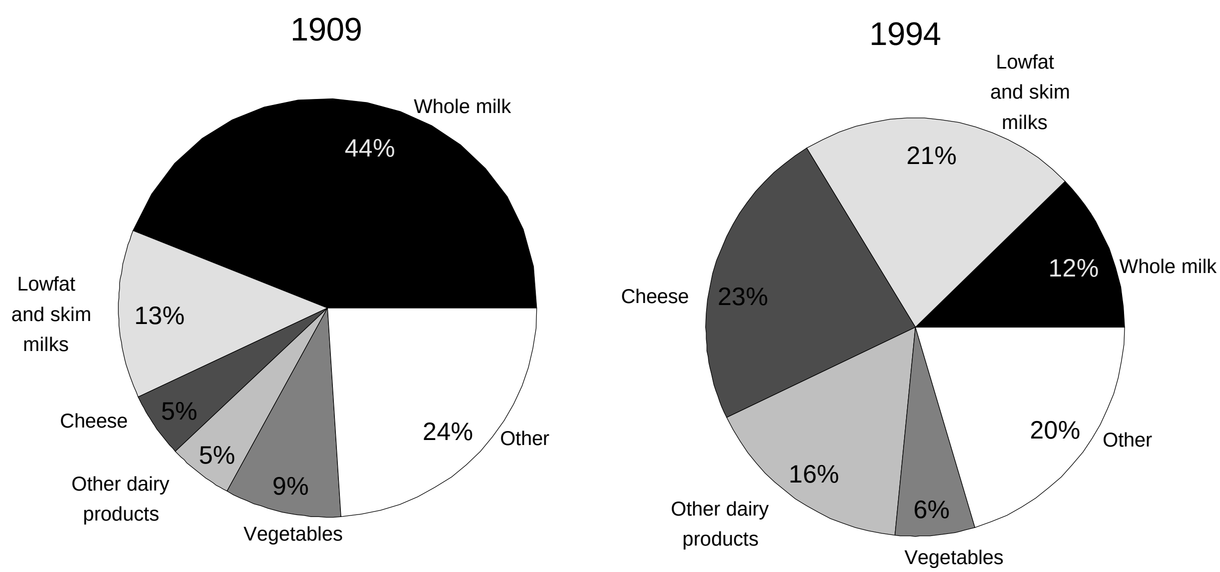
Food supply data includes per capita nutrient estimates for calcium, phosphorus, magnesium, iron, zinc, copper, and potassium. Per capita levels of minerals in the food supply generally exceed the RDA for a healthful diet by a generous margin.

Calcium.—Calcium is essential for the formation of bones and teeth, and daily recommendations for intake increase significantly during adolescence, early adulthood, pregnancy, and lactation. Calcium is a very important nutrient from a public health perspective because an inadequate intake of calcium may increase the risk of osteoporosis, a condition characterized by decreased bone mass and bone density that weakens bone.

The amount of calcium available in the food supply has shifted over the years. Calcium levels peaked in 1946, at 1,080 mg per capita per day because of an increase in whole, canned, and dried milk and in the use of cheese. Calcium levels declined from the mid-1940's to the early 1980's. Since then, levels have been on the rise, primarily due to the increases in lowfat milk and cheese use.

Animal products, particularly dairy products, have always been the predominant source of calcium in the food supply, contributing around three-quarters of calcium in the food supply. A shift within the dairy group—decreased use of whole milk and increased use of lowfat and skim milks—has occurred over the years. Even though the share of calcium

Figure 4. Sources of Calcium in the U.S. Food Supply



contributed by lowfat and skim milks has increased, this increase did not completely compensate for the calcium loss due to the decreased use of beverage milk products. Cheese contributions increased nearly fivefold from 1909 to 1994. The vegetable group has been the secondary source of calcium over time (fig. 4).

Phosphorus.—Phosphorus is a component of every cell and ranks second to calcium in abundance in human tissue. It has numerous critical functions in the body related to bone, nucleic acid, and energy metabolism. Because practically all foods contain phosphorus, dietary deficiencies of the nutrient generally do not develop.

Phosphorus levels in the food supply fluctuated downward from 1909 to 1935. This decrease reflects the decline in use of the grain group and the meat, poultry, and fish group, especially in the mid-1930's. An increased use of dairy products accounted for the peak level, 1,670 mg per capita per day in 1946. Phosphorus levels declined from 1946 to 1987, but since then have steadily increased to a high of 1,680 mg per capita per day in 1994, reflecting the increase in dairy products, especially cheese, and grains.

