NUTRIENT UPDATE

FOOD CONSUMPTION SURVEYS IN THE US DEPARTMENT OF AGRICULTURE

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One mission of the US Department of Agriculture (USDA) is to encourage the production and availability of a sufficient, safe, and nutritionally adequate supply of food for Americans. In support of this mission, USDA conducts surveys to monitor food use and food-consumption patterns in the US population. This article presents an overview of USDA food-consumption studies—their historical context, uses, and results—and provides information on current efforts to improve data collection.

HISTORICAL OVERVIEW OF USDA FOOD CONSUMPTION SURVEYS

Food-consumption surveys conducted by USDA may be divided into four periods: (1) early, small-scale studies; (2) nationwide, but nonrepresentative, surveys in 1935–36, 1942, and 1948; (3) nationwide surveys of household use of food conducted in 1955, 1965–66, 1977–78, and 1987–88; and (4) nationwide surveys of dietary intakes by individuals conducted in 1965–66, 1977–78, 1987–88, 1985–86, 1989–91, 1994–96, and 1998. The surveys conducted in 1965–66, 1977–78, and 1987–88 contained two components—household use of food and intakes by individuals. Two recent intake surveys, those in 1989–91 and 1994–96, were coupled with a telephone follow-up survey designed to measure attitudes and knowledge about diet and health among Americans. Table 1 presents a summary of USDA nationwide surveys.

Early Small-Scale Studies

In 1894, Congress mandated that human nutrition investigations be conducted by the USDA Office of Experiment Stations. W. O. Atwater, the first director of the experiment stations, is credited with the first food-consumption studies in the United States in the late nineteenth century. Atwater sought food-consumption information that would help him develop recommendations on what a working man should eat and how families could spend their food money wisely.[1,2] In early studies, participants were simply whoever volunteered, or, as the investigators put it, "willing families." Researchers used a food-inventory record

Table 1. Overview of USDA Nationwide Food Surveys, 1936–1998

Survey	Population	Sample	Type of Data	Dietary Method	Advances	Selected Findings
Nonrepresentative nationwide studies						
1935–1936 Consumer Purchases Study	Farm, village, and city households in five geographic regions	Husband and wife families, white and native born	Household food use	7-day list-recall; 7-day food inventory record	List-recall imposed less respondent burden than food inventory record; later shown to have better response rates as well[5]	One-third of families had diets poor by nutritional standards.[6] This finding led to President Roosevelt's statement that a third of the nation was ill-fed.[7] Diets of farm families were better than diets of those in villages or cities and diets of families in the north and west were better than those in other areas. Diets of higher income families were better than others, but large expenditures did not guarantee good diets.[6]
1942 Family Spending and Saving in Wartime	Cities, rural nonfarm areas, and farms in Spring	Housekeeping families and single persons	Household food use	7-day list-recall	Recommended Dietary Allowances issued in 1941 by the Food and Nutrition Board provided basis for assessing calorie and nutrient intakes Enrichment of bread, flour, and cereals with thiamin, niacin, and iron and of	Rising food costs and food shortages affected food consumption during the war period.[10] Dietary improvement credited to higher incomes, concerted nutrition education programs, some enrichment of bread and cereals, and improvements in transportation and distribution of foods.[7] Greatest improvements were for low-income families.[11]

					margarine with vitamin A affected diets	
1948 Food Consumption of Urban Families	Urban families nationwide in Spring plus surveys in 4 cities	Housekeeping families of 2 or more persons	Household food use	7-day list-recall	Most bread and flour enriched. Computers first used in data analysis[12]	Increases in household dietary levels of iron, thiamin, riboflavin, and niacin—the nutrients used for enriching white bread and white flour. Again, the greatest improvements were for low-income families.[11] Food spending amounted to one-third of family income. About 15% of food dollar spent on food eaten away from home.[13]
Nationally representative surveys WITH household food use component						
1955 Household Food Consumption Survey (HFCS)	48 states plus a supplement of farm households	Housekeeping households	Household food use	7-day list-recall	Self-weighting probability sample provided first nationally representative food use estimates; commercial firm used to collect data. Results used as baseline for pilot Food Stamp Program	About 13% of diets rated "poor" at the time, a figure subsequently revised to 15% based on new criteria developed from the 1963 RDAs.[7] Households in the South had diets that were not as good as those in other regions. Diets of farm households generally furnished larger amounts of most nutrients than those of city households. High-income households were more likely than low-income to have diets that met RDAs.[11]
1965–1966 HFCS	48 states	Two separate samples (basic and low income); household respondent	Household food use. Individual intake	7-day list-recall. 24-hr dietary recall in spring only	First coverage of all 4 seasons. First data on food intakes by individuals	About one-fifth of households had diets rated poor.[23] About 17% of the food dollar was spent away from home.[24] About 43% of energy intake was

