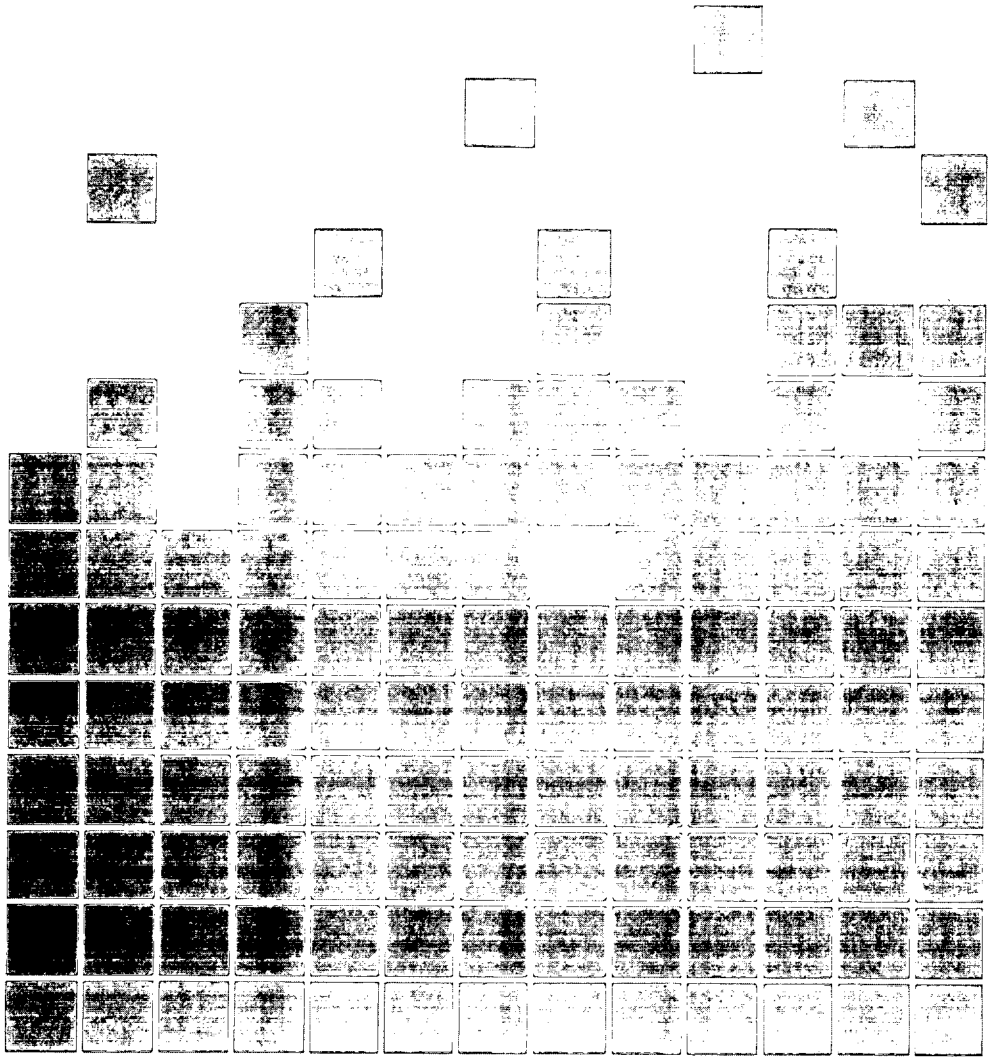
Nutrition Monitoring in the United States

A Progress Report from the Joint Nutrition Monitoring Evaluation Committee



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
National Center for Health Statistics

U.S. DEPARTMENT OF AGRICULTURE
Food and Consumer Services
Human Nutrition Information Service

Hyattsville, Maryland
July 1986

DHHS Publication No. (PHS) 86-1255

Suggested Citation
U.S. Department of Health and Human Services and U.S. Department of Agriculture: *Nutrition Monitoring in the United States — A Report from the Joint Nutrition Monitoring Evaluation Committee.* DHHS Publication No. (PHS) 86-1255. Public Health Service. Washington. U.S. Government Printing Office. July 1986.

Library of Congress Catalog Card Number 86-600550

For sale by the Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

The Joint Nutrition Monitoring Evaluation Committee is a Federal advisory committee jointly sponsored by the U.S. Departments of Agriculture (USDA) and Health and Human Services (DHHS). It was established in October 1983 as stipulated in the Joint Implementation Plan for a Comprehensive National Nutrition Monitoring System submitted to Congress by USDA and DHHS in 1981. Its purpose is to develop reports on the nutritional status of the U.S. population to be issued to Congress jointly by the Secretaries of Agriculture and Health and Human Services at 3-year intervals. The Committee is to integrate and interpret information from the component parts of the monitoring system and to make recommendations concerning the monitoring system. The members are appointed by the Assistant Secretary for Food and Consumer Services, USDA, and the Assistant Secretary for Health, DHHS, who jointly chair the Committee.

Contents

Symbols

*	Indicates figure does not meet standards for reliability or precision
-	Quantity zero
0.0	Quantity is greater than zero but less than .05
. . .	Category not applicable
- - -	Data not available

LIST OF CHARTS

EXECUTIVE SUMMARY

The National Nutrition Monitoring System, operated by the U.S. Departments of Agriculture (USDA) and Health and Human Services (DHHS), is a unique Federal resource. No comparable system for monitoring the nutritional status of a nation exists elsewhere in the world. Through the Nationwide Food Consumption Surveys, conducted by USDA, the National Health and Nutrition Examination Surveys, conducted by DHHS, and other surveillance activities, data are generated systematically on the dietary status and nutritional health of the U.S. population. From these data, it is possible to detect favorable or unfavorable trends in the American diet and to assess the effect of such trends and of many other influences on the nutritional status of Americans. Indeed, information derived from the National Nutrition Monitoring System is indispensable to the development and maintenance of an enlightened national nutrition policy.

For all these reasons, Americans can take justifiable pride in their National Nutrition Monitoring System. This remarkable system merits strong support from Government and from the private sector. This is not to say that the system in place is perfect and provides answers to all questions about the diet and nutritional status of the population in a timely manner. Neither nutrition science nor monitoring methods have progressed to this point. However, because of the monitoring system, we now have a clearer picture of many key aspects of nutrition and health.

The nutritional status of the U.S. population should be considered primarily in relation to this Nation's major nutrition-related health problems. Dietary and nutritional factors are implicated in several of the leading causes of death in the United States, although more research will be needed to determine the exact extent to which dietary changes could reduce morbidity and mortality from diseases related to nutritional status. Some of the diseases associated with nutritional status are hypertension, coronary heart disease, stroke, some cancers, non-insulin-dependent diabetes, and chronic liver disease. Nutritional status also affects the performance and quality of life of the population in ways that are important to understand more fully.

Highlights

The Joint Nutrition Monitoring Evaluation Committee, a Federal advisory committee jointly sponsored by USDA and DHHS, was established to develop periodic reports to Congress on the nutritional status of the U.S. population and to make recommendations on the monitoring system. On the basis of data currently available from Federal nutrition monitoring efforts (see pages 13-15), the Committee reached the following conclusions about the nutritional status of the American population.

- In the United States today, the food supply is safe and adequate, indeed, abundant. Although some Americans may not have sufficient food, clinically significant nutritional deficiencies for which the diet is responsible are relatively rare. Food choices based on variety, balance, and moderation can provide a diet adequate to meet nutritional needs.

- The principal nutrition-related health problems experienced by Americans arise from overconsumption of certain food components: Fat, saturated fatty acids, cholesterol, and sodium. Excessive intakes of these food components are associated with an increased risk of developing cardiovascular diseases.

- Twenty-eight percent of the American population ages 25-74 years, approximately 32 million people, are overweight. Of this group, 11.7 million are severely overweight. Overweight greatly increases the risk of having hypertension and diabetes, particularly among adults under age 45. Overweight is most prevalent among black women and women below the poverty level. These groups also exhibit especially high prevalences of certain obesity-related diseases such as hypertension and diabetes.

- Available monitoring data suggest that, overall, Americans maintain very low levels of physical activity. Overweight is the result of consuming more food energy (calories) than is needed for maintenance or growth and can be reduced by eating less and/or exercising more. Dietary intake data indicate that the high prevalence of overweight among adults is not matched by a correspondingly high energy intake. The health consequences of inactivity may be serious, and they deserve more investigative attention.

- Dietary and biochemical data indicate that intakes of iron and vitamin C are low in certain subgroups of the population. Impaired iron status is most frequently found among young children and females of childbearing age, especially those children and women who are black or poor. Evidence of vitamin C depletion is most frequently found among the poor, especially adult males who smoke cigarettes.

- Because calcium deficiency has been implicated as a contributor to the prevalence of osteoporosis among postmenopausal white women, the relatively low intake of calcium among women is a cause of concern.

- Prevalences of health conditions directly or indirectly related to poor nutritional status are generally highest among the low-income population. Obesity is more prevalent among the poor, indicating an imbalance of energy intake to energy expenditure. Many of the health problems of the poor are related to obesity. Paradoxically, reported dietary intake data suggest that the lower income population have lower intakes of food energy than do the higher income population. Food energy intake may be underreported, or energy expenditure may be unusually low in this group. Reported dietary intake data also indicate that the lower income population have lower intakes of many vitamins and minerals, which is associated in part with their lower calorie intakes. However, lower income households obtain more of most nutrients per food dollar than do higher income households.

Focus of the Report

The focus of this report is the nutritional status of the U.S. population. The nutritional status of an individual is defined as that person's condition of health as influenced by the intake and utilization of nutrients. For this report, nutritional status was inferred from dietary and health data from representative samples of the population. The primary source of dietary data was the USDA Nationwide Food Consumption Survey (NFCS), and the primary source of health data was the DHHS National Health and Nutrition Examination Survey (NHANES). Special attention was given to the nutritional problems of the poor. However, the surveys are not able to include a certain small segment of the population--individuals without a permanent address--among whom poverty may be prevalent. Native Americans residing on reservations and active-duty military personnel are also excluded from the surveys.

The report is organized into five major sections that cover the following topics: (1) The Committee, the National Nutrition Monitoring System, sources of data on nutritional status, and criteria used for assessment in the report; (2) dietary and available health indicators of the nutritional status of the population in relation to food energy, protein, total fat, fatty acids, cholesterol, total carbohydrate, added caloric sweeteners, crude fiber, alcohol, vitamin A, thiamin. riboflavin, niacin, vitamin B_6, vitamin B_{12}, folacin, vitamin C, calcium, phosphorus, magnesium, iron, sodium, and zinc; (3) health conditions and practices that may be related to diet and nutritional status; (4) factors influencing food intake; and (5) recommendations for improving the National Nutrition Monitoring System.

The ability of the Committee to assess the nutritional status of the population from information obtained through Federal surveys was dependent on the quantity and quality of dietary and health data as well as the availability and applicability of criteria for determining the significance of these data. Food components for which data were the most complete had sufficient good quality (1) dietary intake data and assessment criteria and (2) health data and assessment criteria. The data were considered less complete if one of these characteristics was lacking, and the data were considered least complete if both characteristics were lacking. The Committee assessed the completeness of available data for food components as follows:

- Food components for which data were the most complete: Food energy, protein, vitamin A, vitamin C, and iron.
- Food components for which data were less complete: Thiamin, riboflavin, niacin, vitamin B_6, vitamin B_{12}, calcium, and phosphorus.
- Food components for which data were the least complete: Fat, fatty acids, cholesterol, carbohydrate, added caloric sweeteners, fiber, folacin, magnesium, sodium, and zinc.

When survey data were judged incomplete, the Committee used other sources of information to reach conclusions about the public health importance of selected food components. Limited information on alcohol and fluoride also was reviewed for this report. Other food components were not included in the report because data about them and standards for assessment were even more limited. Obviously these information gaps should be narrowed or closed by research and improvements in the monitoring system.

As mentioned previously, the Committee used information from a number of sources, particularly NFCS and NHANES. This is the first time that data from these two major cornerstones of the National Nutrition Monitoring System (NNMS) have been examined so thoroughly in concert and that such an extensive effort has been made to integrate these data into a single evaluation of the nutritional status of the U.S. population. Results of the evaluation, presented in this report, represent a significant milestone in reaching one of the major goals of the NNMS--a coordinated interpretation of information generated by the system.

Information on the nutrient content of food eaten and results of biochemical analyses from health and nutrition examinations of the population are used in this report as indicators of nutritional status. The criteria or cutoffs used for assessing the dietary data in this report are the Recommended Dietary Allowances (RDA) established by the Food and Nutrition Board of the National Academy of Sciences (National Research Council, 1980a). These are not minimum requirements but rather average daily amounts of nutrients that will meet the known nutritional needs of nearly all healthy people. Because the needs of individuals vary, intakes below the RDA are not necessarily inadequate. Although the relationship may not be linear, the risk of some individuals having inadequate intakes may be increased the further intakes fall below the RDA. In contrast, for most of the biochemical measures of nutritional status in this report, the cutoffs used define low levels--the level below which overt signs of malnutrition begin to appear. Because of differences in the nature of dietary and biochemical cutoffs, the prevalence of diets not meeting the RDA will greatly exceed the prevalence of biochemical shortcomings reported.

This study provided the Committee with an increased understanding of the strengths and weaknesses of the surveys and of the dietary and health measurements they provide as indicators of nutritional status. Certain problems of comparability between NFCS and NHANES were identified. For example, differences between the two surveys in sample design and definitions of age categories make it difficult to compare the extrapolations of results to the U.S. population. These findings reaffirm the importance of ongoing departmental efforts to improve comparability among the surveys within the NNMS without forgoing their separate objectives. Another high priority for future research is the identification of more valid health-related methods for assessing nutritional status and more valid methods for assessing dietary intake. These and other issues are included in the Committee's recommendations for improvements in the NNMS, and coordinating meetings between DHHS and USDA are already underway for increased compatibility in future surveys.

Findings

Nutrition-related health problems affected by public health policy are addressed in this report. Inadequacies or excesses of food components in the diet and their effects on nutritional status are a cause of concern. Food components were placed in one of three categories of monitoring status priority based on their relationship to nutritional status. The first two categories represent two levels of public health significance; the third includes food components about which the evidence was insufficient to permit assignment. The categories are as follows:

- Food components warranting public health monitoring priority status.
- Food components warranting continued public health monitoring consideration.
- Food components requiring further investigation.

The entire dietary spectrum requires continued monitoring, but special emphasis should be given to food components in the first category because of the greater potential for related public health problems. For food components in the third category, emphasis should be placed on the development of assessment methods and standards to permit more meaningful monitoring.

Food Components Warranting Public Health Monitoring Priority Status

High dietary consumption	Low dietary consumption
Food energy	Vitamin C
Total fat	Calcium
Saturated fatty acids	Iron
Cholesterol	Fluoride*
Sodium	
Alcohol*	

*Limited data included in the report.

Food components were included in this category if (1) evidence from health and nutrition surveys indicated related health problems in the population, and a substantial proportion of the population had 3-day dietary intakes considerably higher or lower than recommended levels; or (2) evidence from epidemiological and controlled clinical studies indicated related health problems in the population, and a substantial proportion of the population had 3-day dietary intakes considerably higher or lower than recommended levels. Although only limited information on alcohol and fluoride was reviewed for this report, they are included in this category because of the importance of related health problems. In addition to social and public safety problems, excessive alcohol intake is related to cirrhosis of the liver and certain cancers, especially esophageal. Fluoride is a major preventive factor in dental caries. Fluoride may occur naturally in water or be added to municipal water supplies. However, some Americans may not ingest sufficient fluoride from food and water to benefit from this preventive effect. Possible benefits from high intakes of some food components, such as purported advantages of vitamins A and C in cancer prevention, and harmful effects from excessive intakes of supplements, particularly fat-soluble vitamins and trace minerals, are not covered in this report but merit continuing surveillance and evaluation.

Food energy intake in excess of energy expenditure over time leads to obesity and overweight. A recent National Institutes of Health Consensus Development Panel (1985a) concluded that, based on overwhelming evidence, overweight adversely affects health and longevity. The Consensus Panel found that, in addition to its psychological burdens, overweight is clearly associated with hypertension, high-risk serum cholesterol levels, non-insulin-dependent diabetes mellitus, certain cancers, and other medical problems.

National survey data show that in 1976-80 approximately 32 million Americans 25-74 years of age were overweight. This constituted approximately 28 percent of the adult population. The risks of having diabetes, high-risk serum cholesterol levels, and hypertension were higher among those who were overweight than among those who were not. For example, the risk of hypertension among the overweight was more than twice that of persons not overweight. The risk of hypertension was about 3.3 times greater for younger overweight persons (25-44 years of age) than for persons of the same age who were not overweight. The prevalence of overweight remained the same among surveys conducted in 1960-62, 1971-74, and 1976-80. In all three surveys, the prevalence was higher among females than males and was highest among black females.

The relationship of body weight to the balance between food energy intake and expenditure is well recognized. However, energy expenditure could not be assessed from the national survey data used in this report. Because of the great variation among individuals in energy expenditure, standards of "average" energy needs are not meaningful as a method of relating food energy intake to body weight. However, average Recommended Energy Intakes (REI) for age and sex groups are specified by the Food and Nutrition Board of the National Academy of Sciences (National Research Council, 1980a). The REI provide a useful reference point for comparison with intakes of various subgroups of the population.

One would expect populations with a high prevalence of overweight persons to have food available in excess of that required to meet the energy needs of most people. Indeed, USDA data show that sufficient food has been consistently available in food supplies and in U.S. households to provide the population with energy intakes that would be considered excessive for most people. For example, since 1909 the quantities of food available at the wholesale or retail level of distribution have provided approximately 3,400 Calories per capita per day. This is well above the average REI of 2,700 Calories for men of average height and weight doing light work and the corresponding REI of 2,000 Calories for women. Data from food consumption surveys conducted in the mid-1950's, mid-1960's, and late 1970's also indicate that food used in U.S. households could provide energy levels well above the REI. Because information on the food supply and household food use includes data on some food that is not ingested, food energy levels are expected to be higher than actual intakes.

One would also expect populations with a high prevalence of overweight persons to have food energy intakes in excess of their needs. However, individual food intakes reported in the 1965-66 and 1977-78 surveys consistently provided mean energy intakes below the REI. For example, mean energy intakes for the age group 19-64 years were 87 percent of the REI for males and 79 percent of the REI for females.

We can only speculate that the discrepancy between the high prevalence of overweight and the prevalence of food energy intakes lower than the REI is attributable to low levels of physical activity. We do not know how well the level of activity assumed in setting the REI represents the actual average level of physical activity in the population. Several other possible explanations are as follows: (1) Individuals may not fully report their intake, especially of high-calorie low-nutrient foods and beverages; (2) excessive food energy intakes may have occurred at some time prior to the survey periods, and current intakes may reflect attempts to lose weight; and (3) the aggregation of data for individuals surveyed may mask the relationship between food intake and body weight for a single individual.

Total fat, saturated fatty acids, cholesterol, and sodium are considered a public health monitoring priority because high intakes have been linked to cardiovascular diseases, especially coronary heart disease (CHD), and intakes are higher than many authorities recommend. CHD is the major cause of heart attacks. Other cardiovascular diseases include arteriosclerosis, hypertension, and cerebrovascular disease (which may lead to stroke). The interrelationships among these diseases are complex, and factors which affect the incidence and prevalence of one disease may also affect the incidence and prevalence of others.

Elevated serum cholesterol levels, elevated blood pressure, cigarette smoking, and obesity have been identified from epidemiological studies as major controllable risk factors for CHD. Obesity is also a major risk factor for hypertension. The prevention and management of cardiovascular disease have improved with increased emphasis on diet, exercise, better medical services, greater availability of coronary care units, advanced surgical and medical treatment of coronary heart disease, and improved control of blood pressure. The independent effect of any one factor is difficult to identify.

A high serum cholesterol level is a major predisposing risk factor for CHD and death from heart attacks. National survey data show that men and women in the United States in the late 1970's had serum cholesterol levels averaging approximately 215 milligrams per 100 milliliters, with 22 percent of them having sufficiently elevated levels to put them at high risk of having or developing CHD, according to criteria chosen by a National Institutes of Health Consensus Development Panel (1985b).

Populations with diets relatively high in fat, especially saturated fatty acids, and cholesterol tend to have high serum cholesterol levels. Dietary data indicate that the U.S. population as a whole has relatively high intakes of all of these food components. In diets reported over a 3-day period, the proportion of calories from fat averaged 41 percent. Few individuals, regardless of sex, age, economic status, or race, reported diets which provided less than 30 or even 35 percent of calories from fat, as recommended by some authoritative groups, such as the American Heart Association (1978) and the National Academy of Sciences, Food and Nutrition Board (National Research Council, 1980a). Data on the fatty acid composition of individual intakes were not available, but information on total per capita quantities of food available at the wholesale or retail level of distribution indicate that less than one-fifth of the fatty acids in the U.S. food supply in 1982 were polyunsaturated, and more than one-third were monounsaturated and saturated--45 and 38 percent, respectively. Diets containing roughly equal proportions of these fatty acids would be more in line with the recommendations of some authoritative groups. Cholesterol intakes of individuals averaged 385 milligrams per day (214 milligrams per 1,000 Calories). These intakes are higher than upper limits recommended by some groups, which range from 250 to 350 milligrams per day (U.S. Senate Select Committee on Nutrition and Human Needs, 1977; American Heart Association, 1978; National Institutes of Health Consensus Development Panel, 1985b).

High blood pressure is a major risk factor for CHD. In populations with high sodium intakes, high blood pressure is common. In the United States about one in four adults has elevated blood pressure, although certain groups, such as black individuals, have a higher prevalence. If people with high blood pressure severely restrict their sodium intakes, their blood pressures will usually fall, although not always to normal levels without concurrent use of drug therapy. Estimates of the dietary intake of sodium by the U.S. population included only sodium that was found naturally in food, added during commercial processing, or added to standard recipes. Salt added in other cooking or at the table and sodium from water or medicines were not included. Even on this limited basis, the intakes of most individuals averaged close to or above the upper limit of the suggested safe and adequate range of intake (National Research Council, 1980a).

During the period 1940-63, CHD rates increased by approximately 18 percent (Moriyama et al., 1971). Since the peak year of 1963, CHD rates have dropped by more than 25 percent. Stroke mortality rates have been undergoing an uninterrupted decline since 1940. CHD rates and stroke mortality rates may be better understood by examining trends in some of the factors which influence the incidence of these diseases, such as serum cholesterol levels, prevalence of hypertension, and dietary factors. From the early 1960's to the late 1970's, serum cholesterol levels decreased 3 percent for men and 4 percent for women. During the same period, the percent of Americans with hypertension remained about the same--35 percent of persons aged 25-74 years. However, the percent of all hypertension controlled by medication went up considerably, from 16 percent in 1960-62 to 34 percent in 1976-80.

The per capita quantity of total fat provided by the annual U.S. food supply (food at wholesale or retail level of distribution) has increased since 1909. These data include some fat that is not ingested but is discarded in processing, home use, and as plate waste. Whether or not the proportion of fat discarded has changed since the beginning of the century is not known. Food consumption surveys conducted in the mid-1950's, mid-1960's, and late 1970's indicate that the level of fat available for use in households did not change from the mid-1950's to mid-1960's and declined from the mid-1960's to late 1970's. Also, the amount of fat ingested by individuals declined from the mid-1960's to late 1970's. The proportions of various types of fatty acids in the U.S. food supply have moved in the direction of dietary recommendations. Since the beginning of the century, the proportion of saturated fatty acids has declined while the proportion of polyunsaturated fatty acids has increased. The per capita level of cholesterol provided by the U.S. food supply reached a peak in the mid-1940's and then fluctuated downward, declining about 10 percent since 1970.

Similarly, the trends in hypertension are consistent with both the downturn in CHD and the continuing decrease in stroke mortality. However, the fact that complex factors are involved in influencing stroke mortality is evidenced by the downturn in stroke mortality rates early in this century, long before the advent of widespread programs for high blood pressure control.

Vitamin C is considered a public health monitoring priority because of low serum vitamin C levels and differences in vitamin C intakes among certain segments of the population. For the population as a whole, mean levels of serum vitamin C were within the acceptable range, with only about 3 percent of the population having low levels. Vitamin C intakes over 3 days also averaged above the RDA (147 percent), but roughly 40 percent of the population did not meet the RDA. Low intakes of vitamin C, even for a short time, are of concern because the body does not store large amounts of this vitamin.

A more detailed examination of the health data revealed subgroups of the population in which vitamin C status may be compromised. For example, low serum levels were observed among 14 percent of males aged 25-74 years who were below the poverty level and 11 percent of black males aged 25-74 years. The prevalence of low serum levels was 20 percent among poor males 55-74 years of age and 16 percent among black males 55-74 years of age. The characteristics of these groups indicate that age, sex, race, and poverty status are factors that may influence serum vitamin C status.

Adults 19-64 years of age had lower dietary intakes of vitamin C (expressed as a percent of the RDA) than younger individuals, a finding consistent with the health data. However, males had higher intakes than females had. Other factors associated with serum vitamin C levels may help to explain why males have higher prevalences of low serum vitamin C levels. For example, cigarette smoking is associated with low serum levels, and more males than females smoke cigarettes. In addition, the use of vitamin and/or mineral supplements is associated with higher serum vitamin C levels, and more females than males use supplements. Another finding consistent with the health data is that economic status appears to be positively correlated with dietary levels of vitamin C; that is, individuals above the poverty level had higher intakes than those below had. However, at similar economic levels, the vitamin C intakes of black individuals were not lower than those of white individuals. The relative importance of factors associated with vitamin C status and their interrelationships require further study.

Calcium has public health monitoring priority status because of low dietary intakes, especially among women, and the possible association of low intake with osteoporosis in elderly women. Precise estimates of the prevalence of osteoporosis, which is characterized by decreased bone mass and increased susceptibility to fractures, are lacking, but 15-20 million Americans are estimated to be affected by this disease. For the population as a whole, intakes of calcium from food averaged below the RDA (87 percent), with 68 percent of the population not meeting the RDA.

The relationship of dietary calcium to osteoporosis is not fully understood. Several factors have been associated with the development of this disease, such as age, sex, race, menopausal status, use of estrogen therapy, and the amount of weight-bearing exercise. These factors seem to affect either the total bone mass attained or the rate of decline in bone mass.

The incidence of bone fractures is highest among postmenopausal white women, and diets reported by adult women provided considerably less than their RDA for calcium. About 80 percent of women over the age of 18 reported diets that did not provide their RDA for calcium. Their diets were notably lower in calcium than were diets reported by men. In addition, women are at greater risk than men of developing osteoporosis because they have less bone mass and the rate of decline in their bone mass accelerates after menopause. Because of the role dietary calcium may play in the attainment of peak bone mass, which occurs during adolescence and young adulthood, relatively low calcium intakes by females 9-18 years of age are also of concern.

White women are believed to be at higher risk for osteoporosis than black women are, and white men at higher risk than black men. However, dietary intakes of calcium were notably higher for the white population than for the black population, even for groups at similar economic levels. This apparent contradiction is at least partially explained by the greater bone mass of black than of white individuals, which illustrates the fact that factors in addition to dietary calcium are involved in the development of osteoporosis.

Iron warrants public health monitoring priority status, especially among young children, poor females 25-54 years of age, and black females 12-17 years of age, because of relatively high prevalences of impaired iron status (12-21 percent) and low dietary intakes of iron. Of the total population, 66 percent consumed diets over 3 days that did not meet the RDA for iron.

The highest prevalence of impaired iron status (20.6 percent) was observed among poor children 1-2 years of age. Diets reported for 96 percent of the children in this age group did not provide their RDA for iron.

Among people 15-64 years of age, females had a higher prevalence of impaired iron status than males had. The dietary data corroborate this finding. About 80 percent of females 19-64 years of age, but only about 10 percent of males in this age group, reported diets that did not provide their RDA for iron.

Black females 12-17 years of age also had a relatively high prevalence of impaired iron status. The dietary intakes of females in the broad age range 9-64 years appear to be uniformly low relative to their RDA. Notable differences in dietary iron intakes by race or poverty status were not observed for females. However, dietary intakes of iron by males did appear to differ by race and poverty status. In general, iron intakes were higher for white males than for black males, even among those at similar economic levels; and for both white and black males, those above poverty level had higher intakes than those below poverty level.

There are a number of reasons for these differences between dietary and health data related to iron status. As mentioned earlier, different definitions for cutoff points in the standards used are important. In addition, dietary data may not identify fully the level of iron from vitamin and/or mineral supplements, water, and other nonfood sources. Questions as to the bioavailability of iron supplied through these sources, as well as the body's ability to adapt to lower iron intake, complicate our understanding. It is also important to understand the nonspecific nature of some of the biochemical indicators used to detect iron deficiency, making erroneous conclusions possible.

Food Components Warranting Continued Public Health Monitoring Consideration

More consideration	Less consideration
Protein	Total carbohydrate
Vitamin A	Vitamin B_{12}
Thiamin	Phosphorus
Riboflavin	
Niacin	

Food components were included in this category if (1) no currently available evidence from health and nutrition examination surveys indicated related health problems in the population, and most of the population had 3-day dietary intakes that met recommended levels; or (2) potential health problems related to inadequate intakes are ruled out at this time.

Inadequacies of these nutrients are unlikely for the majority of Americans. Intakes of protein, vitamin A value, thiamin, riboflavin, and preformed niacin in diets reported by individuals averaged at or above recommended levels, and at least one-half of the individuals surveyed had intakes that met such levels over a 3-day period. Dietary levels of protein and preformed niacin were lower for individuals with lower incomes, but average levels were still considerably above those recommended. The health data show that low levels of serum albumin (an indicator of protein status) and of serum vitamin A were rarely found in the population and were not associated with race or poverty status. However, the Committee recommends that protein and vitamin A continue to be monitored in dietary and health surveys because of past or potential public health problems related to inadequate or excessive intakes.

Carbohydrate, along with fat and protein, is one of the major sources of energy in the diet. Dietary guidance that recommends lowering fat intake usually recommends substituting complex carbohydrate (starch) as a source of energy. Dietary data for vitamin B_{12} and phosphorus indicate relatively high levels of these nutrients; diseases related to dietary inadequacies have not appeared as public health problems in the past, nor are problems anticipated for the future.

Food Components Requiring Further Investigation

Added caloric sweeteners
Fiber
Vitamin B_6
Folacin
Magnesium
Zinc

Food components were classified as requiring further investigation if (1) information from dietary and health surveys was insufficient to permit a judgment about public health significance; or (2) intakes deviated from recommended levels for many in the population, but related health problems were not found or methods of identifying health problems were not available; or (3) despite theoretical reasons for believing that the food components might have public health significance, intakes were in an acceptable range and related health problems could not be identified.

The added caloric sweetener content of the diet is an important factor in the development of dental caries, especially if the sugar is in a form that adheres to the tooth surface. Foods high in added caloric sweeteners provide simple carbohydrate, a source of energy, but are generally not high in nutrients. Nutritionists usually recommend that when carbohydrate intake is increased, the increment should be in the form of complex carbohydrate (starch) rather than simple carbohydrate. More research is needed to determine whether any particular ratio of complex to simple carbohydrate in the diet has a clear health advantage.

The importance of fiber in the diet has been stressed by several authoritative groups, but food composition data for total fiber and its component substances are limited, and standards for assessment that are generally agreed on are not available. This lack of information about fiber suggests the need for continuing research on the subject.

Dietary surveys indicate relatively low intakes of vitamin B_6, and data on the nutrient content of the U.S. food supply indicate relatively low levels of folacin and zinc available for consumption per capita. However, only scanty health survey data relate low intakes to health problems in the population. More information is needed about the dietary levels and public health significance of these nutrients, and research is needed to develop better measures of nutritional status.

Although dietary data show that a significant fraction of the population had intakes of magnesium below recommended levels, health survey data fail to show related health problems. These observations suggest that standards for magnesium intake may be too high. Further study of the problem is warranted.

Recommendations

The Committee was charged with issuing recommendations to improve the National Nutrition Monitoring System. The Committee made 14 such recommendations. Their implementation is the responsibility of USDA and DHHS. The recommendations are categorized into four broad areas:

Improve Information Exchange Between Data Users and Gatherers

- Establish a mechanism for learning more about the data needs of users, especially Federal agencies. The Committee recommends development of an inventory of Federal Government programs affecting nutrition and an annotated bibliography of evaluations of these programs to determine the contribution of National Nutrition Monitoring System data to program design and evaluation.

- Sponsor periodic conferences related to survey design and data analysis.

- Increase the availability of nutrition information from Federal surveys by publicizing Federal reports in professional journals and computerized bibliographic data bases on nutrition and health.

- Establish a listing of data bases, including methods and techniques, related to food, nutrition, and health. National surveys, special-purpose surveys, and surveys conducted at State and local levels should be included.

Increase Use of Data Collected Under the National Nutrition Monitoring System

- Provide resources for policy-relevant analyses of existing data.

- Provide more complete and uniform documentation of data files available to the public.

- Improve comparability of data from all national surveys conducted as part of the National Nutrition Monitoring System.

- Provide resources to improve the timeliness of release of data tapes and publication of survey results.

Improve Methods and Techniques for Gathering Information for Assessing Nutritional Status

- Continue and expand efforts to study the factors that influence food intake and nutritional status, especially of high-risk groups.

- Improve coverage of the low-income population in activities of the National Nutrition Monitoring System.

- Evaluate the feasibility of developing nutrition indicators for monitoring changes in food consumption and nutritional status. These might be viewed as analogous to leading economic or environmental indicators and could be the basis for anticipating potential nutritional status problems.

- Increase research to improve methods for assessing dietary intake and nutritional status. Special attention should be given to identifying and reducing sources of inconsistency and error.

Increase Resources for the National Nutrition Monitoring System

- Provide adequate resources for the National Nutrition Monitoring System to implement these recommendations and for the Committee, which is charged with interpreting the data collected by this system and also with assessing the need for improvements in the system.

- Identify more completely potential sources of complementary data for the Committee to review and consider as part of the National Nutrition Monitoring System.

Summary of categories of nutritional monitoring status

Food components warranting public health monitoring priority status

Definition:

- Evidence from health and nutrition surveys indicated related health problems in the population, and a substantial proportion of the population had 3-day dietary intakes considerably higher or lower than recommended levels; or
- Evidence from epidemiological and controlled clinical studies indicated related health problems in the population, and a substantial proportion of the population had 3-day dietary intakes considerably higher or lower than recommended levels.

Food component	Completeness of data	Type of data used: Dietary (Nationwide Food Consumption Survey and other)	Type of data used: Health (National Health and Nutrition Examination Survey and other)
High dietary consumption			
Food energy................	+++	FS, H, I	Overweight and associated health conditions
Total fat..................	+	FS, H, I	Serum cholesterol level
Saturated fatty acids......	+	FS	Serum cholesterol level
Cholesterol................	+	FS, [1]I	Serum cholesterol level
Sodium.....................	+	[1]I	Blood pressure
Alcohol....................	+	([2])	Alcoholism and associated health conditions
Low dietary consumption			
Vitamin C..................	+++	FS, H, I	Serum level
Calcium....................	++	FS, H, I	[3]Consensus Development Statement
Iron.......................	+++	FS, H, I	Blood levels of three indicators
Fluoride...................	+	---	Dental caries

See page 15 for footnotes and explanations of symbols.

Summary of categories of nutritional monitoring status--Con.

Food components warranting continued public health monitoring consideration

Definition:

- No currently available evidence from health and nutrition examination surveys indicated related health problems in the population, and most of the population had 3-day dietary intakes that met recommended levels; or
- Potential health problems related to inadequate intakes are ruled out at this time.

Food component	Completeness of data	Type of data used: Dietary (Nationwide Food Consumption Survey and other)	Type of data used: Health (National Health and Nutrition Examination Survey and other)
More consideration			
Protein....................	+++	FS, H, I	Serum albumin level
Vitamin A.................	+++	FS, H, I	Serum level
Thiamin....................	++	FS, H, I	---
Riboflavin................	++	FS, H, I	---
Niacin......................	++	FS, H, I	---
Less consideration			
Total carbohydrate........	+	FS, H, I	---
Vitamin B_{12}...............	++	FS, [1]H, [1]I	---
Phosphorus................	++	FS, H, I	---

See page 15 for footnotes and explanations of symbols.

Summary of categories of nutritional monitoring status--Con.

Food components requiring further investigation

Definition:

- Information from dietary and health surveys was insufficient to permit a judgment about public health significance; or
- Intakes deviated from recommended levels for many in the population, but related health problems could not be found or methods of identifying health problems were not available; or
- Despite theoretical reasons for believing that the food components might have public health significance, intakes were in an acceptable range and related health problems could not be identified.

Food component	Completeness of data	Type of data used: Dietary (Nationwide Food Consumption Survey and other)	Type of data used: Health (National Health and Nutrition Examination Survey and other)
Added caloric sweeteners...	+	FS, [1]I	---
Crude fiber................	+	FS	---
Vitamin B_6.................	++	FS, H, I	---
Folacin....................	+	FS	---
Magnesium..................	+	FS, [1]H, [1]I	---
Zinc.......................	+	FS	[4]Serum level

+++ = Most complete--food components having sufficient good quality (1) dietary intake data and assessment criteria and (2) health data and assessment criteria.
++ = Less complete--food components lacking (1) or (2).
\+ = Least complete--food components lacking (1) and (2).
FS = Food supply--per capita food use at the wholesale or retail level of food distribution.
H = Household--food used by households.
I = Individual--food ingested by individuals.

[1]Food composition data less certain than for other food components in 1977-78.
[2]Alcohol, Drug Abuse, and Mental Health Administration, 1983.
[3]National Institutes of Health Consensus Development Panel, 1984.
[4]Health status indicator less certain than for other nutrients.

CHAPTER 1

INTRODUCTION

Charge to the Committee

The Joint Nutrition Monitoring Evaluation Committee was established to integrate and report the results of the nutrition monitoring activities conducted by the U.S. Departments of Agriculture (USDA) and Health and Human Services (DHHS). This report is the first to be developed by the Committee. The charge to the Committee is stated in the 1981 Joint Implementation Plan for a Comprehensive National Nutrition Monitoring System:

> The Committee will develop reports on the nutritional status of the population to be issued to Congress jointly by the two Departments at three-year intervals. The reports will evaluate the findings of the Nationwide Food Consumption Survey, National Health and Nutrition Examination Survey, and other Federal nutrition monitoring efforts. The Committee's reports will address in detail the nutritional health and dietary status of the general population and certain priority subgroups. The Committee will assess the current state of knowledge about nutrition monitoring, identify deficiencies and special areas of need in the system, recommend more appropriate approaches, and eliminate any unnecessary duplications of effort. Factors which may have influenced nutritional health and dietary status will be identified and reported (U.S. Departments of Health and Human Services and Agriculture, Aug. 1981).

History

The Food and Agriculture Act of 1977 (Public Law 95-113) instructed the Secretary of Agriculture and the Secretary of Health, Education, and Welfare (now Health and Human Services) to submit to Congress a proposal for a comprehensive nutritional status monitoring system to integrate the ongoing nutrition survey activities of both Departments. The Departments' proposal was submitted to Congress in May 1978 and, at the request of the Committee on Science and Technology, was reviewed by the General Accounting Office, which recommended the development of a comprehensive implementation plan. This plan, the Joint Implementation Plan for a Comprehensive National Nutrition Monitoring System, was submitted to Congress in September 1981.

The National Nutrition Monitoring System (NNMS) incorporates existing and proposed research and survey activities with the overall purpose of monitoring the nutritional status of the U.S. population.

The five component parts of the system are:

- Health status measurements,
- Food consumption measurements,
- Food composition measurements,
- Assessments of dietary knowledge and attitudes, and
- Food supply determinations.

The goals of the NNMS are as follows:

- To provide the scientific foundation for the maintenance and improvement of the nutritional status of the U.S. population and the nutritional quality and healthfulness of the national food supply.
- To collect, analyze, and disseminate timely data on the nutritional and dietary status of the U.S. population, the nutritional quality of the food supply, food consumption patterns, and consumer knowledge and attitudes concerning nutrition.
- To identify high-risk groups and geographic areas, as well as nutrition-related problems and trends, in order to facilitate prompt implementation of nutrition intervention activities.
- To establish national baseline data and to develop and improve uniform standards, methods, criteria, policies, and procedures for nutrition monitoring.
- To provide data for evaluating the implications of changes in agricultural policy related to food production, processing, and distribution which may affect the nutritional quality and healthfulness of the U.S. food supply.

The National Health and Nutrition Examination Survey (NHANES), conducted by the National Center for Health Statistics of DHHS, and the Nationwide Food Consumption Survey (NFCS), conducted by the Human Nutrition Information Service of USDA, are the cornerstones of the NNMS. These surveys, which provide the most comprehensive information on health status and food consumption available, are explained in detail later in this chapter.

USDA and DHHS carry out a variety of activities in addition to NHANES and NFCS that make significant contributions to the understanding of the diets and nutritional well-being of Americans. For example, USDA's Human Nutrition Information Service determines the nutrient content of the U.S. food supply each year and maintains the National Nutrient Data Bank. The Agricultural Research Service, in five Nutrition Research Centers, conducts basic research on human nutritional requirements and methods for determining the composition of foods.

The Centers for Disease Control of DHHS collect information on the health status of people in high-risk groups who use public health facilities in 34 States. The Food and Drug Administration's Total Diet Study determines levels of selected nutrients and contaminants in diets prepared from standard market baskets of foods in several regions of the country. Other DHHS activities include collection of statistics on the extent and nature of illness and disability of the population, determinants of health, and utilization of health care; collection of basic vital statistics, including live births, fetal deaths, and deaths; and studies of food knowledge, attitudes, and preferences. The National Institutes of Health support the country's largest program in human nutrition research, including research in nutritional epidemiology, clinical nutrition, and assessment of nutritional status. Both Departments conduct research on methods and standards for nutritional assessment.

The National Nutrition Monitoring System has an important limitation. Its large monitoring surveys are not fully adequate for evaluation of food assistance programs. These programs--such as the Food Stamp Program, the Nutrition Program for the Elderly, and the Special Supplemental Food Program for Women, Infants, and Children--are offered to diverse populations that often are undergoing concurrent changes other than program intervention. Also, most of these programs have objectives in addition to improvement of the diet. However, the surveys do collect information about program participation for use as variables in studies of determinants of nutritional and dietary status. Unless evaluations of the effects of programs are designed as carefully controlled experiments from the outset, a large number of intervening variables will confound the interpretation of results. Meaningful results require studies in which data for control groups or for the population prior to intervention are collected and compared with data for program participants.

The Joint Implementation Plan for a National Nutrition Monitoring System set two major objectives:

(1) Achievement of the best possible coordination of the two largest components of the system--the National Health and Nutrition Examination Survey and the Nationwide Food Consumption Survey, and

(2) Development of a reporting system to translate findings from the two surveys and other monitoring activities into periodic reports to Congress on the nutritional status of the American population.

Four scientists from outside the Federal Government were selected in June 1982 to serve on a committee, chaired by the Assistant Secretary for Health and the Assistant Secretary for Food and Consumer Services, called the Joint Nutrition Monitoring Evaluation Committee. This Committee was to help accomplish the second objective. The charter for this permanent national advisory committee was published in the Federal Register for public comment and approved in fall 1983. The Committee members were officially appointed shortly thereafter. The Committee was convened for the first meeting in December 1983, allowing 1 year for the preparation of its first report, due November 1984. However, as the Committee planned the first report, it became apparent that more time would be needed for completion. Staff support to the Committee was provided by USDA and DHHS. The final report will be submitted to Congress by the Secretary of Agriculture and the Secretary of Health and Human Services. Chart 1 shows the relationship of the Committee to USDA and DHHS.

Principles Used by the Committee

Because the Joint Nutrition Monitoring Evaluation Committee is permanent and reports are to be prepared periodically, the members decided to attempt to provide a foundation for future reports in the initial report. The Committee set objectives as to what would be achieved in its first report and what would be reserved for future reports.

The objectives for the first report had to be modest. In establishing the Committee, no resources were provided to permit new analysis of data or consultation with scientific experts outside the Committee. The Committee therefore decided to compile available data into a report that contains baseline data, descriptive information, and selected pertinent literature references. The intent was to give special attention to the dietary and health status of the poor compared with the nonpoor. Subsequent reports will build on this descriptive base through interpretations designed to provide information helpful in planning and assessing nutrition and health programs and in setting policy. The Committee may need to interact with a broad range of experts in the nutrition community to determine desirable frames of reference and focuses of future reports. Also, data from a wider variety of sources may be included in future reports.

Nutritional Status

The nutritional status of an individual is the condition of his or her health as influenced by the intake and utilization of nutrients (National Institutes of Health, 1970). Because nutritional status cannot be measured directly by any single test, assessment is dependent on the collective interpretation of relevant dietary and health data. The measures or tests that produce these data are best viewed as indicators of nutritional status. Dietary data alone provide information on food and nutrient intake which may or may not have health consequences for an individual, depending on his or her particular nutrient needs. Alternatively, health data alone may indicate problems unrelated to diet. Therefore, both dietary and health data are necessary for reliable statements concerning nutritional status.

Indicators of nutritional status included in this report are as follows:

(1) Levels of specific food components in diets;

(2) Clinical, anthropometric, hematological, and biochemical measurements directly related to specific food components; and

(3) Health conditions or diseases that may be associated with inadequate or excessive intakes of several food components.

Assessment of the dietary and health indicators of nutritional status involves comparison of the levels of these indicators--for example, levels of nutrients in dietary intakes and in blood--with appropriate interpretative criteria. Most assessments of the dietary and health indicators of nutritional status are discussed relative to sex and age. Economic and sociodemographic factors that may influence these indicators are also included.

Deficiency and Toxicity

Criteria have been established that identify clinical, physiological, or biochemical indicators of severe nutritional deficiencies. In the past, populations in various parts of the world have exhibited high prevalences of illness or death because of dietary deficiencies in energy; protein; vitamins A, C, and D; niacin; thiamin; or certain minerals, including iodine and iron. Other severe nutrient deficiencies have been reported occasionally for individuals but not described as widespread problems in populations. Examples of such instances include deficiencies of vitamins K, B_6, and B_{12} and the minerals copper, selenium, and zinc.

Nutrient toxicities are far more a concern now than they were in the past. Much less research has been done to develop criteria for evaluating dietary and health indicators of toxicity than to develop such criteria for undernutrition. This is partly because deficiency of most nutrients causes signs and symptoms specific to the deficient nutrient, while toxicity causes more general symptoms that may mimic diseases, and also because the misuse of vitamin and mineral supplements is a relatively new phenomenon. Nutrient intakes up to 10 times the Recommended Dietary Allowances (RDA) are seldom associated with toxicities. Higher levels of intake are almost impossible to obtain from a diet containing the usual mix of foods available in the United States but are possible by the use of megadoses of vitamin and/or mineral supplements. Such misuse of supplements poses a serious health problem for the individual and in rare instances could create a public health problem. Medically, supplement use is rarely necessary. Unfortunately, self-prescription of supplements may delay individuals in seeking appropriate medical treatment.

Marginal Nutritional Status and Imbalances

The easily recognizable forms of severe nutritional deficiencies or toxicities are rarely found in the population of the United States. Accordingly, many nutritionists and physicians have turned their attention to more subtle marginal deficiencies, excesses, and nutritional imbalances. In marginal nutritional states, nutrient stores may be low, the activity of some enzymes may be below normal or in the low range of normal, and growth may be slightly impaired, but evidence of impaired performance, health, and survival is difficult to document. Persons at these marginal levels are at some risk of falling to lower, more critical levels of deficiency, especially when subjected to stress. In theory, better nutrition would result in improved performance, health, and survival, even though these improvements may be too small to be detected by present scientific methods. When there is no evidence of associated harm, it is prudent for individuals to raise nutrient intake enough to enhance nutrient stores and maintain enzyme activities at normal levels. In affluent countries, risk to an individual's health is usually the only harm considered when recommending higher dietary nutrient intakes.