Magnesium.—More than half of the magnesium in the human body is found in bones, with most of the rest in intracellular fluid. It functions as an activator of many enzyme systems in the body. Magnesium levels have fluctuated somewhat over the series, but levels in 1994 were similar to those in 1909 at 380 mg and 390 mg per capita per day, respectively. Higher magnesium levels are related to increases in the use of grain products, dairy foods, or vegetables. Thus, the highest level, 400 mg per capita per day in 1945, was due to the combined increased use of these foods during the World War II years; and the lower levels throughout the mid-1950's and early 1980's were due to a general decrease in the use of grain products.

Iron.—Iron is found in all body cells. As a component of hemoglobin in the blood and myoglobin in the muscle, iron carries oxygen. Iron-deficiency anemia is the most common nutritional deficiency in the United States. The amount of iron present in the food supply was relatively high in 1909, 14.2 mg, compared with the following 30 years. In 1940, the National Research Council of the National Academy of Sciences endorsed the addition of iron to white flour, and by 1942, the Food and Drug Administration established standards of identity for enriched flour. These standards have changed over the years with the last revision for iron in 1983. Consequently, iron levels in the food supply have shifted.

Even before enrichment of white flour, the predominant source of iron was grain products. Because grain product use has dropped, its iron share declined after 1909 until flour enrichment began in the 1940's. Consequently, iron levels in the food supply increased despite the decrease in consumption of grain products. In the 1980's, grain use increased, and by 1994, grain products accounted for over half of the iron in the food supply. After grain products, the meat, poultry, and fish group—particularly red meats—has ranked second as a source of iron through most of the years.

Zinc.—Zinc is involved with the metabolism of carbohydrates, lipids, proteins, and nucleic acids. It plays an important role in wound healing, blood formation, and the general growth and maintenance of all body tissues. In 1909, the level of zinc was at its peak at 13.7 mg per capita per day. From 1909 to 1935, zinc levels dropped to their lowest level, 11.1 mg. The decrease was attributed to the decrease in the meat, poultry, and fish group and the grain group. Since that time, zinc levels have fluctuated, with levels consistently higher since the mid-1980's due to an increase in use of grains. In 1994, the zinc level was 13.2 mg per capita per day, somewhat lower than the 1909 level. This value reflects the decrease in zinc shares from grain products and the meat, poultry, and fish group, offset by the increase in the zinc share from dairy foods when compared with shares from these foods in 1909.

Copper.—Copper is found in all body tissues and works with iron in the formation of hemoglobin. Copper also helps maintain healthy bones, blood vessels, and nerves. The level of copper in the food supply did not vary greatly over the series. The copper level was highest, 2.1 mg in 1909, when the consumption of grain products and white potatoes was high. After 1909, the level of copper decreased to their lowest level, 1.5 mg in 1965, due to decreased use of these foods. Since that time, copper levels increased from 1.6 mg to 1.9 mg per capita per day in 1991 with levels stable through 1994. In 1909, the vegetable group was the leading source of copper, providing 33 percent to the food supply. Because of the decline in potato use, copper contributions from the vegetable group dropped to 20 percent in 1994. Grain products replaced the vegetable group as the major source of copper, providing 23 percent of the copper in the food supply in 1994. The share of copper from the legumes, nuts, and soy group has doubled since 1909 to 20 percent in 1994, reflecting greater use of these foods.

Potassium.—Potassium aids in muscle contraction and in maintaining fluid and electrolyte balance in the body. Potassium functions in nerve impulses as well as in carbohydrate and protein metabolism. During the earlier years and the World War II years, potassium levels were generally higher in the food supply series. This was due to the high use of dairy products and vegetables. From the peak level, 4,240 mg per capita per day in 1946, values dropped to 3,400 mg per capita per day in 1981. Since that time, potassium levels have increased to 3,780 mg in 1994. Even though the contribution from plants, the primary source, has decreased over the years, plant foods provided 64 percent of the copper in the food supply in 1994. This decrease is attributed to the decline in the consumption of vegetables, particularly white potatoes. On the other hand, the contribution from fruit has increased over time from 7 percent in 1909 to 12 percent in 1994. Over the series, the leading source of potassium has been the vegetable group, followed by the dairy and the meat, poultry, and fish groups.

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