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Table 1.—*Continued*

		was asked to provide intake information for selected household members			allowed comparison of intakes with sex- and age-specific RDAs	from fat. The diets of individuals in high-income households were more likely to meet the RDAs than were those in low-income households. The RDAs least likely to be met were for calcium, iron, vitamin C, and vitamin A.[25] About 38% of individuals had some food or beverage away from home.[25]
1977–1978 Nationwide Food Consumption Survey (NFCS)	48 states (1977–78 supplements on low-income, elderly, Puerto Rico, Alaska, and Hawaii; 1979–80 low-income follow up)	Two separate samples (basic and low income); all household members were asked to provide intake information	Household food use Individual intake	7-day list-recall 3 consecutive days: 24-hr dietary recall and 2-day diet record	Data set made widely available to public on magnetic data tape for first time. First nationwide survey to collect multiple days of dietary intake data Results provided for food energy and 14 nutrients	About 23% of the food dollar was spent away from home.[26] About 40% of energy intake was from fat. Average intakes exceeded RDAs for 9 of 12 nutrients; the RDAs least likely to be met were vitamin B-6, calcium, magnesium, iron, vitamin A, and vitamin C.[27] About 62% of individuals had some food or beverage away from home.[27]
1987–1988 NFCS	48 states	Two separate samples (basic and low income); all household members were asked to provide intake information	Household food use Individual intake	7-day list-recall 3 consecutive days: 24-hr dietary recall and 2-day diet record	Facilitation of list-recall with laptop computer Heavy respondent burden and poor response rates led to discontinuation of household component	About 33% of the food dollar was spent away from home.[28] Trend toward consumption of lower fat milk and more meat and grain mixures. Total fat intake decreased to 36% of calories.[29]

Nationally representative surveys WITHOUT household food use component

1985–1986 Continuing Survey of Food Intakes by Individuals (CSFII)	48 states	Two separate samples (basic and low income); women 19–50 yr and their children 1–5 yr in both years and men 19–50 yr in 1985 only	Individual intake	Women and children: 6 nonconsecutive 24-hr dietary recalls; day 1 in person and remaining days by telephone Men: day 1 only	Surveys timed closer together to provide early indications of dietary changes First use of telephone for second and subsequent days of data collection Nutrient intakes provided for food energy and 27 nutrients First Dietary Guidelines for Americans issued in 1980	Less whole and more lowfat milk, less meat eaten separately and more as part of mixtures, more grain products (especially grain mixtures)[30] Nutrient intakes as high as in 1977, but some still below RDA: B-6, calcium, magnesium, iron. Also, women's intakes were low in three nutrients not examined in 1977: Vitamin E, folacin, and zinc. Observations were apparent at all levels of income and in all geographic regions.[30] About 58% of women used vitamin and/or mineral supplements, up from 39% in 1977.[30]
1989–1991 CSFII	48 states	Two separate samples (basic and low income); all household members were asked to provide intake information	Individual intake	3 consecutive days: 24-hr dietary recall and 2-day diet record	First linkage of intakes with knowledge and attitude information provided by Diet and Health Knowledge Survey. First 3-year survey	Shift to lower fat, higher carbohydrate diets since 1977–1978. Total fat as a proportion of food energy decreased to 34%; still above Dietary Guidelines recommendation of 30%.[32] Shift types of beverages consumed: Intake of fluid milk declined 12% while intake of carbonated soft drinks increased 72%. Among milk types, continued trend toward lower fat milks, especially among high-income individuals.[32] Continued increase in intakes of grain and meat mixtures. About 47% of individuals ate no fruit/fruit juice on any given day.[32]

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Table 1.—*Continued*

1989–1991 Diet and Health Knowledge Survey (DHKS)	48 states	Main meal planners/preparers with a completed day 1 intake in CSFII	Dietary knowledge, behavior, and attitudes	Telephone follow-up to CSFII	Initiated to improve understanding of factors related to food choices; data linkage with CSFII	About one-fourth of main meal-planners/preparers had diets that met recommendations for fat and saturated fat, but three-fourths thought that their own diet was "about right" in fat.[33]
1994–1996 CSFII	50 states	Oversampling of the low-income population; only selected household members were asked to provide intake information	Individual intake	2 nonconsecutive 24-hr dietary recalls	Multiple-pass method for 24-hr recall Reporting food intake data as Pyramid servings facilitated comparison of food intakes to Food Guide Pyramid recommendations Data released within a year of data collection and on CD-ROM for first time	The percentage of calories from fat (33%) was slightly lower than in 1989–1991 as a result of increased carbohydrate intakes.[35] Diets were below Pyramid recommendations for fruit, dairy and meat; near bottom of ranges for grain and vegetables; fat and sugar intakes exceeded recommendations.[35] About 57% of individuals ate away from home, up from 43% in 1977–1978.
1994–1996 DHKS	50 states	Adults 20 yr and over with a completed day 1 intake in CSFII	Dietary knowledge, behavior, and attitudes	Telephone follow-up to CSFII		Two-thirds of adults had intakes that failed to meet the recommendation for fat, but only about half thought they ate too much fat.[34]
1998 Supplemental Children's Survey to CSFII 1994–1996	50 states	Children 0–9 yr	Individual intake	2 nonconsecutive 24-hr dietary recalls	Undertaken to provide increased sample size for estimation of exposure to pesticide residues when merged with CSFII 1994–1996 data	Not available yet.

to collect data by determining the weight and cost of food used by the family from inventories of food on hand at the start and end of the survey period and from records of foods brought into the home during the period.[3] Because this complex procedure was found to be too intrusive, too time-consuming, and too costly, it was replaced in the 1930s by the food-list recall (or food list). The new technique required only an interview with the household respondent (usually the homemaker) who recalled, using the food list, the quantities of listed foods used by the household during the preceding week and the amounts paid for purchased items.