Examples of important current studies on marginal deficiencies include those on mild iron, calcium, vitamin B_6, and folacin deficiencies. Even more complicated are the studies of diseases, such as cancer or cardiovascular disease, which may be influenced by marginal deficiencies and excesses of several food components as well as many other factors unrelated to nutritional status. These diseases may take years to develop. Diets may change over time and may change as a result of disease. Therefore, it is important to note that current dietary intakes may not correlate with clinical or biochemical signs of disease. Criteria are needed for dietary indicators that are associated with increased risk of disease and for health indicators that allow early detection of disease or predisease states. In general, desirable ranges of dietary intake have been established on the basis of observations of intake and disease-specific mortality in different populations around the world. It is not known to what degree deviations from these ranges might be detrimental.

Poverty and Hunger

The Committee acknowledges that in the world today and in the United States in the past, severe nutritional deficiencies of public health significance have been related primarily to the ability to grow or purchase sufficient amounts of a healthy variety of food. Therefore, the Committee examined the association of poverty with dietary and health indicators of poor nutritional status. The potential benefits of high intakes of food components to prevent certain chronic diseases among the poor were not examined.

Even when undernutrition is not an income-related problem for the general U.S. population, some individuals in the society may suffer from dietary inadequacies resulting from poverty. The association may be simple or part of a complex of problems including lack of information, physical and mental illness, addiction to drugs and alcohol, dietary fads, and child abuse. Factors that affect nutritional status may be public health problems in their own right. Even if they are not, they require appropriate clinical and social intervention on an individual level.

Unassuaged hunger, which is the perceived need to eat, may be a result of poverty but may not be associated with measurable deficiencies in stored energy and nutrients. However, a relationship is easily understood in which poverty results in the inability to obtain a sufficient quantity or variety of food to prevent hunger and to maintain good nutritional status. When hunger results in attendance at soup kitchens, migration, or stealing, it is also a social problem, whether or not it has nutritional implications.

The report published by the President's Task Force on Food Assistance (1984) noted that hunger is a concern among three main groups in the population: The traditional poor, notably female-headed households and the elderly; the new poor, who have suffered from extended periods of unemployment; and the homeless or street people. The sampling plans for the Nationwide Food Consumption Survey and the National Health and Nutrition Examination Survey are based on the distribution of households in the United States and do not include individuals without a permanent address, nor do they include Native Americans living on reservations. Therefore, some small segments of the population in which the prevalence of poverty is high are underrepresented in these surveys.

In the 1977-78 NFCS, some information was collected on the perceived adequacy of household food supplies. Respondents were asked to describe food used in their household as: (1) "Enough and kind wanted," (2) "enough but not always kind wanted," (3) "sometimes not enough to eat," or (4) "often not enough to eat." Approximately 3 percent of the respondents said that sometimes or often there was not enough food to eat in their households. Individuals from these households had intakes of food energy and 12 nutrients, expressed as percents of the RDA, that averaged about 18 percentage points lower than intakes for the rest of the population. Differences ranged from 9 percentage points for vitamin B_6 to 39 percentage points for vitamin C. However, biochemical data to corroborate a nutritional effect are lacking, and the relation of "hunger" to its determinants and consequences is not further developed in this report.

Data Sources

The information available to the Committee included that which has been collected as part of the National Nutrition Monitoring System. Health status measurements and food consumption measurements are the primary nutrition monitoring activities. Implicitly included in these two types of nutrition monitoring are all related research activities on human dietary needs, survey methodology, physiological measures, biochemical analyses, food composition measurements, and standards for assessing dietary and health data. Assessments of nutrition knowledge and attitudes concerning foods provide information on some of the factors that may influence nutritional status. This important aspect of nutrition monitoring is briefly discussed in Chapter 4. Food supply determinations, which have been used to assess trends in the levels of food components in the U.S. food supply since 1909, are an important part of the first Committee report.

Indicators of dietary status from the Nationwide Food Consumption Survey and indicators of health status from the National Health and Nutrition

Examination Survey are the primary focus of this report. Compared with other Federal food and nutrition surveys, these two surveys sample the U.S. population in the most representative fashion. Also, the sample sizes are large enough to show any major public health problems. Even so, the proportion of the U.S. population actually interviewed or examined is relatively small, and some groups are not covered or are not sampled in sufficient numbers to make reliable statistical estimates. A nutritional problem would have to affect about 2 million people (or approximately 1 percent of the U.S. population) to be identified in these surveys with high probability. Thus, localized public health problems or problems affecting small numbers of people who are dispersed clinical cases cannot be identified or monitored by these surveys. For instance, cases of life-threatening protein-calorie deficiency may exist in some individuals, such as neglected children, even though low dietary protein intake does not appear from these surveys to be a public health problem in the United States.

The following sections of this chapter briefly describe the sources of dietary and health data used in this report. More detailed descriptions are provided in the appendixes.

Dietary Data

The American diet can be assessed in several different ways. Information on diets is collected by USDA at three levels--U.S. food supply, household food use, and individual food intakes. The U.S. food supply data represent annual quantities of energy and nutrients per capita per day that are available for consumption from the food supply of the United States. USDA's food consumption surveys, conducted about every 10 years, provide information about diets at the next two levels--food used by households and food eaten by individual household members. Household diets represent food which is available for consumption in the household. Intakes of household members represent food actually eaten by individuals both at home and away from home.

Quantities of food energy, nutrients, and other food components in the American diet at the food supply, household, and individual intake level are calculated using standard tables of the nutritive value of foods. (See U.S. Department of Agriculture Reports on Food Composition in the bibliography.) The content of food components in diets is then assessed to provide indicators of dietary status. Assessments are made for the following food components at one or more of the three levels:

Food supply, household, individual:		Food supply:	Individual:
Food energy	Preformed niacin	Cholesterol	Cholesterol
Protein	Vitamin B_6	Saturated fatty acids	Sodium
Total fat	Vitamin B_{12}	Oleic acid	Added caloric sweeteners
Total carbohydrate	Vitamin C	Linoleic acid	
Vitamin A value	Calcium	Simple carbohydrate	
Thiamin	Phosphorus	Complex carbohydrate	
Riboflavin	Magnesium	Crude fiber	
	Iron	Folacin	
		Zinc	

Food Composition Data

The nutrient contents of foods in the food supply and reported in the food consumption surveys are based on food composition data compiled by scientists in USDA. The collection and publication of these food composition data are ongoing responsibilities of USDA. The food supply series uses information on the nutrient content of the 300-400 basic foods that comprise the U.S. food supply. These foods are at the wholesale or retail level of distribution; they are in a preprocessed or "uncombined" form, for example, flour and sugar rather than breads and bakery products. Nutritive values are for only the edible portion of these foods.

The household phase of the 1977-78 Nationwide Food Consumption Survey uses information on the nutrient content of approximately 3,900 foods and food combinations in household diets. These foods are in the form in which they enter the household. Some are ready to eat and some, such as meat and potatoes, require cooking. Nutritive values are adjusted for refuse and cooking losses. The individual phase of the survey uses information on the nutrient content of approximately 4,500 foods and food combinations in diets of individuals. These foods are in the great variety of forms in which foods are eaten, such as fried and baked chicken, salads, and stews.

U.S. Food Supply Historical Series

The U.S. food supply historical series, dating from 1909, is the only source of information on trends in food and nutrient availability since the beginning of the century. It is based on annual "disappearance" of food at the wholesale or retail level of distribution. It shows the potential of the U.S. food supply for meeting the population's energy and nutrient needs if no foods or nutrients were lost between the wholesale or retail level and actual ingestion. The data do not provide information on the distribution of food among individuals or subgroups within the population.

USDA specialists estimate the "disappearance" of the 300-400 foods that comprise the U.S. food supply. Data on use (exports, military use, yearend inventories, and nonfood use) are deducted from data on supply (production, imports, and beginning-of-the-year inventories). Per capita consumption is derived by dividing the amount of food available by the population of the 50 States. These quantities of food are multiplied by their nutritive value to derive the total nutrient content of the U.S. food supply available per individual.

Nationwide Food Consumption Survey

Since the mid-1930's, USDA has conducted six national food consumption surveys. These surveys, authorized by Congress in legislation (currently the Agriculture and Food Act of 1981), are used to collect information on diets of households and individual household members. Socioeconomic data such as income, household composition, and food program participation are also collected. Data from the surveys are used to assess food and nutrient consumption by the population; to identify factors associated with selected consumption patterns; and to form the basis for food assistance, regulatory, and nutrition education programs.

Most of the dietary data presented in this report are from USDA's most recent survey--the 1977-78 Nationwide Food Consumption Survey. This survey, conducted from April 1977 through March 1978, was from a stratified area probability sample of households in the 48 coterminous States. Households were selected to be representative of households in each of nine census geographic divisions (aggregated for reporting as Northeast, North Central, South, and West) and three levels of urbanization (central city, suburban, and nonmetropolitan) during each of the four seasons. Of the 20,812 households contacted, approximately 72 percent (14,930) completed the household questionnaire. Of eligible individuals in participating households, about 81 percent provided 3 days of dietary information. Separate surveys were conducted in Alaska and Hawaii.

In the household phase of the survey, the person with major responsibility for meal planning was interviewed about food used by the household during a specific 7-day period. Grocery receipts and other reminders were used. The interviewer asked which foods from a prompting list were used, and the food manager responded with the kind, amount, source (purchased, home produced, gift, or pay), and if purchased, the price of the food. Information on the number of meals eaten at home and away from home by household members and the number of meals eaten by guests was also obtained. In this phase of the survey, food consumption was measured at the level at which food enters the household and should be interpreted as consumption in an economic rather than a physiological sense. These consumption data include some food that is not eaten, such as food discarded in the kitchen and at the table and leftovers fed to animals. However, adjustments were made in these data for retention of vitamins during cooking. Data on household food use do not show how food was distributed among household members.

In the individual phase of the survey, members of the participating households provided information on foods they ate on 3 consecutive days. They were asked by the interviewer to recall the food eaten during the day prior to the interview and were asked to keep records of food eaten on the interview day and on the day following the interview. Intakes of persons under 12 years of age were usually reported by the household respondent. For each food eaten, the individual reported the amount ingested, the name of the eating occasion, and with whom and where the food was eaten. Each individual also was asked about his or her health condition, height and weight, water consumption, and use of vitamin and/or mineral supplements. Each was asked whether he or she was on a reducing or other special diet or was a vegetarian.

As in all measurements, variability and errors are a consideration in the interpretation of dietary data. All dietary surveys in which individuals report their food intake are limited by the degree to which individuals describe adequately the type and amount of food they ate. In addition, some individuals may underreport food intake because they do not remember all the food they ate, or they may unconsciously and sometimes consciously minimize eating practices they consider undesirable and maximize those they consider desirable. Day-to-day variability in food intake by individuals is also a consideration in the interpretation of survey data. In an effort to decrease effects of intraindividual variability, 3 days of dietary data were collected and averaged for each individual in the 1977-78 NFCS.

Criteria for Dietary Data

The criteria for evaluating much of the dietary data in this report are the Recommended Dietary Allowances, established by the National Academy of Sciences, Food and Nutrition Board (National Research Council, 1980a). RDA have been established for 17 sex and age groups for 14 of the 25 food components discussed in following chapters. The Food and Nutrition Board also has established ranges of Recommended Energy Intake (REI) for food energy and estimated safe and adequate ranges of intake for sodium and 11 other food components. Dietary levels of food components that do not have established RDA, such as fat, cholesterol, and added caloric sweeteners, were compared with dietary guidelines proposed by other authoritative groups. Each food component is assessed separately because no generally accepted method exists for assessing the nutritional quality of the diet as a whole.

When the RDA are used as criteria to aid in assessment of the adequacy of nutrient intakes, the basic assumptions used in setting the RDA must be considered. The RDA are expected to support body stores of nutrients and biochemical and physiological processes in essentially all normal healthy people. The Food and Nutrition Board has specifically cautioned against confusing the RDA with nutrient requirements. They state: "Differences in the nutrient requirements of individuals are ordinarily unknown. Therefore, RDA (except for energy) are estimated to exceed the requirements of most individuals and thereby to ensure that the needs of nearly all in the population are met. Intakes below the recommended allowances for a nutrient are not necessarily inadequate" (National Research Council, 1980a).

Because the RDA include a margin of safety above the average requirement level, it can be concluded with reasonable certainty that a diet that meets the RDA will meet the requirements of nearly all healthy individuals. This statement of assurance cannot be made for diets that do not meet the RDA.

The RDA do not mark levels below which deficiency is likely to occur. Therefore, dietary assessments are not by themselves conclusive evidence of nutritional deficiency. Corroborating health data are needed. Although it is reasonable to assume that the risk of nutritional deficiency is greater the further dietary intakes fall below the RDA, the relationship between dietary intakes and health effects may not be linear. The nature of the relationship remains to be determined. The extent to which dietary intake data obtained over a short period of time, such as days, represent an individual's usual intake is also unknown. A special National Academy of Sciences Committee, sponsored by USDA, studied the use of data from food consumption surveys to assess nutrient adequacy. Their report (National Research Council, 1986) was released after the present report was written.

The RDA are for quantities of nutrients "ingested." Nutrients in food reported as ingested are estimated in the individual phase of the 1977-78 NFCS and therefore are comparable with the RDA. Some food reported as used by households in the 1977-78 NFCS and some food available for consumption in the U.S. food supply may not be ingested. If food and nutrient loss occurs prior to ingestion, then the nutrient content of household diets and the food supply would need to be in excess of the RDA if diets as ingested are to meet the RDA.

In this report, the RDA were used to assess diets reported by individuals for 3-day intervals in the 1977-78 NFCS in two different ways. In the first method, the nutrient intake for each individual was compared directly with his or her RDA. In the second method, the nutrient-to-calorie ratio of the individual's intake was compared with the RDA ratio. The first comparison would indicate lower than actual levels of intake if there were underreporting of food ingestion by survey respondents. Alternatively, the second comparison would indicate an unduly favorable picture of nutrient intakes--that is, higher than actual levels of intake--if, as is sometimes hypothesized, survey respondents are least likely to fully report those foods that are high in calories and low in vitamins and minerals.

Health Data

Appraisal of nutritional status requires measures of health status in addition to dietary information. DHHS conducts a diverse vital and health statistics program to collect information on determinants of health and on the extent and nature of illness and disability in the U.S. population, including life expectancy, morbidity, and mortality. Six types of nutrition-related measures are made:

- Hematological and biochemical tests,
- Body measurements,
- Dietary intakes,
- Clinical signs of nutritional deficiency,
- Tests for diseases or conditions associated with diet, and
- Assessments of nutrition knowledge and attitudes.

DHHS agencies contributing to nutrition monitoring include the National Center for Health Statistics (NCHS), the Centers for Disease Control (CDC), and the Food and Drug Administration.

The health data in this report are drawn primarily from two sources: The examination component of the 1976-80 National Health and Nutrition Examination Survey (NHANES II), conducted by NCHS, and the Pediatric Nutrition Surveillance System, conducted by CDC.

National Health and Nutrition Examination Survey

The National Health and Nutrition Examination Surveys are a series of related programs carried out during the past 20 years by NCHS. These programs, authorized by Congress under the National Health Survey Act of 1956, are national in scope, based on probability sampling, and used to collect a broad range of morbidity data and related health information.

The first three programs of the National Health Examination Survey, which were conducted for selected periods from 1960 through 1970, focused on different aspects of sickness and health for specific age groups. Information was also collected on height and weight, other body measurements, dental health, and vision and hearing levels. Then, in 1971, a responsibility for monitoring the nutritional status of the population was added, and the National Health Examination Survey became the National Health and Nutrition Examination Survey.

The first National Health and Nutrition Examination Survey, conducted from 1971 through 1974, was designed to assess certain aspects of health status, with particular emphasis on dental health, skin problems, eye conditions, and the nutritional status of the population 1-74 years of age. The nutritional components included body measurements, biochemical and hematological assessments, 24-hour dietary recall, and a questionnaire on the frequency of eating foods from major food groups. In addition, information on health care needs and general well-being were included.

NHANES II was conducted in 1976-80. Because most of the health data in this report are derived from NHANES II, its design will be described in a bit more detail. The target population of this survey was the ambulatory civilian noninstitutionalized population 6 months through 74 years of age residing in the United States, including Alaska and Hawaii. NHANES II utilized a multistage probability design that involved selection of primary sampling units (a county or small group of coterminous counties), segments (clusters of households) within primary sampling units, households, eligible persons, and sample persons.

The sample design provided for oversampling among persons 6 months through 5 years of age, those 60-74 years of age, and those living in poverty areas. A sample of 27,801 persons was selected for NHANES II. Of this sample, 20,322 (73.1 percent) agreed to participate and were examined. A more extensive description of the design and operation of NHANES II is provided in Appendix II.

The data for all the National Health and Nutrition Examination Surveys are obtained through household interviews and through direct physical examinations, coupled with laboratory and clinical tests and measurements. Direct examinations are the best source for standardized clinical, physical, and physiological data, and they are the only source of diagnostic data regarding unrecognized and untreated health conditions. The measurements made in NHANES II are listed in Charts 2 and 3.

The examinations are conducted in specially equipped mobile examination centers consisting of three trailers moved from one location to another. At the examination site, the three trailers are set up side by side and connected by enclosed passageways. These mobile examination centers provide a standardized environment in which highly trained teams of health personnel conduct the examinations using carefully calibrated equipment.

Pediatric Nutrition Surveillance System

The Pediatric Nutrition Surveillance System is conducted by CDC in conjunction with more than 30 States. Through this system, the nutritional status of specific high-risk populations is monitored on a continuous basis. Data are used primarily by State and local governments for program planning and evaluation.

The principal sources of nutrition surveillance data are programs designed to improve the health and well-being of high-risk children. Children's height, weight, and hemoglobin or hematocrit are measured. These measures are necessary to obtain data on the most common nutrition-related problems documented by national nutrition surveys: Growth retardation, overweight, and anemia. More information on the system is given in Appendix II.

Data on other important characteristics, such as age, sex, and ethnic background, are also readily available and could be incorporated in the Pediatric Nutrition Surveillance System at minimal cost and effort. Additional items could be added provided they are related to poor nutritional status or predictive of changes in nutritional status and are amenable to quality control.

Criteria for Health Data

In contrast to the RDA, the cutoff points for evaluating biochemical measures of nutritional status are usually set at three levels. The first level is analogous to the RDA in that it is set sufficiently high that nobody with a higher value could be at risk of deficiency. The next cutoff level defines "low"--a level where prudence supported by little evidence of harm indicates that one should improve nutritional status. The third level indicates deficiency. For most of the biochemical measures of nutritional status used in this report, cutoff points are the low levels. This is the level below which overt signs of malnutrition begin to appear. In areas where the prevalence of severe malnutrition is high, this expectation is generally met. Where the prevalence is low, as in the United States, these low values are poor predictors of malnutrition, in part because of the day-to-day variability of the indicators and in part because other factors affect these indicators. The cutoff points come from various sources: Some are derived from distributions of the measure in normal populations, with some arbitrary point (usually the 2.5 percentile) defined as "low"; others are clinical assessment criteria derived from medical references. For each health indicator of nutritional status discussed in Chapter 2, a definition is provided of the cutoff point used.

Limitations of Cutoff Points for Assessing Dietary or Health Data

In this report many measures are evaluated according to whether they are above or below criterion "cutoff" values. For instance, dietary measures for nutrients are evaluated relative to the RDA. The RDA are set so high that individuals ingesting these levels or more are thought to be ingesting enough nutrients to meet their requirements if they are healthy. Although the relationship may not be linear, the risk of some individuals having inadequate intakes may be increased the further intakes fall below the RDA. Alternatively, some health measures are compared with values which are very rarely found in nutritionally healthy individuals and which are compatible with nutritional deficiency. These cutoff values are so low that individuals falling below them are at high risk of being nutritionally deficient. Individual measurements above these cutoffs do not guarantee nutritional health. Therefore, it is not surprising that many more people fall below the conservatively set RDA cutoff values than below the low health cutoffs.

An important issue remaining to be solved by additional scientific investigation is how to set cutoff values for dietary, biochemical, physiological, and anthropometric data to indicate similar levels of nutrient adequacy or inadequacy.

No cutoff point used in this report differentiates perfectly between the deficient and nondeficient. The RDA are higher than any deficient intakes. Thus, the RDA are completely sensitive in picking up inadequate intakes. However, many persons whose intakes are lower than the RDA ingest enough of the nutrients to meet their individual requirements. The RDA are not very specific in that many nondeficient individuals consume less than the RDA. Acknowledging this qualification, usual or conventional cutoff criteria are used in this report.

Organization of the Report and Statistical Criteria for Presentation of Data

This report is organized into five major sections. This introductory chapter provides background information on the charge of the Joint Nutrition Monitoring Evaluation Committee, its history, and how the Committee responded to its charge.

Chapter 2 is organized as a chartbook, showing in graphic form the data reviewed on dietary and health indicators of nutritional status. The chapter begins with a summarized overview of the findings. Certain concepts of importance in interpreting the nutrition monitoring data presented in the report are discussed, and the criteria used by the Committee to judge indicators of nutritional status are provided.

For selected graphic presentations from the Nationwide Food Consumption Survey, tables showing the means, standard errors of the means, and proportion of the population with intakes of specified levels can be found in Appendix I. The standard error is one measure of the statistical quality of an estimate, with smaller standard errors indicating better estimates. The number of households and individuals in each population subgroup for which data are presented in the report are shown in Tables I-1 and I-2 of Appendix I. Mean nutrient intakes and cumulative distributions of intakes are presented in Chapter 2 without further statistical analysis.

For graphic presentations from the National Health and Nutrition Examination Survey, tables showing the means, standard errors of the means, percents, and standard errors of the percents can be found in Appendix II.

In Chapter 3, health conditions that may be related to diet and nutritional status are discussed. Associations between diet and certain chronic diseases will be the subject of a Surgeon General's report. Descriptive data on some of these diseases, such as cardiovascular disease and cancer, are presented here without any judgment on the validity of the claims that they are affected by diet.

Chapter 4 describes certain socioeconomic factors that influence food intake. Statistically significant results from some studies of the socioeconomic and other factors affecting dietary status are also presented.

Chapter 5 provides the Committee's recommendations for improving the National Nutrition Monitoring System.

Chart 1. Relationship of the Joint Nutrition Monitoring Evaluation Committee to the U.S. Department of Agriculture and the U.S. Department of Health and Human Services

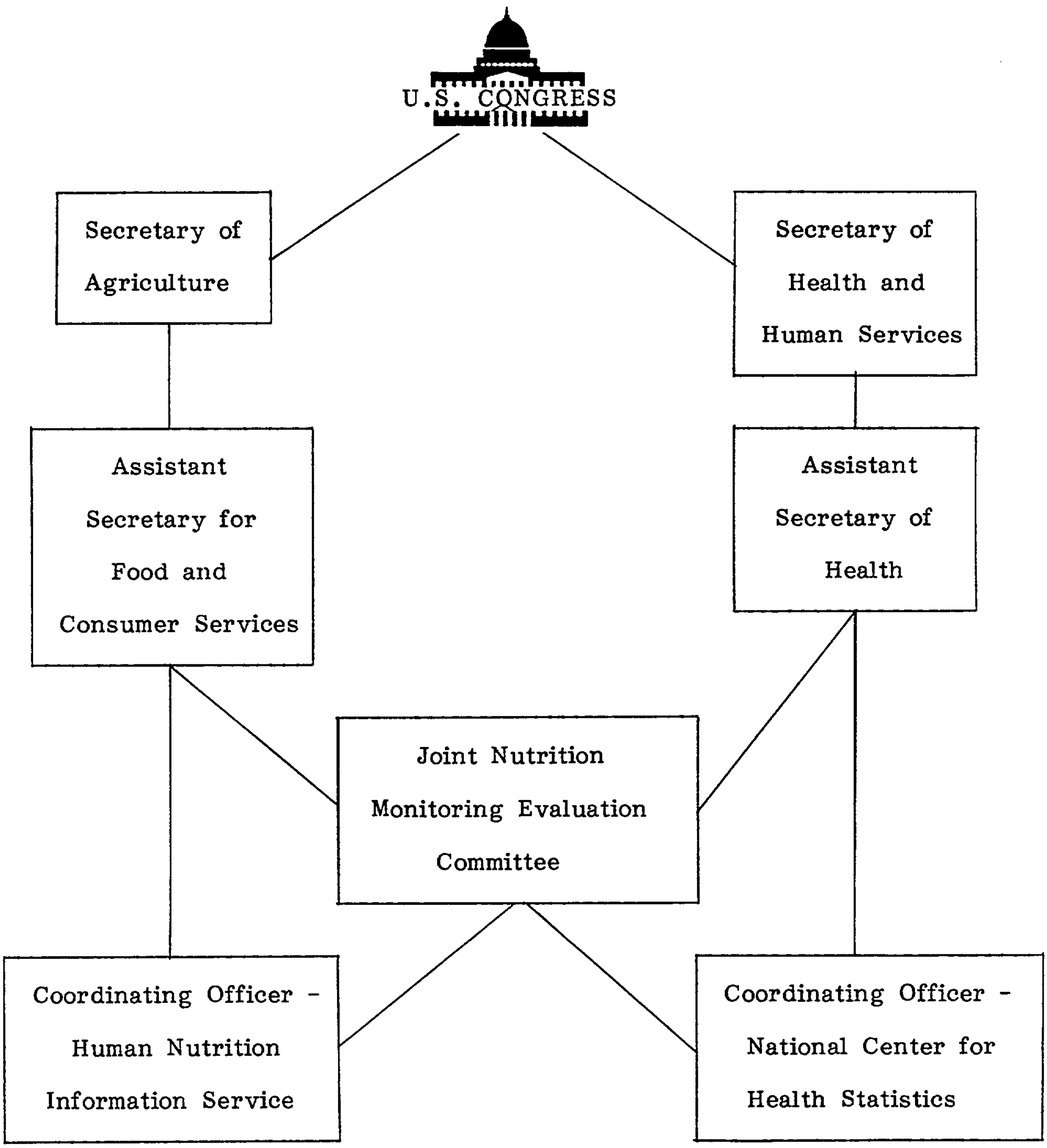


Chart 2. Examination components, by age group: Second National Health and Nutrition Examination Survey, 1976-80

6 months-2 years	*3-11 years*	*12-19 years*	*20-74 years (bile acids test group)*	*20-74 years (glucose tolerance test group)*
...	Urine: 6-11 years only	Urine	Urine	Urine
Body measurements	Body measurements	Body measurements	Body measurements	Body measurements
Physician exam	Physician exam	Physician exam	Physician exam	Physician exam
Venipuncture	Venipuncture	Venipuncture	Venipuncture	Venipuncture
Dietary interview	Dietary interview	Dietary interview	Dietary interview	Dietary interview
...	Audiometry: 4-11 years only	Audiometry	...	...
...	Speech test: 4-6 years only	...	...	...
...	Allergy test: 6-11 years only	Allergy test	Allergy test	Allergy test
...	Spirometry: 6-11 years only	Spirometry	Spirometry: 20-24 years only	Spirometry: 20-24 years only
...	...	...	Electrocardiogram: 25-74 years only	Electrocardiogram: 25-74 years only
...	...	...	Chest and neck X-rays: 25-74 years only	Chest and neck X-rays: 25-74 years only
...	...	...	Back X-ray: 25-74 years for men; 50-74 years for women	Back X-ray: 25-74 years for men; 50-74 years for women
...	...	...	...	Glucose tolerance test
...	...	...	Bile acids test: 35-74 years only	...

Chart 3. Blood and urine assessments, by specimen type and age group: Second National Health and Nutrition Examination Survey, 1976-80

6 months to 2 years	*3-11 years*	*12-19 years*	*20-74 years (bile acids group)*[1]	*20-74 years (glucose tolerance test group)*
		WHOLE BLOOD		
Lead: all examinees	Lead: all examinees of 3-6 years; odd-numbered examinees of 7-11 years	Lead: odd-numbered examinees	Lead: odd-numbered examinees	Lead: odd-numbered examinees
...	Carboxyhemoglobin: even-numbered examinees	Carboxyhemoglobin: even-numbered examinees	Carboxyhemoglobin: even-numbered examinees	Carboxyhemoglobin: even-numbered examinees
Protoporphyrin	Protoporphyrin	Protoporphyrin	Protoporphyrin	Protoporphyrin
[2]Red blood cell folate	[2]Red blood cell folate	[2]Red blood cell folate	[2]Red blood cell folate	[2]Red blood cell folate
		SERUM		
...	[2]Ferritin	[2]Ferritin	[2]Ferritin	[2]Ferritin
...	...	...	Bile acids: 35-74 years only	...
...	...	...	Cholesterol	Cholesterol
...	...	...	...	Triglyceride
...	...	...	...	High density lipoprotein
...	...	Pesticides: even-numbered examinees	Pesticides: all examinees	...
...	...	Creatinine	Creatinine	Creatinine
...	...	Syphilis	Syphilis	Syphilis
Iron	Iron	Iron	Iron	Iron
Total iron binding capacity	Total iron binding capacity	Total iron binding capacity	Total iron binding capacity	Total iron binding capacity
[2]Folate	[2]Folate	[2]Folate	[2]Folate	[2]Folate
[2]B_{12}	[2]B_{12}	[2]B_{12}	[2]B_{12}	[2]B_{12}
...	Vitamin A	...	...	...
...	Copper	Copper	Copper	Copper
...	Zinc	Zinc	Zinc	Zinc
...	Albumin	Albumin	Albumin	Albumin
...	...	...	...	Glucose tolerance 75 gram load at 0-, 1-, and 2-hour intervals
...	Vitamin C	Vitamin C	Vitamin C	Vitamin C
		URINE		
...	N-Multistix: 6-11 years only	N-Multistix	N-Multistix	N-Multistix
...	...	Gonorrhea	Gonorrhea: 20-40 years only	Gonorrhea: 20-40 years for men; 20-24 years for women
...	...	...	...	Microscopy
...	...	...	...	Specific gravity
...	...	Pesticides	Pesticides	...

[1]Bilirubin, serum glutamic-oxaloacetic transaminase and alkaline phosphatase performed only on samples with elevated bile acids.
[2]Performed on samples with abnormal complete blood count, hemoglobin, hematocrit, or mean corpuscular volume, and on a subsample of others.

CHAPTER 2

NUTRITIONAL STATUS

Overview

An important determinant of a healthy population is the availability of food for a safe and adequate diet. In the United States today, our food supply is safe and adequate, indeed, abundant. Although some Americans may have insufficient food or choose an inappropriate diet, the ravages of diseases associated with widespread severe malnutrition, common in some underdeveloped countries, are unknown in this country. The American diet has supported a reasonably healthy population for decades. In general, our health and life expectancy have never been better. However, infant mortality is not as low as it should be, despite a 47-percent decline in the last 15 years (National Center for Health Statistics, Dec. 1985). Also, American diets are changing, perhaps in response to shifting lifestyles, innovations in agriculture and the food industry, concerns about overweight, and reported associations between diet and disease. Results from national surveys show shortcomings in the nutritional status of some Americans.

The nutritional status of an individual can be defined as that person's condition of health as influenced by the intake and utilization of nutrients (National Institutes of Health, 1970). So defined, it is the end result of all factors that influence diet and the availability of nutrients to the body. Adequate nutritional status is fostered by the absence of disease and by a diet that provides sufficient energy, essential nutrients, and other food components. Excessive or imbalanced intakes through either food intake or indiscriminate use of vitamin and/or mineral supplements can compromise nutritional health, but lack of sufficient data prevent adequate assessment of many of these factors. Nonnutritive substances present in food that can adversely affect nutritional status, such as toxins and contaminants, are not reviewed in this report.

Assessment of the nutritional status of individuals and populations requires the collection and analysis of clinical, anthropometric, biochemical, and dietary data. These assessments rely on indicators that differ in their ability to reveal inadequate nutritional status. In addition, the methods by which the data are produced differ in reliability and validity, and the criteria against which they can be assessed, if such exist, differ in appropriateness. However, if several indicators point in the same direction, overall conclusions regarding nutritional status are strengthened. Scientists from several disciplines are striving to develop analytical tools to provide more specificity and sensitivity in these analyses.

Much can be inferred about the nutritional status of the population, even with imperfect data judged by imperfect criteria, especially when a wider knowledge of nutrition is brought to bear. Thus, the data available to the Committee permitted the identification of food components which are a public health priority. To do this, three basic questions were asked:

- What epidemiological, anthropometric, and biochemical evidence indicates a potential public health concern?

- Which food components confirm public health monitoring priority status because they are not ingested in appropriate amounts?

- To what extent are problems related to poverty?

The effects of several physiological, demographic, and socioeconomic factors on nutritional status were considered, but the Committee focused on the association between poverty and indicators of nutritional status in the survey populations.

Quantity and Quality of Data

The quantity and quality of dietary and health data available to the Committee varied among food components and health conditions. The confidence with which the dietary and health data could be interpreted varied with the availability and applicability of assessment criteria. Table 1 shows the sources of information, the availability of appropriate criteria for assessing the data, and the Committee's evaluation of the completeness of the information.

Food components were classified into three categories on the basis of the completeness of related data: Most complete, less complete, and least complete. Food components classified as having the most complete data are those for which the greatest quantity of good quality dietary intake data and health data, as well as recognized assessment criteria, exist. In this category are food energy, protein, vitamin A, vitamin C, and iron. Food components having less complete data are those for which there exist either sufficiently reliable dietary data and assessment criteria or health data and assessment criteria, but not both. Included in this category are thiamin, riboflavin, niacin, vitamin B_6, vitamin B_{12}, calcium, and phosphorus. Food components having the least complete data are those for which neither reliable dietary nor health data and criteria to evaluate them exist. Included in this category are fat, fatty acids, cholesterol, carbohydrate, added caloric sweeteners, fiber, folacin, magnesium, sodium, and zinc. Other food components are not included in this report because data on them are even more limited. Fluoride and alcohol were an exception. They were included because of their public health significance even though information on them included in this report is very limited.

Classification of Food Components by Monitoring Priority

On the basis of its evaluation of the available dietary and health data, the Committee grouped food components into three broad categories of monitoring status priority.

- Food components warranting public health monitoring priority status.

- Food components warranting continued public health monitoring consideration.
- Food components requiring further investigation.

The classification of food components in this report distinguishes between two types of health problems, public health and individual medical problems. Public health problems affect a significant segment of the population and can be reduced or eliminated by appropriate public health strategies, such as food assistance and health care programs (such as the Food Stamp Program and the Special Supplemental Food Program for Women, Infants, and Children), nutrient enrichment of food (enriched flour and bread), and economic incentives to improve the availability of certain types of food. The focus of the present report is on health problems that can be affected by diet and that are amenable to public health programs and policy. On the other hand, individual medical problems must be diagnosed and treated on an individual basis. For example, pernicious anemia is a nutritional deficiency disease in that it is caused by a lack of vitamin B_{12}. However, in the United States, the cause of the deficiency does not usually relate to inadequate intake but to inadequate absorption because of a medical condition. Nutritional problems resulting from child neglect or mental disease are public health problems but are not amenable to public health policy related to nutrition.

Individuals without a permanent address who are not represented in the dietary and health data available to the Committee may have a higher prevalence of nutritional problems than the survey populations have. The President's Task Force on Food Assistance (1984) reported that almost 1 percent of the population, or roughly 2 million people, may be homeless. Approximately one-third of this group were estimated to have been released from psychiatric institutions, and many are regular users of alcohol and drugs. Other groups not surveyed are migrant workers and individuals living on Indian reservations. These groups may have nutritional problems that are part of a complex picture of medical, economic, and social problems that may be public health problems but are not identified by the present National Nutrition Monitoring System. Diet and health surveys also do not include active-duty military personnel and individuals in institutions, such as hospitals, nursing homes, and prisons. Diets in these institutions are expected to follow the regulations governing them.

The dietary data and related health data for the food components in each of the categories of monitoring status are summarized in Tables 2 and 3. When the Recommended Dietary Allowances (RDA) are used as criteria for assessment of nutrient intakes, one must consider that the requirement for a nutrient varies among individuals. The RDA are intentionally set above average requirements to cover safely the requirements of essentially all healthy people; this means that most people do not require as much of the nutrient as the RDA.

For 14 nutrients, the RDA are used as criteria to assess intakes (3-day reported diets) in two different ways. In the first method, the quantity of the nutrient ingested is compared directly with the RDA. In the second method, the nutrient quantity-to-calorie ratio of intake is compared with the RDA nutrient-to-calorie ratio. The Committee believes that intakes of survey respondents relative to RDA cutoffs were probably at values somewhere between the values obtained by assessments based on these two methods.

Food Components Warranting Public Health Monitoring Priority Status

High dietary consumption	Low dietary consumption
Food energy	Vitamin C
Total fat	Calcium
Saturated fatty acids	Iron
Cholesterol	Fluoride*
Sodium	
Alcohol*	

*Limited data included in the report.

These food components should be given priority in monitoring efforts because available data indicate that they present potential problems warranting public health attention. Food energy, total fat, saturated fatty acids, cholesterol, alcohol, and sodium need attention because of possible excessive intakes, while available evidence suggests that intakes of vitamin C, iron, and calcium are insufficient in many diets.

Food components were included in this category if (1) evidence from health and nutrition surveys indicated related health problems in the population, and a substantial proportion of the population had 3-day dietary intakes considerably higher or lower than recommended levels; or (2) evidence from epidemiological and controlled clinical studies indicated related health problems in the population, and a substantial proportion of the population had 3-day dietary intakes considerably higher or lower than recommended levels. When dietary data were lacking or limited, classification was based solely on health data; that is, a food component was considered a public health priority if experimental evidence indicated a strong association between its consumption level and disease.

Very little information on fluoride and alcohol was reviewed for this report. However, these food components warrant public health monitoring priority status because of their relationship to health. Fluoride is a major factor in preventing dental caries. Many Americans do not ingest sufficient fluoride from food and water to benefit from this effect. Excessive alcohol intake is associated with cirrhosis of the liver, birth defects, and some forms of cancer, especially esophageal. The social and public safety consequences of excessive alcohol intake are well known. Available information from tax and industry records indicates high consumption of alcohol in the United States.

Food energy intake in excess of energy expenditure over long periods of time leads to obesity, a risk factor for several chronic conditions--high blood pressure, increased levels of blood fats (triglycerides) and cholesterol, heart disease, strokes, non-insulin-dependent diabetes, certain cancers, and many other types of ill health. In the Nationwide Food Consumption Survey (NFCS) and the National Health and Nutrition Examination Survey (NHANES), information is collected over a short time. Insufficient data on energy expenditure are obtained to determine the balance between energy intake and expenditure. Because the actual energy need of each individual is unknown, the midpoints of the ranges of Recommended Energy Intakes (REI), which are based on hypothetical average energy expenditures, were used as criteria.

A high prevalence of overweight was observed in NHANES, yet the energy levels of diets reported by individuals in national surveys were low in comparison with REI midpoints. Overweight was most common among black women, middle-aged people, and low-income women. Dietary data also differ by poverty status and race--food energy intakes were highest for the white population above the poverty level and lowest for the black population below the poverty level. Two possible explanations for this seeming lack of consistency between dietary data and body weight measurements are that some survey respondents underreported their food intakes and that actual energy needs are lower than the REI, implying that the population is more sedentary than had been assumed in setting the REI. Underreporting of food intake may be greatest for relatively high-calorie low-nutrient foods, such as alcoholic beverages, fats, and sweets. Regardless of possible underreporting, most overweight individuals can be assumed to have a lifestyle that is too sedentary for balancing their intake of food energy. To achieve a more reasonable body weight, they would need to reduce energy intake or increase their activity level. Because obesity adversely affects health (see Chapter 3), all aspects of this issue, including measurements of energy intake and expenditure and criteria for assessment, warrant attention in the future.

For total fat, saturated fatty acids, cholesterol, and sodium, problems relate to overconsumption. Clinical, human metabolic, epidemiological, and animal experimental evidence links cardiovascular diseases to high intakes of fat (especially saturated fatty acids), and cholesterol. Some epidemiological evidence and findings from animal studies suggest links among high-fat diets, obesity, and some cancers. Excess sodium intake is a major hazard for persons who have high blood pressure. Not everyone is equally susceptible, but at present there is no good way to predict who will develop high blood pressure and most Americans eat more sodium than is needed. (See Chapter 3.)

Dietary guidelines issued by the U.S. Departments of Agriculture and Health and Human Services (1980 and 1985) suggest that Americans should avoid too much fat, saturated fatty acids, cholesterol, and sodium. No quantitative guidelines were provided for these dietary substances by the National Academy of Sciences, Food and Nutrition Board (National Research Council, 1980a). However, the Food and Nutrition Board has established a safe and adequate range of intake for sodium, and other authoritative groups have recommended specific goals for cholesterol and fat intakes. Dietary recommendations are discussed in relation to specific food components later in Chapter 2.

Levels of sodium, fat, and cholesterol in diets reported by individuals in the 1977-78 NFCS were generally higher than suggested levels of intake. This was true for sodium even though estimated intakes did not include all dietary sources of sodium. On this limited basis, few differences in sodium intake were seen by age, sex, race, and poverty status. The proportion of calories from fat averaged 41 percent in the 1977-78 NFCS. Few individuals, regardless of sex, age, economic status, or race, reported diets in which less than 30 or even 35 percent of calories were from fat, as recommended by some authorities. Cholesterol intakes were higher for the black than for the white population. Data on individual intakes of saturated fatty acids were not available, but information from the U.S. food supply series indicates considerable increases in the level of fat (especially linoleic acid, an unsaturated fatty acid) available for consumption since the beginning of the century.

Vitamin C intake is classified as a public health priority because of possible inadequacies among certain segments of the population. Although average intakes of vitamin C were above the RDA, women had lower intakes than men had and individuals below the poverty level had lower intakes than did individuals above the poverty level. Low serum vitamin C levels occurred in only about 3 percent of the population. However, the prevalence of low serum levels was greater within subpopulations who smoked cigarettes, had low intakes of vitamin C from diets and supplements, and had low incomes. Possible benefits from high intakes of vitamin C and harmful effects from excessive intakes, particularly from megadoses of supplements, were not monitored in the population but are also reason for priority monitoring.

Calcium is a priority because of low intakes among women, which may be associated with osteoporosis. Levels of calcium in the food supply, household diets, and individual intakes were low for the population in general, but intakes for females were especially low. Only about one in five adult women reported diets that provided the RDA for calcium, and intakes for teenage girls were almost as low. Dietary calcium levels also were notably lower for the black population than for the white population. Dietary calcium levels appear to be positively associated with economic status, but race may be a more important factor.

Recently a National Institutes of Health Consensus Development Panel (1984) reviewed the evidence relating low calcium intakes to osteoporosis. It was concluded that the data are of sufficient strength to warrant recommending that women have calcium intakes that are higher than the present RDA. A complex interrelationship of cellular, physiologic, and metabolic factors underlies the development of osteoporosis. Diet, genetics, and intestinal and renal function all influence the mineral balance necessary to maintain the skeleton. Although bone mass decreases with age in all people, women are at higher risk than men because they have less bone mass initially, and their rate of bone mass decline is accelerated in the years following menopause. The prevalence of bone fractures is highest among postmenopausal women. Black people have denser skeletons than those of white people. This may partly explain the lower incidence of bone fractures among elderly black people despite generally lower calcium intakes.

Iron is a priority because of low dietary intakes by children 1-5 years of age, black females 12-17 years, and poor women 25-54 years. Prevalences of abnormal clinical and biochemical indicators of iron status were high enough to indicate concern for these groups, especially among the poor. Less than one-half of the population surveyed in the 1977-78 NFCS reported diets over 3 days that provided their RDA for iron by quantity, and the proportion meeting the criterion for iron remained low even on the basis of the iron-to-calorie ratio. Iron levels in household diets and the U.S. food supply also were considered low.

The black population had slightly higher prevalences of abnormal clinical and biochemical values for iron than the white population had. Dietary intakes of iron were lower for black males than for white males and were uniformly low among females. In general, dietary levels of iron were positively associated with economic status. Income below the poverty level also was associated with higher prevalences of abnormal iron status.

Food Components Warranting Continued Public Health Monitoring Consideration

More consideration	Less consideration
Protein	Total carbohydrate
Vitamin A	Vitamin B_{12}
Thiamin	Phosphorus
Riboflavin	
Niacin	

There is currently no evidence to warrant public health concern about these nutrients, but they should continue to be monitored so that any trends in the use of food or in changing lifestyles that might lead to a problem can be identified. Food components were included in this category if (1) no currently available evidence from health and nutrition examination surveys indicated related health problems in the population, and most of the population had 3-day dietary intakes that met recommended levels; or (2) potential health problems related to inadequate intakes are ruled out at this time.

All of the food components included in this category except carbohydrate have established RDA. Mean intakes of these food components in 3-day diets reported by individuals in the 1977-78 NFCS averaged above the 1980 RDA for all groups regardless of age, sex, race, or poverty status. At least 50 percent of the survey population reported diets providing the RDA for these nutrients by quantity, and a considerably higher proportion met the RDA in terms of quantity-to-calorie ratios. This favorable picture of individual dietary intakes was corroborated by information on household food use from the 1977-78 NFCS and by information from the U.S. food supply series for 1909-82.

Widespread deficiencies of protein, vitamin A, thiamin, riboflavin, and niacin still occur in various parts of the world today, and deficiencies, particularly of protein and niacin, have occurred in the United States in the past. However, for the majority of the American public, deficiencies of these nutrients are unlikely today. This does not preclude the possibility of deficiencies occurring among individuals or segments of the population, but these isolated problems cannot be solved by changes in public health policy related to nutrition.

The health data on protein and vitamin A available from national surveys indicate that low intakes of these nutrients do not pose current public health problems. The prevalence of low serum albumin (an indicator of protein status) in the 1976-80 NHANES was so small that no comparisons can be made by race or poverty status. In an earlier phase of NHANES conducted in 1971-74, low levels of serum vitamin A were found in less than 1 percent of persons 12-74 years of age. Therefore, in the 1976-80 survey, vitamin A status was assessed only in children 3-11 years of age. For these children, mean serum vitamin A levels were all within normal ranges, and no consistent patterns in the prevalence of low values occurred by race or poverty status.

Benefits that may be derived from high intakes of protein, vitamin A, thiamin, riboflavin, and niacin as well as harmful effects from excessive intakes are not considered in this report. Indiscriminate use of high-potency supplements is of concern; for example, excessive intakes of preformed vitamin A are known to be toxic. Additionally, individuals can develop deficiency diseases when intakes from food sources are chronically low. Therefore, these nutrients should continue to be monitored in diet and health surveys.

No public health problems related to inadequate intakes of carbohydrate, vitamin B_{12}, or phosphorus have been reported in the past in the United States or elsewhere in the world. Carbohydrate is of interest primarily as a source of energy in diets. Dietary guidance that recommends lowering fat intake usually recommends substituting complex carbohydrate (starch) as a source of energy.

Dietary data for vitamin B_{12} and phosphorus indicate relatively high levels of these nutrients, and no public health problems related to these nutrients are anticipated. Vitamin B_{12} deficiency may occur as a result of disease or among strict vegetarians, especially young children. However, deficiency diseases of these nutrients have not been described as public health problems in the United States or in other countries.

Food Components Requiring Further Investigation

Added caloric sweeteners	Folacin
Fiber	Magnesium
Vitamin B_6	Zinc

Limited dietary and health data prevented the assignment of these six food components to the first or second category of public health priority status. Limited available information indicates low dietary levels of most of these food components, but corroborating clinical, biochemical, or epidemiological data are lacking. More complete dietary data and more sensitive health indicators are needed to assess nutritional status related to these food components.

Added caloric sweeteners (sugars) and fiber were not classified for several reasons. Information on the added caloric sweetener and fiber content of food is very limited, and recognized standards for assessment of intakes are not established. In addition, research is still in progress on the association between fiber and some types of cancer.

Excessive intakes of added caloric sweeteners are undesirable because they provide calories but few nutrients. In addition, high and frequent consumption of foods rich in sugars is related to dental caries. However, dental caries are caused by several factors, including the types of food in the diet; the nutrient content of the diet, especially the fluoride content; and oral hygiene. The U.S. food supply series, which is a source of information on trends in types of carbohydrates available for consumption, indicates considerable increases since the beginning of the century in the proportion of simple carbohydrates, especially those from added caloric sweeteners.

The importance of fiber in the diet has been stressed by several authoritative groups, including the U.S. Departments of Agriculture and Health and Human Services (1980 and 1985) in their dietary guidelines, which recommend eating foods with adequate starch and fiber. The U.S. food supply series indicates that per capita quantities of crude fiber have declined since the beginning of the century. No information on levels of dietary fiber ingested by individuals is available from national surveys.

Vitamin B_6 levels in the U.S. food supply, household diets, and individual intakes were low compared with the RDA, but individuals were probably more successful at meeting their vitamin B_6 needs than these data indicate. The RDA for vitamin B_6, which increase as protein increases, are based on assumed levels of protein intake that are higher than the protein intakes of the survey population. Therefore, the survey population's need for vitamin B_6 was probably less than the RDA. Dietary levels of this vitamin were not consistently associated with economic status. Moreover, assessments of vitamin B_6 are less reliable than those for other nutrients because of weaknesses in the 1977 data base on the vitamin B_6 content of foods.

Food composition data on folacin and zinc were so limited that their content in individual diets was not estimated. Estimates of folacin and zinc levels are from the U.S. food supply series only. Levels of folacin and zinc provided by the U.S. food supply per capita per day are below the RDA, but the basis for these RDA are thought to be less reliable than those for many other nutrients. Health indicators of zinc status were low for less than 2 percent of males and 3 percent of females 3-74 years of age.

Females 20-44 years of age have been found to be at the greatest risk of developing folacin deficiency. Improved food composition data and further research on clinical and biochemical methods and standards are needed before nutritional status related to these nutrients can be fully assessed.

The dietary data for magnesium indicate low levels in comparison with the RDA, but some authorities believe that the RDA for magnesium are unduly high. Magnesium was considered unlikely to be a public health concern for the future because no current or historical evidence associates magnesium intakes with widespread health problems. Dietary intakes differed most by race and sex, being higher for the white than for the black population and higher for males than for females.

Dietary Guidance

The purpose of this report is to assess the nutritional status of the U.S. population, not to make dietary recommendations. However, the Committee decided to comment on certain issues related to dietary recommendations because they have practical implications for improving the diets of those population groups identified in this report as having nutritional problems. Dietary recommendations should ideally be based on proven scientific knowledge about the quantity of individual nutrients in diets and about related health indicators of nutritional status. However, to be prudent, dietary guidance must sometimes take into account knowledge which is not yet completely proven with scientific certainty. To be practical, dietary guidance must take into consideration many factors in addition to nutritional biochemistry.

The pattern of nutrients in the American food supply and diets must be considered in making dietary recommendations. In everyday life, diets are composed of foods--each a complex mixture of energy, nutrients, and other components. Planning diets that supply all nutrients at exactly the RDA levels is not usually possible, nor is it necessary. For example, most diets that meet the RDA for all minerals exceed the RDA for protein. Some nutrients, such as protein, are commonly consumed and well tolerated in amounts that exceed the RDA by as much as 2 to 3 times. However, excesses of some food components are highly undesirable. For example, energy intakes in excess of need will lead to obesity, and high intakes of vitamins A and D and certain minerals can be toxic. Diets composed of the variety of conventional foods available to Americans are not likely to approach toxic levels. However, toxicity can occur from megadoses of vitamin and/or mineral supplements.

Recommended levels of intakes have been established for some but not all components of food. The positive and negative effects of food components on each other and on health are not completely understood. In fact, it is suspected that not all components of food necessary for health are known. Therefore, it is desirable that diets consist of a wide variety of conventional foods rather than of a more limited selection containing some foods highly fortified with only the better understood nutrients.

Moderation in consumption of certain food components associated with increased risk of chronic diseases is prudent, even though precise connections between diet and disease are still being studied. For example, the dietary guidelines of the U.S. Departments of Agriculture and Health and Human Services (1980 and 1985) recommend avoiding too much fat, cholesterol, and sugar and eating foods with adequate starch and fiber. Moderation in the use of alcohol by those who choose to consume it and avoidance by pregnant women also have been recommended. For some individuals, following these recommendations would require substantial changes in food selection patterns.

If dietary advice is to be followed, it must be practical. It must reflect the wide variety of foods available to Americans and the numerous food combinations that will meet nutritional needs. It must recognize the many socioeconomic factors that may affect an individual's food choices, such as financial and time resources, attitudes toward food and health issues, food preferences, and culinary skills. Nutrition educators and health professionals have sufficient knowledge about dietary practices, food composition, and human nutritional requirements to allow them to make practical recommendations for improving diets to reduce risks of nutritional deficiencies and certain chronic diseases. These recommendations must be reevaluated periodically based on continued monitoring of the nutritional status of the population and research on human nutritional requirements and relationships between diet and disease.

Table 1. Summary of food components classified by completeness of available data

Data completeness and food component	Dietary data: Source of data: U.S. food supply series	Dietary data: Source of data: NFCS: Households	Dietary data: Source of data: NFCS: Individuals	Dietary data: Criteria for assessment[1]	Health data: Source of data: NHANES	Health data: Source of data: CDC surveillance: Children	Health data: Source of data: CDC surveillance: Pregnant women	Health data: Criteria for assessment[1]
Most complete								
Food energy	x	x	x	x	x	x	---	x
Protein	x	x	x	x	x	---	---	x
Vitamin A	x	x	x	x	x	---	---	x
Vitamin C	x	x	x	x	x	---	---	x
Iron	x	x	x	x	x	x	x	x
Less complete								
Thiamin	x	x	x	x	---	---	---	---
Riboflavin	x	x	x	x	---	---	---	---
Niacin	x	x	x	x	---	---	---	---
Vitamin B_6	x	([2])	([2])	x	---	---	---	---
Vitamin B_{12}	x	([2])	([2])	x	---	---	---	x
Calcium	x	x	x	x	---	---	---	---
Phosphorus	x	x	x	x	---	---	---	---
Least complete								
Fat	x	x	x	---	---	---	---	---
Fatty acids	x	---	---	---	---	---	---	---
Cholesterol	x	---	([2])	---	x	---	---	x
Carbohydrate	x	x	x	---	---	---	---	---
Added caloric sweeteners	x	---	([2])	---	---	---	---	---
Fiber	x	---	---	---	---	---	---	---
Folacin	x	---	---	x	---	---	---	x
Magnesium	x	([2])	([2])	x	---	---	---	---
Sodium	---	---	([2])	x	---	---	---	---
Zinc	x	---	---	x	x	---	---	([3])
Alcohol	([4])	---	---	---	---	---	---	x
Fluoride	---	---	---	---	---	---	---	---

[1]See discussions of specific food components.
[2]Food composition data were less reliable for these nutrients than for others in 1977-78.
[3]Standards for assessing health data on zinc are less certain than standards for other nutrients and food components.
[4]Not part of U.S. food supply series; compiled from sales data (Alcohol, Drug Abuse, and Mental Health Administration, 1983).

SOURCES: U.S. food supply series, 1909-82; NFCS = Nationwide Food Consumption Surveys, 1955, 1965, and 1977-78 (household data only for 1955); NHANES = National Health and Nutrition Examination Survey, 1976-80; CDC = Centers for Disease Control surveillance data, 1975-83.

Table 2. Summary of dietary data for food components classified by category of nutritional monitoring status

Monitoring status and food component	Average RDA for population, 1977[1]	U.S. food supply: Quantity per capita per day	Household food use: Percent of households having RDA	Individual food intake: Mean percent of RDA: Total	Individual food intake: Mean percent of RDA: Below poverty	Individual food intake: Mean percent of RDA: Above poverty	Individual food intake: Percent of intakes providing RDA as: Quantity	Individual food intake: Percent of intakes providing RDA as: Quantity-to-calorie ratio
<u>Warrants priority status</u>								
Food energy	2,200 Calories	3,360 Calories	79	84	80	85	24	---
Total fat	---	156 g	---	---	---	---	---	---
Saturated fatty acids	---	53 g	---	---	---	---	---	---
Cholesterol	---	485 mg	---	---	---	---	---	---
Alcohol	---	[2]1.0 oz	---	---	---	---	---	---
Vitamin C	57 mg	118 mg	94	147	132	150	59	69
Calcium	855 mg	890 mg	70	87	81	88	32	47
Iron	13 mg	17 mg	86	103	97	104	44	58
Sodium	---	---	---	---	---	---	---	---
Fluoride	---	---	---	---	---	---	---	---
<u>Warrants continued consideration</u>								
Protein	46 g	101 g	98	166	164	165	88	100
Total carbohydrate	---	391 g	---	---	---	---	---	---
Vitamin A value[3]...	4,200 IU	7,700 IU	83	133	136	133	50	61
Thiamin	1.14 mg	2.09 mg	90	112	115	112	55	73
Riboflavin	1.33 mg	2.37 mg	95	132	132	132	66	88
Niacin, preformed[4].......	14.8 mg	25.8 mg	94	124	119	125	67	91
Vitamin B_{12}	2.9 mcg	9.4 mcg	88	173	171	174	66	82
Phosphorus	853 mg	1,510 mg	97	136	125	138	72	96

Table 2. Summary of dietary data for food components classified by category of nutritional monitoring status--Con.

Monitoring status and food component	Average RDA for population, 1977[1]	U.S. food supply: Quantity per capita per day	Household food use: Percent of households having RDA	Individual food intake				
				Mean percent of RDA			Percent of intakes providing RDA as:	
				Total	Below poverty	Above poverty	Quantity	Quantity-to-calorie ratio
Requires further investigation								
Added caloric sweeteners	---	[5]18 %	---	---	---	---	---	---
Fiber	---	---	---	---	---	---	---	---
Vitamin B_6	1.92 mg	2.01 mg	69	75	74	75	20	25
Folacin	366 mcg	286 mcg	---	---	---	---	---	---
Magnesium	304 mg	335 mg	79	83	78	84	25	44
Zinc	14 mg	12.5 mg	---	---	---	---	---	---

[1]Recommended Dietary Allowances (National Research Council, 1980a), weighted for the sex and age distribution of the U.S. population in 1977 (1980 Census of Population, U.S. Department of Commerce, Bureau of the Census).
[2]Alcohol per day for individuals 14 years of age and over (Alcohol, Drug Abuse, and Mental Health Administration, 1983).
[3]The RDA for vitamin A in retinol equivalents were converted to International Units.
[4]The RDA for niacin are for total niacin, but dietary data are for preformed niacin only.
[5]Percent of calories.

NOTE: g = grams, IU = International Units, mcg = micrograms, mg = milligrams, oz = ounces.

SOURCES: U.S. food supply series, 1977; Household food use data in Nationwide Food Consumption Survey (NFCS), Spring 1977, 7-day household diet with adjustments made for sex and age of household members and proportion of meals eaten at home; individual intake data in 1977-78 NFCS, 3-day intake.

Table 3. Summary of health survey data for food components classified by category of nutritional monitoring status

Monitoring status, food component, health indicator, and age[1]	Persons with abnormal levels: In the United States: Percent	In the United States: Number in thousands	In groups with highest percent of abnormal levels of health indicators: By race: Percent	By race: Race	By race: Sex	By race: Age[1]	By poverty status: Percent	By poverty status: Poverty status	By poverty status: Sex	By poverty status: Age[1]
Warrants priority status										
Food energy (overweight), 25-74	28	31,756	60.5	Black	Female	45-74	48.3	Below poverty	Female	35-74
Cholesterol (high-risk serum levels), 25-74	22	24,913	35.6	White	Female	55-74	35.9	Above poverty	Female	55-74
Vitamin C (low serum levels), 3-74	3	6,268	11.4	Black	Male	25-74	14.3	Below poverty	Male	25-74
Iron (impaired iron status), 1-74	3	6,610	12.0	Black	Male	3-5	20.6	Below poverty	Both sexes	1-2
Warrants continued consideration										
Protein (low serum albumin levels), 3-74	0.1	196	1.2	Black	Male	55-74	1.6	Below poverty	Male	55-74
Vitamin A (low serum levels), 3-74	3	842	6.1	White	Female	3-5	6.6	Above poverty	Female	3-5
Requires further investigation										
Zinc (low serum levels), 3-74	2	4,113	5.6	Black	Female	18-74	6.7	Below poverty	Female	3-5

[1] Age in years.

Energy-Yielding Food Components

Food Energy

Description

Energy from food, measured in kilocalories (Calories), is required for all life processes: Maintenance of body temperature, growth and repair of bones and tissues, and movement of muscles, including involuntary muscles such as the heart. Food energy is provided by carbohydrates, fats, and proteins. Carbohydrates and proteins each provide 4 Calories per gram, whereas fats provide more than twice as much--9 Calories per gram. Alcohol is also an energy source, providing 7 Calories per gram. Food energy not needed immediately in metabolic processes is stored, predominantly as body fat.

Diets chronically low in energy compared to expenditure will lead to underweight and, in extreme cases, semistarvation. Insufficient food is a widespread problem in many underdeveloped countries and has been a public health problem in certain parts of the United States. It is still seen regularly as a clinical problem in this country among patients with a variety of physical and mental diseases. Healthy individuals spontaneously consume enough food to maintain their body weight when sufficient food is available. Obesity resulting from energy intakes in excess of needs is common in this and other developed countries.

Body weight for height is an indicator of energy balance. It represents the gross mass of tissue produced and maintained by the balance between food energy consumed in the diet and energy expended through activity and exercise. A body mass index was used in the 1976-80 National Health and Nutrition Examination Survey (NHANES II) to assess the prevalence of overweight.

Dietary intakes of food energy are assessed relative to the 1980 Recommended Energy Intakes (REI). The appropriate food energy intake for an adult balances with expenditure to maintain desirable body weight. Energy needs depend on the individual's sex, age, height, weight, metabolic rate (rate of chemical activity), environment, and level of work and leisure activity. Additional energy is needed during childhood for growth and during pregnancy and lactation. The REI are ranges of energy intake estimated to meet the needs of "average" healthy individuals in 17 sex and age groups engaged in "light activity" in a moderate climate. For example, the average male over 18 years of age was considered to be 70 inches tall and 154 pounds. A typical light activity pattern for a day would include 3 hours of activities such as walking (2.5-3-miles per hour), tailoring, carpentry, washing clothes, and playing golf or volleyball.

Since individual energy needs are unknown, the midpoints of the ranges of the REI were used as the criteria for food energy intakes. For males 23-50 years of age, the REI midpoint is 2,700 Calories per day, and for females of the same age, it is 2,000 Calories per day. Because of the variability among individuals in energy needs, it is virtually impossible to develop meaningful dietary standards for the assessment of energy intake. For this reason, the REI are not very useful when employed for assessment purposes. If it is assumed that individuals differing from the REI in their energy needs are randomly distributed throughout the population, then the REI are best utilized to facilitate comparisons among groups of individuals at the time of the survey.

An individual's body weight compared to his or her height is the best indicator of the past adequacy of energy intake. Possible explanations for a lack of agreement between body weight and reported food energy intake include the following: Individuals may not report fully their food intake; the midpoints of the REI ranges may be higher than "average" energy needs, implying that the population is more sedentary than was assumed in setting the REI; and days on which energy intakes are excessive for an individual may be infrequent and not sufficiently sampled in national food consumption surveys. Regardless of the current energy level of reported diets, overweight individuals who do not have physiological defects in energy metabolism, are assumed to have average energy intakes greater than their needs.

Major Findings

- Health data in this report indicate that overweight, not underweight, is a major problem in the United States: 28 percent of the population 25-74 years of age is overweight.

- About 60 percent of middle-aged black women are overweight. This is of concern because hypertension, diabetes, and high levels of serum cholesterol are more common among the overweight than those not overweight. (Refer to Chapter 3 for a discussion of overweight and health.)

- Food energy levels of diets reported by individuals in national surveys averaged below the midpoints of the REI ranges. In 3-day diets reported in the 1977-78 Nationwide Food Consumption Survey (NFCS), food energy levels were higher for males than for females, and they were higher for the white population above poverty level than for the black population below poverty level. If reported diets represent usual food energy intakes and such a large proportion of the population is overweight, it must be concluded that many Americans are underactive.

- Nutrient sources of energy in diets reported by individuals were as follows: Protein averaged 17 percent of food energy; fat, 41 percent; and carbohydrate, 43 percent.

- Major food sources of energy in household diets were the meat, poultry, and fish group and grain products.

- Food energy provided by the U.S. food supply has fluctuated since the beginning of the century but without a consistent trend. However, the proportion of food energy from fat increased while the proportion from carbohydrate declined. In 1982, the food energy level was 3,360 Calories per capita per day.

Individual Intake

Food energy intakes by individuals (3-day dietary reports) in the 1977-78 NFCS averaged 84 percent of the REI midpoints (Food energy 1-1). If the REI for the population were based on "very light" as opposed to "light" activity levels, average energy levels in diets reported by the survey population would exceed estimated average energy needs. About one-quarter of this population had intakes of at least the REI midpoints, and more than one-half (52 percent) had intakes of at least 80 percent of the REI midpoints, an energy need consistent with "very light" activity (chart 1-2).

Food energy levels related to REI midpoints were higher for males 9-64 years of age than for females in the same age groups but differed little for males and females over 64 years of age (charts 1-1 and 1-3). Food energy levels were lowest for females 19-64 years of age.

Food energy levels differed by poverty status and race--highest for the white population above poverty level and lowest for the black population below poverty level (charts 1-1 and 1-4).

Among the four regions of the country, food energy levels were highest in the West and lowest in the South (charts 1-1 and 1-5). Food energy levels by urbanization and season differed little.

Household Food Use

Households with higher income per capita reported using food with more calories per person than did lower income households (chart 1-6). However, higher income households paid more for calories than did lower income households; that is, they obtained fewer calories from each food dollar. Among households eligible for the Food Stamp Program, participants used food slightly higher in calories per person than did nonparticipants but similar in calories per dollar. Compared with higher income households that were ineligible for the program, participating households used food about the same in calories per person but higher in calories per dollar.

Households using food with higher money value per person averaged more calories per person but fewer calories per dollar than did households with lower food costs. Smaller households used food with more calories per person but fewer calories per dollar than did larger households.

Almost one-half of the food energy of household diets was provided by two food groups: One-fourth by the meat, poultry, and fish group and one-fourth by grain products (chart 1-7). Of the food groups, the fats and oils group was the most economical source of food energy. Of the total money value of food used by households, the largest percent was allocated to the meat, poultry, and fish group.

Historical Trends

The per capita food energy level provided by the U.S. food supply was about the same in 1982 as in 1909-13 (chart 1-8). The level fluctuated over the years, but not more than 12 percent from the highest to the lowest point. The food energy level declined in the early 1920's, mid-1930's, and the late 1950's. These declines are probably attributable to general changes in the economy and food availability in the years following World War I, during the depression of the 1930's, and during the recession of the 1950's. From 1960 to 1970, the level of food energy rose slightly because of increased use of three food groups--fats and oils; meat, poultry, and fish; and sugars and sweeteners. Thereafter, the level fluctuated, declining from 1970 to 1975, then rising again. For the most part, these changes reflected the level of fat in the food supply.

Data from USDA's food consumption surveys indicate almost no change in the food energy level of household diets from 1955 to 1965-66, but data for both household diets and individual intakes show a decline of 8-9 percent from the mid-1960's to 1977-78.

Nutrient sources of food energy in the food supply changed from the beginning of the century to 1982 (chart 1-9). Although the proportion of food energy from protein remained relatively unchanged over the years, the source of energy in the diet shifted away from carbohydrate to fat. Major factors influencing these changes were decreased use of grain products and increased use of fats and oils and of meat, poultry, and fish.

Chart 1-10 shows the percent of the survey population in the 1977-78 Nationwide Food Consumption Survey having intakes that provided various proportions of food energy from protein, fat, and carbohydrate. The steepness of the curves suggests that survey participants did not differ greatly from each other in the proportion of their food energy provided by protein, fat, and carbohydrate. They averaged 17 percent of energy from protein, 41 percent from fat, and 43 percent from carbohydrate. Alcohol contributed about 1 percent of calories on average in these self-reported data, which underreport alcohol intake. The percentages sum to more than 100 percent because of rounding.

Differences between food energy sources in the food supply and food intakes are explained partly by the different stages in the food distribution system at which food disappearance and individual intake are measured. The food supply data are for nutrients in foods at a wholesale or retail level of distribution, and the individual intake data are for nutrients in foods as they are ingested. During processing, marketing, and home or institutional preparation, high-protein foods, which tend to be expensive, may be selectively retained, with relatively greater loss, waste, or discard occurring in high-carbohydrate foods or high-fat portions of food.

Body Weight

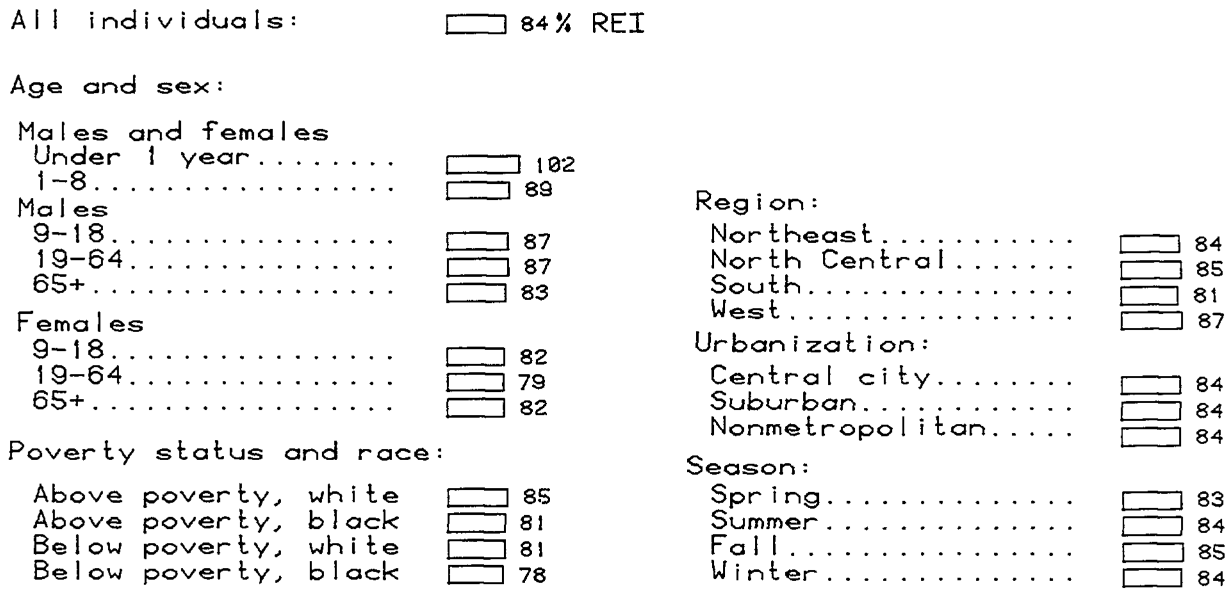
Body weight for height is an indicator of energy balance. Because tall people should weigh more than short people do, a body mass index (weight/height^2) was used to standardize weight for height. The median body mass index (BMI) for men is 23.7, since that is the BMI value at the 50th percentile for men 20-29 years of age. The median BMI for women is 22.0. Overweight was defined as a BMI equal to or higher than the 85th percentile for men and nonpregnant women ages 20-29 years examined in NHANES II. Severe overweight was defined as a BMI equal to or higher than the 95th percentile of this same reference group. A 5 foot 8 inch tall man who weighs 205 pounds or more is considered severely overweight, but a 5 foot 8 inch tall woman would not be considered severely overweight unless she weighed 215 pounds or more, because the BMI cutoff for severely overweight men is 31.1, while the cutoff for women is 32.3. These cutoff points were used because young adults are relatively lean, and increases in body weight with age are usually attributable to fat accumulation. The cutoff points are a statistical approach to defining overweight and are not based on the morbidity or mortality experience of the survey population.

Overall, 28.0 percent of adults 25 years and older were overweight, with more women (29.6 percent) than men (26.3 percent) in this category (Food energy 2-1 and 2-2). For women, overweight was more prevalent in the black population (about 60 percent for women 45 years and over) than in the white population (30-36 percent for those 45 years and over).

Overweight occurred more frequently in women below poverty level than in women above poverty level, but this relationship does not hold for men (charts 2-3 and 2-4).

The prevalence of overweight can be compared for three surveys conducted in 1960-62, 1971-74, and 1976-80. No consistent pattern over time was seen for men (chart 2-5), but an increase was seen within age groups in women up to 45-54 years, followed by a decline (chart 2-6). The prevalence of severe overweight by age group was not significantly different over the three surveys for men and women (charts 2-7 and 2-8).

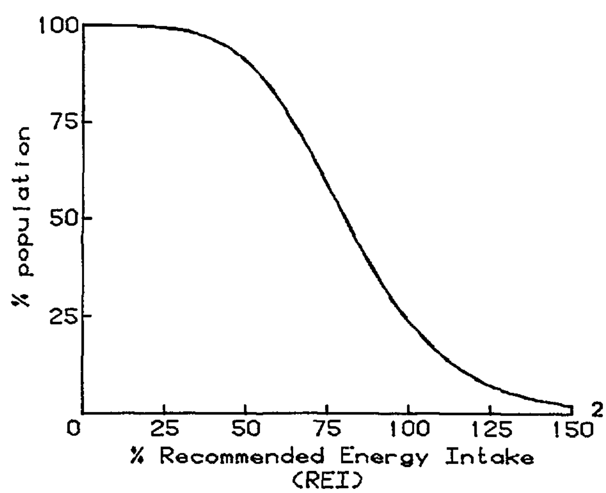
Food energy 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Energy Intake (REI),[1] by selected characteristics (3-day average)



[1]Midpoint of range.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

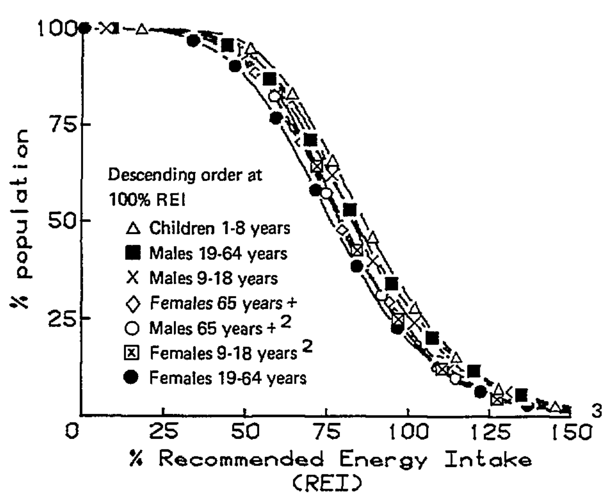
Food energy 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 REI.[1] (3-day average)



[1]Midpoint of range.
[2]Truncated at 150% REI.
Example: 24% of population had at least 100% REI.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

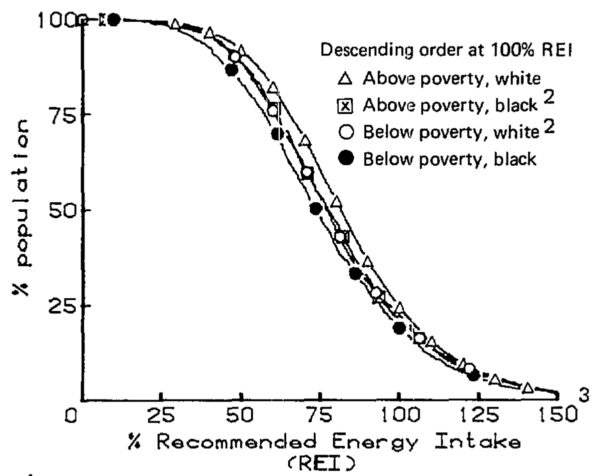
Food energy 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 REI,[1] by sex and age (3-day average)



[1]Midpoint of range.
[2]Equal at 100% REI.
[3]Truncated at 150% REI.
Example: 31% of children 1-8 years had at least 100% REI.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

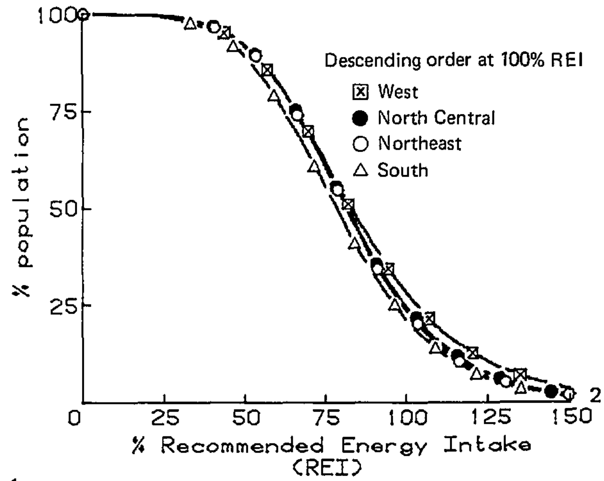
Food energy 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 REI,[1] by poverty status and race (3-day average)



[1]Midpoint of range.
[2]Equal at 100% REI.
[3]Truncated at 150% REI.
Example: 25% of above poverty, white population had at least 100% REI.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

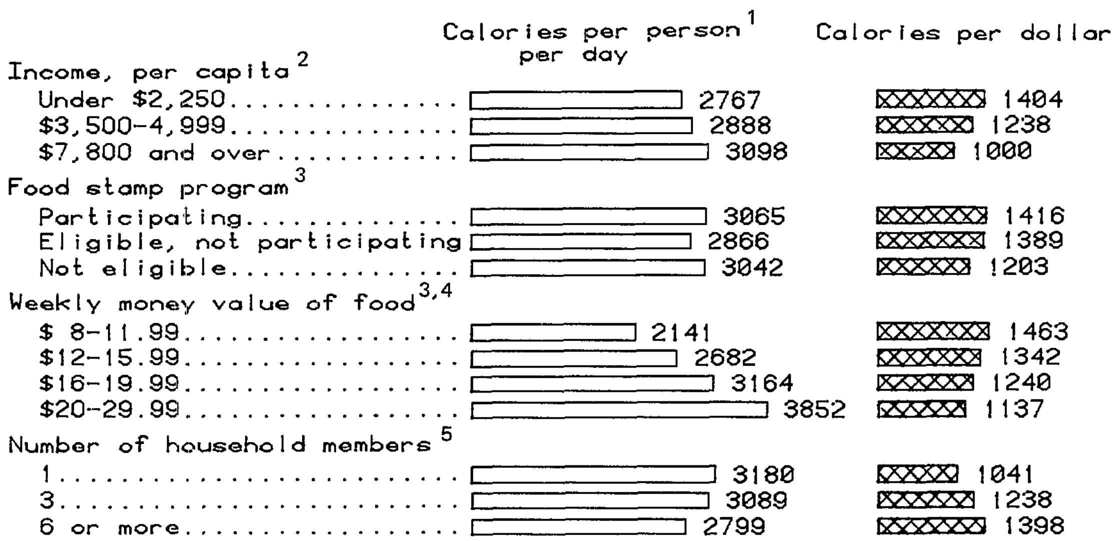
Food energy 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 REI,[1] by region (3-day average)



[1]Midpoint of range.
[2]Truncated at 150% REI.
Example: 29% of population in the West had at least 100% REI.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

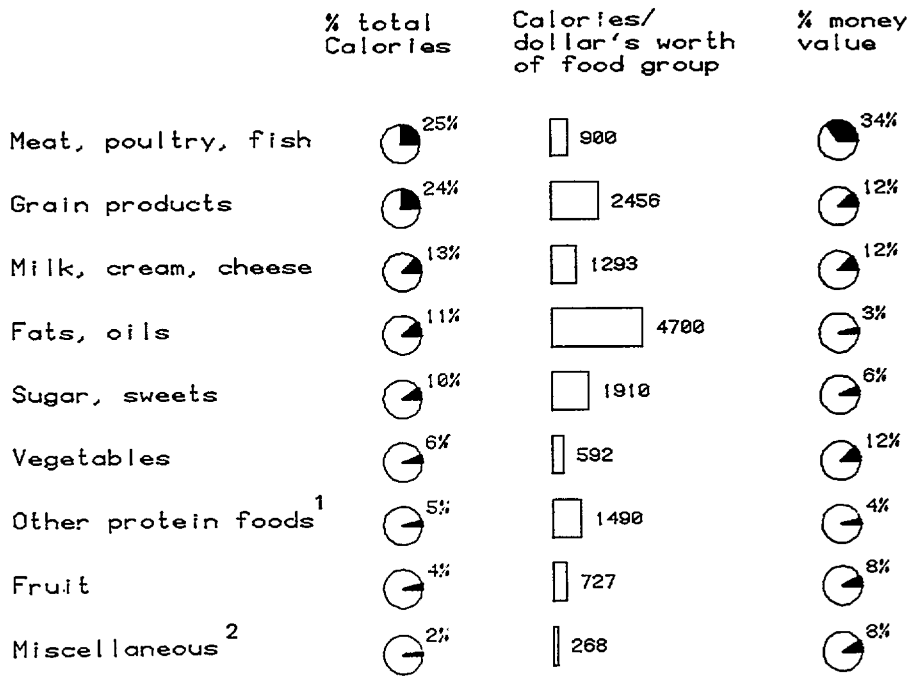
Food energy 1-6. Household diets, spring 1977: Calories per person and per dollar's worth of food used at home, by selected characteristics



[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

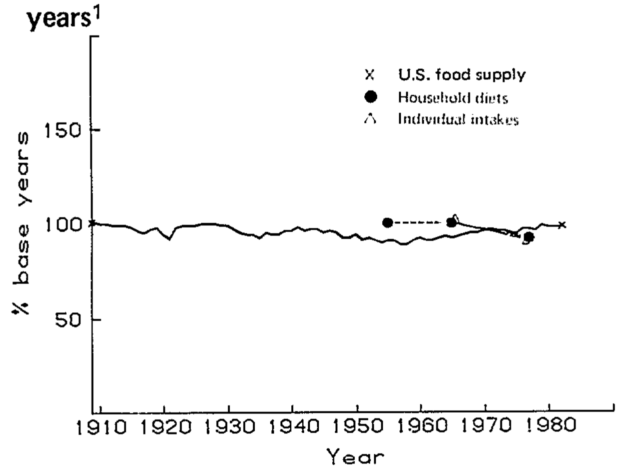
Food energy 1-7. Household diets, spring 1977: Contribution of food groups



[1]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

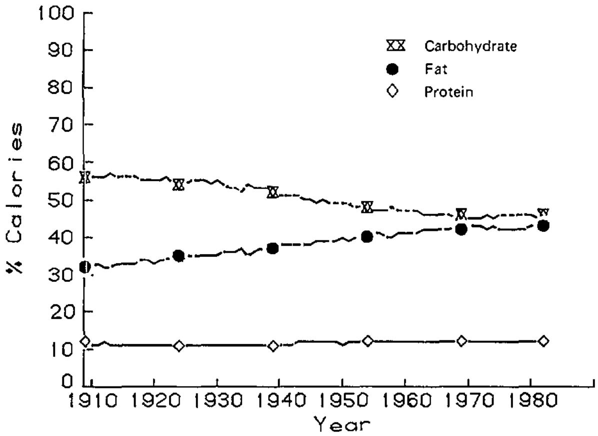
Food energy 1-8. U.S. food supply, household diets, and individual intakes: Percent of base years[1]



[1]U.S. food supply, 1909-13=3,467 Calories/capita/day; household, 1955=3,220 Calories/meal-at-home equivalent person/day; individual, 1965=2,060 Calories/individual/day (3-day average).

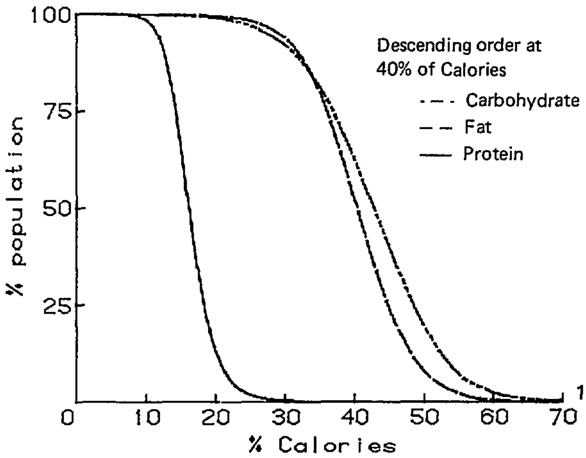
SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

Food energy 1-9. U.S. food supply: Percent of Calories from carbohydrate, fat, and protein



SOURCE: USDA: Data from the U.S. food supply historical series.

Food energy 1-10. Individual intakes, 1977-78: Cumulative percent of population having carbohydrate, fat, and protein intakes of at least specified levels (3-day average)

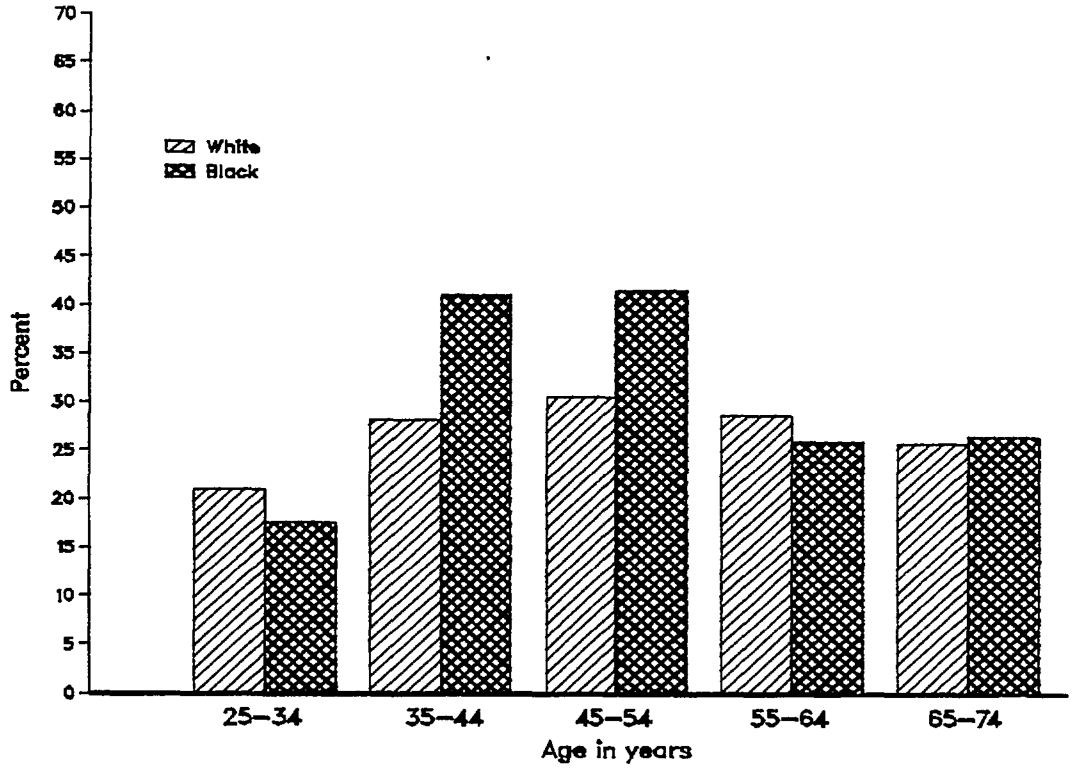


[1]Truncated at 70% of Calories.

Example: 53% of population had fat intakes above 40% of Calories.

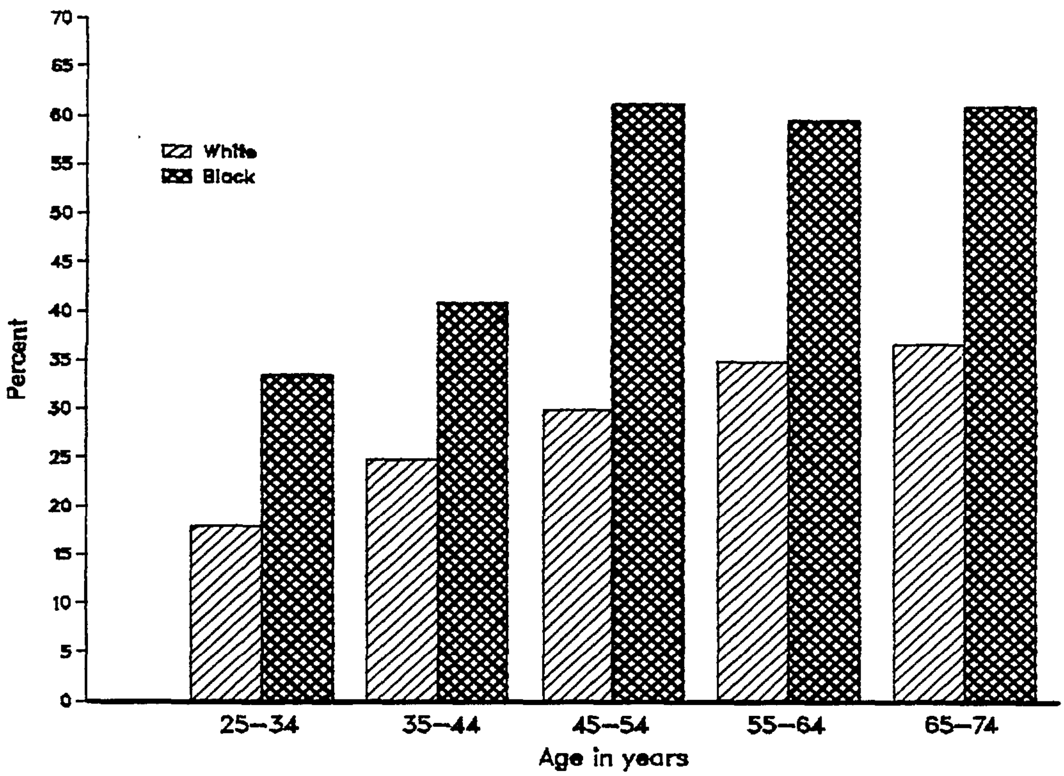
SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Food energy 2—1. Percent of males overweight, by race and age: 1976-80



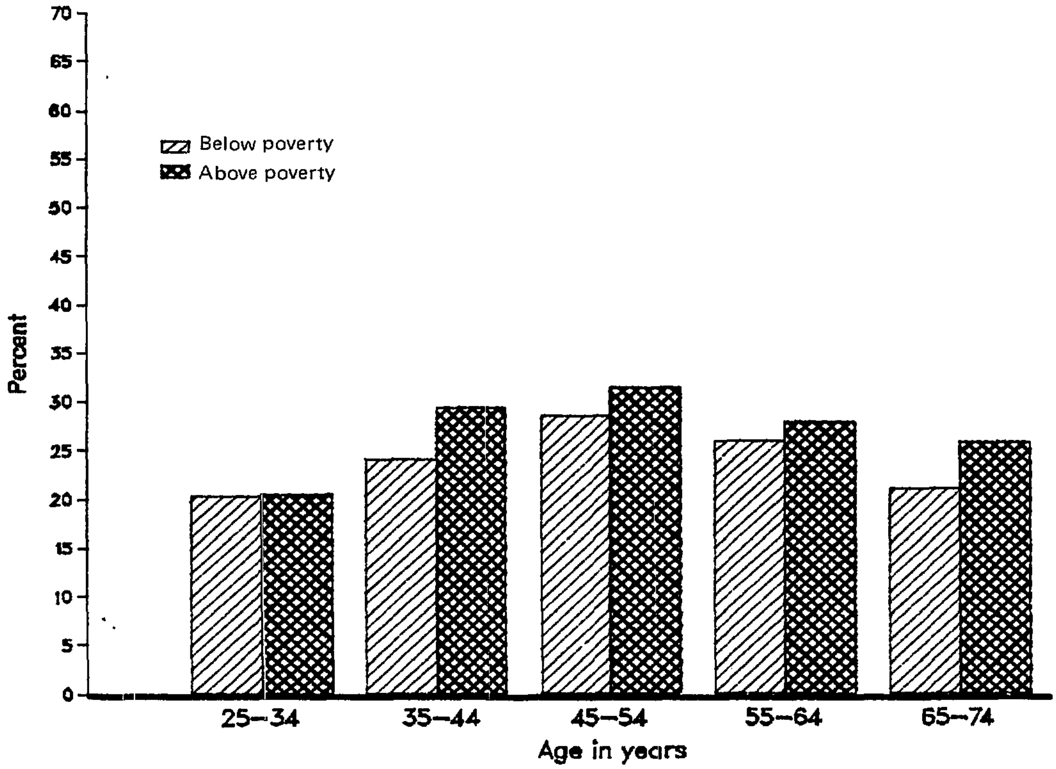
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Food energy 2—2. Percent of females overweight, by race and age: 1976-80



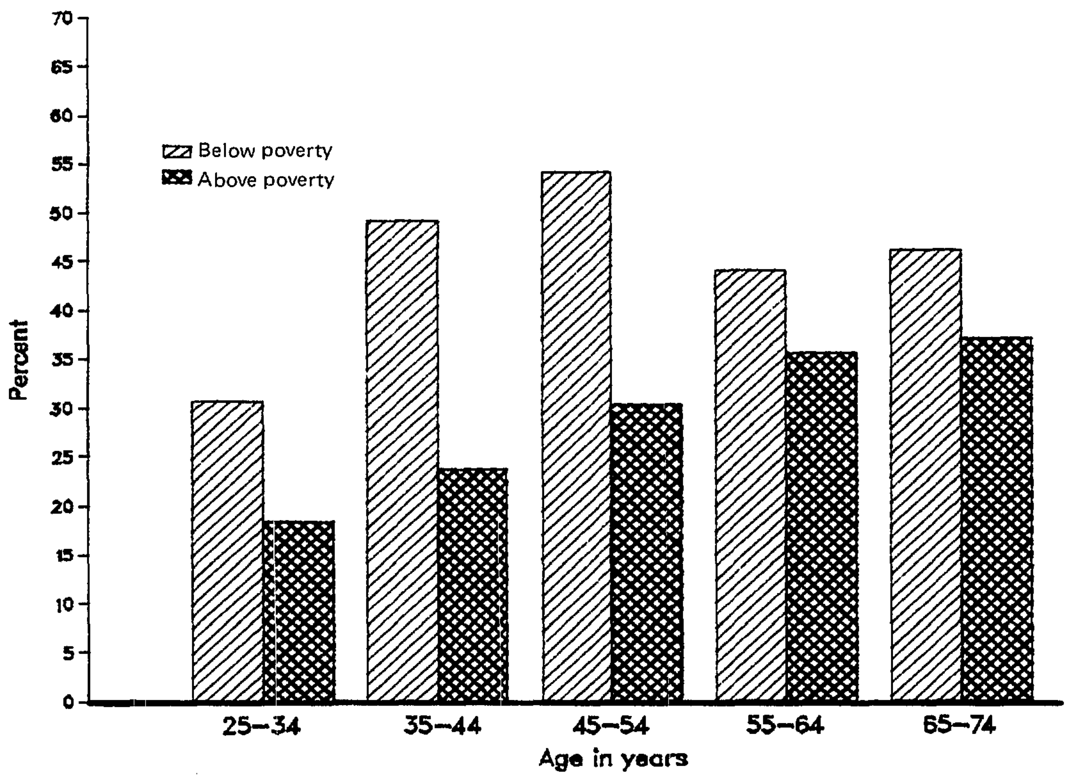
NOTE: Data based on nonpregnant females only. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Food energy 2—3. Percent of males overweight, by poverty status and age: 1976-80