Nationwide Nonrepresentative Surveys

During the Depression years of the 1930s, concern about the quality of American diets was high. USDA began periodic nationwide surveys of households in the 1930s using the food-list recall method along with statistical sampling techniques that permitted the collection of data from large numbers of households in relatively short periods. Because the surveys conducted in the 1930s and 1940s preceded the advent of probability sampling in surveys,[4] they were less than fully representative of the US population.[5] However, as the best benchmark data available at the time, they were important for various federal uses. The comprehensive picture of household food consumption and dietary levels obtained in the Consumer Purchases Study of 1935–36 indicated that a third of the nations's families had diets that were poor by nutritional standards in use at the time.[6] On the basis of this finding, President Franklin D. Roosevelt stated that a third of the Nation was ill-fed.[7] The survey findings gave impetus to the enrichment of white flour and bread with iron and three B vitamins, establishment of the National School Lunch Program, and expansion of nutrition education and research. Also, USDA economists used results to project food consumption in the United States and to develop food budgets to help families select good diets. A later version of the least costly of these food budgets, the Thrifty Food Plan, is still used in the federal formulas for counting the nation's poor[8] and for setting benefit levels in the Food Stamp Program.[9]

The 1942 Spending and Saving in Wartime Survey measured the early effects of World War II on food consumption in urban, rural, and farm families at different income levels.[10] As in earlier studies, the nutritive values computed for family diets were based on values of food as they were purchased, and authors cautioned that losses in nutrients caused by preparation and household waste should be considered in comparing the results with any yardstick. Before the date of the survey, a widespread nutrition program had been carried on throughout the nation; people were being urged to increase their consumption of milk, fruits, vegetables, and whole-grain cereals. For many families this was a matter of education in food selection; for others, it was a matter of having money to buy these foods. Nevertheless, the survey found marked improvement from the 1930s in diets overall, but many families' intakes of several nutrients were low compared with the new standards, the Recommended Dietary Allowances (RDA) first issued in 1941. Greatest improvements were for low-income families.[11] Types of information available included quantities of food used, nutritive value of diets, the effect of income on diets, food groups as sources of "dietary essentials," and the money value of both purchased food and food from other sources such as home production.

A postwar survey, Food Consumption of Urban Families in 1948, included both a nationwide survey in the spring and surveys of four cities; as in earlier surveys, interviewers were selected locally and trained by USDA staff. The 1948 survey was the first in which computers were used for data analysis; a USDA staffer applied the new technology to food-consumption data using computers at the Bureau of Mines.[12] The findings provided basic data on food-consumption patterns for use in educational, research, and marketing programs and in the use of agricultural products. Types of information available focused heavily on food consumption, including the kinds of foods used by different groups in a week, the share of income spent for food by different groups, the division of the family food dollar among different kinds of food, and the amount of food obtained without direct expenditure. Included in one survey publication was a discussion of methods of analyzing family food data, including the estimation of income elasticities.[13]

Between the surveys of 1935–36 and 1948, great strides were made in the distribution and storage of food products, most notably in home refrigeration. These changes affected the way people purchased and used food.

Nationally Representative Surveys of Household Food Use and the Shift Toward Individual Intake Data Collection

Recognition of the need for nationally representative food-consumption data resulted in the development of larger surveys in the mid-twentieth century. During this period, USDA also conducted smaller methodologic or special-purpose surveys of food consumption. Some of these studies explored techniques for collecting dietary data from individuals.[14,15] Other studies addressed survey methodology issues such as the use of the food-inventory record versus the food-list recall, food discard measurement, questionnaire design and wording, and interviewer training.[13,16–19] The research on the food-inventory record versus the food-list recall confirmed the decision to adopt the list-recall technique for use in future surveys. Still other surveys were conducted to pro-

vide information on levels of living for farm and nonfarm families.[20] USDA conducted four nationwide food surveys of household food use—the Household Food Consumption Survey (HFCS), 1955; HFCS, 1965–66; Nationwide Food Consumption Survey (NFCS), 1977–78; and NFCS, 1987–88. The latter three of these surveys also incorporated a component that measured food intake by household members.

Results from the 1955 Household Food Consumption Survey showed an overall improvement in the adequacy of US diets.[21] Nevertheless, food shortages were still found even among households in the upper third of the income scale, indicating continued need for dietary improvements. Results were used to develop new educational materials for both low- and high-income families.[7,21] Widespread concern for disadvantaged and low-income families in the 1950s and early 1960s led to the use of survey results as baseline data for the Pilot Food Stamp Program that was initiated in 1961 in eight economically depressed areas. A before-and-after study of food-consumption and dietary levels in an urban and a rural area showed that the Food Stamp Program increased the purchase of more nutritious foods by needy families and also expanded the market for agricultural products—another government objective being to use farm surpluses.[22] The Food Stamp Program became permanent with the Food Stamp Act of 1964.

Between the surveys of 1955 and 1965–66, the availability and consumer acceptance of many new, more convenient food products changed the cooking practices and patterns of food use in many American households. For example, the use of mixes for baked products such as cakes and muffins, and the availability of ready-made baked products, led to a decrease in baking "from scratch," and household consumption of flour, sugar, and other basic baking ingredients decreased.

A major purpose of the Household Food Consumption Survey of 1965 was to compare current household food consumption with that in earlier surveys.[23,24] Diets of about a fifth (20%) of US households were rated "poor" by new standards based on the 1963 RDAs, compared with a revised figure of 15% for 1955.[7] Decreased use of milk and some milk products and of vegetables and fruits was pinpointed as the principal cause for the increased proportion of households with poor diets. Both education and action programs were stepped up as a result of the survey findings.