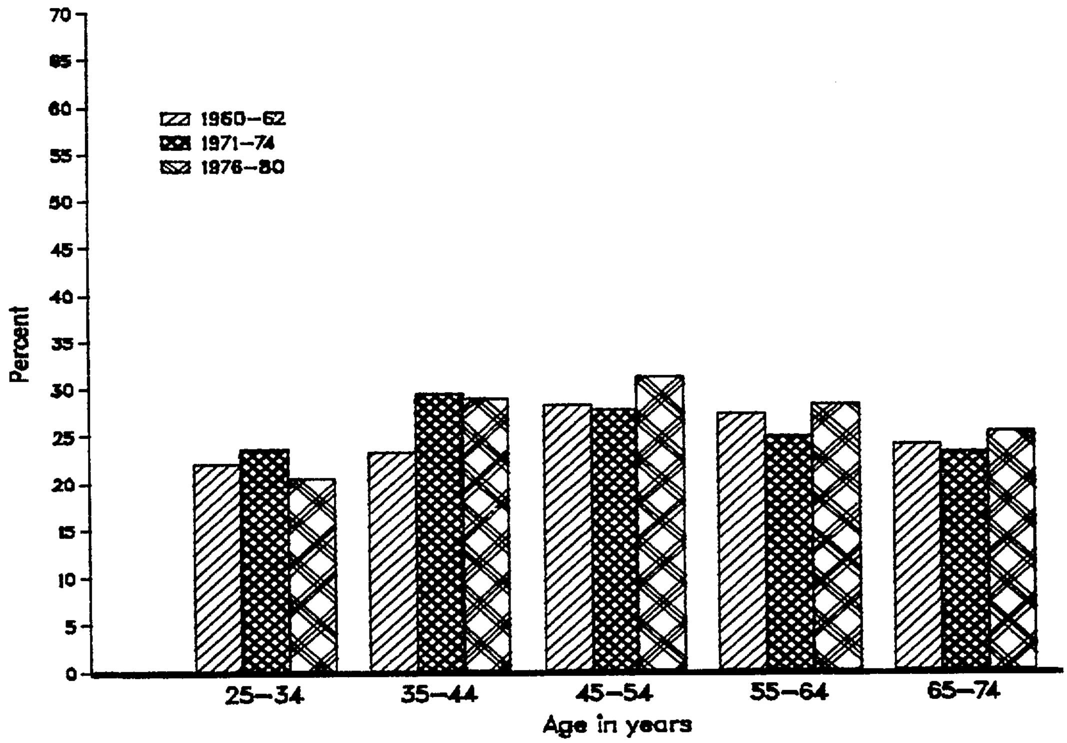
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Food energy 2—4. Percent of females overweight, by poverty status and age: 1976-80



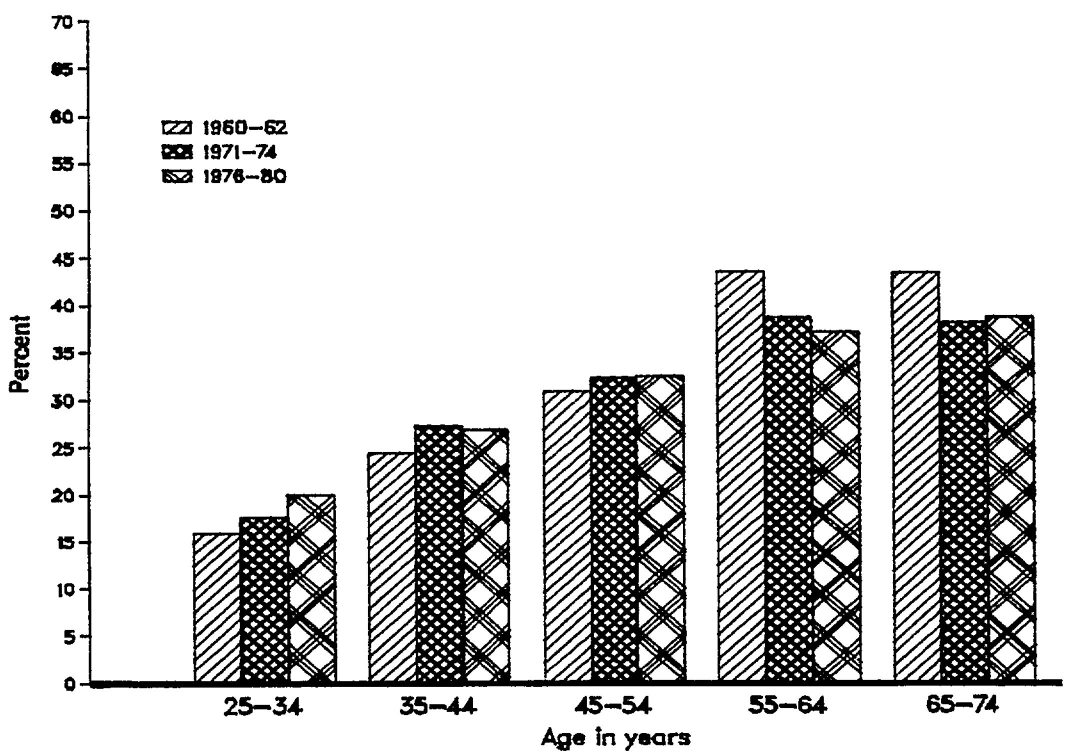
NOTE: Data based on nonpregnant females only. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Food energy 2—5. Percent of males overweight, by age: 1960-62, 1971-74, and 1976-80



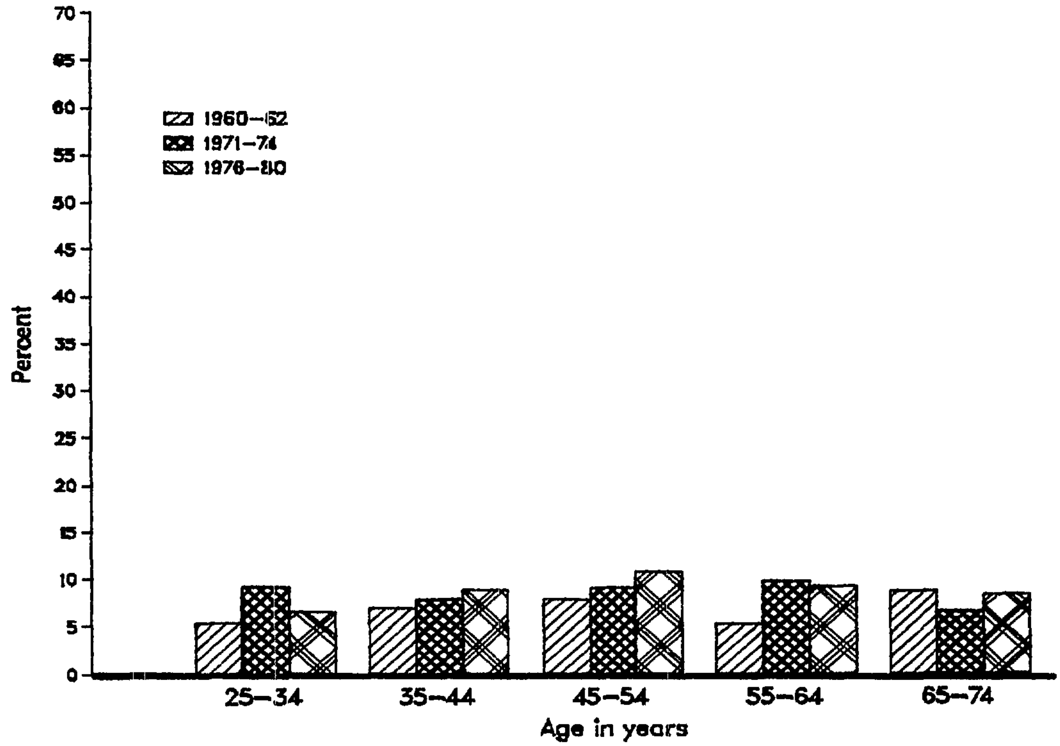
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Surveys.

Food energy 2—6. Percent of females overweight, by age: 1960-62, 1971-74, and 1976-80



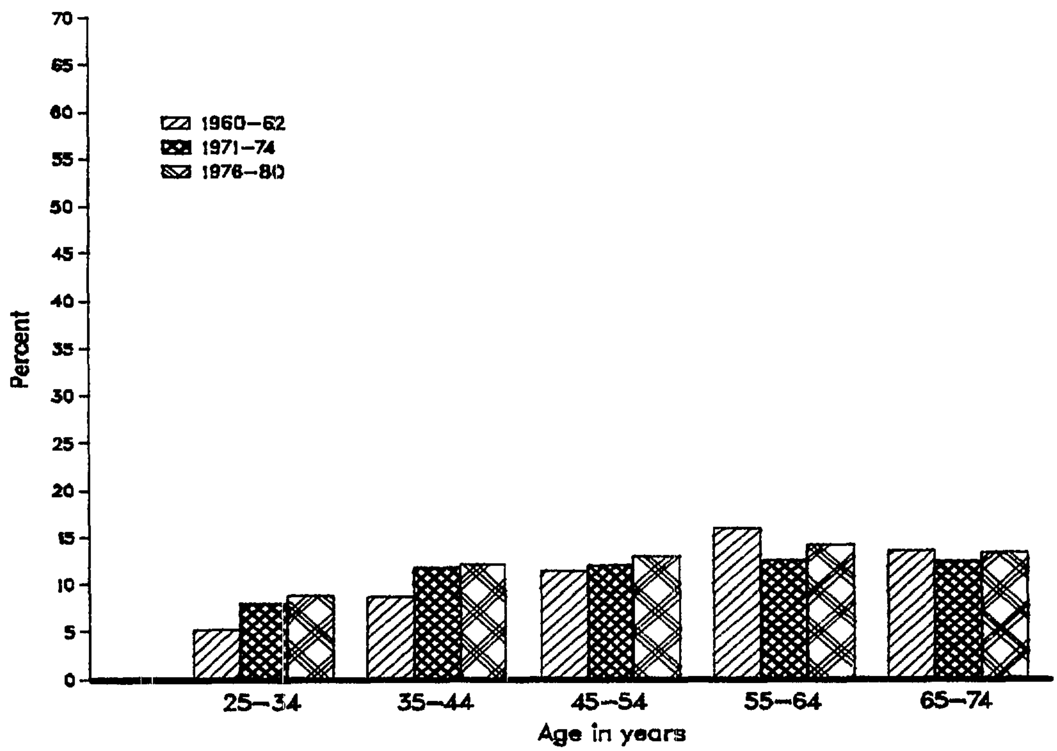
NOTE: Data based on nonpregnant females only. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Surveys.

Food energy 2–7. Percent of males severely overweight, by age: 1960-62, 1971-74, and 1976-80



NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Surveys.

Food energy 2–8. Percent of females severely overweight, by age: 1960-62, 1971-74, and 1976-80



NOTE: Data based on nonpregnant females only. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Surveys.

Protein

Description

Protein is a nutrient required in the diet. It is essential for growth, development, and maintenance of body tissues and is involved in almost all metabolic processes. Food protein provides amino acids to form body proteins that comprise muscle, connective tissue, bone matrix, and other body components. Proteins also form antibodies that help fight disease, enzymes essential for chemical reactions, and hormones that regulate physiological functions. Proteins regulate the balance of water, acids, and bases and also regulate the transport of nutrients in and out of cells. When protein is consumed in excess or when diets are deficient in food energy, protein may be converted to energy. Dietary protein intake in excess of need may be converted to body fat. Food sources of protein include meat, poultry, fish, eggs, milk, and cheese.

Protein-calorie malnutrition, a life-threatening condition usually caused by some combination of deficiencies of protein and calories, is still a public health problem among young children and pregnant and lactating women in some countries. However, protein deficiency rarely occurs in the United States. When it does, it is usually associated with child neglect or food faddism or caused by some underlying illness.

Dietary intakes of protein are assessed both relative to the 1980 RDA and relative to the contribution of protein to total energy intake. The RDA are 56 grams per day for males 15 years of age and older and 44 grams per day for females of the same age. Most dietary recommendations concerning the ratio of energy-yielding nutrients in the diet have focused on the percent of energy provided by fat and carbohydrate without suggesting a change in the current percent of dietary energy provided by protein. Serum albumin, a blood protein that normally composes 50-65 percent of total serum proteins, is a biochemical indicator of protein nutritional status. Values for serum albumin were assessed in the 1976-80 National Health and Nutrition Examination Survey (NHANES II).

Major Findings

- National survey data indicate that the protein intake and status of the U.S. population are adequate in comparison with all known standards. This does not mean that every American has an adequate protein intake. If inadequate intakes occur, they are expected to be few and are probably in population subgroups, such as the elderly, who report diets providing protein intakes exceeding the RDA by the smallest margin.

- Dietary levels of protein averaged well above the RDA, and low serum albumin levels (below 3.5 grams per deciliter) were essentially nonexistent in the population--less than 0.1 percent.

- Dietary levels of protein appear to be positively associated with economic status.

- The major source of protein in household diets was the meat, poultry, and fish group, which also accounted for the largest share of household food dollars.

- Protein provided by the U.S. food supply has been close to 100 grams per capita per day since the beginning of the century. The proportion of protein from the less expensive vegetable sources has declined while the proportion from the more expensive animal sources has increased.

Individual Intake

Protein intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey (NFCS) averaged 166 percent of the RDA (Protein 1-1). Eighty-eight percent of the survey population had intakes of at least the RDA, and 97 percent had intakes of at least 70 percent of the RDA (chart 1-2). One hundred percent of the survey population had diets providing at least the RDA protein-to-calorie ratios.

The contribution of protein to total calorie intake averaged 17 percent for the survey population. Two-thirds of the population had protein intakes providing more than 15 percent of calories, and 3 percent had intakes providing more than 24 percent of calories (chart 1-3).

Dietary levels of protein were higher for males than for females 9-64 years of age but similar for males and females 65 years of age and over (charts 1-1 and 1-4). Intakes by the elderly were the least likely to be at or above the RDA; even so, 80 percent of their intakes met the RDA.

Dietary levels of protein averaged above the RDA by race, poverty status, region, urbanization, and season (charts 1-1, 1-6, and 1-8). White individuals below poverty level reported diets providing relatively less of the RDA for protein than any other of these groups. The percent of total calories from protein was 16-17 percent for all groups studied except children under 1 year of age (chart 1-5, 1-7, and 1-9).

Household Food Use

Households with higher income per capita reported using food providing more protein per person than did lower income households (chart 1-10). However, higher income households paid more for protein than did lower income households; that is, they obtained less protein from each food dollar. Among households eligible for the Food Stamp Program, participants used food higher in protein per person and slightly higher in protein per dollar than did nonparticipants. Compared with higher income households that were ineligible for the program, participating households used food similar in protein per person but higher in protein per dollar.

Households using food with higher money value per person averaged more protein per person but less protein per dollar than did households with lower food costs. Smaller households used food with more protein per person but less protein per dollar than did larger households.

The meat, poultry, and fish group provided 47 percent of the protein in household diets (chart 1-11). The milk, cream, and cheese group (dairy products) and the grain products group were the next most important protein sources, with 19 percent and 17 percent, respectively. The meat, poultry, and fish group and the "other" protein foods group (eggs, beans, nuts, and mixtures containing some meat, poultry, or fish) furnished the most protein per 1,000 Calories of food group: 25 percent and 15 percent more, respectively, than the next highest food group--dairy products. The "other" protein foods group was the most economical source of protein. The dairy, grain, and meat groups also provided protein economically.

Historical Trends

The per capita level of protein provided by the U.S. food supply has been relatively constant since the beginning of the century (chart 1-12). Levels declined slightly during the World War I era and the depression of the 1930's and rose slightly during the mid-1940's, when use of dairy products was high.

Three food groups provided approximately 80 percent of the protein in the food supply, but their proportionate contributions changed over the years. The meat, poultry, and fish group was the major source in 1982, providing 42 percent of the total, compared with 30 percent early in the century. Most of this increase occurred after the late 1940's because of increased use of beef and poultry. Grain products were the leading source of protein at the beginning of the century, providing 36 percent of the total. However, in 1982, they provided only 19 percent of the protein as a result of a decline in their use of close to 50 percent. These changes in food use were primarily responsible for the overall shift from vegetable to animal protein sources in the food supply. In 1982, animal sources provided 68 percent of total protein and vegetable sources provided 32 percent, whereas at the beginning of the century, they provided almost equal proportions of the protein in the food supply.

Data from USDA's food consumption surveys indicate a slight increase in the protein level of household diets from 1955 to the mid-1960's and a slight decrease in the level of protein in both household diets and individual intakes from the mid-1960's to 1977-78.

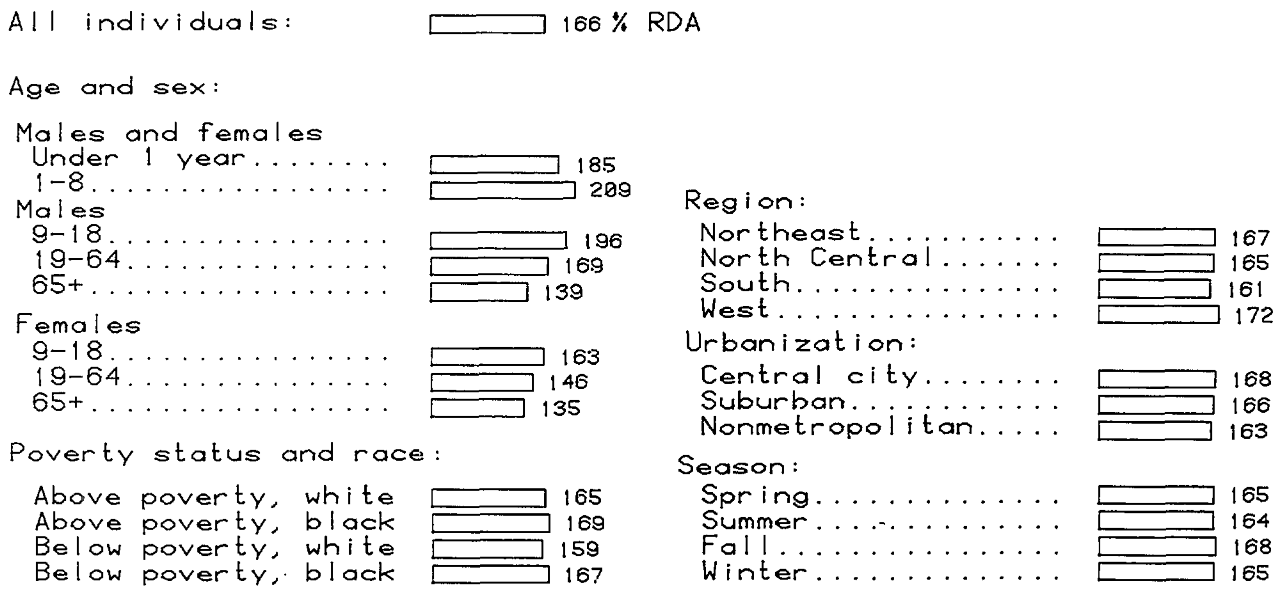
Serum Albumin

Serum albumin is a blood protein that normally composes 50-65 percent of total serum proteins. Serum albumin is an indicator of protein nutritional status. Although a reduced level of serum albumin is a good indicator of protein-calorie malnutrition, a normal value does not preclude this deficiency state. Values of 3.5 grams per deciliter or higher indicate an acceptable state of protein nutriture (Sauberlich et al., 1974).

Data from NHANES II indicate that mean serum albumin levels of white and black males and females are well within normal ranges (Protein 2-1 and 2-2). Furthermore, there were no differences between those above poverty level and those below poverty level in serum albumin (charts 2-3 and 2-4). Again, mean levels were within normal ranges.

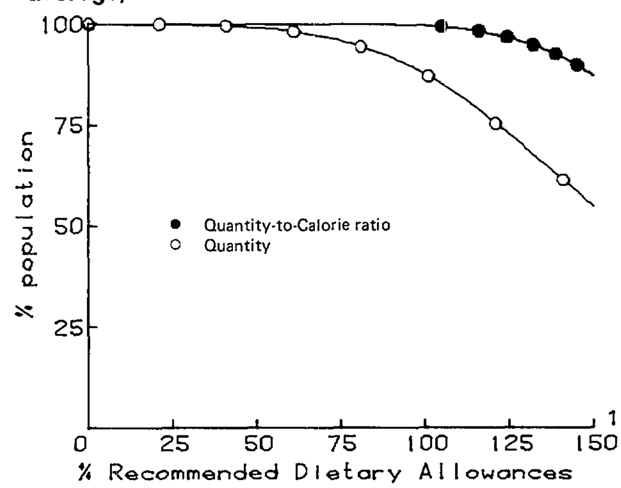
The overall prevalence of low serum albumin in NHANES II was less than 0.1 percent. The prevalences of low serum albumin were small and did not differ significantly by race or poverty status. Indeed, only 19 individuals out of 15,457 who were examined had serum values below 3.5 grams per deciliter. Thus, no differences in prevalences can be shown by race or poverty status, and no charts are provided.

Protein 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Protein 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)

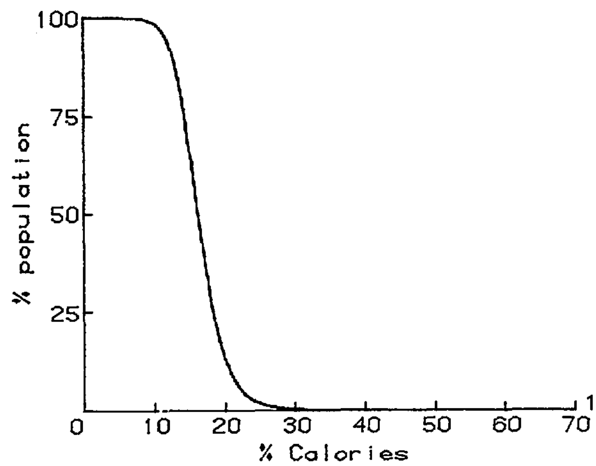


[1]Truncated at 150% RDA.

Example: 88% of the population had at least 100% RDA by quantity, and 99% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Protein 1-3. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels (3-day average)

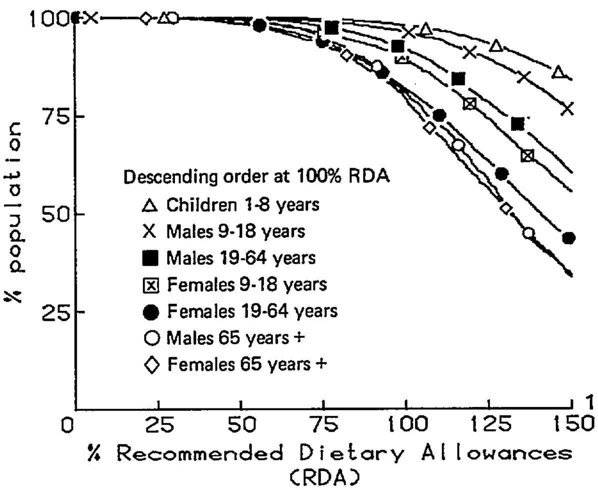


[1]Truncated at 70% of Calories.

Example: 40% of population had protein intakes above 17% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

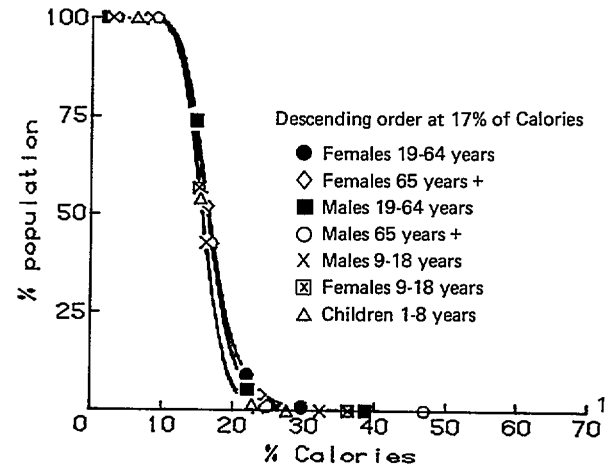
Protein 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



1Truncated at 150% RDA.
Example: 98% of children 1-8 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

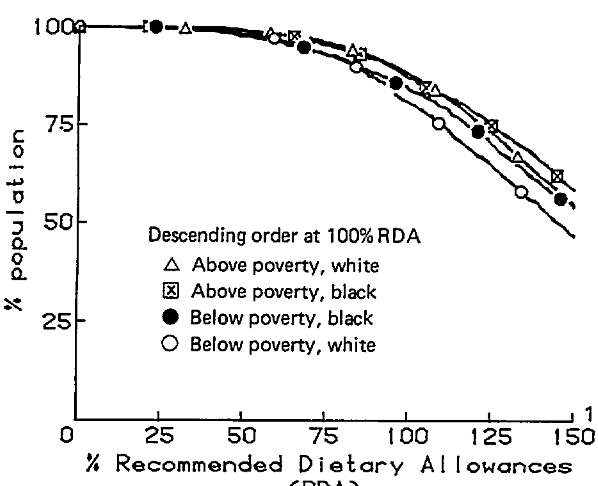
Protein 1-5. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by sex and age (3-day average)



1Truncated at 70% of Calories.
Example: 46% of females 19-64 years had protein intakes above 17% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

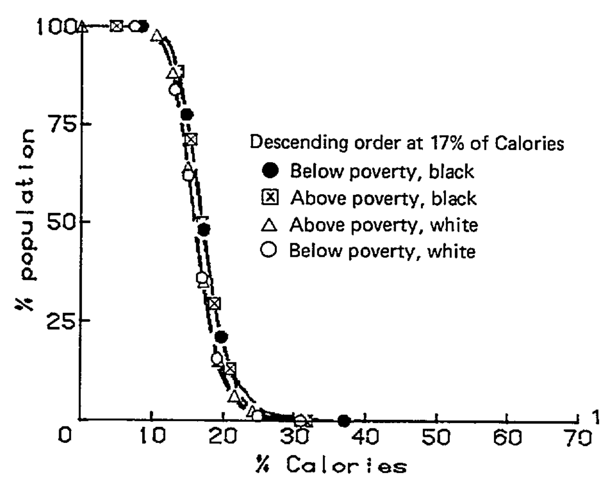
Protein 1-6. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)



1Truncated at 150% RDA.
Example: 89% of above poverty, white population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

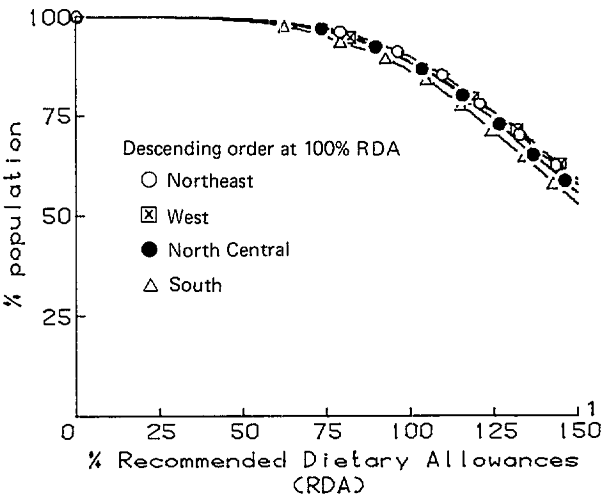
Protein 1-7. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by poverty status and race (3-day average)



1Truncated at 70% of Calories.
Example: 51% of below poverty, black population had protein intakes above 17% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Protein 1-8. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)

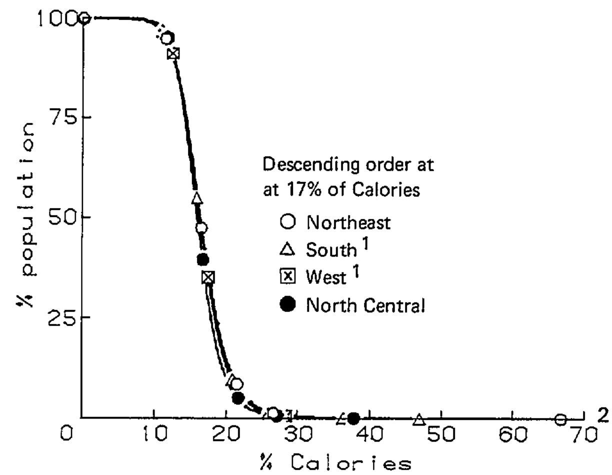


[1]Truncated at 150% RDA.

Example: 90% of population in the Northeast had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Protein 1-9. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by region (3-day average)



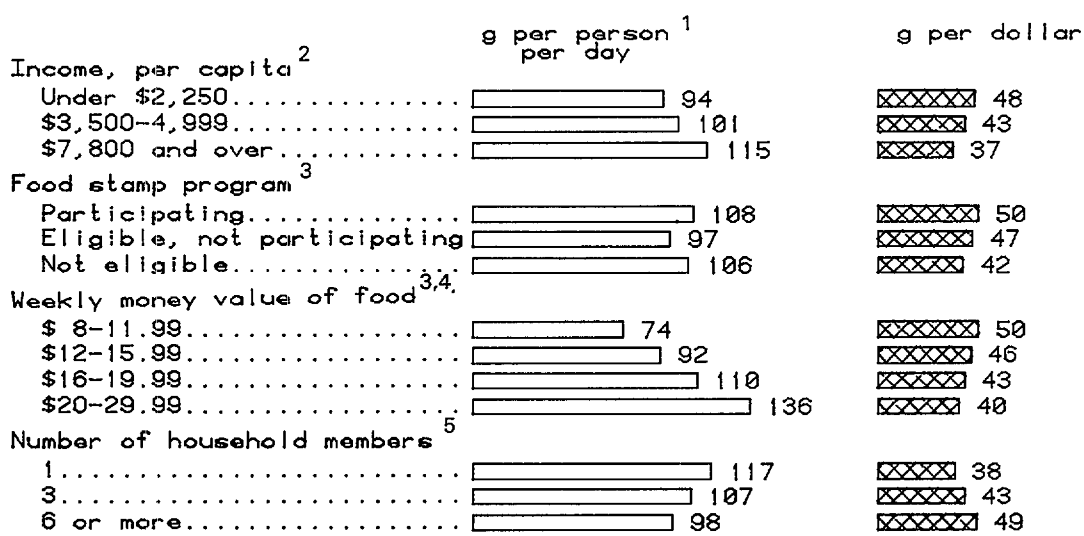
[1]Equal at 17% of Calories.

[2]Truncated at 70% of Calories.

Example: 43% of population in the Northeast had protein intakes above 17% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

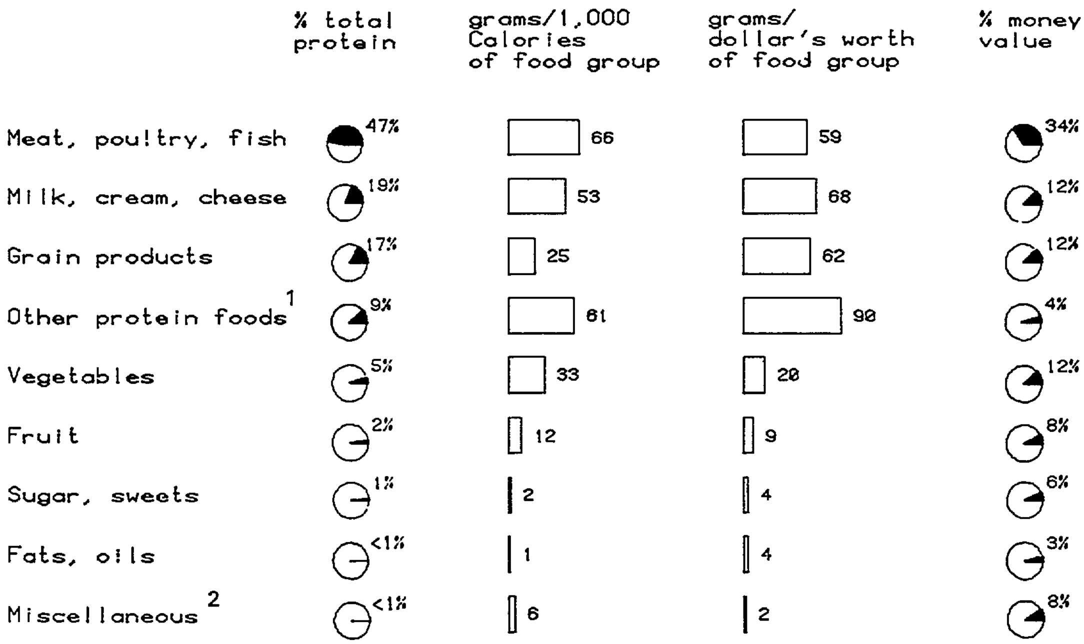
Protein 1-10. Household diets, spring 1977: Grams (g) per person and per dollar's worth of food used at home, by selected characteristics



[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

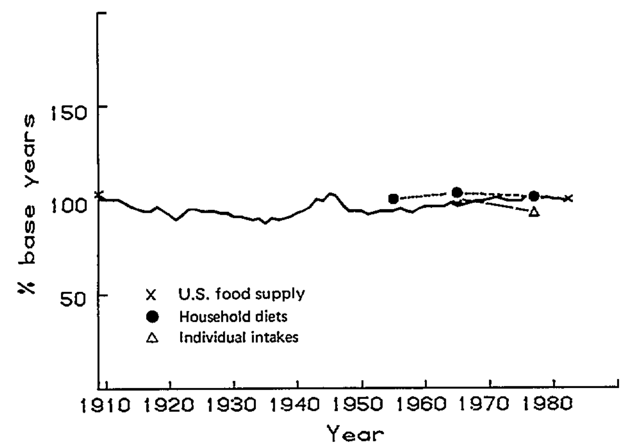
Protein 1-11. Household diets, spring 1977: Contribution of food groups



[1]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

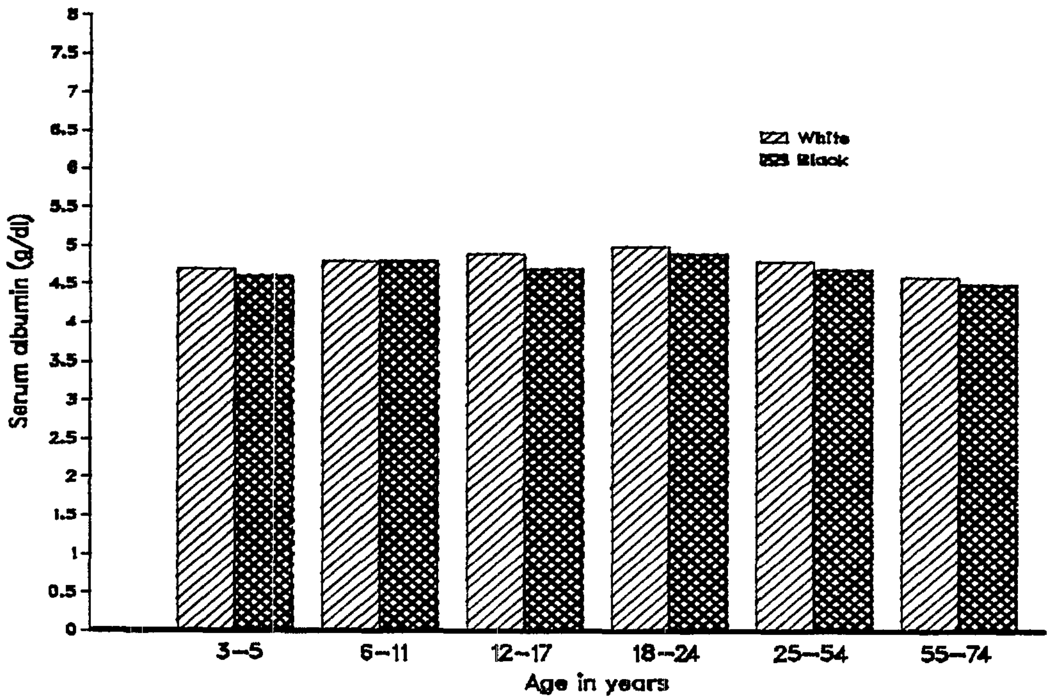
Protein 1-12. U.S. food supply, household diets, and individual intakes: Percent of base years[1]



[1]U.S. food supply, 1909-13=100 grams (g)/capita/day; household, 1955=103 g/meal-at-home equivalent person/day; individual, 1965= 82 g/individual/day (3-day average).

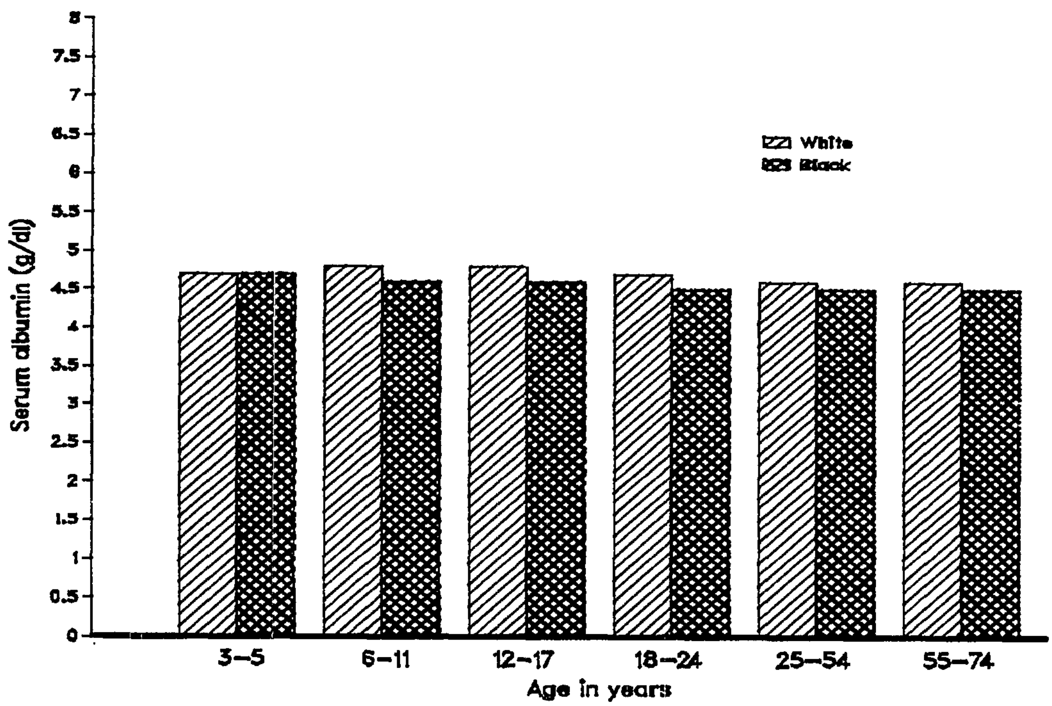
SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

Protein 2-1. Mean serum albumin for males, by race and age: 1976-80



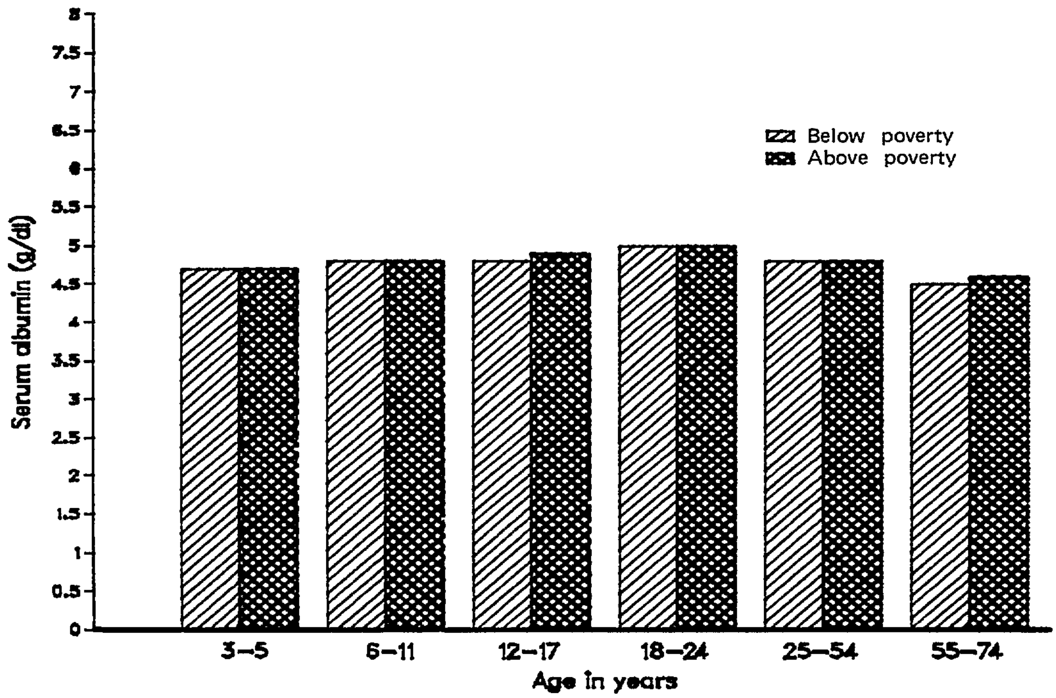
NOTE: Albumin measured in grams per deciliter (g/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Protein 2-2. Mean serum albumin for females, by race and age: 1976-80



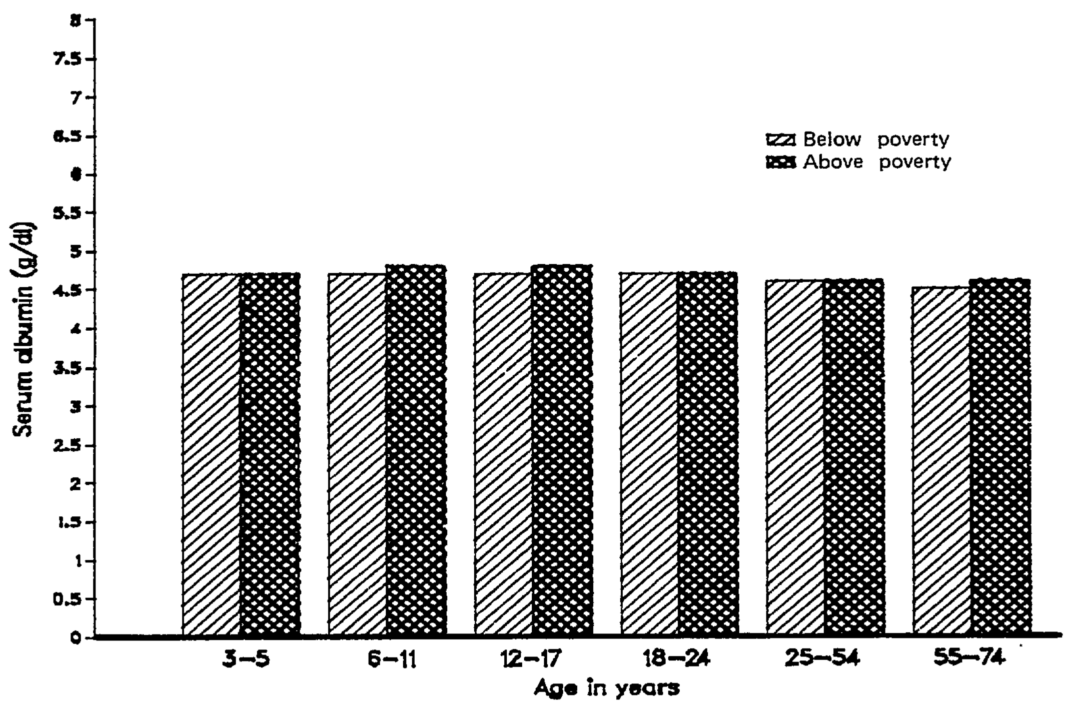
NOTE: Albumin measured in grams per deciliter (g/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Protein 2-3. Mean serum albumin for males, by poverty status and age: 1976-80



NOTE: Albumin measured in grams per deciliter (g/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Protein 2-4. Mean serum albumin for females, by poverty status and age: 1976-80



NOTE: Albumin measured in grams per deciliter (g/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Fat, Fatty Acids, and Cholesterol

Description

Fat provides a concentrated source of energy for the body and acts as a carrier for the fat-soluble vitamins A, D, E, and K. Fats are structural and functional components of cell membranes and, as precursors of other compounds, fats are involved in the regulation of widely diverse physiological processes.

Fatty acids are the major component of fats and are classified as saturated, monounsaturated, and polyunsaturated, depending on the proportion of hydrogen atoms they contain. The greater the concentration of hydrogen atoms, the greater is the degree of saturation. Humans cannot synthesize the essential polyunsaturated fatty acid linoleic acid; therefore, it is required in the diet. The body uses linoleic acid in the formation of a special class of hormone-like substances called prostaglandins. Prostaglandins influence many physiological processes, including gastric secretion, blood pressure regulation, pancreatic function, and blood coagulation.

Cholesterol, a fat-like substance, is not an essential part of the diet because it is produced in the body by the liver. Cholesterol is a normal and essential body chemical. It is involved in the formation of cell membranes and the protective covering on nerves, the synthesis of vitamin D and some steroid hormones, the digestion of fat, and the transport of fatty acids. The cholesterol level in blood is influenced by many factors in addition to the amount of cholesterol in the diet.

No public health problems have been ascribed to inadequate intakes of fat or cholesterol, even in populations with relatively low intakes. Deficiencies of fat-soluble nutrients may be a problem in clinical cases in which fat absorption is limited. However, deficiencies in fat and cholesterol are unknown, except for rare deficiencies in polyunsaturated fatty acids occurring in infants fed nonfat milk formula. Excessive fat intake is a concern in relation to the development of obesity, cardiovascular disease, and some cancers (Chapter 3).

The RDA for fat, fatty acids, or cholesterol have not been established by the National Academy of Sciences, Food and Nutrition Board, Committee on Dietary Allowances (National Research Council, 1980a), but several authoritative groups have made recommendations concerning intakes. In this report, dietary levels of fat and cholesterol based on data from the 1977-78 Nationwide Food Consumption Survey (NFCS) are compared with these recommendations. Data on fatty acids were available only from the U.S. food supply historical series, but USDA's Continuing Survey of the Food Intake of Individuals, which began in April 1985, will focus considerably more attention on determining both the amounts and types of fat in the diet. Hence, more information on fatty acid intakes will be available shortly. Of the lipid and lipoprotein measurements made in the 1976-80 National Health and Nutrition Examination Survey (NHANES II), only serum cholesterol measurements were available to the Committee. Data on serum triglycerides and high-density lipoproteins will be forthcoming.

Fat in food is responsible for certain characteristic flavors and textures, and it helps to satisfy the appetite. Oleic acid is the most common monounsaturated fatty acid in foods, and linoleic acid is the most common polyunsaturated fatty acid. Animal fats such as butter, lard, and other meat fats are relatively high in saturated fatty acids; vegetable fats such as corn and soybean oil are relatively high in unsaturated fatty acids.

Fish, especially fatty fish, contains appreciable amounts of the polyunsaturated fatty acid eicosopentaenoic acid (a member of the omega-3 family of fatty acids). Research is in progress on the possible effect of this fatty acid or other substances present in fish on lowering the prevalence of coronary heart disease. Cholesterol is found in foods of animal origin; foods of vegetable origin do not contain dietarily significant amounts of cholesterol. Food sources of cholesterol include brains, kidney, liver, eggs, shrimp, meat, and cheese.

Fat--Moderation or a reduction in the consumption of total fat as a prudent measure for the public has been recommended by the American Cancer Society, 1984; American Heart Association, 1978; American Medical Association, Council on Scientific Affairs, 1979; National Academy of Sciences Committee on Diet, Nutrition, and Cancer (National Research Council, 1982); National Cancer Institute of the National Institutes of Health, 1984; National Institutes of Health Consensus Development Panel (Statement on lowering blood cholesterol to prevent heart disease), 1985b; Office of the Assistant Secretary for Health and the Surgeon General, 1979; U.S. Senate Select Committee on Nutrition and Human Needs, 1977; and U.S. Departments of Agriculture and Health and Human Services, 1980 and 1985. The reasons for moderating fat intake include maintaining and improving health, maintaining desirable body weight, and reducing the risk of certain diseases, especially coronary heart disease and cancer.

Several groups have suggested specific goals for fat intake by the American public. The National Academy of Sciences Committee on Diet, Nutrition, and Cancer (National Research Council, 1982) and a National Institutes of Health Consensus Development Panel (1985b) have each recommended a reduction in fat intake to 30 percent of total calories. The American Heart Association (1978) recommended 30-35 percent of calories from fat as an appropriate level, and the U.S. Senate Select Committee on Nutrition and Human Needs (1977) recommended 27-33 percent. The National Academy of Sciences, Food and Nutrition Board, Committee on Dietary Allowances (National Research Council, 1980a) suggested a reduction in fat intake to not more than 35 percent of calories, particularly in diets of less than 2,000 Calories.