In the spring quarter of 1965, information on dietary intakes by individuals in households was obtained for the first time.[25] Findings of the survey provided new information on diets of household members and were used in nutrition education programs and in estimating the effect that different levels of food fortification had on the diets of different age groups. Results showed that the groups needing most attention were children, teenagers, and older people. The spring 1965 individual intake data were so useful as baseline data that there were many requests for enlarging their scope to include more intake days per individual, all seasons, and more questions on dietary practices. The scope of the surveys was greatly expanded in 1977–78 and the name changed from the Household Food Consumption Survey to the Nationwide Food Consumption Survey.

Between the HFCS 1965–66 and the NFCS 1977–78 surveys, the proliferation of new products was especially marked. Technologic changes, such as freeze-dried coffee, and the increasing variety of commercially frozen foods reflected breakthroughs in food processing and packaging. Lifestyle changes, such as increases in the proportion of women employed outside the home, may have decreased the time spent in meal preparation and increased the demand for convenience foods and fast-food restaurants.

The NFCS 1977–78 survey was the largest of all the USDA nationwide surveys, even including subsequent surveys. Food-use information was obtained from approximately 14,000 households and dietary intakes from the approximately 36,000 individuals in those households.[26,27] Reporting from the NFCS 1977–78 survey was extensive and included food-use estimates by income, season, urbanization, and region as well as estimates of the money value of food at home and away from home. Results from the individual intake portion of the NFCS 1977–78 survey were provided for food energy and 14 nutrients—4 more nutrients than were reported in 1965–66.

The last USDA survey to include both a household food-use component and an individual intake component was the NFCS 1987–88 survey.[28,29] Most of the procedures used to obtain food intake information were similar to those used in the NFCS 1977–78 survey. One innovation of the NFCS 1987–88 survey was the use of a lap-top computer for interviewing that was programmed to handle the burden of a growing food list. As food supplies had increased and become more varied over the years, the number of foods on the food-list recall form had also increased rapidly from approximately 200 items in 1948 to nearly 3,000 items by 1987.[5]

Results from NFCS 1987–88 survey showed that more of the household food dollar was spent away from home and fewer meals were consumed from household food supplies in 1987–88 than in 1977–78.[28] These changes may have resulted from a desire for increased convenience and variety. The food industry responded in a number of ways: more and varied restaurants; more microwaveable packaging; and more bakeries, delicatessens, and salad bars in supermarkets.

The collection of both household food use and individual intake information in the same survey created heavy respondent burden and, in the NFCS 1987–88 survey, low response rates. The need to decrease respon-

dent burden was one of the reasons USDA did not include a household food-use component in subsequent surveys. Another reason for the shift from household to individual intake data collection was that the then-current emphasis on diet and health gave greater urgency to the need for assessing the nutrient adequacy of diets. Household data are less than ideal for analyses of diet quality relative to the RDAs. To compare household intake levels with the RDAs, it was necessary to adjust for the consumption of food away from home, which was not surveyed in the household component, as well as to make various assumptions related to the apportionment of food among household members and their differing nutritional needs. Also, household food-consumption data included discarded food and food fed to pets, which resulted in overestimates of nutritional quality. Individual intake data represent foods as eaten, excluding food discard and including both food eaten at home and food away from home; therefore, these data are more precise than household food-use data for the assessment of diet quality. Individual intakes can appropriately be compared with sex- and age-specific RDAs.

The elimination of the household food-use component resulted in loss of data on the monetary value of food used at home and expenditures for food away from home, nutrients per dollar's worth of food, and the value and quantity of home-produced food. Also, because much food is purchased at the household level, the discontinuation of the household survey created a gap in tracking food from the farmer to the consumer and made it more difficult to develop food plans that meet nutritional and cost criteria as well as reflect food consumption practices of households.

Individual Intake Surveys Without the Household Food-Use Component

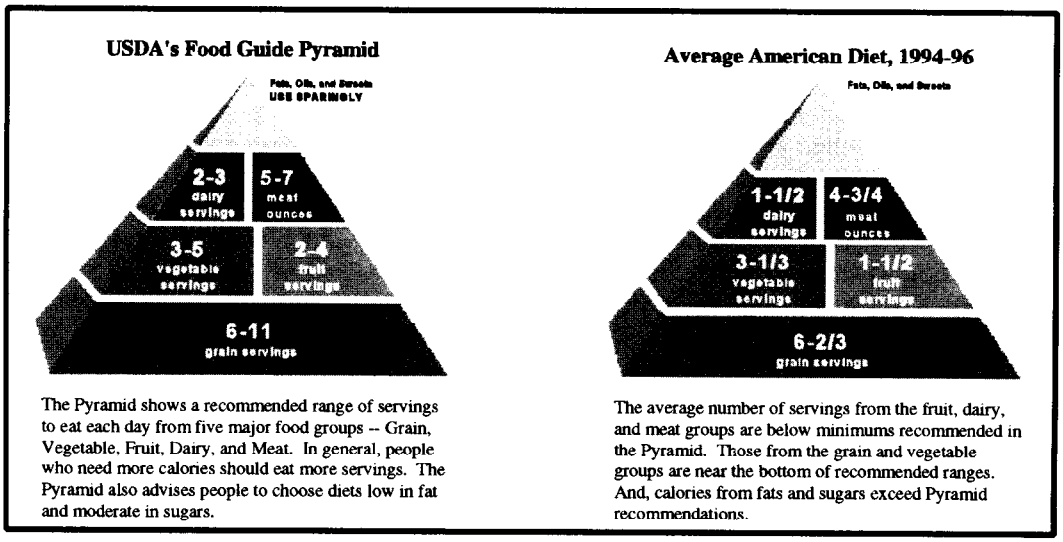
In 1985, the first national USDA survey of dietary intake by individuals independent of a household food-use component began.[30] The purpose of the 1985–86 Continuing Survey of Food Intakes by Individuals (CSFII) was to collect data more frequently than every 10 years, thus providing up-to-date information on the adequacy of the diets of selected population groups and early indications of dietary changes—important considerations for data that are used in planning food-assistance and educational programs and in administering a variety of public programs affecting the supply, safety, and distribution of the nation's food. Food-intake data were collected using a panel approach: Collection from each individual took place on up to 6 nonconsecutive days at intervals of approximately 2 months over a 1-year period.

Between 1977 and 1985, when the CSFII was initiated, substantial changes occurred in food intakes—shifts to lower-fat milk, less meat eaten separately (*ie*, not as part of a mixture), and more grain products.[30] These shifts, most prominent among higher-income, more-educated respondents, may have reflected concerns about diet and health issues. The first Dietary Guidelines for Americans were issued in 1980.[31]

In 1989, the panel aspect of the CSFII 1985–86 was dropped and the CSFII 1989–91 was conducted using a 1-day recall and 2-day record, the same methodology as for the individual-intake portion of the NFCS 1977–78 and NFCS 1987–88. Also in 1989, the Diet and Health Knowledge Survey (DHKS) 1989–91 was initiated to improve understanding of factors that affect food choices and provide a link between an individual's knowledge and attitudes and his or her dietary behavior. Individuals who were identified as the main meal-planners/preparers in the CSFII were asked to answer a series of questions about their knowledge of and attitudes toward diet, health, and food safety. Data from the CSFII 1989–91 showed that eating habits followed national dietary guidelines more closely than in the past.[32] However, the DHKS 1989–91 revealed that Americans' perceptions about their diets did not always match reality.[33]

USDA's most recent survey, the CSFII/DHKS 1994–96,[34,35] popularly known as the What We Eat in America survey, addressed the requirements of the National Nutrition Monitoring and Related Research Act of 1990 (Public Law [P.L.] 101–445) for continuous monitoring of the dietary status of the American population. Along with improvements in data-collection methods such as the multiple-pass approach for the 24-hour recall,[36] an advance made during the 1990s involved the way information on food intake by individuals was reported to the public. Since the 1965–66 HFCS, average quantities of foods consumed have been reported in grams or as the percentages of individuals consuming food from selected food groups or subgroups. Such information has numerous uses, including comparing food consumption over time. However, food intakes given in grams are difficult to interpret for the public, especially in light of recent dietary recommendations that are given as the number of servings from specified food groups to eat each day in, for example, the Food Guide Pyramid.[37] To make interpretation easier, USDA developed a method for converting CSFII data on grams of food eaten into servings of food from selected food groups.[38] A comparison of intakes in the CSFII 1994–96 to Pyramid recommendations is provided in Figure 1. Additional results from the CSFII/DHKS 1994–96 are provided in Table 2.

The surveys are used in numerous food- and nutrition-related programs and public policy applications. In addition to providing the detailed benchmark data on the food and nutrient intakes and eating patterns of the general and low-income populations that have been the hallmark of USDA surveys, the most recent surveys continue to be used by USDA to assess the nutritional impact of



Source: USDA Continuing Survey of Food Intakes by Individuals, 1994-96, Individuals 2 years of age and over; ARS, Beltsville Human Nutrition Research Center, Food Surveys Research Group.

Figure 1. Comparison of the average American diet against Food Guide Pyramid recommendations.

USDA's food-assistance programs, to monitor food security and hunger,[39] and to estimate the demand for agricultural products and marketing facilities. The surveys are also used by other federal agencies: by the Food and Drug Administration to develop food fortification and enrichment policies[40] and food labeling policies under the Nutrition Labeling and Education Act of 1990 (P.L. 101–535);[41] by both USDA and the US Department of Health and Human Services to evaluate the content and adequacy of American diets in relationship to dietary recommendations such as the Dietary Guidelines for Americans,[31] USDA's Food Guide Pyramid,[37] and the Year 2000 Nutrition Objectives;[42] by the Federal Trade Commission to understand the effects of information on consumer behavior better;[43] and by the Environmental Protection Agency to estimate exposure to pesticide residues, food additives, and contaminants. The National Academy of Sciences has used the data in developing the Recommended Dietary Intakes[44] and, more recently, the Dietary Reference Intakes.[45] The data are also used by state agencies and county health departments, food and agricultural industries, and university researchers.