Other groups have stated that guidance on fat intake is appropriate only for certain subgroups in the population. The Food and Nutrition Board of the National Academy of Sciences in Toward Healthful Diets (National Research Council, 1980b), recommended that individuals reduce fat intake if they are overweight or if their energy needs are low. The American Council on Science and Health (1982) recommended that individuals who are at high risk of coronary heart disease reduce their fat intake.

Fatty acids--A reduction in saturated fatty acid intake or the avoidance of too much saturated fatty acid in the diet has been recommended by the U.S. Departments of Agriculture and Health and Human Services (1980 and 1985), the National Academy of Sciences, Food and Nutrition Board, Committee on Dietary Allowances (National Research Council, 1980a), and the Office of the Assistant Secretary for Health and the Surgeon General (1979). These groups did not recommend specific levels or limits for saturated fatty acids. The American Heart Association (1978) and a National Institutes of Health Consensus Development Panel (1985b) recommended that saturated fatty acid intake be reduced to less than 10 percent of calories.

The National Academy of Sciences Committee on Diet, Nutrition, and Cancer (National Research Council, 1982), the American Cancer Society (1984), and the National Cancer Institute (1984) have stated that high-fat diets are associated with some types of cancer. They have recommended that intake of both saturated and unsaturated fatty acids be reduced, but they have not suggested target levels. The U.S. Senate Select Committee on Nutrition and Human Needs (1977) recommended that saturated, monounsaturated, and polyunsaturated fatty acids each provide 8-12 percent of total calories. Because the consequences of prolonged ingestion of large quantities of polyunsaturated fatty acids are unknown, the American Heart Association (1982), the National Institutes of Health Consensus Development Panel (Statement on lowering blood cholesterol to prevent heart disease, 1985b), and the National Academy of Sciences, Food and Nutrition Board, Committee on Dietary Allowances (National Research Council, 1980a) specifically cautioned against exceeding 10 percent of total calories from polyunsaturates.

At least two groups have stated that recommendations about the level or proportion of saturated and polyunsaturated fatty acids in the diet are inappropriate for healthy persons--the National Academy of Sciences, Food and Nutrition Board, in Toward Healthful Diets (National Research Council, 1980b), and the American Medical Association, Council on Scientific Affairs, 1979.

Cholesterol--The dietary guidelines of the U.S. Departments of Agriculture and Health and Human Services (1980 and 1985) and the Office of the Assistant Secretary for Health and the Surgeon General (1979) recommended that healthy Americans avoid too much or consume less cholesterol, but suggested no target figures. The U.S. Senate Select Committee on Nutrition and Human Needs (1977) recommended that healthy Americans limit their cholesterol intake to 250-350 milligrams per day. The American Heart Association (1978) and a National Institutes of Health Consensus Development Panel (1985b) recommended limits for the general population of 300 milligrams per day and 250-300 milligrams per day, respectively.

In contrast, in the report Toward Healthful Diets, the National Academy of Sciences, Food and Nutrition Board (1980b) stated that available information was insufficient to support a guideline on dietary cholesterol for healthy persons. The American Medical Association, Council on Scientific Affairs (1979) stated that the level of cholesterol in the diet is not important for all people.

Assessment of cholesterol intakes per 1,000 Calories is a method of comparing groups of individuals who differ in calorie intake. For example, based on the midpoint of the 1980 Recommended Energy Intakes (REI) range for adult females of 2,000 Calories per day, a cholesterol intake of 300 milligrams per day would equal 150 milligrams per 1,000 Calories.

Major Findings

- Dietary data indicate that intakes of total fat, saturated fatty acids, and cholesterol are higher than many authorities recommend. Health data indicate links between cardiovascular disease and high intakes of fat, especially saturated fatty acids, and cholesterol. Less conclusive evidence has linked high fat intakes with some cancers (Chapter 3).

- Dietary levels of fat in individual intakes averaged 41 percent of calories. Few individuals reported diets in which less than 35 percent of calories were from fat. The U.S. food supply data indicate that the percent of total calories from fat was 10 percentage points lower in 1909-13 than in 1982. (See section on food energy.)

- Dietary levels of cholesterol averaged 385 milligrams per day, or 214 milligrams per 1,000 Calories.

- Serum cholesterol was at high-risk levels for 21.8 percent of individuals 25-74 years of age. Mean serum cholesterol levels have declined significantly since 1960. (See Chapter 3.)

- The prevalence of elevated serum cholesterol did not differ significantly by race. Women over 54 years of age, regardless of race, showed the highest prevalence. The prevalence was higher for individuals above poverty than for those below poverty among males 35 years and older and females 55 years and older.

- Dietary levels of fat and cholesterol were slightly higher for males than for females and higher for adults than for teenagers or children. Cholesterol intakes differed most by race--higher for the black than for the white population.

- Dietary levels of fat and cholesterol were not consistently associated with economic status.

- Two food groups--meat, poultry, and fish; and fats and oils--were the primary sources of fat in household diets. Eggs and the meat, poultry, and fish group were the primary sources of cholesterol in the U.S. food supply.

- Fat provided by the U.S. food supply has increased about 30 percent since the beginning of the century, but food consumption surveys indicate a decrease in individual fat intake since the mid-1960's.

- The proportion of saturated fatty acids in the food supply has decreased since the beginning of the century while the proportion of unsaturated fatty acids, especially linoleic acid, has increased. Increased use of vegetable fats, primarily salad and cooking oils, was responsible for this change.

- The per capita level of cholesterol provided by the U.S. food supply reached a peak in the mid-1940's and then fluctuated downward, declining 10 percent from 1970 to 1982. The decline is attributed to decreased use of eggs, whole milk, and red meat.

<u>Individual Intake</u>

<u>Total fat</u> intakes by individuals (3-day dietary reports) in the 1977-78 NFCS averaged 41 percent of calorie intake (Fat 1-1). Ninety-four percent of the survey population had fat intakes providing more than 30 percent of calories; 80 percent, more than 35 percent of calories; 53 percent, more than 40 percent of calories; and 8 percent, more than 50 percent of calories (Fat 1-2).

Dietary levels of fat differed slightly by sex and age, averaging from 37 to 42 percent of calories for various groups (Fat 1-1 and 1-3). Levels were generally higher for males than for females in the same age groups. For both sexes, the highest levels were for individuals 19-64 years of age, with roughly 60 percent of these groups having intakes of more than 40 percent of calories from fat. Children under 9 years of age had the lowest dietary levels of fat.

Fat intake as a percent of calorie intake differed little by poverty status, race, region, urbanization, and season (Fat 1-1, 1-4, and 1-5).

Cholesterol intakes by individuals (3-day dietary reports) in the 1977-78 NFCS averaged 385 milligrams per day, or 214 milligrams per 1,000 Calories (Cholesterol 1-1 and Appendix I). The cholesterol intake of 58 percent of the population was greater than 300 milligrams per day; slightly more than one-third of the population had intakes above 400 milligrams per person per day. In terms of calorie intake, over two-thirds of the survey population had cholesterol intakes greater than 150 milligrams per 1,000 Calories; nearly 30 percent had intakes above 250 milligrams per 1,000 Calories (Cholesterol 1-2).

Males reported diets containing more cholesterol than did females. However, this difference was less when cholesterol intake was calculated per 1,000 Calories because males also had diets higher in calories (Cholesterol 1-1 and 1-3). Dietary levels of cholesterol per 1,000 Calories were lowest for individuals under 19 years of age and highest for males 65 years of age and over.

Dietary levels of cholesterol, both absolute amounts and amounts per 1,000 Calories, were higher for the black than for the white population, even when these groups were categorized by poverty status (Cholesterol 1-1 and 1-4). Cholesterol levels per 1,000 Calories were higher for those below poverty level than for those above poverty, especially for the white population.

Dietary cholesterol levels, both absolute amounts and amounts per 1,000 Calories, were highest in the South and West (Cholesterol 1-1 and 1-5). Cholesterol levels were higher in central cities than in suburban and nonmetropolitan areas.

Household Food Use

Households with higher income per capita reported using food with more fat per person than did lower income households (Fat 1-6). However, higher income households paid more for fat than did lower income households; that is, they obtained less fat for each food dollar. Among households eligible for the Food Stamp Program, participants used food slightly higher in fat per person but similar in fat per dollar to food used by nonparticipants. Compared with higher income households that were ineligible for the program, participating households used food with the same amount of fat per person but higher in fat per dollar.

Households using food with higher money value per person averaged considerably more fat per person but less fat per dollar than did households with lower food costs. Households with six or more members used food with the least fat per person but the most fat per dollar.

The meat, poultry, and fish group provided 41 percent of the fat in household diets, and the fats and oils group provided 26 percent (Fat 1-7). Fats and oils supplied the most fat per 1,000 Calories of food group, but the meat, poultry, and fish group was also a concentrated source. The fats and oils group also supplied the most fat per dollar, more than 5 times as much as any other group. However, this food group accounted for only 3 percent of the food dollar.

Historical Trends

Fat--The level of fat provided by the U.S. food supply per capita per day was lowest about 1920, 120 grams, and highest in 1981, 164 grams (Fat 1-8). Throughout the century, three food groups--fats and oils; meat, poultry, and fish; and dairy products--provided approximately 90 percent of the fat in the food supply. Marked changes occurred in the use of foods within these groups.

In the fats and oils group, use of butter declined from 18 to 4 pounds per capita per year while use of margarine rose from 1 to 11 pounds in the period 1909-13 to 1982. During this time, shortening largely replaced lard as a cooking fat, and use of oils, chiefly salad and cooking oils, rose from about 2 to 23 pounds per capita. These changes were primarily responsible for the large shift from animal to vegetable sources of fat. During this period, the proportion of vegetable fat in the food supply increased from 17 to 42 percent, and the proportion of animal fat decreased from 83 to 58 percent.

In the meat, poultry, and fish group, pork has been the major source of fat, followed by beef. Fat from poultry more than tripled during the century, with nearly all of the increase occurring after the 1940's.

In the dairy products group, fluid whole milk was the chief source of fat until 1980, when cheese became the leading source. Fluid whole milk consumption declined substantially after the middle of the century, and use of other beverages such as lowfat milks and soft drinks increased.

Data from the USDA food consumption surveys indicate that the levels of fat in household diets and individual intakes did not follow the upward trend of the food supply. The level in household diets did not change from 1955 to 1965-66. The levels in both household diets and individual intakes decreased from the mid-1960's to 1977-78. Most of this decrease is attributed to decreased consumption of the fats and oils group. It is important to note that the food supply estimates may include some fat that is lost or discarded in processing, home use, or as plate waste.

Fatty acids--Information on dietary levels of fatty acids was available only from the U.S. food supply series. Food composition data from the 1977-78 NFCS were too limited to permit estimation of the quantities of the various fatty acids in the many foods reported (about 4,000). In some respects, the U.S. food supply is a good source of information on types of fatty acids because data are generally collected on food before processing; that is, quantities of various fats and oils available for consumption are estimated before they are processed into products such as bread, bakery products, and frozen vegetables or entrees.

The quantities of saturated fatty acids, oleic acid, and linoleic acid provided by the U.S. food supply increased from 1909-13 to 1982 (Fat 1-9). The largest increase was in linoleic acid, which almost tripled, reaching a record high of 26 grams per capita per day in 1982. This change is attributed primarily to increased use of vegetable fats, chiefly salad and cooking oils. Increased use of shortening and margarine also contributed to the trend. Use of these fats and oils also partly accounts for the 28-percent rise in the level of oleic acid in the food supply.

Over the century, total saturated fatty acids in the food supply increased 9 percent, to 54 grams per capita per day in 1982. Saturated fatty acids from the fats and oils group declined with decreased use of butter and lard, but increased use of meat, poultry, and fish contributed to the overall rise in the level of saturated fatty acids. Beef and pork provided the major portion of saturated fatty acids from the meat, poultry, and fish group. However, since the mid-1970's, per capita consumption of red meat has declined. Within the dairy products group, changes in consumption affected levels of saturated fatty acids the same way that they affected levels of total fat.

The calories provided by the different types of fatty acids changed with their levels in the food supply. In 1909-13, saturated fatty acids contributed 13 percent of the calories in the food supply; oleic acid, 13 percent; and linoleic acid, 2 percent. In 1982, saturated fatty acids contributed 14 percent of the calories in the food supply; oleic acid, 17 percent; and linoleic acid, 7 percent.

Fat 1-10 shows annual estimates of the percent of total fat from saturated fatty acids, oleic acid, and linoleic acid in the U.S. food supply. The proportion from oleic acid was relatively constant throughout the century--46 percent in 1909-13 and 45 percent in 1982. Saturated fatty acids provided 46 percent of the fat from fatty acids in 1909-13 but only 38 percent in 1982. The difference was balanced by linoleic acid, which accounted for 8 percent of the fat from fatty acids at the beginning of the century, compared with 18 percent in 1982.

Cholesterol--The level of cholesterol provided by the U.S. food supply decreased 6 percent from 1909-13 to 1982 (Cholesterol 1-6). Cholesterol reached its lowest level, 464 milligrams per capita per day, in 1917 and in 1935, periods of economic stress. The highest level of cholesterol--596 milligrams per capita per day--was reached in 1945 and is attributed to increased use of dairy products and eggs. Thereafter, the cholesterol level fluctuated but declined to 479 milligrams per capita per day in 1982, reflecting decreased use of eggs, whole milk, butter, and lard.

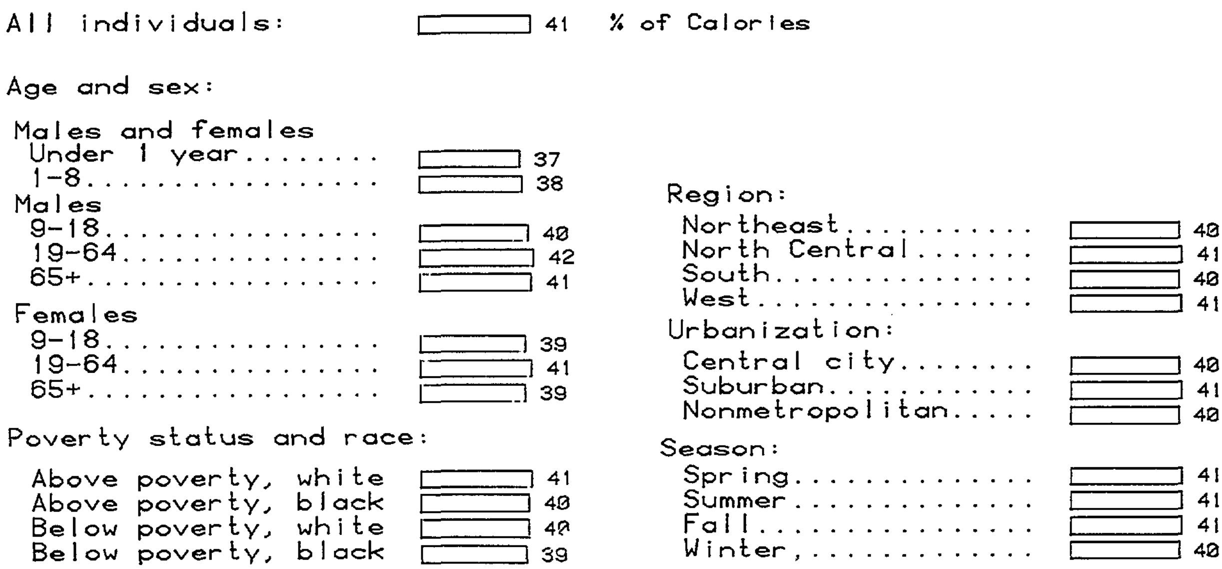
All the cholesterol in the food supply has been provided by four food groups--eggs; meat, poultry, and fish; dairy products; and fats and oils. In 1909-13, the percent contributions of these groups were 44, 28, 15, and 12 percent, respectively. During the century, the proportion of total cholesterol from eggs and from the fats and oils group declined while the proportion from the meat, poultry, and fish group increased. In 1982, the percent contributions of eggs; meat, poultry, and fish; dairy products; and fats and oils were 42, 38, 15, and 5 percent, respectively.

Use of specific foods within the major food groups affected the level of cholesterol in the food supply. Use of eggs declined from 37 to 33 pounds per capita per year during the century. Although the fats and oils group was a major source of fat throughout almost all of the century, this food group accounted for the smallest proportion of the cholesterol, and that proportion declined because of the shift from use of animal fat to use of vegetable fat. Beef replaced pork as the largest contributor of cholesterol in the meat group in the mid-1950's. The amount of cholesterol from dairy products has remained relatively constant. Cholesterol from increased use of cheese, lowfat milks, and frozen desserts has offset the decline from decreased use of whole milk.

Blood Cholesterol

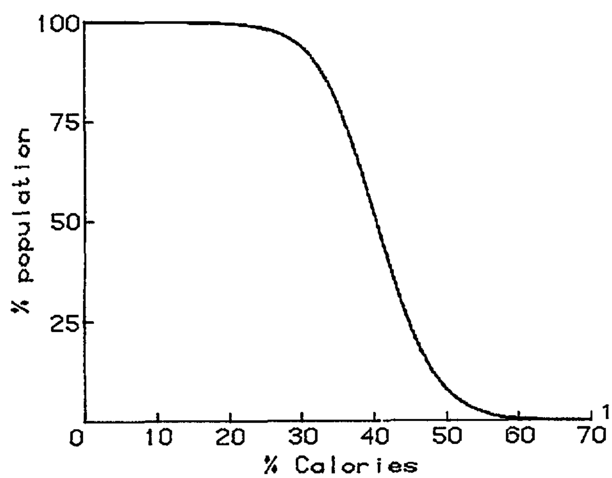
Data on blood cholesterol levels are presented in Chapter 3.

Fat 1-1. Individual intakes, 1977-78: Mean percent of Calories, by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

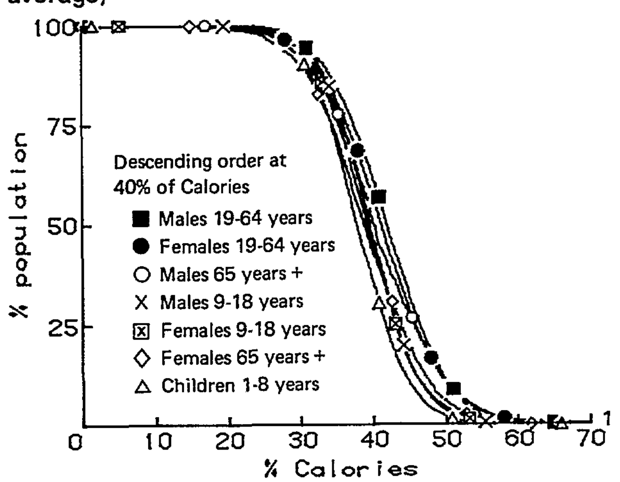
Fat 1-2. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels (3-day average)



[1]Truncated at 70% of Calories.
Example: 53% of population had fat intakes above 40% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

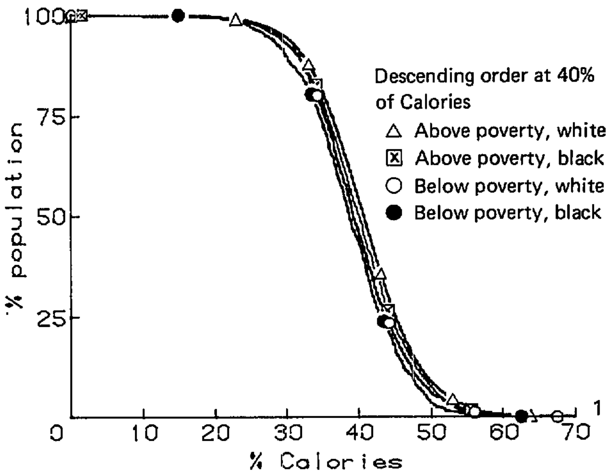
Fat 1-3. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by sex and age (3-day average)



[1]Truncated at 70% of Calories.
Example: 63% of males 19-64 years had fat intakes above 40% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

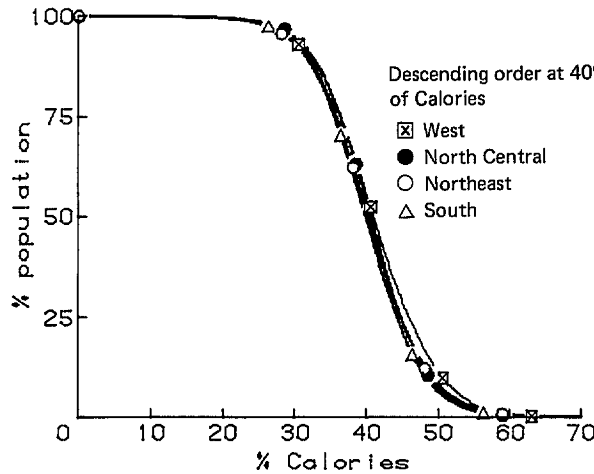
Fat 1-4. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by poverty status and race (3-day average)



[1]Truncated at 70% of Calories.
Example: 55% of above poverty, white population had fat intakes above 40% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

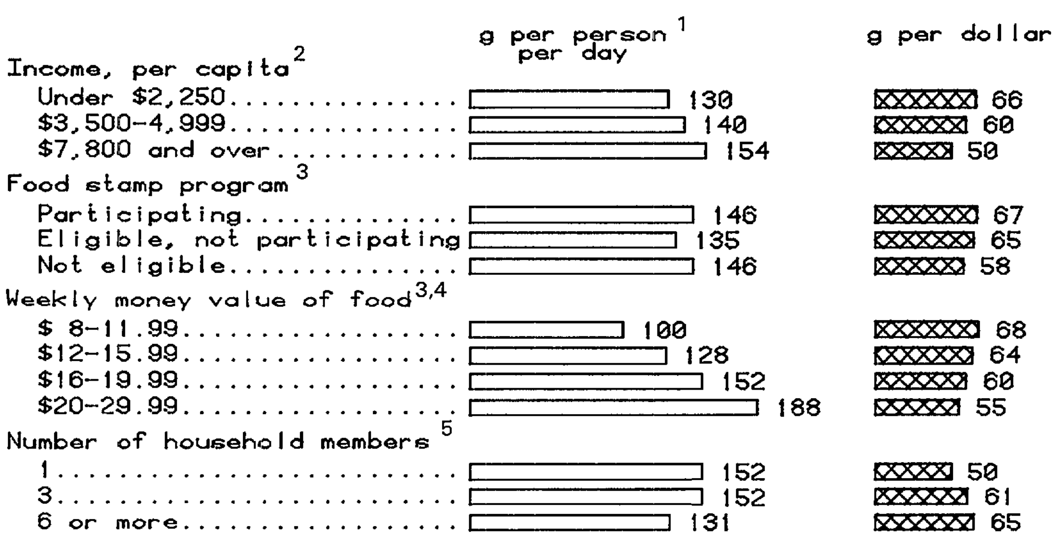
Fat 1-5. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by region (3-day average)



[1]Truncated at 70% of Calories.
Example: 56% of population in the West had fat intakes above 40% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Fat 1-6. Household diets, spring 1977: Grams (g) per person and per dollar's worth of food used at home, by selected characteristics



[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

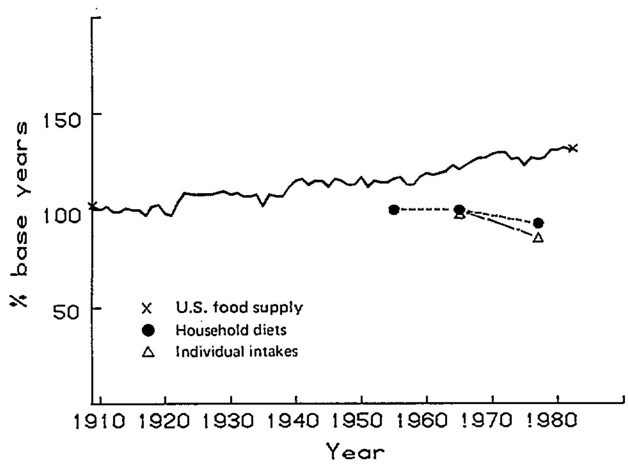
Fat 1-7. Household diets, spring 1977: Contribution of food groups

	% total fat	grams/1,000 Calories of food group	grams/dollar's worth of food group	% money value
Meat, poultry, fish	41%	79	71	34%
Fats, oils	26%	118	519	3%
Milk, cream, cheese	14%	54	78	12%
Grain products	8%	17	42	12%
Other protein foods[1]	7%	63	94	4%
Vegetables	2%	20	12	12%
Sugar, sweets	1%	5	9	6%
Fruit	<1%	6	4	8%
Miscellaneous[2]	<1%	2	<1	8%

[1]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

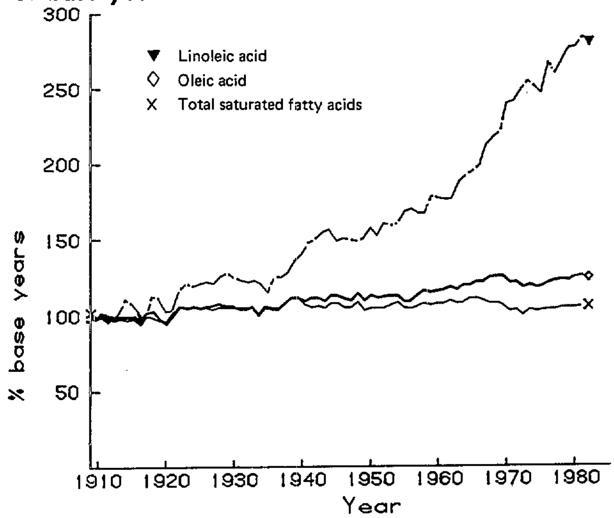
Fat 1-8. U.S. food supply, household diets, and individual intakes: Percent of base years[1]



[1]U.S. food supply, 1909-13=124 grams (g)/capita/day; household, 1955=154 g/meal-at-home equivalent person/day; individual, 1965=99 g/individual/day (3-day average).

SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

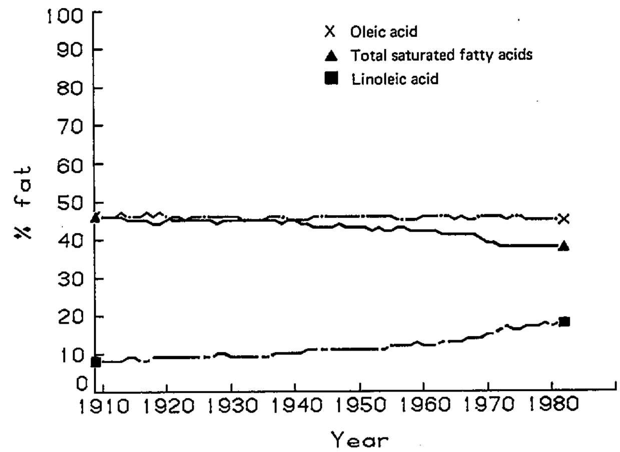
Fat 1-9. U.S. food supply: Fatty acids as percent of base years[1]



[1]U.S. food supply, 1909-13=9.0 grams (g)/capita/day linoleic acid; 50.3 g/capita/day oleic acid; 49.8 g/capita/day total saturated fatty acids.

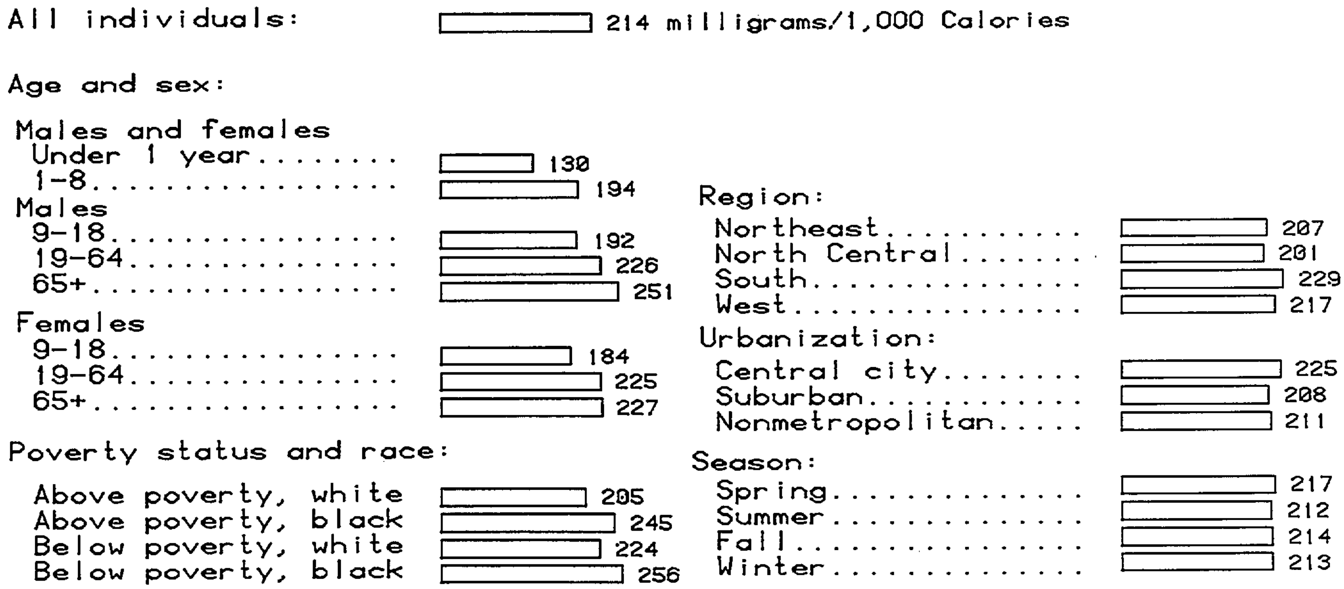
SOURCE: USDA: Data from the U.S. food supply historical series.

Fat 1-10. U.S. food supply: Percent fat from fatty acids



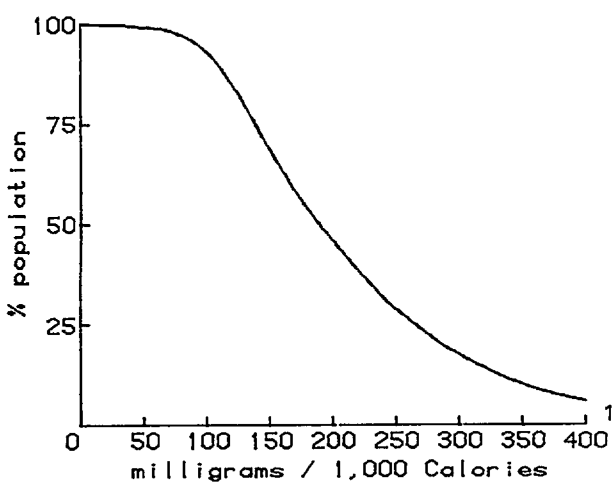
SOURCE: USDA: Data from the U.S. food supply historical series.

Cholesterol 1-1. Individual intakes, 1977-78: Mean intakes per 1,000 Calories, by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

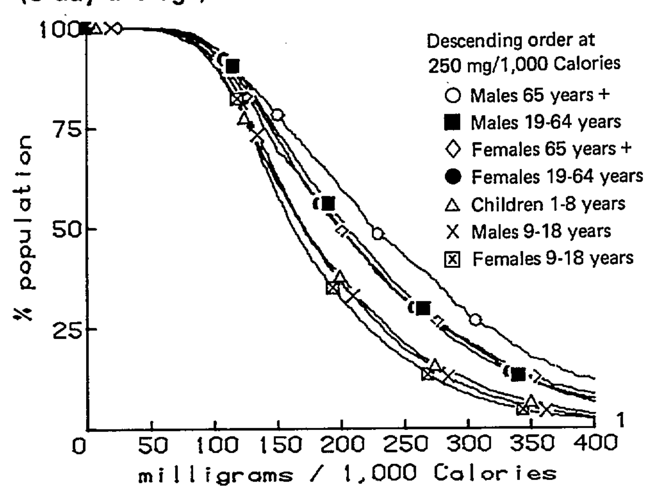
Cholesterol 1-2. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels (3-day average)



[1]Truncated at 400 milligrams (mg)/1,000 Calories.
Example: 29% of population had cholesterol intakes above 250 mg/1,000 Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

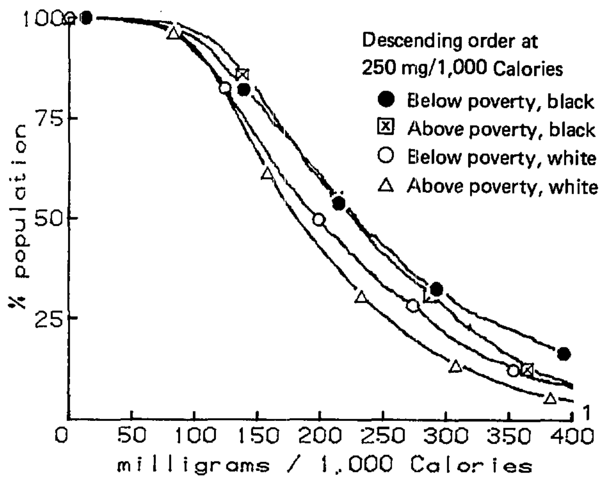
Cholesterol 1-3. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by sex and age (3-day average)



[1]Truncated at 400 milligrams (mg)/1,000 Calories.
Example: 43% of males 65+ years had cholesterol intakes above 250 mg/1,000 Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

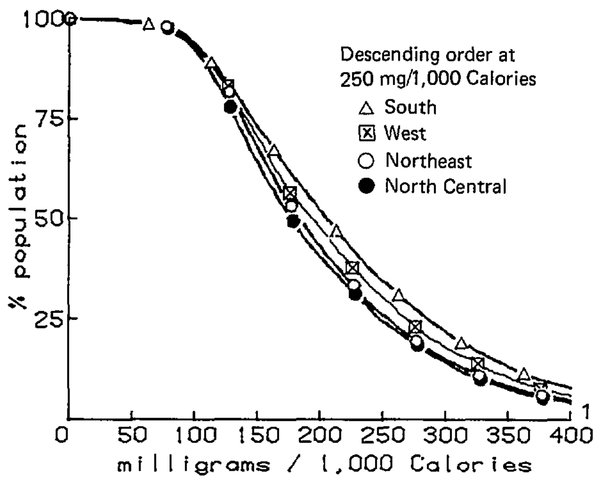
Cholesterol 1-4. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by poverty status and race (3-day average)



[1]Truncated at 400 milligrams (mg)/1,000 Calories.
Example: 42% of below poverty, black population had cholesterol intakes above 250 mg/1,000 Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

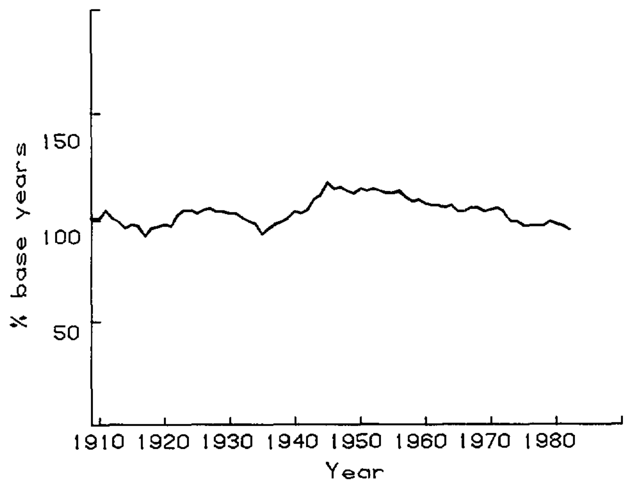
Cholesterol 1-5. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by region (3-day average)



[1]Truncated at 400 milligrams (mg)/1,000 Calories.
Example: 34% of population in the South had cholesterol intakes above 250 mg/1,000 Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Cholesterol 1-6. U.S. food supply: Percent of base years[1]



[1]U.S. food supply, 1909-13=507 milligrams/capita/day.

SOURCE: USDA: Data from the U.S. food supply historical series.

Carbohydrate, Added Sweeteners, and Fiber

Description

Carbohydrate is a major source of energy for the body. Carbohydrate not used immediately for energy may be stored in small amounts in the liver and muscles as glycogen or converted to body fat. Carbohydrates are compounds made up of sugar (saccharide) units. Simple carbohydrates are composed of one (mono) or two (di) saccharide units and also are referred to as sugars. Glucose and fructose are common monosaccharides. Sucrose, lactose, and maltose are common disaccharides. Complex carbohydrates such as starches are composed of many saccharide units (polysaccharides). During digestion, digestible carbohydrates are broken down into monosaccharide units by enzymes before absorption from the intestine.

Carbohydrate is found almost exclusively in food of plant origin. Milk, with its high lactose content, is the only important exception. Fruits and vegetables are sources of other simple carbohydrates, such as glucose, fructose, and sucrose. These sugars are also added to foods as sweeteners. In fruits and vegetables, simple carbohydrates are accompanied by a variety of other nutrients needed for good health, such as vitamins, minerals, and fiber. Grain products and vegetables are sources of complex carbohydrates.

The RDA for total carbohydrate, added sweeteners, or fiber have not been established by the National Academy of Sciences, Food and Nutrition Board, Committee on Dietary Allowances (National Research Council, 1980a), but several authoritative groups have made recommendations concerning appropriate intakes or limits on intake of these food components. Dietary intakes were compared with these recommendations. Biochemical, hematological, or other health indicators directly related to carbohydrate, added sweeteners, and fiber were not available from national surveys.

The U.S. Senate Select Committee on Nutrition and Human Needs (1977) recommended that carbohydrate provide 55-61 percent of the total calories in the diet, with complex carbohydrates and naturally occurring sugars providing 45-51 percent of calories and refined and other processed (added) sugars providing no more than 8-12 percent. The American Heart Association (1982) recommended that dietary carbohydrate be increased to 45-55 percent of calories and that this increase probably should take the form of complex carbohydrates rather than simple sugars. The Office of the Assistant Secretary for Health and the Surgeon General (1979) and the National Academy of Sciences, Food and Nutrition Board, Committee on Dietary Allowances (National Research Council, 1980a) recommended maintaining or increasing consumption of complex carbohydrates and decreasing consumption of refined sugars. Two of the recommendations in the dietary guidelines of the U.S. Departments of Agriculture and Health and Human Services (1980 and 1985) relate to carbohydrate: "Eat foods with adequate starch and fiber" and "Avoid too much sugar."

Excessive calorie intake from any source can result in obesity, which is a public health concern. Recommendations for decreasing the proportion of fat in the diet implicitly recommend increasing the proportion of carbohydrate if protein intake remains unchanged. If diets contain appropriate amounts of protein and fat, the appropriate amount of carbohydrate is that needed to maintain desirable body weight. If fat in U.S. diets were reduced to 30-35 percent of calories and protein remained at 17 percent of calories, as provided in diets reported by respondents in the 1977-78 Nationwide Food Consumption Survey (NFCS), carbohydrate would provide 48-53 percent of calories.

The terms "added sweeteners" or "added caloric sweeteners" are used to describe sugars such as table sugar, honey, molasses, and corn sweeteners added to foods for flavor or to achieve the desired texture or cooking conditions. No-calorie or low-calorie sweeteners such as saccharin or aspartame are not included in this group. Although honey and molasses contain traces of some minerals, they and other added sweeteners contribute little more than simple carbohydrate and calories to the diet.

Excessive calories from added sweeteners are particularly undesirable because many foods that are high in these substances contain few nutrients. In addition, the risk of tooth decay is increased with excessive intake of sugars and foods high in sugars, especially if they are eaten frequently and if they adhere to the teeth. Both starches and sugars appear to increase the risk of tooth decay when eaten frequently, but simple sugars offer a higher risk. However, the incidence of dental caries is influenced by many factors. Careful dental hygiene and exposure to adequate amounts of fluoride, especially through fluoridated water, can reduce the risk of caries. These preventive measures are believed to be important contributors to the consistent decline in the prevalence of dental caries among schoolchildren and young adults over the last 10-30 years.

The added sweetener content of many processed foods and food mixtures is not known precisely; however, intakes have been estimated for individuals in the 1977-78 NFCS. The U.S. food supply series provides quantitative information on types of added caloric sweeteners available for consumption before the sweeteners are combined with other ingredients in products such as bread, bakery products, and soft drinks.

Fiber is a complex mixture of plant materials that are resistant to digestion by secretions of the human digestive system. This mixture includes cellulose, hemicellulose, pectins, lignin, and mucilages, which are both structural and nonstructural components of plant materials. In the past, "fiber" meant only "crude fiber," which is the residue that remains after a food sample is treated with strong chemicals. It is composed mostly of lignin and cellulose. The chemical procedures for determining the crude fiber content of food, however, destroy some of the components that are not digested by humans. Hence, levels of crude fiber in food are lower than the levels of total fiber in the diet. The term "dietary fiber" has been introduced to refer to the total fiber content of the diet. Dietary fiber can be either insoluble or soluble. Insoluble dietary fiber includes cellulose, hemicellulose, and lignin, and comes from plant cell walls. Soluble fiber includes gums, mucilages, and pectins.

Fiber contributes bulk to food and helps to satisfy appetite. As an undigested residue, fiber also promotes normal elimination by providing bulk for stool formation and thus hastening the passage through the body of stool and reducing gut exposure to deleterious byproducts. Recent studies indicate that fiber may protect against some types of cancer, particularly the colorectal form (National Cancer Institute, 1984).

Most foods of plant origin contain both soluble and insoluble dietary fiber. Wheat bran contains relatively large amounts of insoluble fiber, although other grains and beans are also sources. Fruits, vegetables, and some cereals such as oats are sources of soluble dietary fibers.

Food composition data are sufficient for estimating the levels of crude fiber in diets, but no information on dietary fiber is available from the 1977-78 NFCS or the U.S. food supply. Difficulties in chemical analysis as well as confusing terminology have hindered progress in obtaining food composition data for dietary fiber. Considerable reseach efforts are underway to improve this situation in laboratories of the Agricultural Research Service of USDA and the Food and Drug Administration of DHHS. New food composition tables and the Continuing Survey of Food Intakes of Individuals, begun in April 1985, will provide information on total dietary fiber.

The importance of dietary fiber has been stressed by several groups, such as the U.S. Senate Select Committee on Nutrition and Human Needs (1977); the National Academy of Sciences, Food and Nutrition Board (1980a); the U.S. Departments of Agriculture and Health and Human Services (1980 and 1985); and the American Cancer Society (1984). The National Cancer Institute (1984) has recommended eating 25 to 35 grams of fiber per day. The National Academy of Sciences Committee on Diet, Nutrition, and Cancer (National Research Council, 1982) did not believe evidence was sufficient to make a recommendation about dietary fiber. However, they did suggest including whole-grain cereal products, fruits, and vegetables in the daily diet.

Major Findings

- Dietary levels of total carbohydrate averaged lower than those recommended by some authoritative groups. Average levels of added sweeteners in diets were close to the maximum intake range recommended by some groups.

- Dietary levels of carbohydrate and added sweeteners were generally higher for individuals 18 years of age and under than for older individuals, and they were slightly higher for females than for males in the same age group.

- Individuals above poverty had lower dietary levels of total carbohydrate and higher levels of added sweeteners than did those below poverty, but the differences were small.

- Grain products and the sugars and sweets group were the major sources of carbohydrate in household diets.

- The per capita level of carbohydrate provided by the U.S. food supply has declined about 20 percent since the beginning of the century, and the level of crude fiber has declined 34 percent. Of the total carbohydrate in the U.S. food supply, the proportion of complex carbohydrate has declined from 68 to 47 percent, with a reciprocal increase in the proportion of simple carbohydrate. This can be related to decreased use of grain products and increased use of sugars and other caloric sweeteners. Use of sucrose has declined and use of corn sweeteners has increased.

Individual Intake

Total carbohydrate intakes by individuals (3-day dietary reports) in the 1977-78 NFCS averaged 43 percent of calorie intake (Carbohydrate 1-1). Sixty-three percent of the survey population had carbohydrate intakes above 40 percent of calories, 20 percent had intakes above 50 percent of calories, and 2 percent had intakes above 60 percent of calories (Carbohydrate 1-2).

Dietary levels of carbohydrate were generally higher for individuals 18 years of age and under than for older individuals (Carbohydrate 1-1 and 1-3). Levels were highest for children 1-8 years of age and lowest for individuals 19-64 years of age. Females had diets higher in carbohydrate level than did males in the same age group.

Dietary levels of carbohydrate differed more by poverty status than by race (Carbohydrate 1-4). Levels were higher for individuals below poverty than for those above poverty. Carbohydrate levels differed little by region, urbanization, and season (Carbohydrate 1-1 and 1-5).

Added sweetener intakes by individuals (3-day dietary reports) in the 1977-78 NFCS averaged 12 percent of calorie intake (Added sweeteners 1-1). Fifty-six percent of the population had added sweetener intakes above 10 percent of calories, and 29 percent had intakes above 15 percent of calories (Added sweeteners 1-2).

Dietary levels of added sweeteners were higher for individuals 18 years of age and under than for older individuals, especially those 65 years of age and over (Added sweeteners 1-1 and 1-3). Children under 1 year of age were an exception; their intakes were low.

Dietary levels of added sweeteners were slightly higher for individuals above poverty than for those below poverty (Added sweeteners 1-4). Levels were somewhat higher in the South and North Central regions than in the Northeast and West (Added sweeteners 1-5).

Household Food Use

The carbohydrate level per person of household diets differed little by per capita income or by Food Stamp Program eligibility or participation (Carbohydrate 1-6). However, higher income households paid more for carbohydrate than did lower income households; that is, they obtained less carbohydrate per food dollar. Among households eligible for the Food Stamp Program, carbohydrate return per dollar did not differ by participation.

Households using food with higher money value per person averaged more carbohydrate per person but less carbohydrate per dollar than did households with lower food costs. The carbohydrate level of household diets differed little by household size, but smaller households obtained less carbohydrate return per dollar than did larger households.

Grain products and the sugar and sweets group provided, respectively, 42 and 23 percent of the carbohydrate in household diets (Carbohydrate 1-7). Fruits, vegetables, and the milk, cream, and cheese group each provided 10 percent of the carbohydrate in household diets. The sugar and sweets group and fruits contributed the most carbohydrate per 1,000 Calories, each providing at least 25 percent more carbohydrate than any other food group. The sugar and sweets group and the grain products group furnished the most carbohydrate per dollar--more than twice as much as any other food group.

Historical Trends

The per capita level of carbohydrate provided by the U.S. food supply was highest at the beginning of the century (Carbohydrate 1-8). It reached its lowest point of 363 grams per capita per day in 1963 and then rose to 388 grams per capita per day in 1982. Data from USDA's food consumption surveys indicate a slight increase in the carbohydrate level of household diets from 1955 to the mid-1960's and a decrease in both household diets and individual intakes from the mid-1960's to 1977-78.

Throughout the century, roughly 75 percent of the carbohydrate in the food supply has come from grain products and sugars and sweeteners, but the proportion from each group has changed. The proportion of carbohydrate from grain products declined from 56 to 37 percent, while that from sugars and sweeteners increased from 22 to 38 percent. The rise in carbohydrate from sugars and sweeteners in the early part of the century is attributed to increased use of sucrose, or table sugar, and the rise since 1970 is attributed to increased use of corn sweeteners.