A 1993 report of the National Academy of Sciences entitled *Pesticides in the Diets of Infants and Children* (NRC 1993) raised concern that current food-consumption data did not provide sufficient sample sizes to estimate adequately exposure to pesticide residues in the diets of children.[46] To permit better exposure estimates and as a response to the 1996 Food Quality Protection Act of 1996 (P.L. 104–170), a survey of food and nutrient intakes by children younger than 10 years was conducted in 1998 as a supplement to the CSFII 1994–96. The Supplemental Children's Survey (SCS) will provide the Environmental Protection Agency with information on food-consumption patterns in a statistically valid sample of infants and children. The method of data collection for the SCS is identical to that used in the CSFII 1994–96; the SCS includes 2 days of dietary intake on approximately 5000 children from birth through 9 years of age. Results will be available in the year 2000. Food-consumption data from the CSFII 1994–96 are being translated into commodity level data specified to meet the requirements of the Food Quality Protection Act of 1996. This work is being conducted through an interagency agreement with EPA.

CURRENT EFFORTS TO IMPROVE DATA COLLECTION

Methodology research has been integral to planning the increasingly complex food-consumption surveys at the USDA. USDA's Food Surveys Research Group (part of the Beltsville Human Nutrition Research Center of the Agricultural Research Service) has implemented an extensive dietary survey methods research program to improve dietary-intake data and to develop more cost-effective methods of data collection for national surveys of food consumption.

This program includes 2 years of comprehensive methodologic research, followed by two full-scale pilot studies in 1999, as part of the contract for the CSFII/DHKS 1999–2002. The focuses of this research are the refinement of the multiple-pass 24-hour dietary-recall method to improve the completeness and accuracy

Table 2. How Do Americans' Diets Measure up to the 1995 Dietary Guidelines for Americans?

Over 16,000 people nationwide participated in the Continuing Survey of Food Intakes by Individuals, popularly known as the *What We Eat in America* survey.[34,35] In addition, almost 6000 of them answered questions on their attitudes and knowledge about dietary guidance and health. This is how Americans fare . . .

Eat a variety of foods.

- Women's intakes failed to meet the 1989 Recommended Dietary Allowances (RDA) for five nutrients: calcium, vitamin E, vitamin B-6, magnesium, and zinc. Men's intakes fell short of the RDA for vitamin E, magnesium, and zinc.
- About 85% of Americans ate breakfast, about the same as in previous USDA surveys. Coffee and fluid milk are still the most popular foods consumed at breakfast. Breakfast provided 18% of Americans' daily intake of calories and 12% to 28% of their daily intake of vitamins and minerals.
- About 57% of Americans ate away from home on any given day, up from 43% in 1977–1978. Foods eaten away from home in 1994–1996 accounted for more than 25% of total calorie and fat intakes.

Balance the food you eat with physical activity—maintain or improve your weight.

- More than 90% of adults say it is important to them to maintain a healthy weight. However, almost 40% think they eat too many calories. And more than one-half of adults are overweight, based on a body mass index (BMI) of 25 or more (self-reported heights and weights).
- Thirty minutes of moderate physical activity is recommended daily, but 28% of men and 44% of women say they rarely or never exercise vigorously.

Choose a diet with plenty of grain products, vegetables, and fruits.

- People's behavior doesn't always reflect their beliefs.
- Two-thirds of adults think it is very important to choose a diet with plenty of vegetables and fruits. However, consumption has increased only slightly since the late 1970s. And Americans still consume low amounts of dark green and deep yellow vegetables, despite recommendations to do otherwise.
- On the other hand, less than one-third of adults think it is very important to choose a diet with plenty of breads, cereals, rice, and pasta. Yet, consumption has increased by more than 40% since the late 1970s. Consumption of grain mixtures, such as pizza and lasagna, continued to rise.

Choose a diet low in fat, saturated fat, and cholesterol.

- An increase in energy intakes, with most of the increase as carbohydrate, resulted in a continued decline in the percent of calories from fat from 34% in 1989–1991 to 33% in 1994–1996. Average fat intake (in grams) stayed about the same as in 1989–1991.
- About two-thirds of adults failed to meet the recommendation for fat (30% of calories), but only about half think they eat too much fat.
- About 60% of adults fail to meet the recommendation for saturated fat (10% of calories), but only about one-third think they eat too much. Adults average 11%.
- The Guideline suggests cholesterol intake be limited to no more than 300 milligrams per day. At 213 milligrams per day, the average intake by women is below this level. However, at 331 milligrams per day, the average intake by men exceeds it. About three of ten adults think their diets are too high in cholesterol.

Choose a diet moderated in sugars.

- About 85% of adults think it is important to use sugars only in moderation. Yet, Americans consume an average of 20 teaspoons of added sugars a day, accounting for 16% of calories.
- Among young children, consumption of fluid milk has decreased by 16% since the late 1970s, while consumption of carbonated soft drinks has increased by 16%. Consumption of noncitrus juices, including grape- and apple-based mixtures, rose by 280%.

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Table 2.—Continued

- Beverages, particularly carbonated soft drinks, were the most popular food item consumed outside the home. French fried potatoes and grain mixtures such as pizza, lasagna and ravioli, and Mexican foods are among the foods popular at home or away.

Choose a diet moderated in salt and sodium.

- According to the Guideline, sodium intake should be limited to no more than 2400 milligrams per day. The average intakes from foods alone are over 4000 milligrams for men and almost 3,000 milligrams for women. Intakes may be even higher because salt added at the table is not included in these values.
- Only about one-fourth of adults think their diets are too high in salt or sodium.

If you drink alcoholic beverages, do so in moderation.

- About 23% of men and 12% of women drank liquor, wine, beer or ale on the day of the survey, up slightly from the late 1970s. Most alcoholic beverages were consumed as beer and ale, followed by wine.

Additional results from CSFII/DHKS 1994–1996 are available on the web site for the Food Surveys Research Group: <http://www.barc.usda.gov/bhnrc/foodsurvey/home.htm>

of dietary-intake data collection, and the selection and testing of food-measurement aids to improve portion-size estimation. The pilot studies will test, on a national scale and in an integrated form, the food-measurement aids, a computer-assisted telephone interview incorporating the new 24-hour-recall methodology, and other data collection procedures that result from the research.

Another critical component of the research program is a large-scale validation study of 400 subjects to compare estimates of individuals' energy intake as determined by the 24-hour dietary-recall method against estimates of their energy expenditure as determined by the doubly labeled water technique.[47] The doubly labeled water technique provides precise measures of energy expenditure in free-living individuals and may be used to validate the assessment of energy intake by other methods.[48] This research is being conducted in collaboration with the Diet and Human Performance Laboratory, Beltsville Human Nutrition Research Center, Agricultural Research Service (ARS). The study will be completed in 1999.

Dietary-assessment-methodology research also was conducted collaboratively with the University of Arkansas Children's Research Institute to provide preliminary information on using the telephone to collect 24-hour dietary-recall data on a national scale. Research in partnership with Tennessee State University and Kansas State University was conducted to identify the cognitive strategies respondents use to estimate portion sizes and the preferred measurement aids, as well as to examine the accuracy of reported intakes using different aids and procedures. Collaborative research with Texas A&M University identified which questions in USDA's Diet and Health Knowledge Survey have the most predictive validity regarding fat intake, and cognitive research conducted with the Center for Survey Methods Research, Bureau of the Census, provided information on the use of appropriate response scales for the DHKS. Earlier cooperative work with the University of Texas to improve survey-processing techniques focused on completion of a technical database system for trends analysis; that system was used to produce the multiversion nutrient and food-coding databases released with the final CSFII 1994–96 3-year data set.

For over a century, USDA's surveys have provided benchmark data on food consumption in the United States. The current research on dietary intake survey methodology is expected to produce further improvements in estimates of food and nutrient intakes.

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REFERENCES

1. Atwater WO. Foods: nutritive value and cost. USDA Farmers' Bulletin No 23; 1894.
2. Atwater WO. Methods and results of investigations of the chemistry and economy of food. USDA Ext Sta Bulletin No 21; 1895.
3. Bryant AP. Some results of dietary studies in the United States. In: USDA Yearbook of Agriculture, 1898. p. 439–52; 1899.
4. Cochran WG. Sampling techniques. New York: John Wiley and Sons; 1953.
5. Pao EM, Sykes KE, Cypel YS. USDA methodological research for large-scale dietary intake surveys, 1975–88. USDA Home Economics Research Report No 49; 1989.
6. Stiebeling H. Are we well fed? A report on the diets of families in the United States. USDA Miscellaneous Publication No 430; 1941.
7. Clark F. Recent food consumption surveys and their uses. Federation Proceedings 1974;33:11.
8. Orshanski M. How poverty is measured. Monthly Labor Review 1969;92(2):37–41.
9. Peterkin BB, Blum AJ, Kerr RL, Cleveland LE. The Thrifty Food Plan, 1983. USDA Human Nutrition Information Service Administration Report No 365; 1983.
10. U.S. Department of Agriculture. Family food consumption in the United States. USDA Miscellaneous Publication No 550; 1944.
11. LeBovit C, Cofer E, Murray J, Clark F. Dietary evaluations of food use in the United States. USDA Household Food Consumption Survey 1955, Report No 16; 1961.
12. Peterkin BB. USDA food consumption research: parade of survey greats. J Nutr 1994;124:1836S–41S.
13. Clark F, Murray J, Weiss GS, Grossman E. Food consumption of urban families in the United States . . . with an appraisal of methods of analysis. USDA Agriculture Information Bulletin No 132; 1954.
14. Adelson SF. Some problems in collecting dietary data from individuals. J Am Diet Assoc 1960;36(5):453–61.
15. Adelson SF, Keys A. Diet and some health characteristics of 123 business and professional men and methods used to obtain dietary information. USDA Agriculture Research Service Publication No 62–11;1962.
16. Adelson S, Asp E, Noble I. Household records of food used and discarded. J Am Diet Assoc 1961;39(6): 578–84.
17. Adelson SF, Blake EC. Diets of families in the open country, a Georgia and an Ohio county, summer 1945. USDA Bureau of Human Nutrition and Home Economics, Miscellaneous Publication No 704; 1950.
18. Clark F, Fincher L. Nutritive content of homemaker's meals; four cities, winter 1948. USDA Information Bulletin No 112; 1954.
19. Murray J, Blake E, Dickens D, Moser A. Collection methods in dietary surveys: a comparison of the food list and record in two farming areas of the South. South Carolina Agricultural Experiment Station, Southern Cooperative Series Bul 23; 1952.
20. Reagan BB, Grossman E. Rural levels of living in Lee and Jones counties, Mississippi, 1945, and a comparison of two methods of data collection. USDA Agriculture Information Bulletin No 41; 1951.
21. U.S. Department of Agriculture. Dietary levels of households in the United States. USDA Household Food Consumption Survey 1955, Report No 6; 1957.
22. Reese RB, Adelson SF. Food consumption and dietary levels under the Pilot Food Stamp Program, Detroit, Michigan, and Fayette County, Pennsylvania. USDA Agricultural Economics Report No 9; 1962.
23. U.S. Department of Agriculture. Dietary levels of households in the United States, Spring 1965. USDA Household Food Consumption Survey 1965–66, Report No 6; 1969.
24. U.S. Department of Agriculture. Food consumption of households in the United States, Spring 1965. Household Food Consumption Survey 1965–66, Report No 1; 1968.
25. U.S. Department of Agriculture. Food and nutrient intake of individuals in the United States, Spring 1965. Household Food Consumption Survey 1965–66, Report No 11; 1972.
26. U.S. Department of Agriculture, Human Nutrition Information Service. Food consumption: households in the United States, seasons and year 1977–78. Nationwide Food Consumption Survey 1977–78, Report No H–6; 1983.
27. U.S. Department of Agriculture, Human Nutrition Information Service. Nutrient intakes: individuals in 48 States, year 1977–78. Nationwide Food Consumption Survey 1977–78, Report No I-2; 1984.
28. U.S. Department of Agriculture, Human Nutrition Information Service. Food consumption and dietary levels of households in the United States, 1987–94. Nationwide Food Consumption Survey 1987–94, Report No 87-H-1; 1993.
29. U.S. Department of Agriculture, Human Nutrition Information Service. Food and nutrient intakes by individuals in the United States, 1 day, 1987–88. Nationwide Food Consumption Survey 1987–88, Report No. 87-I-1, 1993.
30. U.S. Department of Agriculture, Human Nutrition Information Service. Women 19–50 years and their children 1–5 years, 1 day. NFCS, CSFII Report No 85–1; 1985.
31. U.S. Department of Agriculture and U.S. Department of Health, Education, and Welfare. Nutrition and your health: Dietary Guidelines for Americans. Public Health Service, Stock No. 017-001-00416-2. 1980. Subsequent editions were released in 1985 (2nd ed), 1990 (3rd ed), and 1995 (4th ed) as USDA Home and Garden Bulletin No 232 by the U.S. Department of Agriculture and U.S. Department of Health and Human Services.