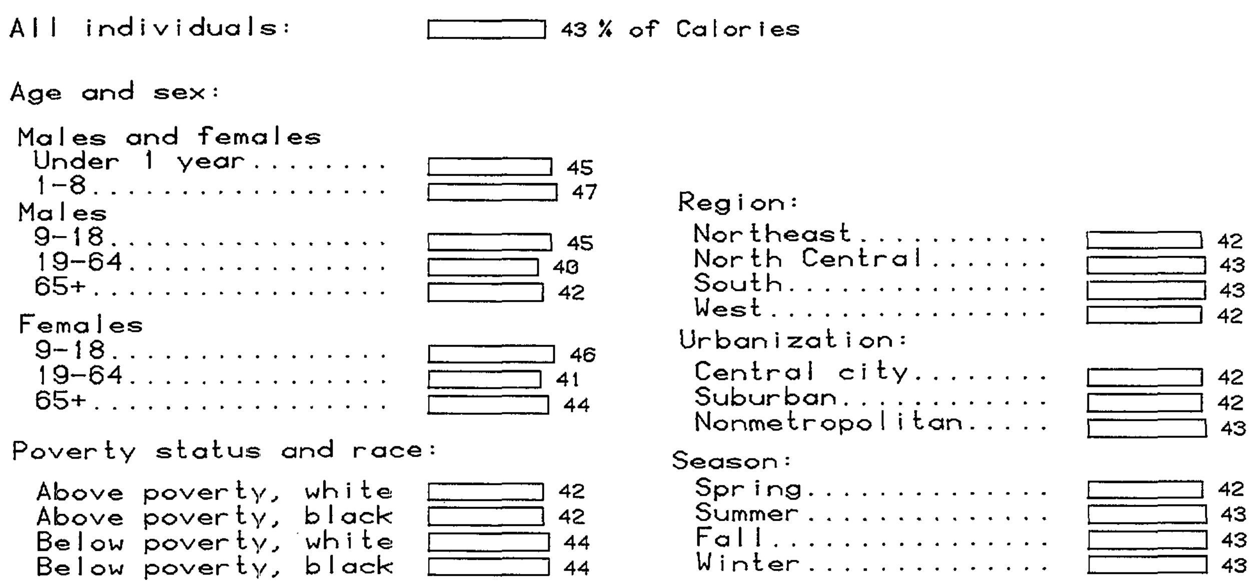
Changes in food sources of carbohydrate are reflected in the levels of complex and simple carbohydrate in the U.S. food supply as percents of the level for 1909-13 (Carbohydrate 1-9). The level of simple carbohydrate in the food supply increased from 154 grams per capita per day at the beginning of the century to 204 grams in 1982. Simple carbohydrate levels were high during the 1920's but declined during the depression years of the 1930's and the war years of the 1940's. Thereafter, except for a brief period in the mid-1970's, the level of simple carbohydrate gradually increased, reaching a peak in 1979. On the other hand, the level of complex carbohydrate in the food supply declined 45 percent from 1909-13 to 1982, from 336 to 184 grams per capita per day. This decline is attributed mainly to decreased use of grain products and, to a lesser extent, decreased use of potatoes.

The proportion of simple carbohydrate from sucrose and lactose declined from 1909-13 to 1982, although sucrose, primarily from refined table sugar, remained the primary source (Carbohydrate 1-10). The decline in lactose reflects a decrease in milk consumption. The proportion of simple carbohydrate from fructose, glucose, and maltose has increased since the beginning of the century. This increase is attributed mainly to increased use of corn sirup, especially high fructose corn sirup.

Table sugar provided 87 percent of the carbohydrate from added sweeteners in 1909-13, compared with 58 percent in 1982 (Added sweeteners 1-6). Carbohydrate from glucose corn sirup increased more than fourfold during the century, representing 14 percent of the carbohydrate from added sweeteners in 1982. After only 15 years on the market, high fructose corn sirup provided 24 percent of the carbohydrate from added sweeteners in 1982. Carbohydrate from corn sugar increased more than threefold but accounted for only 3 percent of the carbohydrate from added sweeteners in 1982. Use of other sweeteners declined during the century, providing only 1 percent of the carbohydrate from added sweeteners in 1982, compared with 7 percent in 1909-13.

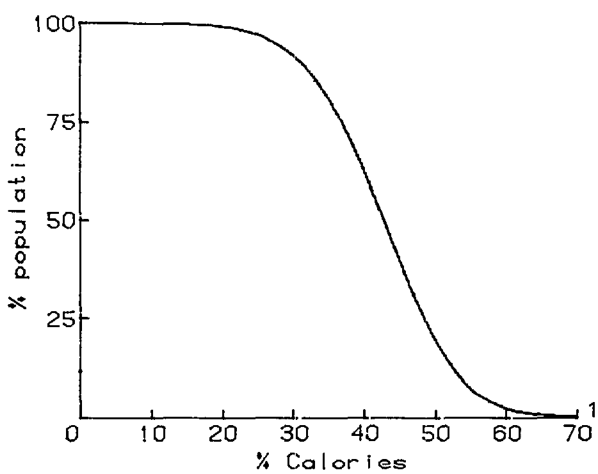
The level of crude fiber provided by the U.S. food supply declined from 6.1 grams per capita per day in 1909-13 to 4.1 grams in 1982 (Crude fiber 1-1). At the beginning of the century, grain products supplied 32 percent of the crude fiber in the food supply, and potatoes supplied 18 percent. In 1982, these food groups provided 19 percent and 13 percent of crude fiber, respectively. Marked decreases in the use of certain fresh foods, such as apples and cabbage, also contributed to the decline.

Carbohydrate 1-1. Individual intakes, 1977-78: Mean percent of Calories, by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

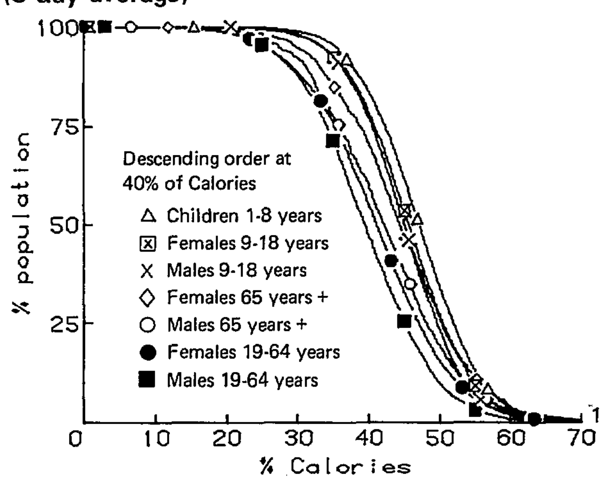
Carbohydrate 1-2. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels (3-day average)



[1]Truncated at 70% of Calories.
Example: 63% of population had carbohydrate intakes above 40% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

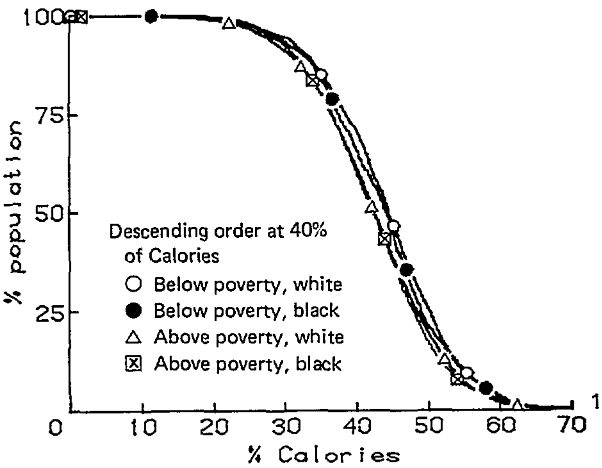
Carbohydrate 1-3. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by sex and age (3-day average)



[1]Truncated at 70% of Calories.
Example: 84% of children 1-8 years had carbohydrate intakes above 40% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

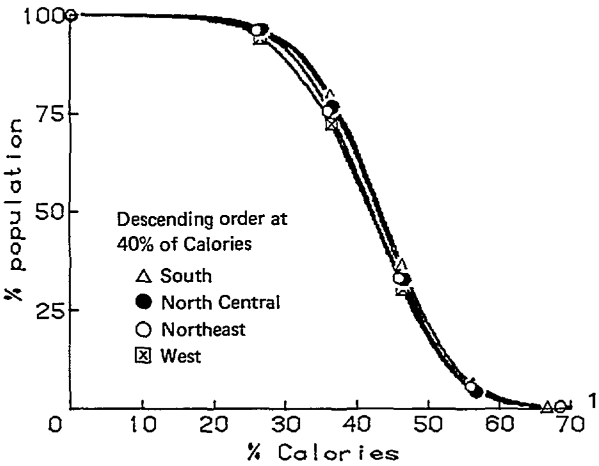
Carbohydrate 1-4. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by poverty status and race (3-day average)



[1]Truncated at 70% of Calories.
Example: 71% of below poverty white population had carbohydrate intakes above 40% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

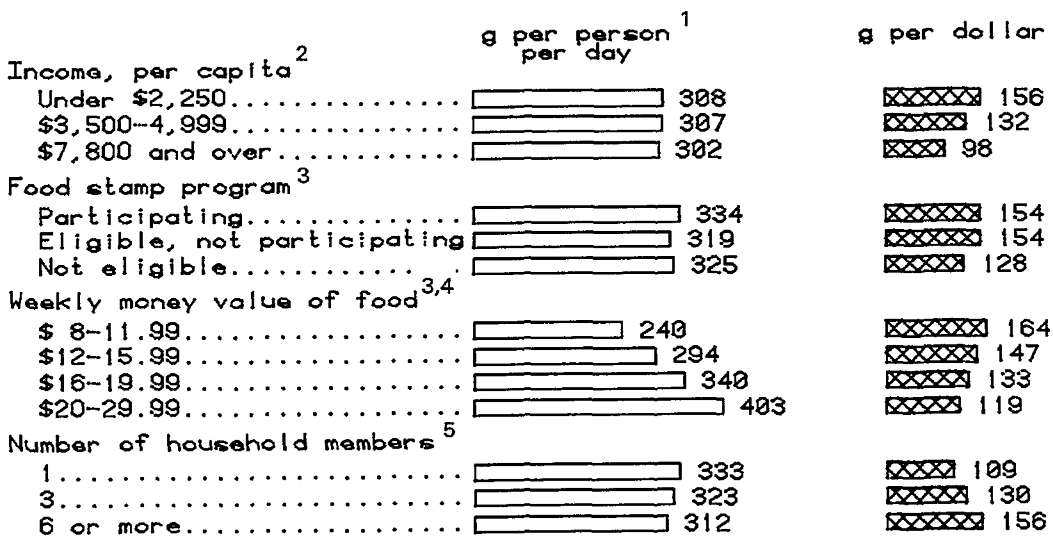
Carbohydrate 1-5. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by region (3-day average)



[1]Truncated at 70% of Calories.
Example: 66% of population in the South had carbohydrate intakes above 40% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Carbohydrate 1-6. Household diets, spring 1977: Grams (g) per person and per dollar's worth of food used at home, by selected characteristics



[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

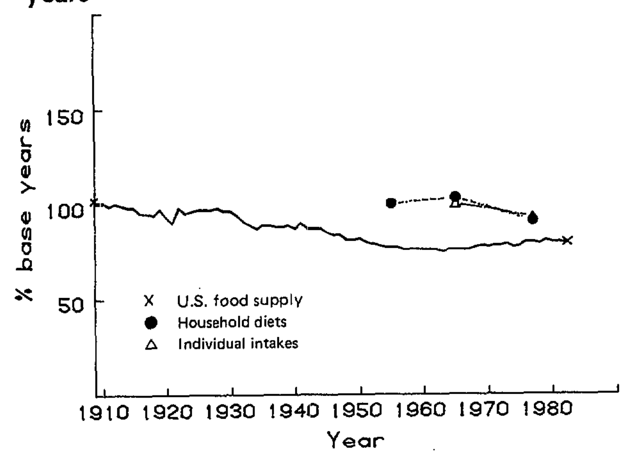
Carbohydrate 1-7. Household diets, spring 1977: Contribution of food groups

	% total carbohydrate	grams/1,000 Calories of food group	grams/ dollar's worth of food group	% money value
Grain products	42%	187	458	12%
Sugar, sweets	23%	243	464	6%
Fruit	10%	245	178	8%
Vegetables	10%	191	113	12%
Milk, cream, cheese	10%	78	101	12%
Other protein foods[1]	3%	54	80	4%
Miscellaneous[2]	2%	104	28	8%
Fats, oils	<1%	5	21	3%
Meat, poultry, fish	<1%	1	1	34%

[1]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

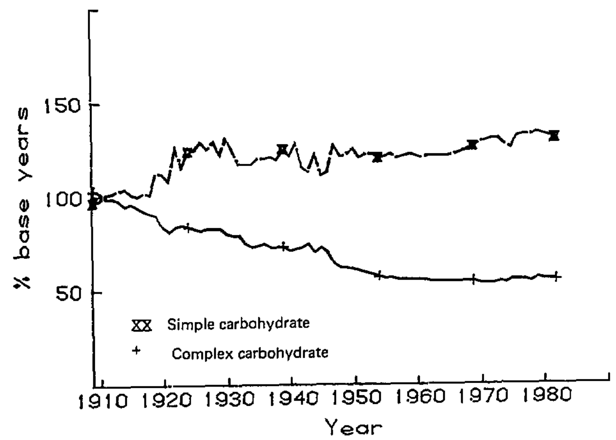
Carbohydrate 1-8. U.S. food supply, household diets, and individual intakes: Percent of base years[1]



[1]U.S. food supply, 1909-13=490 grams (g)/capita/day; household, 1955=344 g/meal-at-home equivalent person/day; individual, 1965=210 g/individual/day (3-day average).

SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

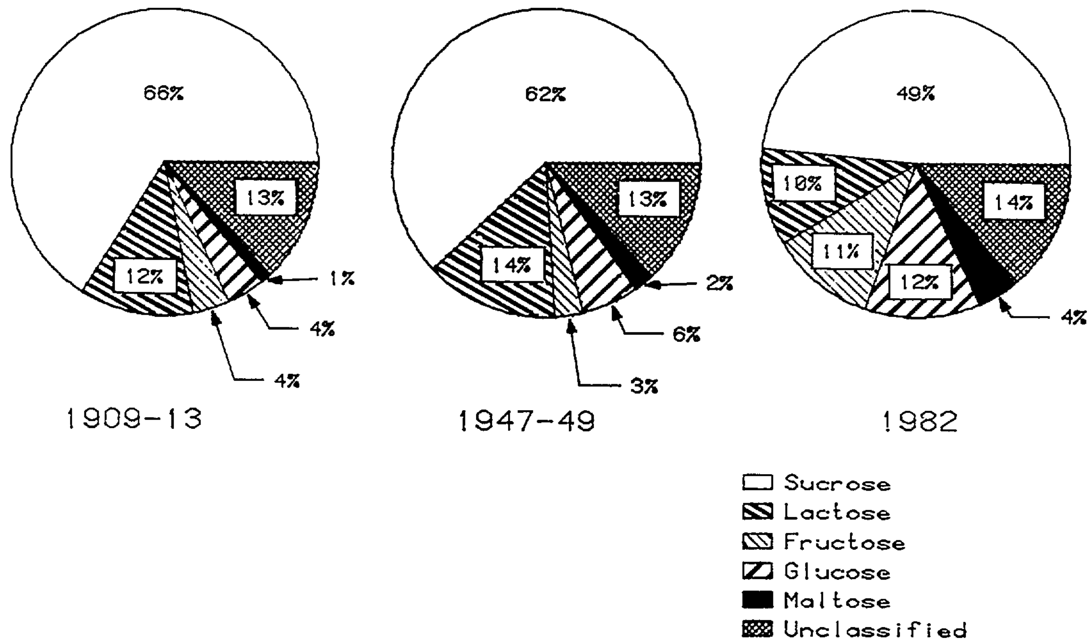
Carbohydrate 1-9. U.S. food supply: Simple and complex carbohydrate as percent of base years[1]



[1]U.S. food supply, 1909-13=154 grams (g) simple carbohydrate and 336 g complex carbohydrate/capita/day.

SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

Carbohydrate 1-10. U.S. food supply, 1909-82: Percent distribution of simple carbohydrate



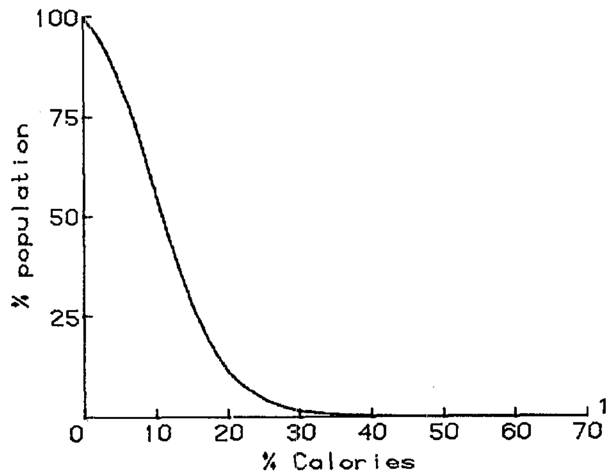
SOURCE: USDA: Data from the U.S. food supply historical series.

Added sweeteners 1-1. Individual intakes, 1977-78: Mean percent of Calories, by selected characteristics (3-day average)

Characteristic	% of Calories
All individuals:	12
Age and sex:	
Males and females	
Under 1 year	5
1-8	14
Males	
9-18	14
19-64	11
65+	10
Females	
9-18	14
19-64	12
65+	10
Poverty status and race:	
Above poverty, white	12
Above poverty, black	13
Below poverty, white	12
Below poverty, black	11
Region:	
Northeast	11
North Central	12
South	13
West	11
Urbanization:	
Central city	12
Suburban	12
Nonmetropolitan	12
Season:	
Spring	12
Summer	12
Fall	12
Winter	11

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

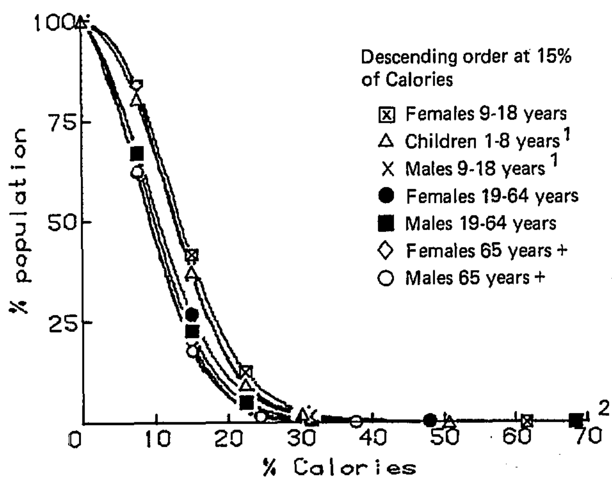
Added sweeteners 1-2. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels (3-day average)



[1]Truncated at 70% of Calories.
Example: 29% of population had added sweetener intakes above 15% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

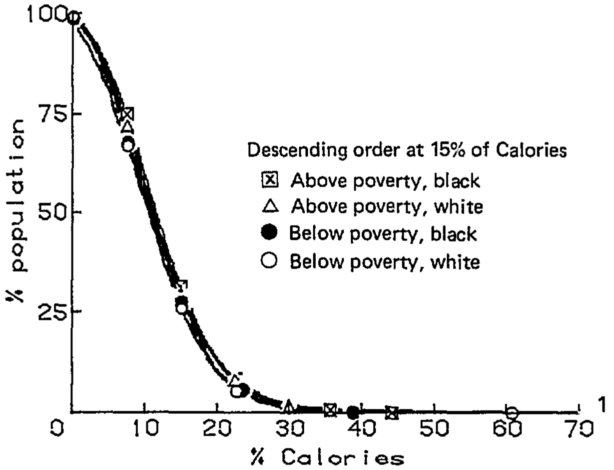
Added sweeteners 1-3. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by sex and age (3-day average)



[1]Equal at 15% of Calories.
[2]Truncated at 70% of Calories.
Example: 42% of females 9-18 years had added sweetener intakes above 15% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

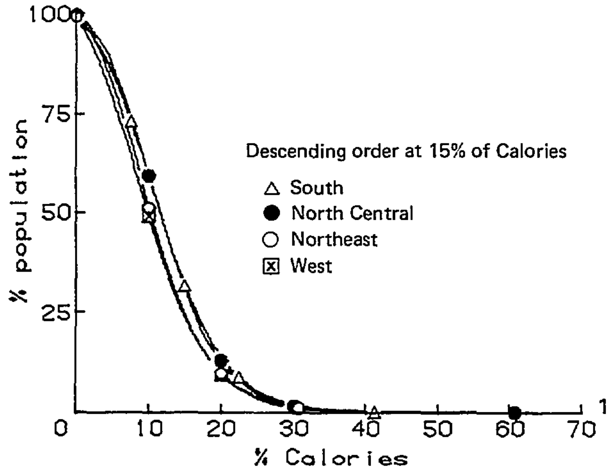
Added sweeteners 1-4. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by poverty status and race (3-day average)



[1]Truncated at 70% of Calories.
Example: 32% of above poverty, black population had added sweetener intakes above 15% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

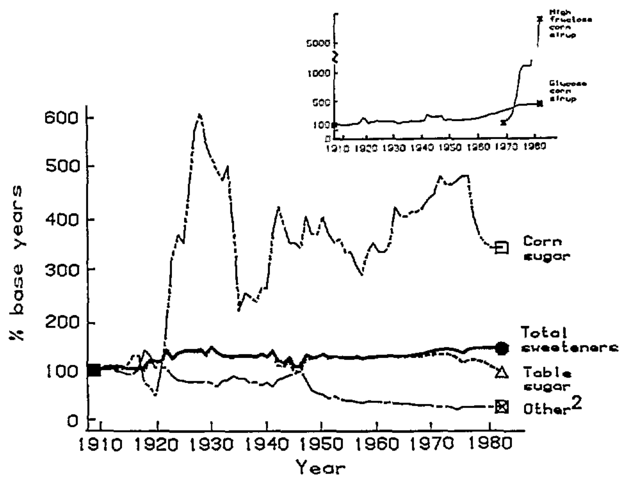
Added sweeteners 1-5. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by region (3-day average)



[1]Truncated at 70% of Calories.
Example: 33% of population in the South had added sweetener intakes above 15% of Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

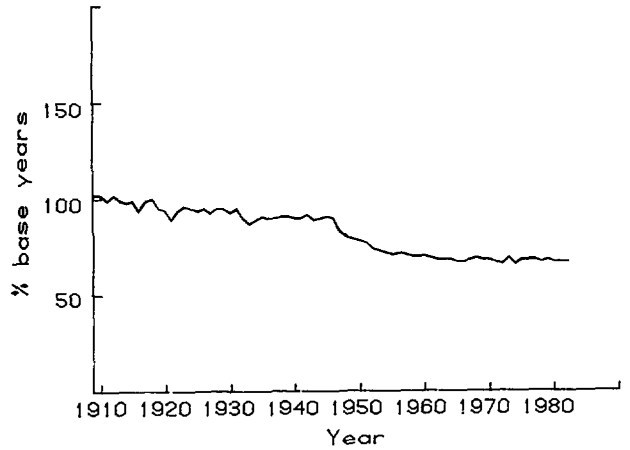
Added sweeteners 1-6. U.S. food supply: Percent of base years[1]



[1]U.S. food supply, 1909-13=106 grams (g)/capita/day carbohydrate from total sweeteners; 1 g/capita/day from corn sugar; 92 g/capita/day from table sugar; 5 g/capita/day from glucose corn sirup, and 7 g/capita/day from other sweeteners. U.S. food supply, 1969=1 g/capita/day carbohydrate from high fructose corn sirup.
[2]Cane, maple, and refiner's sirups, sorgo, molasses, and honey.

SOURCE: USDA: Data from the U.S. food supply historical series.

Crude fiber 1-1. U.S. food supply: Percent of base years[1]



[1]U.S. food supply, 1909-13=6.1 grams/capita/day.

SOURCE: USDA: Data from the U.S. food supply historical series.

Alcohol

Description

Alcohol (ethanol) is produced by the fermentation of the carbohydrate in fruit and grain. Alcohol provides 7 Calories per gram, nearly twice as many calories as carbohydrate. Although the alcohol content of beverages is known, accurate estimates of consumption are difficult to obtain.

Alcoholic beverages are very low in nutrients, especially in relation to the calories they provide. Excessive alcohol intake may result in nutrient deficiencies because of generally poor diets or interference with nutrient absorption. If intake of alcohol is high, the calories it provides may result in overweight, but if food intake is decreased to maintain body weight, nutrient intakes may be inadequate. In addition, excessive alcohol intake can result in medical problems, such as cirrhosis of the liver, pancreatitis, and cancer of the throat. It also contributes indirectly to other physical and mental diseases. The social and public safety problems arising from alcohol abuse extend beyond the alcoholic.

One of the dietary guidelines of the U.S. Departments of Agriculture and Health and Human Services (1980 and 1985) specifically relates to alcohol consumption: "If you drink alcohol, do so in moderation." Several authoritative groups have suggested that pregnant women limit or avoid alcohol consumption and have strongly advised individuals not to drive after drinking.

Major Findings

- Excessive alcohol intake is one of the most detrimental factors in the American diet. Alcohol abuse results in serious medical and social problems.

- Available data indicate that alcohol consumption is high.

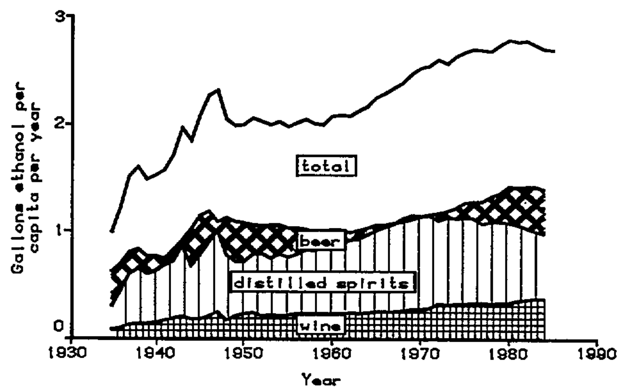
Historical Trends

Data on the apparent consumption of alcoholic beverages have been derived from official reports of States, tax records, and sales reports of the beverage industry (Alcohol, Drug Abuse, and Mental Health Administration, 1983). These "disappearance" data overestimate actual ethanol intake because they include alcoholic beverages that may be lost because of spillage, bottle breakage, and discard of partially consumed alcoholic beverages. In addition, the ethanol (alcohol portion of beer, wine, and distilled spirits) is lost through evaporation when alcoholic beverages are used in cooking. The apparent consumption of alcohol based on these data is much higher than estimates based on self-reported intakes from national food consumption surveys. Data from these surveys are underestimates of true consumption because of deliberate underreporting by individuals, underrepresentation of very heavy drinkers, failure to classify as drinkers individuals who consume alcoholic beverages but did not do so during the survey period, and failure to assess consumption on atypical days.

Based on disappearance data, the apparent consumption of ethanol rose rapidly (130 percent) from 1934 to 1946--increasing from 1.0 to 2.3 gallons per capita per year for persons 14 or 15 years of age and over (Alcoholic beverages 1-1). Consumption then decreased slightly and remained relatively steady at about 2.0 gallons per capita per year during the 1950's. During the 1960's, apparent consumption rose by about 25 percent, reaching 2.5 gallons per capita per year. The rate of increase slowed in the 1970's, but consumption continued to rise. From 1970 to 1983, it rose about 6 percent. Of the ethanol consumed in the United States in 1983, 51 percent was from beer, 36 percent from distilled spirits, and 13 percent from wine.

Apparent consumption of ethanol was estimated to average 2.7 gallons per capita in 1983, an amount equivalent to about 1.0 fluid ounce of ethanol per day for each person 14 years of age and older. One fluid ounce of ethanol is about 2 drinks, with a drink defined as 12 fluid ounces of beer, 1 fluid ounce of distilled spirits, or 4 fluid ounces of wine. These amounts of alcoholic beverages would provide 150-300 Calories, excluding calories from mixers. This could equal 15 percent of a 2,000-Calorie diet. Calories from alcoholic beverages are accompanied by few other nutrients and therefore dilute the nutrient quality of the diet.

Alcoholic beverages 1-1. Apparent U.S. consumption of ethanol, 1934-83[1]



[1]Data through 1969 are for persons 15 years and over; data from 1970 through 1983 are for persons 14 years and over.

SOURCE: US DHHS: *Alcohol and Health*. DHHS Pub No. (ADM) 84-1291. National Institute on Alcohol Abuse and Alcoholism; Alcohol, Drug Abuse, and Mental Health Administration. Washington. U.S. Government Printing Office, 1983 and personal communication.

Vitamins

Vitamin A

Description

Vitamin A, also called retinol, is a fat-soluble nutrient required in the diet. It is involved in the formation and maintenance of healthy skin, hair, and mucous membranes, and it is essential for vision, bone growth, tooth development, and reproduction. Vitamin A is available to the human body in two ways. It may be ingested from food as "preformed" vitamin A (retinol), or it may be formed in the body from some carotenes. Some studies have found that populations with diets relatively high in foods containing preformed vitamin A and carotenes have lower rates of some cancers, especially cancer of the lung, urinary bladder, and larynx. However, the toxicity of vitamin A in doses exceeding those needed for optimum nutrition and the inability of epidemiological studies to distinguish the effects of carotenes from those of preformed vitamin A argue against increasing vitamin A intake by the use of supplements.

Clinical signs of vitamin A deficiency include characteristic changes in the eyes and skin and problems with vision. The seriousness of very low intakes of vitamin A over a short time, such as a few days, is questionable because the body is able to store vitamin A for relatively long periods of time (Underwood, 1984). The Food and Nutrition Board of the National Academy of Sciences (National Research Council, 1980a) has stated that regular ingestion of more than 25,000 International Units daily is not prudent because it may cause toxicity.

Dietary intakes of vitamin A value are assessed relative to the 1980 RDA. Intake is shown in terms of International Units (IU) of vitamin A in this report. Until recently, the vitamin A value in all types of food and the RDA were expressed as IU. The RDA are 5,000 IU per day for males 11 years of age and older and 4,000 IU per day for females of the same age. For greater accuracy, RDA now are stated as retinol equivalents. However, methods are only now being developed for differentiating the forms of vitamin A and its precursors and for converting them to retinol equivalents. This report also contains health data on the level of vitamin A in blood.

Preformed vitamin A is found only in food of animal origin, while vitamin A precursors are found in food of vegetable origin. Food sources of preformed vitamin A include liver, egg yolk, whole milk, whole-milk dairy products, butter, and milks, breakfast cereals, and margarines fortified with vitamin A. Food sources of carotenes include dark-green leafy vegetables, yellow vegetables, and yellow fruits.

Major Findings

- National survey data indicate that the vitamin A intake and status of the U.S. population appear to be adequate. However, ongoing research on the role of carotenes in cancer prevention may lead to the establishment of new criteria for evaluating vitamin A status.

- Dietary levels of vitamin A value averaged above the RDA, and the prevalence of health problems related to vitamin A deficiency in the population was low.

- About 5 percent of children 3-5 years of age had low levels of serum vitamin A. However, diets reported for children 1-8 years of age provided relatively high levels of vitamin A value. A possible explanation for this apparent lack of agreement is that the cutoff point used to define low serum vitamin A is not appropriate for this age group.

- Dietary levels of vitamin A value did not appear to be consistently associated with economic status.

- The major and most economical source of vitamin A value (in terms of International Units) in household diets was the vegetable group.

- The vitamin A value provided by the U.S. food supply was about the same in 1982 (7,800 IU per capita per day) as at the beginning of the century, but below peak levels in the mid-1940's.

Individual Intake

Vitamin A value intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey averaged 133 percent of the RDA (Vitamin A value 1-1). Fifty percent of the survey population had intakes of at least the RDA, and more than two-thirds had intakes of at least 70 percent of the RDA (chart 1-2). Sixty-one percent of the survey population had diets providing at least the RDA ratios of vitamin A value to calories, and 80 percent had intakes of at least 70 percent of the RDA ratios.

All reported population subgroups had average intakes above the RDA for vitamin A, but intakes for individuals within groups varied considerably. Dietary levels of vitamin A value were higher for children 8 years of age or younger and adults over 64 years of age than for other age groups (chart 1-3). Other sex and age groups differed little in dietary levels of vitamin A value.

Both white and black individuals above poverty level were more likely than those below poverty level to have intakes of at least the RDA (chart 1-4). In addition, slightly more black than white individuals in each economic group had intakes of at least the RDA.

Among the four regions, vitamin A value levels were highest in the West and lowest in the South (chart 1-5). Levels of vitamin A value differed little by urbanization and season.

Household Food Use

Households with higher income per capita reported using food with more vitamin A value per person than did lower income households (chart 1-6). However, higher income households paid more for vitamin A value than did lower income households; that is, they obtained less vitamin A value from each food dollar. Among households eligible for the Food Stamp Program, participants used food higher in vitamin A value per person and also slightly higher in vitamin A value per dollar than did nonparticipants. Compared with higher income households that were ineligible for the Food Stamp Program, participating households used food slightly higher in vitamin A value per person and also higher in vitamin A value per dollar.

Households using food with higher money value per person averaged more vitamin A value per person but less vitamin A value per dollar than did households with lower food costs. One-member households used food with more vitamin A value per person and slightly more per dollar than did larger households.

Vegetables provided 41 percent of the vitamin A value (in terms of International Units) in household diets (chart 1-7). This food group supplied the most vitamin A value per 1,000 Calories of food group--more than three times that supplied by fruit, the next most concentrated source. Vegetables also provided the most vitamin A value per dollar's worth of food group--15 percent more than that supplied by fats and oils, the second most economic source.

Historical Trends

The per capita level of vitamin A value provided by the U.S. food supply fluctuated upward in the first half of the century, reaching a peak in 1945 (chart 1-8). This high point is attributed to the popularity of Victory Gardens, high use of dairy products, and the introduction of fortified margarines. Thereafter, vitamin A value declined until the mid-1960's. This is attributed to decreased use of vegetables and dairy products.

Data from USDA's food consumption surveys indicate that the vitamin A value of household diets closely followed the food supply trend, declining from the mid-1950's to the mid-1960's and thereafter rising slowly. However, the vitamin A value of diets reported by individuals in the 1977-78 survey was slightly lower than the value in diets reported in 1965.

Serum vitamin A

In the 1976-80 National Health and Nutrition Examination Survey (NHANES II), serum vitamin A was used as an indicator of vitamin A status. It is a useful indicator of vitamin A status once liver stores are depleted or when liver stores are very high. However, the measure is not sensitive to varying levels of vitamin A stores in the body. It is relatively unaffected by short-term dietary intake. Values below 20 micrograms per deciliter are considered low (Sauberlich et al., 1974).

In NHANES II, vitamin A status was assessed only in children 3-11 years of age. This decision was made because in the first National Health and Nutrition Examination Survey, conducted from 1971 through 1974, low levels of vitamin A were found in less than 1 percent of all persons 12-74 years of age.

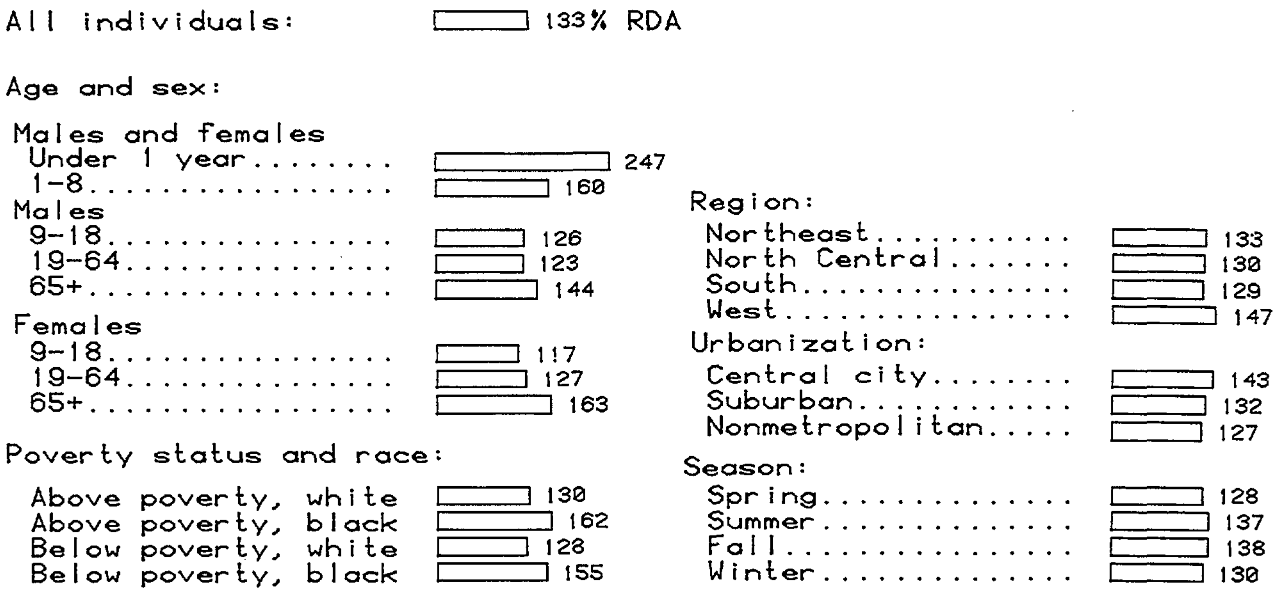
Mean serum vitamin A levels were within normal ranges regardless of race, sex, or poverty status (Vitamin A 2-1 through 2-4).

About 5 percent of children 3-5 years of age had low levels of serum vitamin A (charts 2-5 through 2-8). The percent with low levels decreased to about 1.5 percent in the group 9-11 years of age. Charts 2-5 and 2-6 show no consistent patterns in the prevalence of low values by race for males or females. Although the proportions with low serum vitamin A appear higher for males below poverty level than for males above poverty level (chart 2-7), the differences are not statistically significant. Furthermore, the pattern is not evident in females (chart 2-8).

Additional results show that the positive relationship between serum vitamin A levels and age held, even after the effects of vitamin A intakes, both through diets and supplements, were controlled and after racial and socioeconomic factors were shown to be nonsignificant. This observation raises the interesting question of whether the lower values in young children were physiologically normal. If so, different cutoff points may be needed for describing vitamin A status in young children than those used for older age groups. Alternatively, the generally lower range of values in young children may be indicative of a more marginal vitamin A status.

The questions raised here underscore the need for additional studies with young children under carefully controlled conditions to identify normal ranges of values for serum vitamin A. Documentation is also needed of serum vitamin A levels associated with early manifestations of vitamin A deficiency or toxicity in young children under conditions present in the United States.

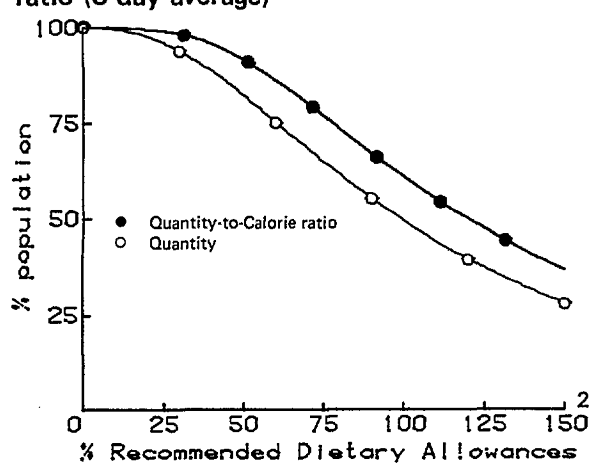
Vitamin A value[1] 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)



[1]Calculated as International Units (IU). See discussion of retinol equivalents.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

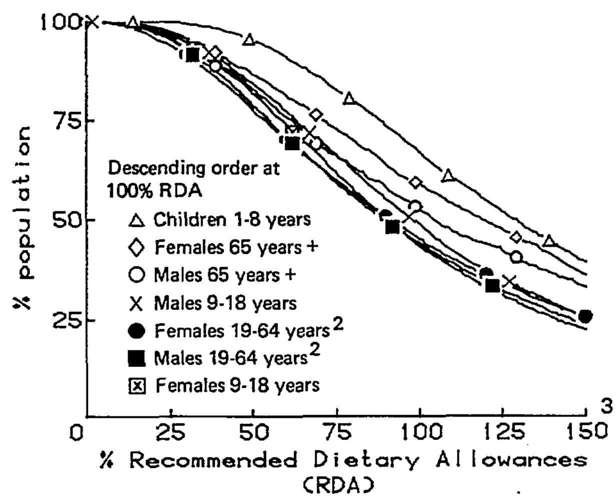
Vitamin A value[1] 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)



[1]Calculated as International Units. See discussion of retinol equivalents.
[2]Truncated at 150% RDA.
Example: 50% of the population had at least 100% RDA by quantity, and 61% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

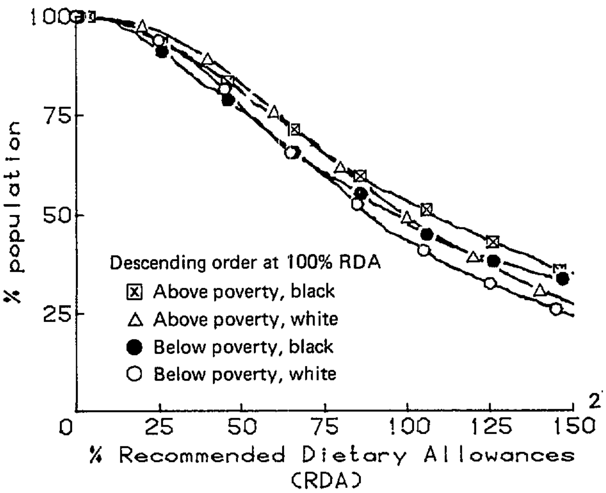
Vitamin A value[1] 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



[1]Calculated as International Units (IU). See discussion of retinol equivalents.
[2]Equal at 100% RDA.
[3]Truncated at 150% RDA.
Example: 67% of children 1-8 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

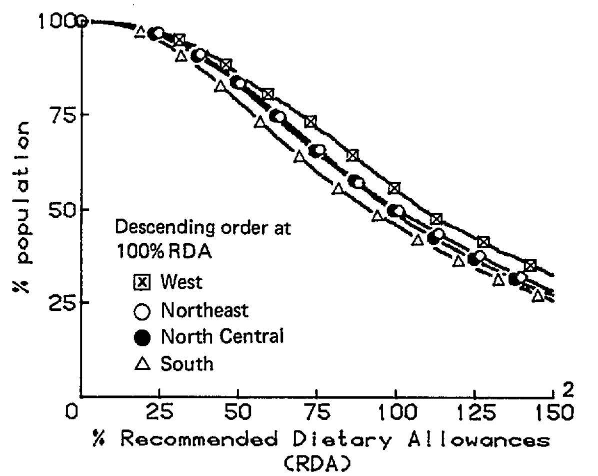
Vitamin A value[1] 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)



[1]Calculated as International Units (IU). See discussion of retinol equivalents.
[2]Truncated at 150% RDA.
Example: 54% of above poverty, black population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

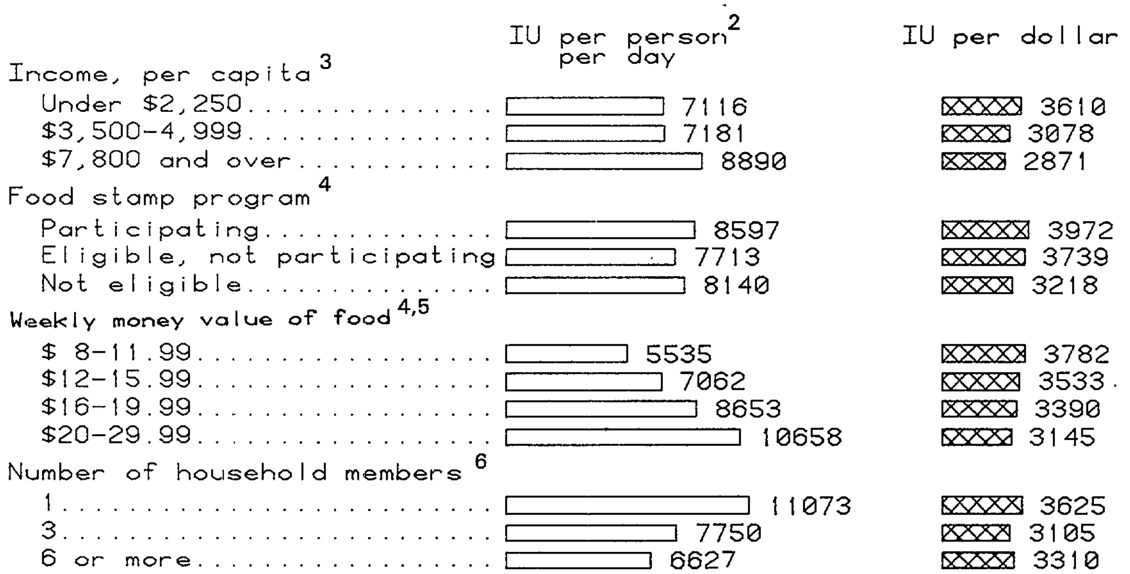
Vitamin A value[1] 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)



[1]Calculated as International Units (IU). See discussion of retinol equivalents.
[2]Truncated at 150% RDA.
Example: 56% of population in the West had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Vitamin A value[1] 1-6. Household diets, spring 1977: International Units (IU) per person and per dollar's worth of food used at home, by selected characteristics



[1]Calculated as (IU). See discussion of retinol equivalents.
[2]Meal-at-home equivalent person.
[3]1976 household income before taxes.
[4]Data for year 1977-78.
[5]Per meal-at-home equivalent person per week.
[6]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

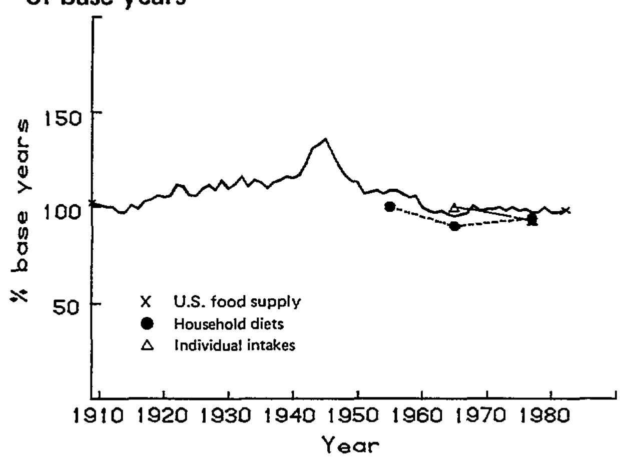
Vitamin A value[1] 1-7. Household diets, spring 1977: Contribution of food groups

	% total Vitamin A value	IU/1,000 Calories of food group	IU/ dollar's worth of food group	% money value
Vegetables	41%	18708	11067	12%
Meat, poultry, fish	13%	1314	1183	34%
Milk, cream, cheese	12%	2521	3259	12%
Grain products	11%	1251	3074	12%
Fruit	10%	5504	4000	8%
Fats, oils	9%	2052	9643	3%
Other protein foods[2]	4%	1806	2692	4%
Sugar, sweets	<1%	71	135	6%
Miscellaneous[3]	<1%	19	5	8%

[1]Calculated as International Units (IU). See discussion of retinol equivalents.
[2]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[3]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

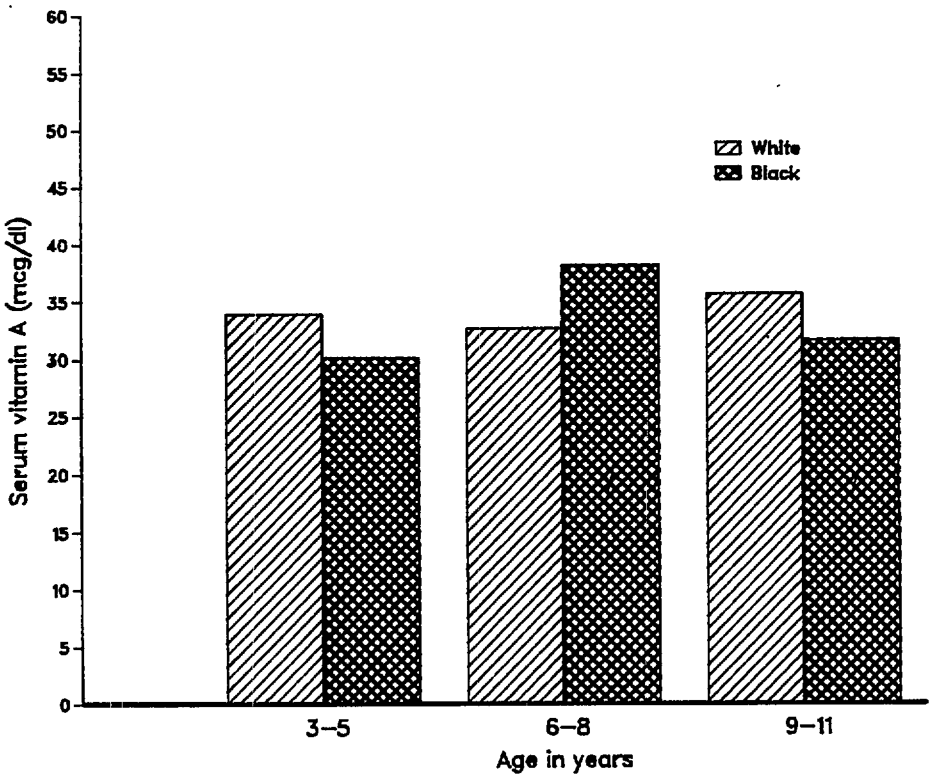
Vitamin A value[1] 1-8. U.S. food supply, household diets, and individual intakes: Percent of base years[2]



[1]Calculated as International Units (IU). See discussion of retinol equivalents.
[2]U.S. food supply, 1909-13=7,917 IU/capita/day; household, 1955=8,150 IU/meal-at-home equivalent person/day; individual, 1965=5,441 IU/individual/day (3-day average).

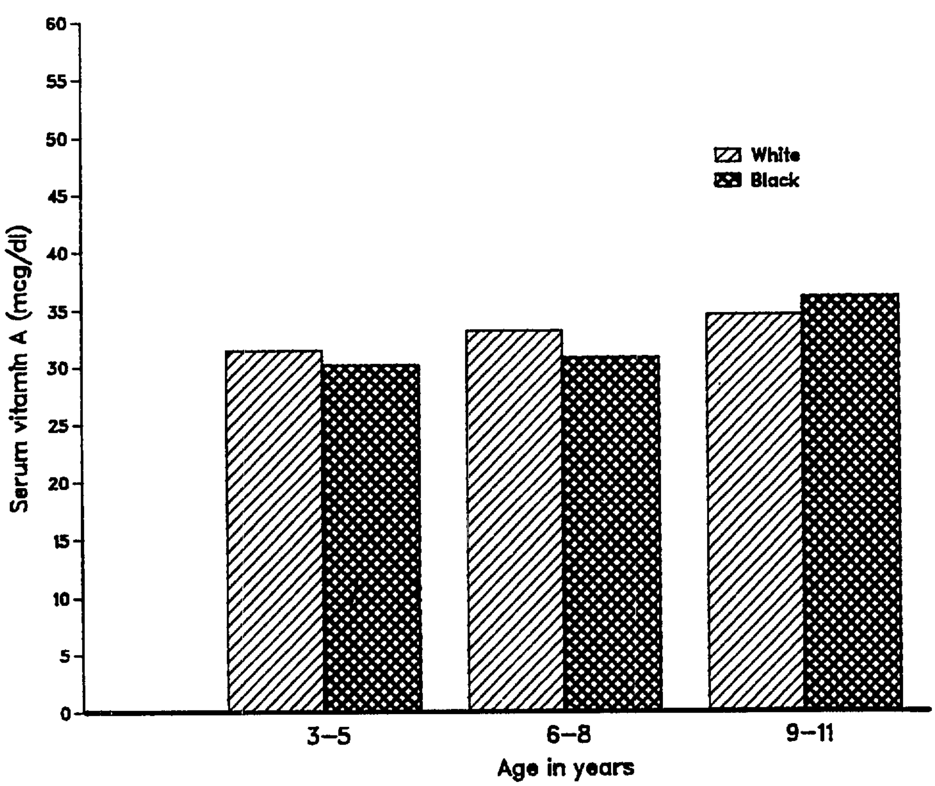
SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

Vitamin A 2—1. Mean serum vitamin A for males, by race and age: 1976-80



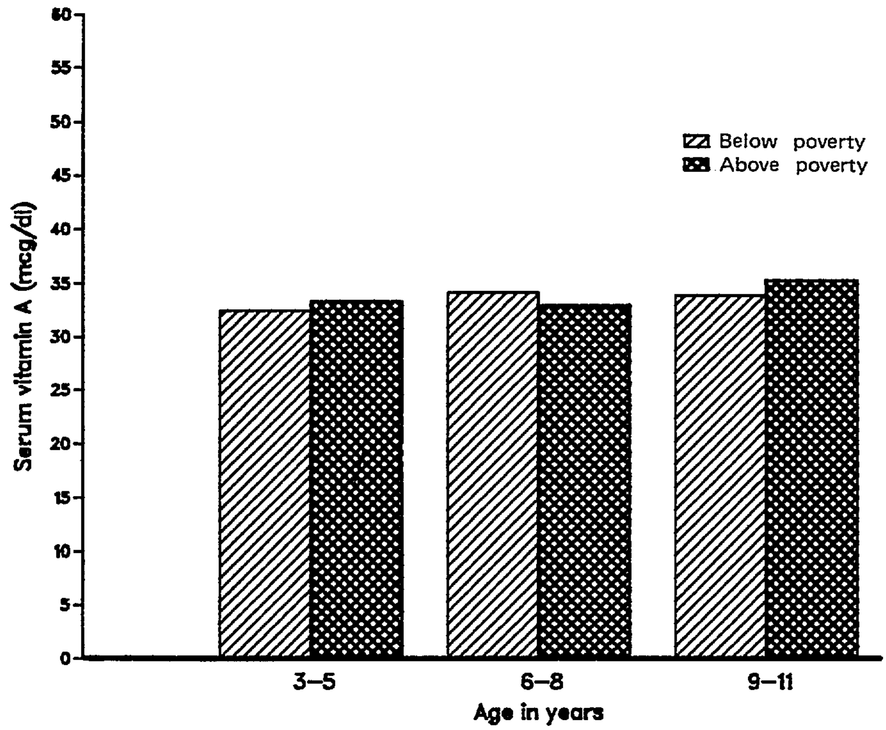
NOTE: Vitamin A measured in micrograms per deciliter (mcg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin A 2—2. Mean serum vitamin A for females, by race and age: 1976-80



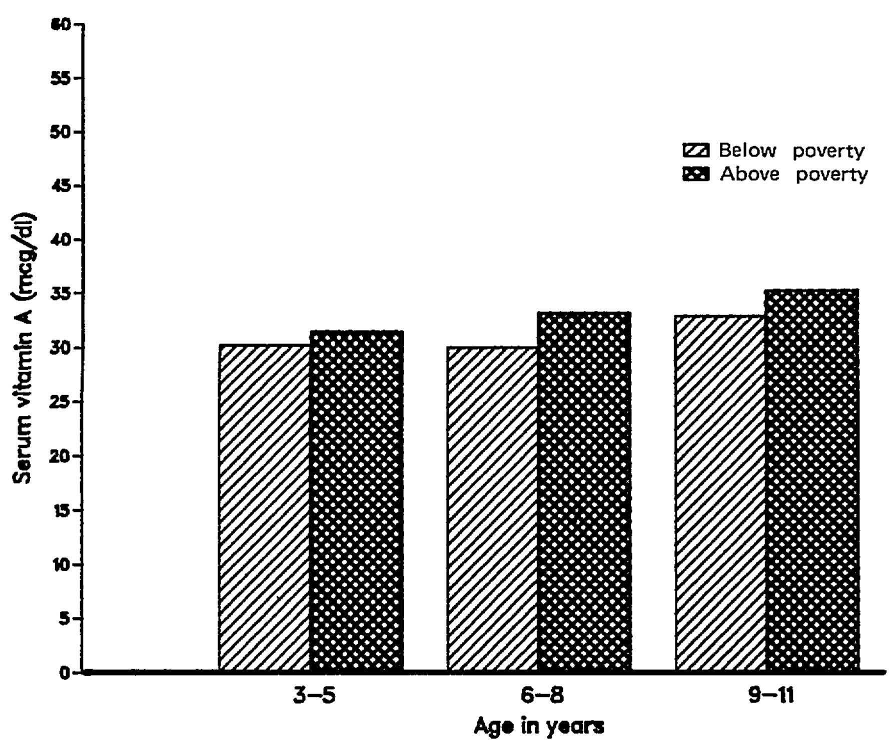
NOTE: Vitamin A measured in micrograms per deciliter (mcg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin A 2—3. Mean serum vitamin A for males, by poverty status and age: 1976-80



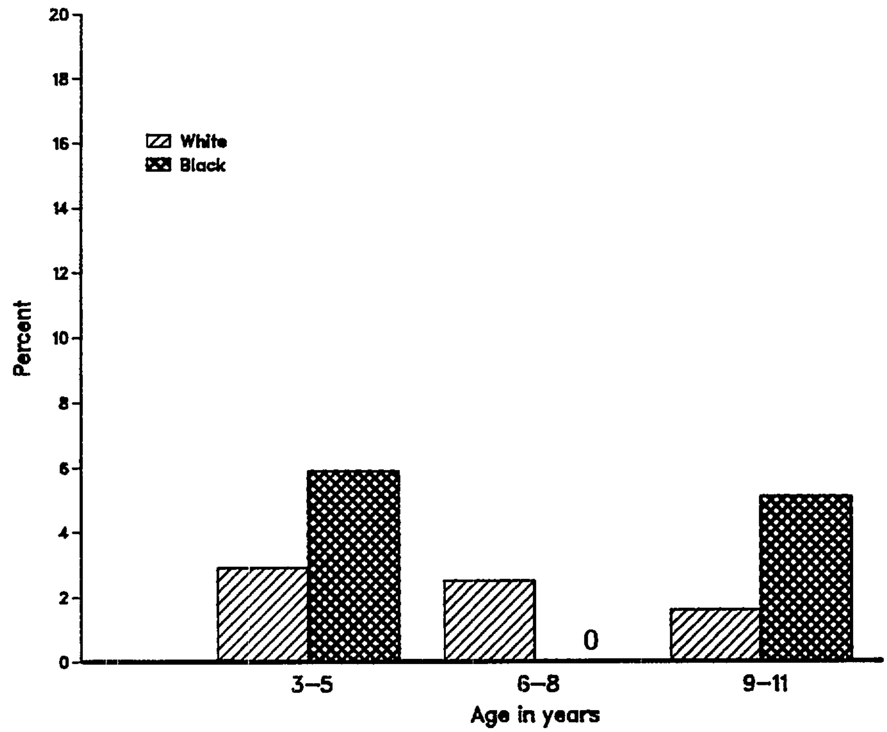
NOTE: Vitamin A measured in micrograms per deciliter (mcg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin A 2—4. Mean serum vitamin A for females, by poverty status and age: 1976-80



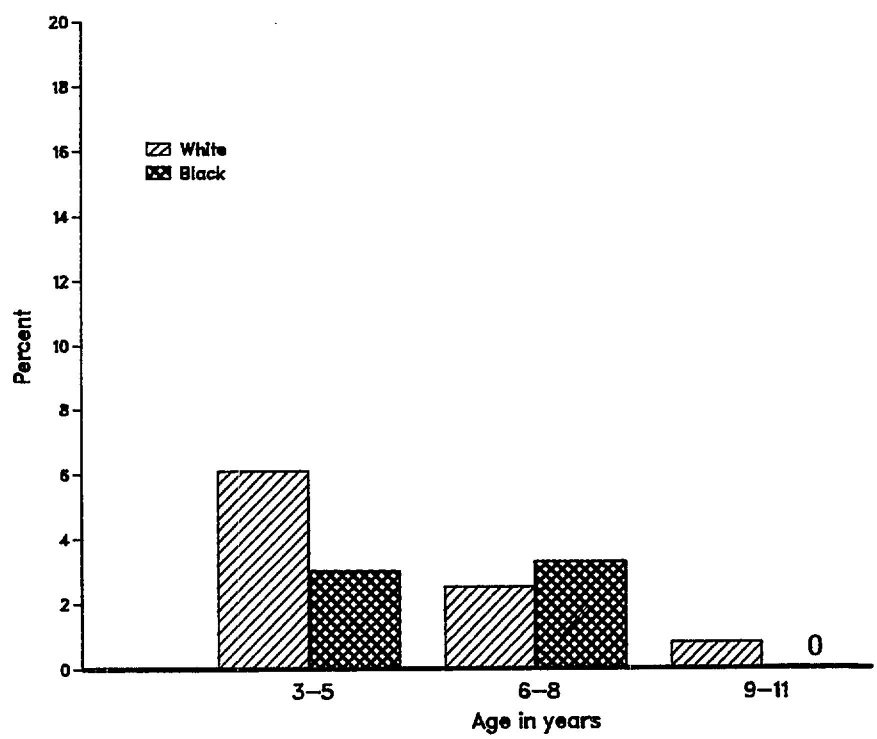
NOTE: Vitamin A measured in micrograms per deciliter (mcg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin A 2–5. Percent of males with low serum vitamin A (less than 20 mcg/dl), by race and age: 1976-80



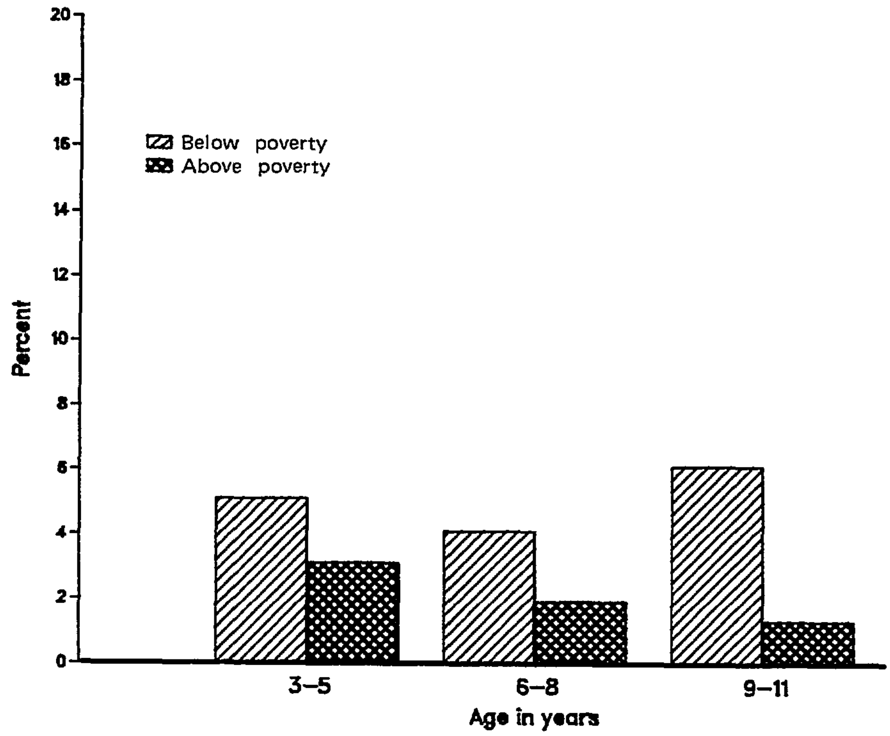
NOTE: Vitamin A measured in micrograms per deciliter (mcg/dl). 0 = Quantity zero. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin A 2–6. Percent of females with low serum vitamin A (less than 20 mcg/dl), by race and age: 1976-80



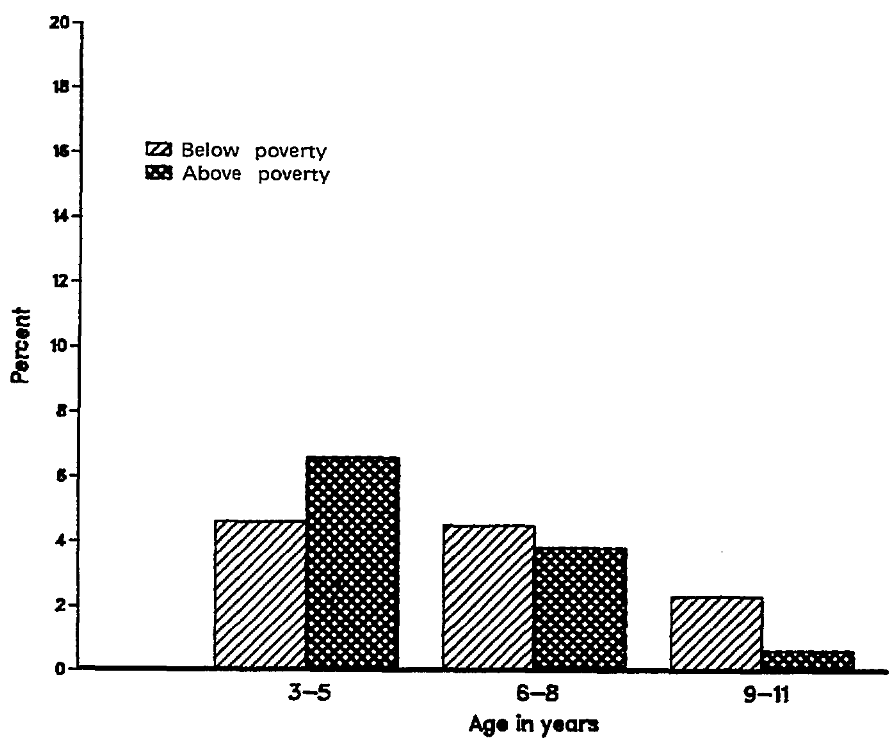
NOTE: Vitamin A measured in micrograms per deciliter (mcg/dl). 0 = Quantity zero. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin A 2—7. Percent of males with low serum vitamin A (less than 20 mcg/dl), by poverty status and age: 1976-80



NOTE: Vitamin A measured in micrograms per deciliter (mcg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin A 2—8. Percent of females with low serum vitamin A (less than 20 mcg/dl), by poverty status and age: 1976-80



NOTE: Vitamin A measured in micrograms per deciliter (mcg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Thiamin

Description

Thiamin, formerly called vitamin B_1, is a water-soluble B-vitamin required in the diet. Thiamin is an essential part of enzymes involved in the release of energy from carbohydrate and fat. It also plays a vital role in cell reproduction, fatty acid metabolism, and normal functioning of the nervous system. Clinical signs of thiamin deficiency include loss of appetite, decreased muscle tone, depression, and neurological changes such as decreased neuromuscular coordination. Beriberi, the classic thiamin deficiency disease, occurs primarily among populations that subsist on highly refined grains. In the United States, thiamin deficiency is usually associated with other diseases, such as alcoholism.

Dietary intakes of thiamin are assessed relative to the 1980 RDA, but health indicators of thiamin status were not available from national surveys. The RDA are 1.4 milligrams per day for males 23-50 years of age and 1.0 milligram per day for females of the same age. Food sources of thiamin include pork, organ meats, and whole-grain and enriched grain products.

Major Findings

- National survey data indicate that the thiamin intake of the U.S. population appears to be adequate.

- Dietary levels of thiamin averaged above the RDA. Levels were slightly higher for younger individuals and males than for older individuals and females.

- Dietary levels of thiamin did not appear to be consistently associated with economic status.

- The major and most economical source of thiamin in household diets was grain products.

- Thiamin provided by the U.S. food supply was higher in 1982 (2.07 milligrams per capita per day) than at the beginning of the century.

Individual Intake

Thiamin intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey averaged 112 percent of the RDA (Thiamin 1-1). Fifty-four percent of the survey population had intakes of at least the RDA, and 83 percent had intakes of at least 70 percent of the RDA (chart 1-2). Seventy-three percent of the survey population had intakes of at least the RDA thiamin-to-calorie ratios, and almost 100 percent had intakes of at least 70 percent of the RDA ratios.

Dietary levels of thiamin were higher for younger than older individuals--highest for children under 1 year of age, followed by those 1-8 years, and higher for males and females 9-18 years of age than for older individuals of the same sex (charts 1-1 and 1-3). For similar age groups, levels were higher for males than for females.

Thiamin levels differed little by poverty status, race, region, urbanization, and season (charts 1-1, 1-4, and 1-5).

Household Food Use

The thiamin level per person of household diets differed little by per capita income level (chart 1-6). However, higher income households paid more for thiamin than did lower income households; that is, they obtained less thiamin for each food dollar. Among households eligible for the Food Stamp Program, participants used food slightly higher in thiamin per person but similar in thiamin per dollar. Compared with higher income households that were ineligible for the program, participating households used food slightly higher in thiamin per person and also higher in thiamin per dollar.

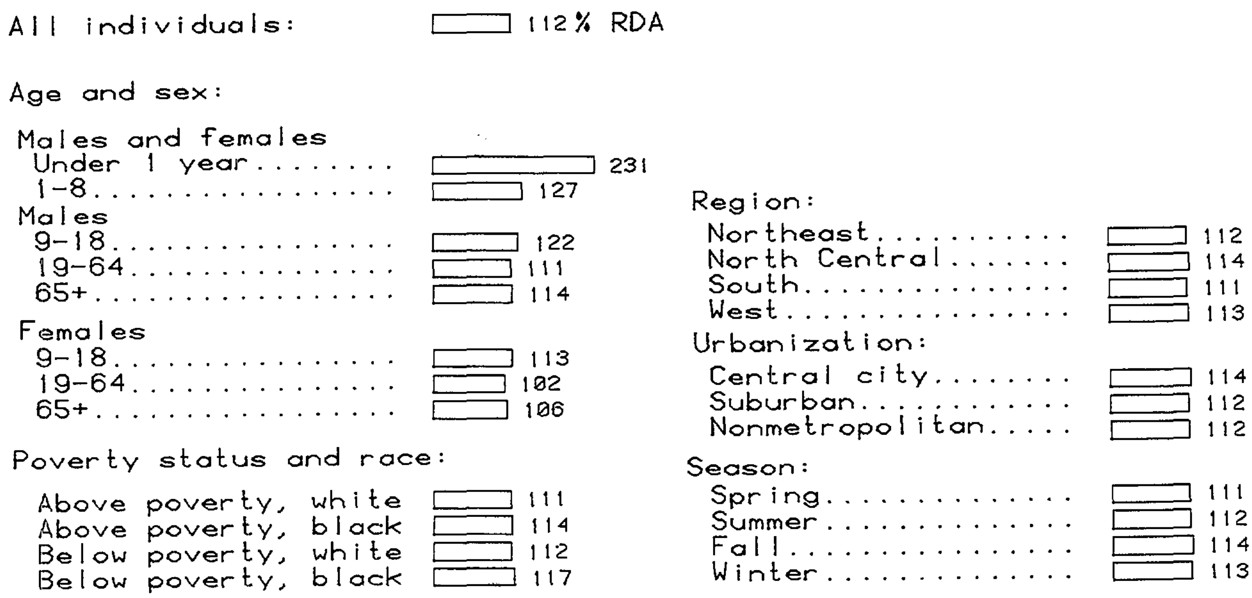
Households using food with higher money value per person averaged more thiamin per person but less thiamin per dollar than did households with lower food costs. Smaller households also used food with slightly more thiamin per person but less thiamin per dollar than did larger households.

Grain products provided almost one-half of the thiamin in household diets (chart 1-7). The next most important source was the meat, poultry, and fish group, accounting for 20 percent of the total. Grain products supplied the most thiamin per 1,000 Calories of food group, but the vegetable group was almost as concentrated a source. Grain products also supplied the most thiamin per dollar of food group--at least three times as much as any other food group.

Historical Trends

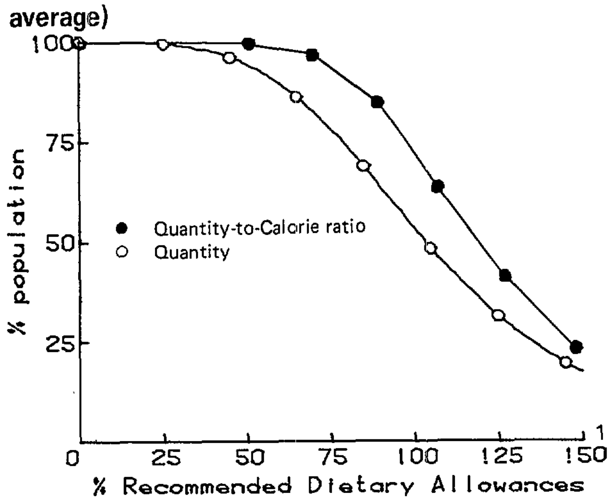
The level of thiamin provided by the U.S. food supply fluctuated but generally decreased from the beginning of the century to 1935 (chart 1-8). Decreased use of grain products and, to a lesser extent, decreased use of potatoes were responsible. The thiamin level rose in the early 1940's with the introduction of enriched flour and bread, but it declined by the late 1940's because of continued decreases in grain product use. Thereafter, the thiamin level fluctuated but generally rose with increased use of enriched foods and foods in the meat, poultry, and fish group (especially beef and chicken). Thiamin in the food supply reached a peak level of 2.16 milligrams per capita per day in 1980. Data from USDA's food consumption surveys indicate that thiamin levels in individual intakes and household diets followed the trends in the U.S. food supply.

Thiamin 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

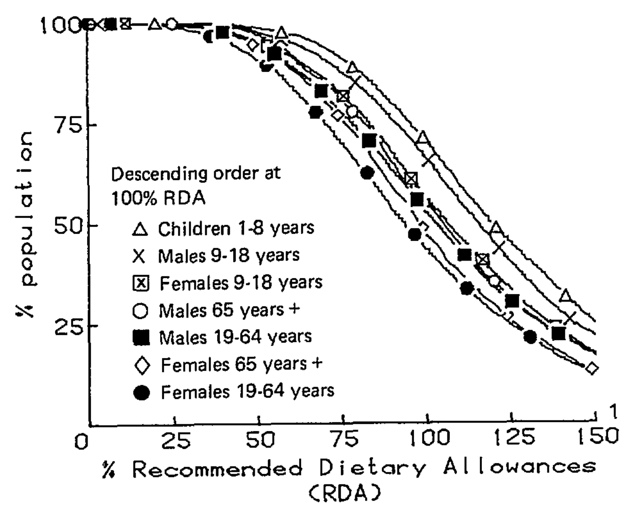
Thiamin 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)



[1]Truncated at 150% RDA.
Example: 52% of the population had at least 100% RDA by quantity, and 73% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

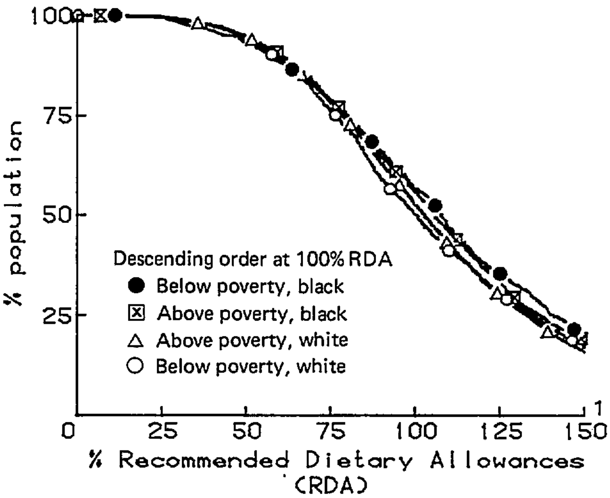
Thiamin 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



[1]Truncated at 150% RDA.
Example: 71% of children 1-8 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

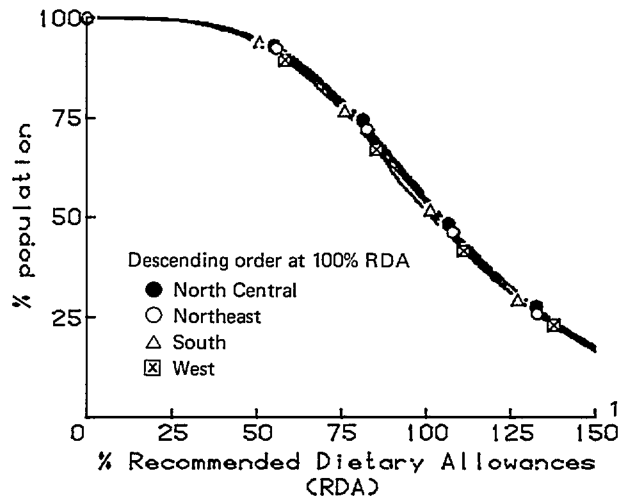
Thiamin 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)



[1]Truncated at 150% RDA.
Example: 59% of below poverty, black population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Thiamin 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)



[1]Truncated at 150% RDA.
Example: 56% of population in the North Central Region had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Thiamin 1-6. Household diets, spring 1977: Milligrams (mg) per person and per dollar's worth of food used at home, by selected characteristics

	mg per person[1] per day	mg per dollar
Income, per capita[2]		
Under $2,250	1.91	0.97
$3,500-4,999	1.83	0.79
$7,800 and over	1.87	0.60
Food stamp program[3]		
Participating	2.09	0.97
Eligible, not participating	1.92	0.93
Not eligible	1.93	0.76
Weekly money value of food[3,4]		
$ 8-11.99	1.46	0.99
$12-15.99	1.74	0.87
$16-19.99	2.04	0.80
$20-29.99	2.41	0.71
Number of household members[5]		
1	2.11	0.69
3	1.93	0.77
6 or more	1.91	0.95

[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

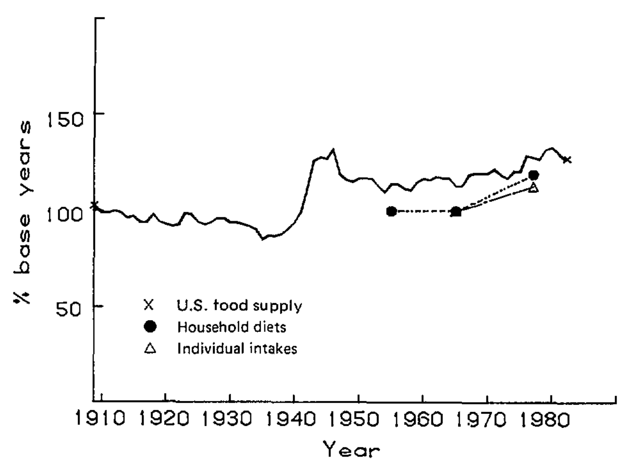
Thiamin 1-7. Household diets, spring 1977: Contribution of food groups

	% total thiamin	milligrams/ 1,000 Calories of food group	milligrams/ dollar's worth of food group	% money value
Grain products	48%	1.29	3.16	12%
Meat, poultry, fish	20%	0.51	0.46	34%
Vegetables	10%	1.13	0.67	12%
Milk, cream, cheese	9%	0.45	0.58	12%
Fruit	7%	0.98	0.71	8%
Other protein foods[1]	5%	0.58	0.87	4%
Sugar, sweets	1%	0.07	0.13	6%
Fats, oils	<1%	<0.01	<0.01	3%
Miscellaneous[2]	<1%	<0.01	<0.01	8%

[1]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Thiamin 1-8. U.S. food supply, household diets, and individual intakes: Percent of base years[1]



[1]U.S. food supply, 1909-13=1.63 milligrams (mg) /capita/day; household, 1955=1.63 mg/meal-at-home equivalent person/day; individual, 1965=1.12 mg/individual/day (3-day average).

SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

Riboflavin

Description

Riboflavin, formerly called vitamin B_2, is a water-soluble B-vitamin required in the diet. Riboflavin is an essential part of enzymes involved in the release of energy from protein, fat, and carbohydrate and of enzymes that have important functions in protein metabolism. Clinical signs of riboflavin deficiency include cracks at the corners of the mouth and soreness and inflammation of the mouth, lips, and tongue. If riboflavin deficiency occurs, deficiencies of thiamin and niacin are also usually observed because several food sources of these vitamins are similar.

Dietary intakes of riboflavin are assessed relative to the 1980 RDA, but health indicators of riboflavin status were not available from national surveys. The RDA are 1.6 milligrams per day for males 23-50 years of age and 1.2 milligrams per day for females of the same age. Food sources of riboflavin include milk, cheese, meat, and enriched grain products.

Major Findings

- National survey data indicate that the riboflavin intake of the U.S. population appears to be adequate.

- Dietary levels of riboflavin averaged above the RDA. Levels were higher for males, individuals 18 years of age and younger, and the white population than they were for females, older individuals, and the black population.

- Dietary levels of riboflavin did not appear to be consistently associated with economic status.

- The major and most economical sources of riboflavin in household diets were dairy products and grain products.

- Riboflavin provided by the U.S. food supply was higher in 1982 (2.28 milligrams per capita per day) than at the beginning of the century.

Individual Intake

Riboflavin intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey averaged 132 percent of the RDA (Riboflavin 1-1). Sixty-six percent of the survey population had intakes of at least the RDA, and 88 percent had intakes of at least 70 percent of the RDA (chart 1-2). Eighty-eight percent of the survey population had diets providing at least the RDA riboflavin-to-calorie ratios, and nearly 100 percent had intakes of at least 70 percent of the RDA ratios.

Dietary levels of riboflavin were higher for males and individuals under 19 years of age than for females and older individuals (chart 1-3). Levels were lowest for females 19-64 years of age, with only about one-half of this group having intakes of at least the RDA.

Dietary levels of riboflavin differed little by poverty status, but they were slightly higher for the white population than for the black population (charts 1-1 and 1-4).

By region, riboflavin levels were lower in the South, especially in comparison to the West (charts 1-1 and 1-5). Levels of riboflavin differed little by urbanization and season.

Household Food Use

Households with higher income per capita reported using food with more riboflavin per person than did lower income households (chart 1-6). However, higher income households paid more for riboflavin than did lower income households; that is, they obtained less riboflavin for each food dollar. Among households eligible for the Food Stamp Program, participants used food higher in riboflavin per person but similar in riboflavin per dollar to food used by nonparticipants. Compared with higher income households that were ineligible for the program, participating households used food differing little in riboflavin per person but higher in riboflavin per dollar.

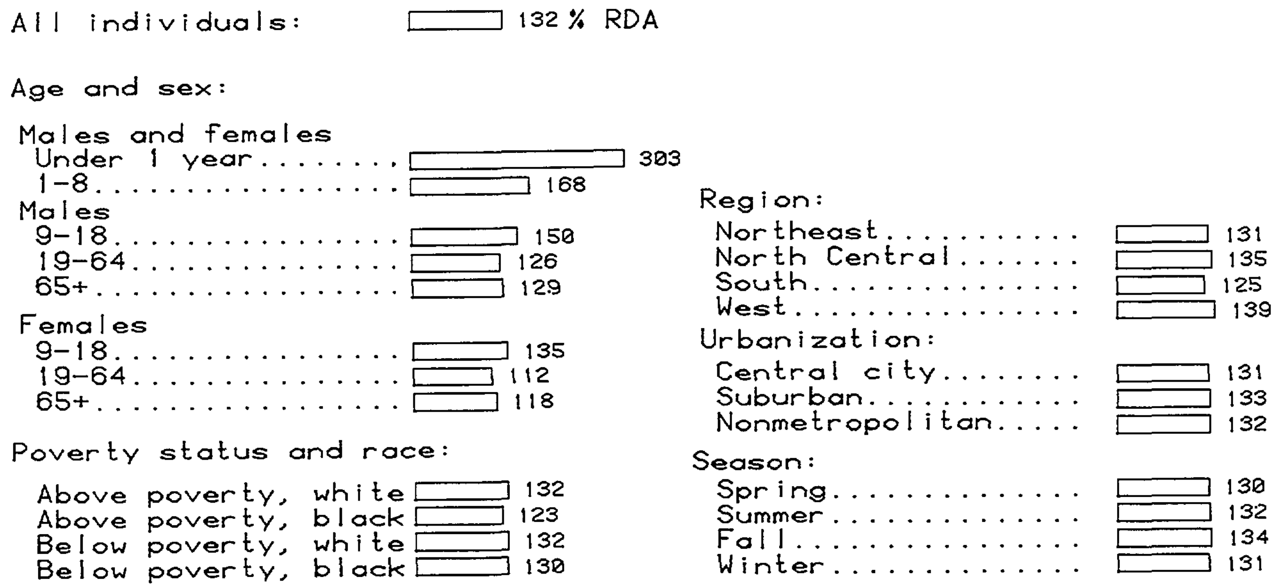
Households using food with higher money value per person averaged more riboflavin per person but less riboflavin per dollar than did households with lower food costs. Smaller households also used food with more riboflavin per person but less riboflavin per dollar than did larger households.

Two food groups--milk, cream, and cheese (dairy products) and grain products--provided 31 and 29 percent of the riboflavin in household diets, respectively (chart 1-7). Per 1,000 Calories and per dollar of food group, both the dairy and grain products groups were rich sources of riboflavin. The miscellaneous group is high in riboflavin per 1,000 Calories because certain included foods contain some riboflavin and the group as a whole is very low in calories.

Historical Trends

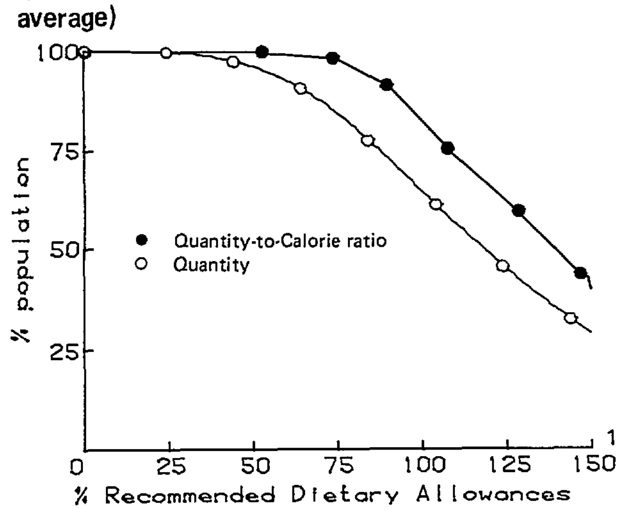
The level of riboflavin provided by the U.S. food supply was 27 percent higher in 1982 than in 1909-13 (chart 1-8). Riboflavin levels were lowest during the World War I era and highest in the mid-1940's. The lower levels in the early part of the century are attributed to lower use of dairy products and meat. The midcentury peak is attributed to high use of dairy products and enrichment of grain products. Riboflavin levels after the early 1970's reflected fluctuations in the use of meat, poultry, and dairy products. Data from USDA's food consumption surveys show no consistent trend in riboflavin levels in recent years.

Riboflavin 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

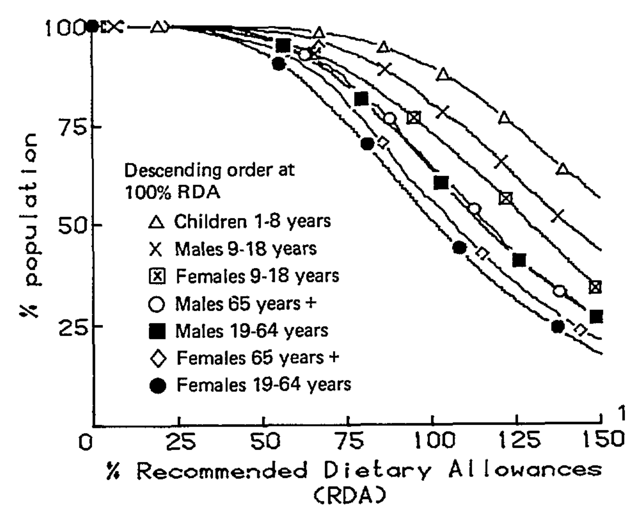
Riboflavin 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)



[1]Truncated at 150% RDA.
Example: 65% of the population had at least 100% RDA by quantity, and 88% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

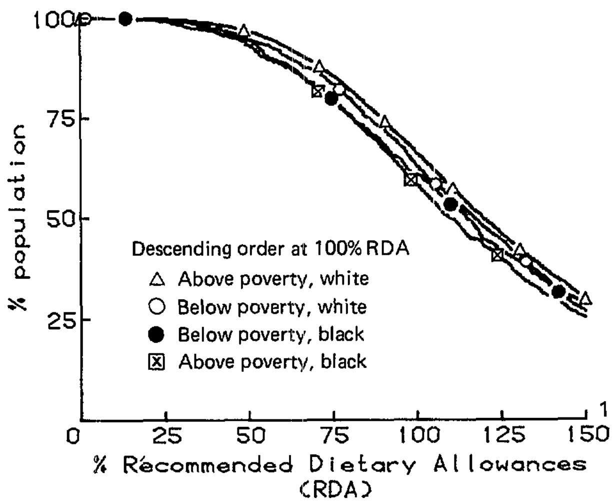
Riboflavin 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



[1]Truncated at 150% RDA.
Example: 90% of children 1-8 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

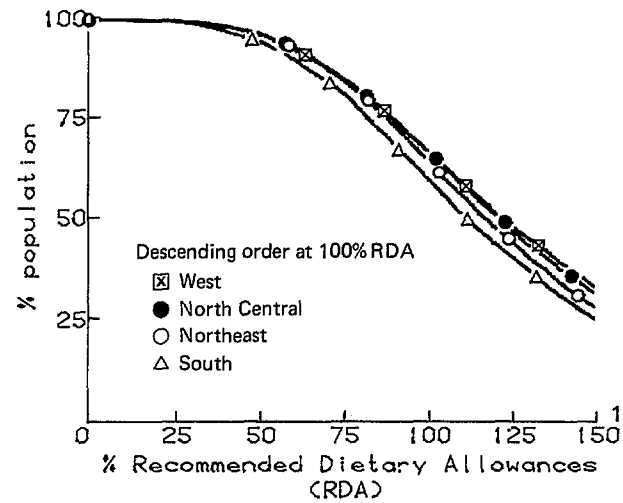
Riboflavin 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)



[1]Truncated at 150% RDA.
Example: 67% of above poverty, white population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Riboflavin 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)



[1]Truncated at 150% RDA.
Example: 69% of population in the West had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Riboflavin 1-6. Household diets, spring 1977: Milligrams (mg) per person and per dollar's worth of food used at home, by selected characteristics

	mg per person[1] per day	mg per dollar
Income, per capita[2]		
Under $2,250	2.45	1.24
$3,500-4,999	2.56	1.10
$7,800 and over	2.72	0.88
Food stamp program[3]		
Participating	2.72	1.26
Eligible, not participating	2.52	1.22
Not eligible	2.66	1.05
Weekly money value of food[3,4]		
$ 8-11.99	1.95	1.33
$12-15.99	2.40	1.20
$16-19.99	2.78	1.09
$20-29.99	3.29	0.97
Number of household members[5]		
1	2.93	0.96
3	2.59	1.04
6 or more	2.58	1.29

[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

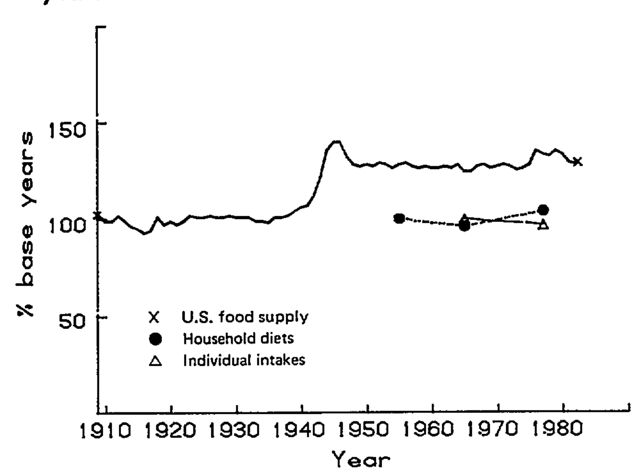
Riboflavin 1-7. Household diets, spring 1977: Contribution of food groups

	% total riboflavin	milligrams/ 1,000 Calories of food group	milligrams/ dollar's worth of food group	% money value
Milk, cream, cheese	31%	2.13	2.76	12%
Grain products	29%	1.07	2.63	12%
Meat, poultry, fish	21%	0.75	0.67	34%
Vegetables	6%	1.01	0.60	12%
Other protein foods[1]	6%	0.90	1.35	4%
Fruit	3%	0.53	0.38	8%
Miscellaneous[2]	3%	1.35	0.36	8%
Sugar, sweets	1%	0.14	0.26	6%
Fats, oils	<1%	0.03	0.14	3%

[1]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Riboflavin 1-8. U.S. food supply, household diets, and individual intakes: Percent of base years[1]



[1]U.S. food supply, 1909-13=1.78 milligrams (mg)/capita/day; household, 1955=2.50 mg/meal-at-home equivalent person/day; individual, 1965=1.77 mg/individual/day (3-day average).

SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

Preformed Niacin

Description

Niacin, also called nicotinic acid, is a water-soluble B-vitamin required in the diet. It plays an essential role in the release of energy from protein, fat, and carbohydrate and is involved in the synthesis of protein and fat. Niacin is available to the human body in two ways. It may be ingested from food as "preformed" niacin or it may be formed in the body from ingested protein, specifically, the amino acid tryptophan.

Pellagra is the classic niacin deficiency disease. It occurs in poor populations whose diets are high in maize or corn. Clinical signs of pellagra progress through a characteristic dermatitis, diarrhea, and depression. Death can result. Pellagra was once considered endemic and a major public health problem in the United States. In 1918, 10,000 deaths were attributed to the disease. Today, this disease rarely occurs in the United States, largely because of increased prosperity, the enrichment of grain products with niacin, and nutrition education efforts that have encouraged variety in food selection.

Dietary intakes of niacin are assessed relative to the 1980 RDA, but health indicators of niacin status were not available from national surveys. The RDA are 18 milligrams per day for males 23-50 years of age and 13 milligrams per day for females of the same age. The RDA are expressed in niacin equivalents--that is, the amount of niacin available to the body regardless of the source. Food composition data are adequate to calculate dietary intakes of preformed niacin. However, in 1977 the data base for the tryptophan content of food was limited, and niacin formed by conversion could not be calculated. Therefore, dietary levels of niacin in this report do not include niacin formed in the body by conversion from protein.

Food sources of preformed niacin include liver, peanuts, poultry, red meat, and legumes. These foods and dairy products and eggs are also sources of tryptophan, which can be converted to niacin. Much of the niacin in grain products is in the outer husk and is removed in milling, but enrichment has done much to compensate for this loss. The niacin in maize or corn is so tightly bound to protein that it is not available to the body. However, treatment of corn or maize with alkalis, a common practice in Central America, liberates the niacin.

Major Findings

- National survey data indicate that the niacin intake of the U.S. population appears to be adequate.

- Dietary levels of preformed niacin and protein averaged above the RDA. Males and individuals above poverty had higher dietary levels of preformed niacin than did females and individuals below poverty.

- Dietary levels of preformed niacin appeared to be positively associated with economic status.

- Major sources of preformed niacin in household diets were the meat, poultry, and fish group and the grain products group.

- Preformed niacin provided by the U.S. food supply in 1982 (25.6 milligrams per capita per day) was almost one-third higher than the level at the beginning of the century.

Individual Intake

Preformed niacin intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey averaged 124 percent of the RDA for niacin (Preformed niacin 1-1). Sixty-seven percent of the survey population had intakes of at least the RDA, and 91 percent had intakes of at least 70 percent of the RDA (chart 1-2). Ninety-one percent of the survey population had intakes of at least the RDA preformed niacin-to-calorie ratios, and nearly 100 percent had intakes of at least 70 percent of the RDA ratios.

Dietary levels of preformed niacin were highest for males and females 19-64 years of age and lowest for those 9-18 years of age (charts 1-1 and 1-3). For the same age groups, levels were higher for males than for females.

Preformed niacin levels in diets differed more by poverty status than by race (charts 1-1 and 1-4). In the population above poverty level, 68 percent of white persons and 69 percent of black persons had intakes of at least the RDA. Below poverty level, 59 percent of white and black persons had intakes of at least the RDA.

Dietary levels of preformed niacin differed little by region, urbanization, and season (charts 1-1 and 1-5).