32. Tippett KS, Mickle SJ, Goldman JD, Sykes KE, Cook DA, Sebastian RS, Wilson JW, Smith J. Food and nutrient intakes by individuals in the United States, 1 day, 1989–91. USDA Nationwide Food Surveys Report No 91–2; 1995.
33. Cypel YS, Tamaki JA, Enns CW, Nowverl AB, Cleveland LE, Tippett KS. Nutrition attitudes and dietary status of main meal planners/preparers, 1989–91. USDA Nationwide Food Surveys Report No 91–1; 1996.
34. U.S. Department of Agriculture, Agricultural Research Service. The 1994—96 Continuing Survey of Food Intakes by Individuals and the 1994–96 Diet and Health Knowledge Survey. CD-ROM. Available from the National Technical Information Service, Springfield, VA; telephone: 1–800-553–6847. Accession No. PB98–500457. 1998.
35. U.S. Department of Agriculture, Agricultural Research Service. Food and nutrient intakes by individuals in the United States by sex and age, 1994–96. USDA Nationwide Food Surveys Report No 96–2; 1998.
36. Tippett KS, Cypel YS, eds. Design and operation: The Continuing Survey of Food Intakes by Individuals and the Diet and Health Knowledge Survey, 1994–96. U.S. Department of Agriculture, Agricultural Research Service, Nationwide Food Surveys Report No 96–1; 1998.
37. U.S. Department of Agriculture. The food guide pyramid. Home and Garden Bulletin No 252; 1992.
38. Cleveland LE, Cook DA, Krebs-Smith SM, Friday J. A method for assessing food intakes in terms of servings based on food guidance. Am J Clin Nutr 1997;65 (suppl):1254S–63S.
39. Federal Interagency Forum on Child and Family Statistics. America's children: key national indicators of well-being. Washington DC: US Government Printing Office in cooperation with US Department of Education; 1998.
40. Crane NT, Wilson DW, Cook A, Lewis CJ, Yetley EA, Rader JI. Evaluating food fortification options: general principles revisited with folic acid. Am J Public Health 1995;85(5):660–6.
41. Federal Register. Food labeling: serving sizes (final rule). January 6, 1993;58(3):2229–300.
42. U.S. Department of Health and Human Services, Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives. DHHS Publication No (PHS) 91–50212; 1991.
43. Ippolito PM, Mathios AD. Information and advertising policy: a study of fat and cholesterol consumption in the United States, 1977–1990. Bureau of Economics Staff Report, Federal Trade Commission; 1996.
44. Food and Nutrition Board, National Research Council. Recommended dietary allowances. 10th ed. Washington DC: National Academy Press; 1989.
45. Institute of Medicine, Food and Nutrition Board, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. Dietary reference intakes: calcium, phosphorus, magnesium, vitamin D and fluoride. Prepublication copy (uncorrected proofs). Washington DC: National Academy Press; 1997.
46. National Research Council. Pesticides in the diets of infants and children. Washington DC: National Academy Press; 1993.
47. Scholler DA. Measurement of energy expenditure in free-living humans by using doubly labeled water. J Nutr 1988;118:1278–89.
48. Black A, Prentice AM, Goldberg GR, et al. Measurements of total energy expenditure provide insights into the validity of dietary measurements of energy intake. J Am Diet Assoc 1993;93:571–9.