Household Food Use

Households with higher income per capita reported using food providing more preformed niacin per person than did lower income households (chart 1-6). However, higher income households paid more for preformed niacin than did lower income households; that is, they obtained less preformed niacin for each food dollar. Among households eligible for the Food Stamp Program, participants used food slightly higher in preformed niacin per person but similar in preformed niacin per dollar to food used by nonparticipants. Compared with higher income households that were ineligible for the program, participating households used food differing little in preformed niacin per person but higher in preformed niacin per dollar.

Households using food with higher money value per person averaged more preformed niacin per person but less per dollar than did households with lower food costs. Smaller households also used food with more preformed niacin per person but less preformed niacin per dollar than did larger households.

Two food groups--the meat, poultry, and fish group and grain products--provided 36 and 33 percent of the preformed niacin in household diets, respectively (chart 1-7). Other food groups provided 10 percent or less of the preformed niacin. Grain products were the most economical source, providing more than twice as much per dollar as other food groups. The miscellaneous group is high in preformed niacin per 1,000 Calories because certain included foods such as coffee contain some preformed niacin and the group as a whole is very low in calories.

Historical Trends

The level of preformed niacin provided by the U.S. food supply fluctuated but generally decreased during the first half of the century as use of grain products decreased (chart 1-8). It rose rapidly in the mid-1940's with the introduction of enriched flour and bread but declined by the late 1940's because of the continued decline in use of grain products. Thereafter, the preformed niacin level fluctuated but rose as use of enrichment became more widespread and use of foods in the meat, poultry, and fish group increased.

Data from USDA's food consumption surveys indicate that the preformed niacin levels in individual intakes and household diets followed the food supply trend.

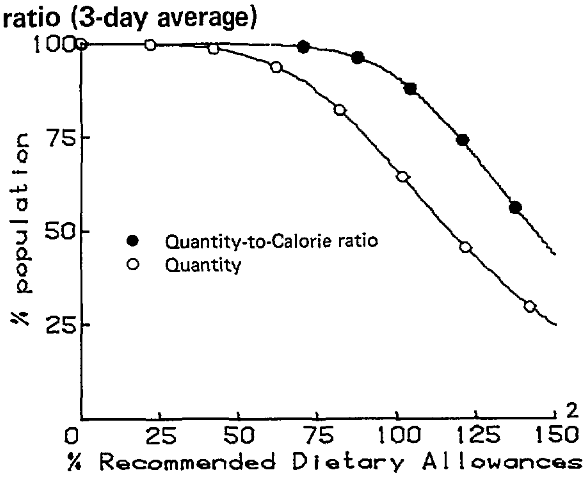
Preformed niacin[1] 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)

Characteristic	% RDA
All individuals:	124% RDA
Age and sex:	
Males and females	
Under 1 year	128
1-8	122
Males	
9-18	122
19-64	134
65+	125
Females	
9-18	112
19-64	123
65+	119
Poverty status and race:	
Above poverty, white	124
Above poverty, black	124
Below poverty, white	116
Below poverty, black	120
Region:	
Northeast	126
North Central	124
South	121
West	127
Urbanization:	
Central city	126
Suburban	124
Nonmetropolitan	123
Season:	
Spring	125
Summer	125
Fall	124
Winter	122

[1]Does not include niacin that may be formed from dietary protein. See discussion of niacin equivalents.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

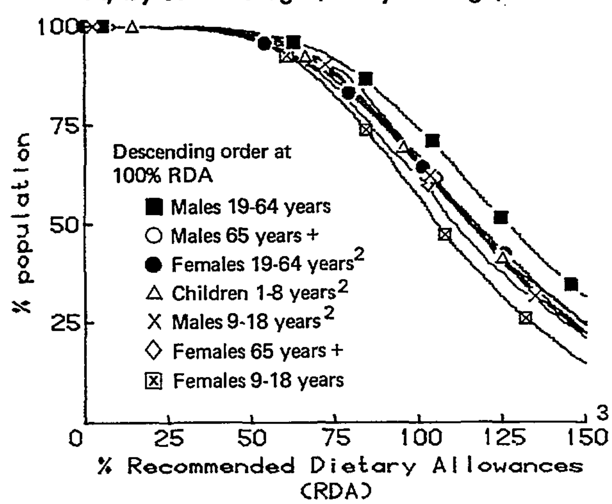
Preformed niacin[1] 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)



[1]Does not include niacin that may be formed from dietary protein. See discussion of niacin equivalents.
[2]Truncated at 150% RDA.
Example: 67% of the population had at least 100% RDA by quantity, and 91% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

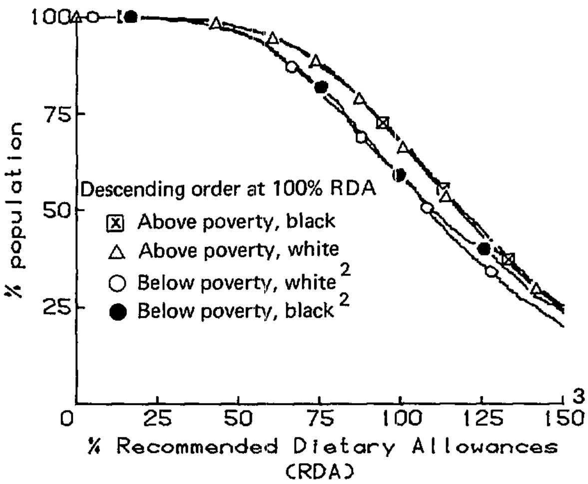
Preformed niacin[1] 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



[1]Does not include niacin that may be formed from dietary protein. See discussion of niacin equivalents.
[2]Equal at 100% RDA.
[3]Truncated at 150% RDA.
Example: 75% of males 19-64 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

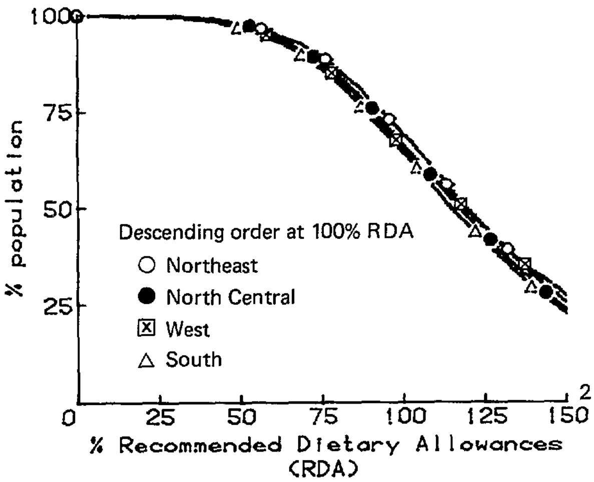
Preformed niacin[1] 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)



[1]Does not include niacin that may be formed from dietary protein. See discussion of niacin equivalents.
[2]Equal at 100% RDA.
[3]Truncated at 150% RDA.
Example: 69% of above poverty, black population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Preformed niacin[1] 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)



[1]Does not include niacin that may be formed from dietary protein. See discussion of niacin equivalents.
[2]Truncated at 150% RDA.
Example: 70% of population in the Northeast had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Preformed niacin[1] 1-6. Household diets, spring 1977: Milligrams (mg) per person and per dollar's worth of food used at home, by selected characteristics

	mg per person[2] per day	mg per dollar
Income, per capita[3]		
Under $2,250	25.3	12.8
$3,500-4,999	26.5	11.4
$7,800 and over	29.6	9.6
Food stamp program[4]		
Participating	28.2	13.0
Eligible, not participating	26.0	12.6
Not eligible	27.9	11.0
Weekly money value of food[4,5]		
$ 8-11.99	19.5	13.3
$12-15.99	24.2	12.1
$16-19.99	29.1	11.4
$20-29.99	35.7	10.5
Number of household members[6]		
1	30.7	10.0
3	27.9	11.2
6 or more	25.9	12.9

[1]Does not include niacin that may be formed from dietary protein. See discussion of niacin equivalents.
[2]Meal-at-home equivalent person.
[3]1976 household income before taxes.
[4]Data for year 1977-78.
[5]Per meal-at-home equivalent person per week.
[6]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

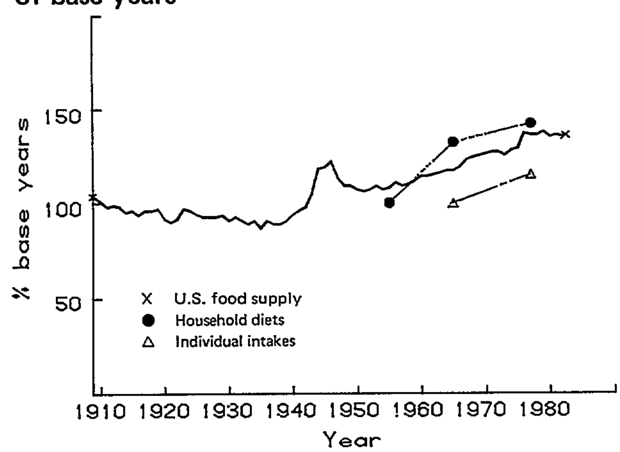
Preformed niacin[1] 1-7. Household diets, spring 1977: Contribution of food groups

	% total preformed niacin	milligrams/ 1,000 Calories of food group	milligrams/ dollar's worth of food group	% money value
Meat, poultry, fish	36%	13.4	12.1	34%
Grain products	33%	13.0	31.9	12%
Miscellaneous[2]	10%	53.8	14.4	8%
Vegetables	9%	14.9	8.8	12%
Other protein foods[3]	6%	9.7	14.4	4%
Fruit	3%	6.8	4.9	8%
Milk, cream, cheese	2%	1.3	1.7	12%
Sugar, sweets	1%	0.7	1.3	6%
Fats, oils	<1%	<0.1	<0.1	3%

[1]Does not include niacin that may be formed from dietary protein. See discussion of niacin equivalents.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.
[3]Meat, poultry, fish mixtures, and eggs, beans, and nuts.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Preformed niacin[1] 1-8. U.S. food supply, household diets, and individual intakes: Percent of base years[2]



[1]Does not include niacin that may be formed from dietary protein. See discussion of niacin equivalents.
[2]U.S. food supply, 1909-13=19.0 milligrams (mg)/capita/day; household, 1955=19.0 mg/meal-at-home equivalent person/day; individual, 1965=16.3 mg/individual/day (3-day average).

SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

Vitamin B_6

Description

Vitamin B_6 is a water-soluble nutrient required in the diet. Vitamin B_6 is a collective term referring to substances, such as pyridoxine, pyridoxal, and pyridoxamine, which have vitamin B_6 activity. These substances function primarily in the metabolism of protein--for example, in forming amino acids needed in protein synthesis; in converting the amino acid tryptophan into the vitamin niacin; and in forming substances involved in proper functioning of the nervous system.

Severe vitamin B_6 deficiency in adults can cause depression, confusion, convulsions, and symptoms similar to those of riboflavin deficiency. Deficiency is suspected among alcoholics because alcohol is known to interfere with the body's utilization of vitamin B_6. Current evidence does not suggest that vitamin B_6 deficiency should be suspected among oral contraceptive users. However, women who have used oral contraceptives for an extended time tend to have lower blood levels of vitamin B_6 during pregnancy and to produce infants with lower levels. If they choose to breast feed their infants, their milk tends to be lower in vitamin B_6. Harm from excessive intakes of vitamin B_6 by misuse of high-potency supplements is also a concern because of possible damage to the peripheral nervous system.

Dietary levels of vitamin B_6 are assessed relative to the 1980 RDA, but biochemical, hematological, or other health indicators of vitamin B_6 status were not available from national surveys. The RDA are 2.2 milligrams per day for males 23-50 years of age and 2.0 milligrams per day for females of the same age. Because vitamin B_6 has such an important role in protein metabolism, an individual's need for vitamin B_6 is directly related to protein intake. The RDA are based on a desired ratio of dietary vitamin B_6 to protein and an assumed level of protein intake.

Food sources of vitamin B_6 include meat, poultry, fish, bananas, and nuts. Food composition data for vitamin B_6 were less reliable than those for other nutrients in 1977.

Major Findings

- The vitamin B_6 intake and status of the U.S. population require further investigation.

- Dietary levels of vitamin B_6 averaged below the RDA. However, many individuals reported diets containing lower levels of protein than those assumed in setting the RDA for vitamin B_6. Therefore, the diets of these individuals may have provided the desired ratio of vitamin B_6 to protein but not the RDA for vitamin B_6.

- Dietary levels of vitamin B_6 were higher for males than for females and generally higher for younger than for older individuals.

- Dietary levels of vitamin B_6 did not appear to be consistently associated with economic status.

- The major source of vitamin B_6 in household diets was the meat, poultry, and fish group. Grain products and vegetables were also important sources.

- Vitamin B_6 provided by the U.S. food supply was about 10 percent lower in 1982 (1.97 milligrams per capita per day) than at the beginning of the century.

Individual Intake

Vitamin B_6 intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey (NFCS) averaged 75 percent of the RDA (Vitamin B_6 1-1). Twenty percent of this population had intakes of at least the RDA, and 49 percent had intakes of at least 70 percent of the RDA (chart 1-2). Twenty-five percent of the survey population had diets providing at least the RDA vitamin B_6-to-calorie ratios, and 68 percent had intakes of at least 70 percent of the RDA ratios.

Dietary levels of vitamin B_6 were higher for males than for females in the same age group (charts 1-1 and 1-3). In general, levels were higher for younger than for older individuals. The exception is females 19 years of age and over, who had uniformly low intakes.

Vitamin B_6 levels in diets differed little by poverty status, race, urbanization, and season (charts 1-1 and 1-4). Levels of vitamin B_6 in diets reported in the West were higher than those in the South (charts 1-1 and 1-5).

Analysis of the 1977-78 NFCS data shows that the percent of the population having at least the appropriate vitamin B_6-to-protein ratio was about 33 percent higher than the percent of the population having at least the RDA. For example, 72 percent of the survey population had intakes of at least 80 percent of the desired vitamin B_6-to-protein ratio, compared with 39 percent of the population having at least 80 percent of the RDA for vitamin B_6.

Household Food Use

Households with higher income per capita reported using food providing more vitamin B_6 per person than did lower income households (chart 1-6). However, higher income households paid more for vitamin B_6 than did lower income households; that is, they obtained less vitamin B_6 per food dollar. Among households eligible for the Food Stamp Program, participants used food higher in vitamin B_6 per person but similar in vitamin B_6 per dollar to food used by nonparticipants. Compared with higher income households that were ineligible for the program, participating households used food similar in vitamin B_6 per person but higher in vitamin B_6 per dollar.

Households using food with higher money value per person averaged more vitamin B_6 per person but less vitamin B_6 per dollar than did households with lower food costs. Smaller households used food with more vitamin B_6 per person but less vitamin B_6 per dollar than did larger households.

The meat, poultry, and fish group provided 34 percent of the vitamin B_6 in household diets (chart 1-7). Grain products and vegetables were the next most important sources, providing 22 and 17 percent of the total, respectively. Vegetables supplied the most vitamin B_6 per 1,000 Calories of food group, more than twice that of the meat, poultry, and fish group and more than three times that of the grain products group. Grain products furnished the most vitamin B_6 per dollar's worth of food group, but the other protein foods group and vegetables were also low-cost sources.

Historical Trends

The level of vitamin B_6 provided by the U.S. food supply was highest in 1909--2.22 milligrams per capita per day (chart 1-8). It then fluctuated downward to a low of 1.80 milligrams in the late 1950's and thereafter increased. Most of the decline in vitamin B_6 levels is attributed to decreased use of grain products and potatoes. Most of the increase in the past two decades is attributed to increased use of the meat, poultry, and fish group. From 1909-13 to 1982, the proportion of vitamin B_6 from the meat, poultry, and fish group increased from 26 to 40 percent while the share from potatoes declined from 24 to 10 percent and the share from grain products declined from 18 to 11 percent.

Vitamin B_6[1] 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)

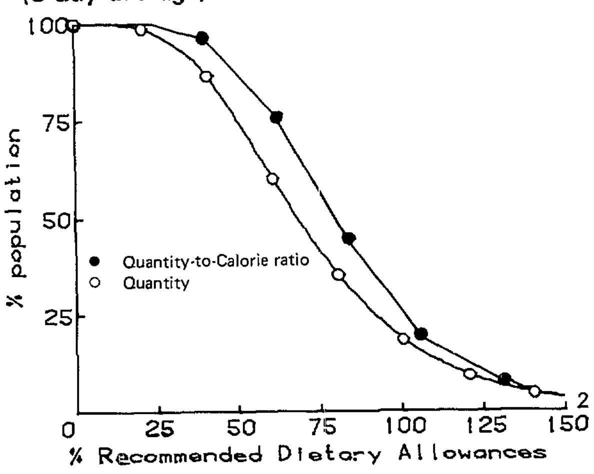
All individuals:	75% RDA
Age and sex:	
Males and females	
Under 1 year	138
1-8	97
Males	
9-18	95
19-64	79
65+	71
Females	
9-18	73
19-64	60
65+	62
Poverty status and race:	
Above poverty, white	75
Above poverty, black	75
Below poverty, white	74
Below poverty, black	74

Region:	
Northeast	76
North Central	75
South	72
West	80
Urbanization:	
Central city	76
Suburban	76
Nonmetropolitan	74
Season:	
Spring	75
Summer	76
Fall	75
Winter	74

[1]See discussion.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

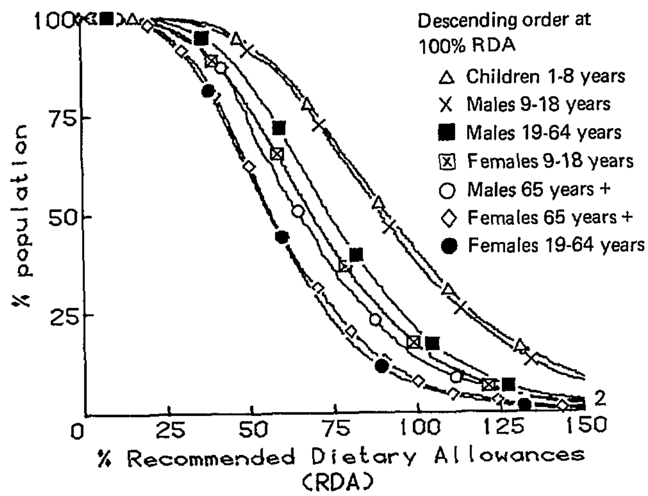
Vitamin B_6[1] 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)



[1]See discussion.
[2]Truncated at 150% RDA.
Example: 19% of the population had at least 100% RDA by quantity, and 25% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

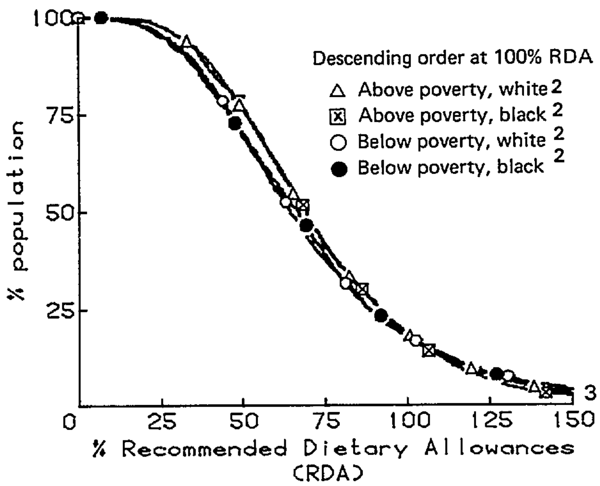
Vitamin B_6[1] 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



[1]See discussion.
[2]Truncated at 150% RDA.
Example: 41% of children 1-8 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

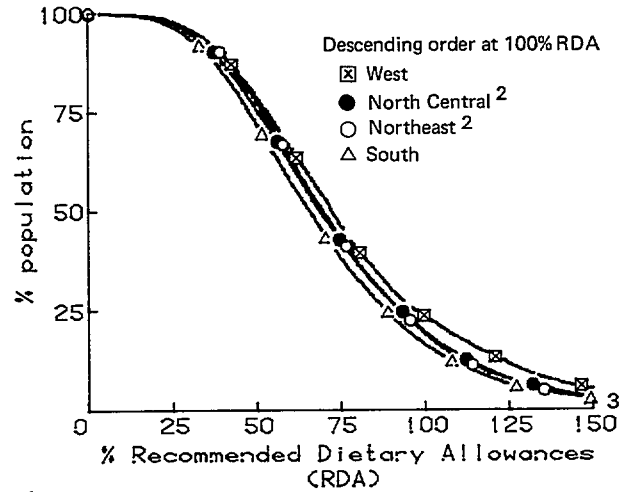
Vitamin B_6[1] 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)



[1]See discussion.
[2]Equal at 100% RDA.
[3]Truncated at 150% RDA.
Example: 19% of above poverty, white population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Vitamin B_6[1] 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)



[1]See discussion.
[2]Equal at 100% RDA.
[3]Truncated at 150% RDA.
Example: 24% of population in the West had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Vitamin B_6[1] 1-6. Household diets, spring 1977: Milligrams (mg) per person and per dollar's worth of food used at home, by selected characteristics

	mg per person[2] per day	mg per dollar
Income, per capita[3]		
Under $2,250	2.04	1.04
$3,500-4,999	2.14	0.92
$7,800 and over	2.40	0.78
Food stamp program[4]		
Participating	2.30	1.06
Eligible, not participating	2.07	1.01
Not eligible	2.25	0.89
Weekly money value of food[4,5]		
$ 8-11.99	1.58	1.08
$12-15.99	1.96	0.98
$16-19.99	2.34	0.92
$20-29.99	2.87	0.85
Number of household members[6]		
1	2.49	0.82
3	2.24	0.90
6 or more	2.06	1.03

[1]See discussion.
[2]Meal-at-home equivalent person.
[3]1976 household income before taxes.
[4]Data for year 1977-78.
[5]Per meal-at-home equivalent person per week.
[6]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

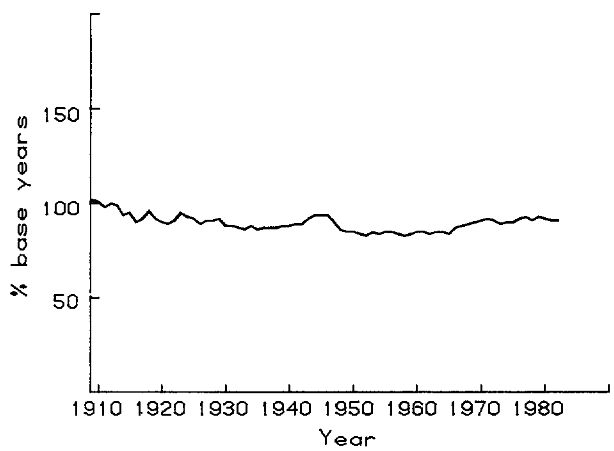
Vitamin B_6[1] 1-7. Household diets, spring 1977: Contribution of food groups

	% total Vitamin B6	milligrams/ 1,000 Calories of food group	milligrams/ dollar's worth of food group	% money value
Meat, poultry, fish	34%	1.02	0.91	34%
Grain products	22%	0.69	1.68	12%
Vegetables	17%	2.20	1.30	12%
Milk, cream, cheese	9%	0.55	0.71	12%
Fruit	9%	1.50	1.09	8%
Other protein foods[2]	6%	0.90	1.35	4%
Miscellaneous	2%	0.77	0.21	8%
Sugar, sweets	1%	0.03	0.06	6%
Fats, oils	<1%	<0.01	<0.01	3%

[1]See discussion.
[2]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[3]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Vitamin B_6[1] 1-8. U.S. food supply: Percent of base years[2]



[1]See discussion.
[2]U.S. food supply, 1909-13=2.17 milligrams/capita/day.

SOURCE: USDA: Data from the U.S. food supply historical series.

Vitamin B_{12}

Description

Vitamin B_{12} is a water-soluble nutrient required in very small amounts in the diet. Vitamin B_{12} is a collective term referring to a group of substances, known as cobalamins, with similar biological activity. Vitamin B_{12} is necessary in forming red blood cells, in building genetic material, in the functioning of the nervous system, and in metabolizing protein and fat. A complex interrelationship exists between vitamin B_{12} and the vitamin folacin.

Vitamin B_{12} deficiency results in a particular type of anemia, known as pernicious anemia, and in neurological damage if deficiency is prolonged. Dietary deficiency may occur among vegetarians who consume no animal foods over a long period of time. Young children of strict vegetarians are the most vulnerable. Vitamin B_{12} deficiency is almost always caused by a lack of "intrinsic factor," a substance produced in the stomach which is necessary for vitamin B_{12} absorption. It is also caused, although rarely, by parasitic interference with absorption. Even after surgical removal of the stomach, sufficient vitamin B_{12} is stored in the liver to prevent the occurrence of deficiency for several years. Sporadic vitamin B_{12} deficiency caused by insufficient intrinsic factor is a commonly seen clinical problem, but it is not related to dietary intake.

Dietary intakes of vitamin B_{12} are assessed relative to the 1980 RDA, but biochemical, hematological, or other health indicators of vitamin B_{12} status were not available from national surveys. For individuals 7 years of age and older, the RDA are 3.0 micrograms per day.

Vitamin B_{12} is found only in foods of animal origin, and these foods vary considerably in concentration. Liver, muscle meat, fish, eggs, and milk contain relatively large amounts of vitamin B_{12}.

Major Findings

- National survey data indicate that the vitamin B_{12} intake of the U.S. population is adequate.

- Dietary levels of vitamin B_{12} averaged above the RDA. Levels were higher for males than for females and generally higher for younger than for older individuals.

- Dietary levels of vitamin B_{12} appeared to be positively associated with economic status.

- Major sources of vitamin B_{12} in household diets were the meat, poultry, and fish group, followed by dairy products.

- Vitamin B_{12} provided by the U.S. food supply has fluctuated from 7.1 to 9.6 micrograms per capita per day since the beginning of the century.

Individual Intake

Vitamin B_{12} intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey averaged 173 percent of the RDA (Vitamin B_{12} 1-1). Two-thirds of the survey population had intakes of at least the RDA, and 85 percent had intakes of at least 70 percent of the RDA (chart 1-2). Eighty-two percent of the survey population had diets providing at least the RDA vitamin B_{12}-to-calorie ratios, and 94 percent had intakes of at least 70 percent of the RDA ratios. Variability within population groups was considerable--groups with the highest average intakes did not always have the largest percent of individuals obtaining the RDA.

Dietary levels of vitamin B_{12} were notably higher for males than for females (charts 1-1 and 1-3). Males 65 years of age and over had lower dietary levels of vitamin B_{12} than did younger males. Fewer females 65 years of age and over than younger females had diets providing the RDA for vitamin B_{12}.

For both the white and black populations, a greater proportion of those above poverty level than below poverty level had vitamin B_{12} intakes of at least the RDA (chart 1-4). Dietary levels of vitamin B_{12} did not differ consistently by race.

Levels of vitamin B_{12} in diets were lower in the South than in other regions but differed little by urbanization and season (charts 1-1 and 1-5).

Household Food Use

Households with higher income per capita reported using food providing more vitamin B_{12} per person than did lower income households (chart 1-6). However, higher income households paid more for vitamin B_{12} than did lower income households; that is, they obtained less vitamin B_{12} for each food dollar. Households participating in the Food Stamp Program used food higher in vitamin B_{12} per person and per dollar than either eligible nonparticipating households or higher income households that were ineligible for the program.

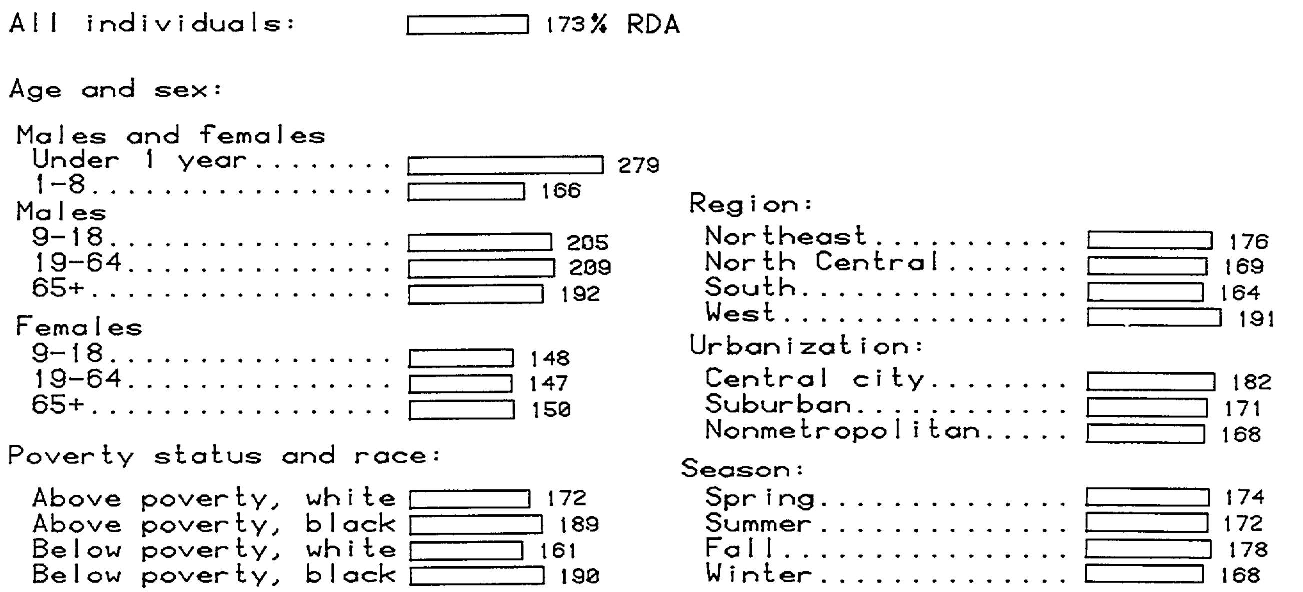
Households using food with higher money value per person averaged more vitamin B_{12} per person but less vitamin B_{12} per dollar than did households with lower food costs. Smaller households used food with more vitamin B_{12} per person than did larger households, but vitamin B_{12} return per dollar did not differ consistently by household size.

Two food groups--the meat, poultry, and fish group; and milk, cream, and cheese (dairy products)--provided 54 and 29 percent of the vitamin B_{12} in household diets, respectively (chart 1-7). These food groups provided about the same quantity of vitamin B_{12} per 1,000 Calories, but the dairy group provided more vitamin B_{12} per dollar.

Historical Trends

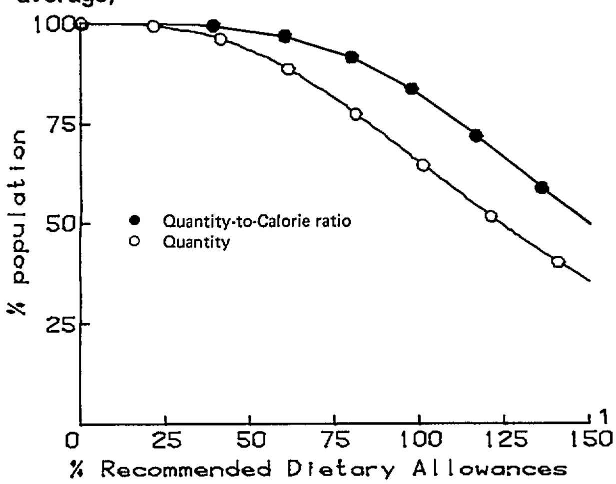
The level of vitamin B_{12} provided by the U.S. food supply was lowest during the 1930's and highest in the mid-1940's, when milk consumption was high (chart 1-8). In general, per capita levels of vitamin B_{12} were higher during the second half of the century than during the first. Higher levels are attributed to increased use of the meat, poultry, and fish group and, to a small extent, to fortification. The relative contribution of the food groups to the level of vitamin B_{12} in the food supply has changed little during the past century.

Vitamin B_{12} 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

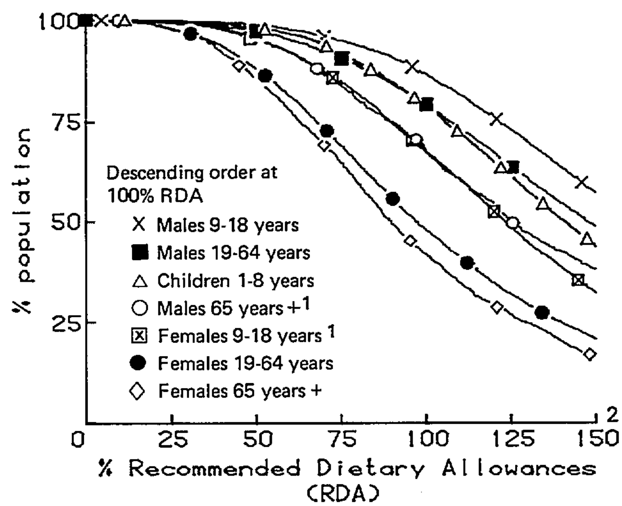
Vitamin B_{12} 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)



[1]Truncated at 150% RDA.
Example: 66% of the population had at least 100% RDA by quantity, and 82% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

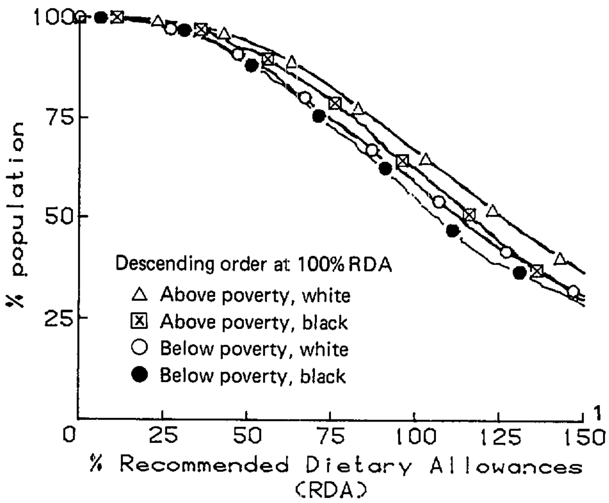
Vitamin B_{12} 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



[1]Equal at 100% RDA.
[2]Truncated at 150% RDA.
Example: 87% of males 9-18 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

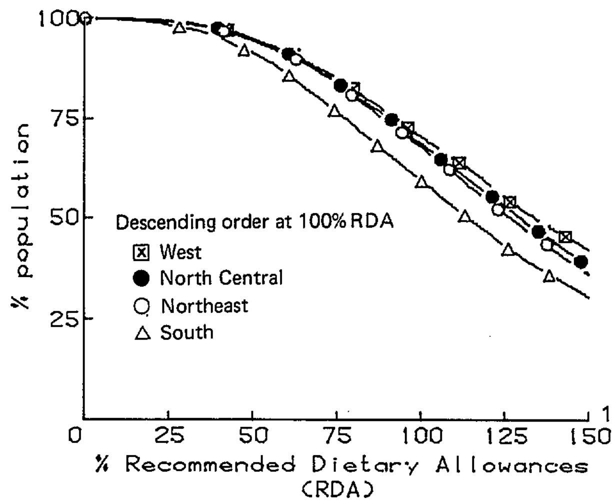
Vitamin B_{12} 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)



[1]Truncated at 150% RDA.
Example: 68% of above poverty, white population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Vitamin B_{12} 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)



[1]Truncated at 150% RDA.
Example: 71% of population in the West had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Vitamin B_{12} 1-6. Household diets, spring 1977: Micrograms (mcg) per person and per dollar's worth of food used at home, by selected characteristics

	mcg per person[1] per day	mcg per dollar
Income, per capita[2]		
Under $2,250	5.65	2.87
$3,500-4,999	5.80	2.49
$7,800 and over	7.59	2.45
Food stamp program[3]		
Participating	7.11	3.29
Eligible, not participating	5.77	2.80
Not eligible	6.18	2.44
Weekly money value of food[3,4]		
$ 8-11.99	4 23	2.89
$12-15.99	5.45	2.73
$16-19.99	6.48	2.54
$20-29.99	8.06	2.38
Number of household members[5]		
1	8.48	2.78
3	6.06	2.43
6 or more	5.57	2.78

[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

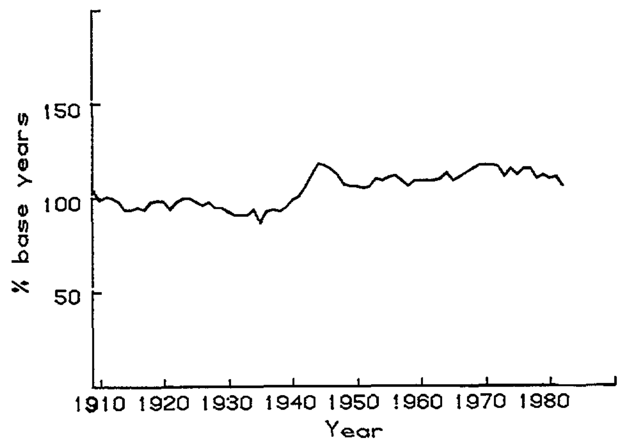
Vitamin B_{12} 1-7. Household diets, spring 1977: Contribution of food groups

	% total Vitamin B12	micrograms/ 1,000 Calories of food group	micrograms/ dollar's worth of food group	% money value
Meat, poultry, fish	54%	4.54	4.09	34%
Milk, cream, cheese	29%	4.68	6.05	12%
Other protein foods[1]	9%	3.55	5.29	4%
Grain products	7%	0.60	1.47	12%
Fats, oils	<1%	0.09	0.43	3%
Sugar, sweets	<1%	0.07	0.13	6%
Vegetables	<1%	0.06	0.04	12%
Miscellaneous[2]	<1%	<0.01	<0.01	8%
Fruit	<1%	<0.01	0	8%

[1]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Vitamin B_{12} 1-8. U.S. food supply: Percent of base years[1]



[1]U.S. food supply, 1909-13=8.2 micrograms/capita/day.

SOURCE: USDA: Data from the U.S. food supply historical series.

Folacin

Description

Folacin, also called folic acid or pteroylglutamic acid, is a water-soluble B-vitamin and a required nutrient in the diet. Folacin is a collective term for compounds having nutritional properties and chemical structure similar to those of folic acid. Folacin is used in forming hemoglobin in red blood cells and in forming genetic material. The clinical symptoms of folacin deficiency include pallor, weakness, forgetfulness, sleeplessness, and periods of euphoria. A deficiency is often associated with chronic alcoholism.

Dietary intakes of folacin are assessed relative to the 1980 RDA. For individuals 11 years of age and older, the RDA are 400 micrograms per day. Serum and red blood cell levels of folacin are used as health indicators of folacin status. Accurate folacin data were not available on a sufficient number of foods to determine the folacin content of individual intakes or household diets in 1977. However, data were sufficient to estimate per capita levels of folacin provided by the U.S. food supply because these estimates are based on a smaller number of foods.

Food sources of folacin include liver, dark-green leafy vegetables, dry beans, peanuts, and wheat germ. The ability of the body to utilize the folacin in food varies greatly depending on the chemical form of this vitamin in the food. Losses in cooking and canning may be very high but are reduced if vitamin C is present.

Major Findings

- The folacin intake and status of the U.S. population require further investigation.

- Data on the nutrient content of the U.S. food supply indicate relatively low levels available for consumption per capita. The Committee is concerned that the RDA for folacin are based on limited research information and that folacin RDA may be higher relative to population requirements than are other RDA.

- An assessment of health indicators of folacin status, based on limited data from the 1976-80 National Health and Nutrition Examination Survey, found females 20-44 years of age to be at greatest risk of developing deficiencies (Life Sciences Research Office, Oct. 1984).

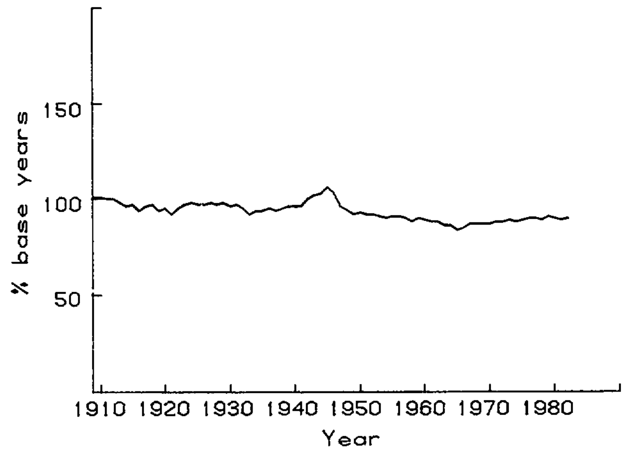
- The major sources of folacin in the U.S. food supply are vegetables; fruit; the meat, poultry, and fish group; and grain products.

- Folacin provided by the U.S. food supply was 10 percent lower in 1982 (283 micrograms per capita per day) than at the beginning of the century and also lower than the RDA for individuals 11 years of age and older.

Historical Trends

The level of folacin provided by the U.S. food supply was highest in 1945, 335 micrograms per capita per day, and lowest in 1964, 267 micrograms per capita per day (Folacin 1-1). Early in the century, vegetables and grain products were the major sources of folacin. Vegetable consumption increased, partly because of the popularity of Victory Gardens, reaching a high in the mid-1940's. Thereafter, vegetable use decreased, and in 1982 this food group provided the same proportion of folacin as at the beginning of the century--27 percent. Since 1909-13, the proportion of folacin from fruit nearly tripled, reaching 15 percent in 1982. The availability and popularity of processed citrus fruits was the primary cause. The proportion of folacin from grain products declined from 24 to 11 percent, and the proportion from potatoes declined from 11 to 5 percent. On the other hand, the proportion from the meat, poultry, and fish group increased from 10 to 14 percent.

Folacin 1-1. U.S. food supply: Percent of base years[1]



[1]U.S. food supply, 1909-13=316 micrograms/capita/day.

SOURCE: USDA: Data from the U.S. food supply historical series.

Vitamin C

Description

Vitamin C, also called ascorbic acid, is a water-soluble nutrient that is important in forming collagen, a protein that gives structure to bones, cartilage, muscle, and blood vessels. Vitamin C helps maintain capillaries, bones, and teeth; aids in absorption of iron; and helps protect other vitamins from oxidation. Vitamin C deficiency causes scurvy, which is characterized by weakness, hemorrhages in the skin and gums, and defects in bone development in children.

Dietary intakes of vitamin C are assessed relative to the 1980 RDA. For individuals 15 years of age and older, the RDA are 60 milligrams per day. The level of vitamin C in serum is a biochemical indicator of vitamin C status. However, this type of measurement may be influenced by recent intake. Research on possible benefits derived from vitamin C intakes higher than the RDA may change the criteria for assessment. Limited evidence suggests that vitamin C can inhibit the formation of some carcinogens and that the consumption of foods containing vitamin C is associated with a lower risk of cancers of the stomach and esophagus (National Research Council, 1982). However, possible harm from megadoses of vitamin C is also a concern (National Research Council, 1980a).

The foods highest in vitamin C are citrus fruits. Other fruits, tomatoes, potatoes, and dark-green vegetables also contain relatively large amounts of this vitamin.

Major Findings

- Dietary levels of vitamin C averaged above the RDA for the survey population, but levels were lower for females 9-64 years of age than for males in this age group.

- Low serum vitamin C levels occurred in only about 3 percent of the population aged 3-74 years. Low serum vitamin C levels were found most often among those over 12 years of age who had low intakes of vitamin C from diet and supplements, smoked cigarettes, and/or had low incomes.

- Dietary levels of vitamin C appeared to be positively associated with economic status.

- Major sources of vitamin C in household diets were fruits and vegetables. These food groups were also relatively low-calorie, economical sources of vitamin C.

- Vitamin C provided by the U.S. food supply in 1982 (118 milligrams per capita per day) was about 10 percent higher than at the beginning of the century.

Individual Intake

Vitamin C intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey averaged 147 percent of the RDA (Vitamin C 1-1). Fifty-nine percent of the survey population had intakes of at least the RDA, and almost three-fourths had intakes of at least 70 percent of the RDA (chart 1-2). Sixty-nine percent of the survey population had diets providing at least the RDA vitamin C-to-calorie ratios, and 83 percent had intakes of at least 70 percent of the RDA ratios.

Dietary levels of vitamin C were higher for males than for females 9-64 years of age but similar for males and females 65 years of age and over (charts 1-1 and 1-3). Levels were highest for children under 1 year of age, followed by males 9-18 years; they were lowest for females 19-64 years of age.

Individuals above poverty had higher levels of vitamin C than those below poverty (charts 1-1 and 1-4). In both economic groups, levels of vitamin C were slightly higher for the black than for the white population.

Vitamin C levels in diets were highest in the Northeast and lowest in the South, and levels were lower in nonmetropolitan areas than in central cities or suburban areas (charts 1-1 and 1-5). By season, levels of vitamin C were higher in the spring and summer and lower in the fall, with winter midway between.

Household Food Use

Households with higher income per capita reported using food providing more vitamin C per person than did lower income households (chart 1-6). However, higher income households paid more for vitamin C than did lower income households; that is, they obtained less vitamin C from each food dollar. Among households eligible for the Food Stamp Program, participants used food slightly higher in vitamin C per person than did nonparticipants but similar in vitamin C per dollar. Compared with higher income households that were ineligible for the program, participating households used food slightly lower in vitamin C per person but slightly higher in vitamin C per dollar.

Households using food with higher money value per person averaged more vitamin C per person but less vitamin C per dollar than did households with lower food costs. Smaller households used food with more vitamin C per person and slightly more vitamin C per dollar than did larger households.

Fruits provided 46 percent of the vitamin C in household diets (chart 1-7). Vegetables provided 34 percent, and other food groups each supplied 10 percent or less. Fruits supplied roughly twice as much vitamin C as vegetables per 1,000 Calories and per dollar's worth of food group.

Historical Trends

The per capita level of vitamin C provided by the U.S. food supply in 1982 was higher than at the beginning of the century but lower than during the mid-1940's (chart 1-8). A peak of 125 milligrams per capita per day in 1944 was attributed to high use of vegetables, many from Victory Gardens. From 1944 to 1964, a steep decline in vitamin C levels occurred, primarily because of lower use of fresh citrus fruit. However, since 1964 vitamin C levels have increased, reflecting more than a twofold increase in use of frozen citrus juices, a roughly 10-percent increase in use of fresh vegetables, and fortification. USDA's food consumption surveys indicate that the vitamin C levels of individual intakes and household diets increased more steeply from the mid-1960's to 1977-78 than did the food supply.

Serum vitamin C

In the 1976-80 National Health and Nutrition Examination Survey, serum vitamin C was used to indicate the vitamin C status of persons 3-74 years of age. This measurement is sensitive to recent intake of vitamin C and therefore does not reflect long term status. However, values below 0.3 milligram per deciliter indicate low or inadequate intakes, with only partial body reserves present (Sauberlich et al., 1974). For this analysis, low serum vitamin C is defined as less than 0.25 milligram per deciliter.

Mean levels of serum vitamin C were within the acceptable range regardless of sex, age, race, or poverty status (Vitamin C 2-1 through 2-4). However, mean levels differed by age and sex. In children and youths, mean levels generally decreased with age from about 1.5 milligrams per deciliter for those 3-5 years to 1.1 milligrams per deciliter for those 12-17 years. In adults, mean values remained fairly stable, with some increase in the oldest age group. Males had lower mean levels than females for all the adult age categories.

Charts 2-5 and 2-6 show the prevalence of low serum vitamn C in males and females by race and age. Very few young children had low serum vitamin C levels. The prevalence of low values generally increased with age. Males 25 years and over had a higher proportion of low values than females in the same age group, with black males 55-74 years of age having the highest proportion of low values (16 percent).

With respect to poverty status (charts 2-7 and 2-8), the prevalence of low serum vitamin C was higher among those below poverty level than those above poverty level. This was most evident among adults.

Other factors (not shown), such as cigarette smoking and taking supplements, can affect levels of serum vitamin C. Adults who smoked cigarettes and seldom or never used vitamin and/or mineral supplements had a much higher prevalence of low serum vitamin C values than would be expected by their representation in the population. In this survey, 34 percent of men were current cigarette smokers who did not regularly use vitamin and/or mineral supplements. This group accounted for 71 percent of the men with low serum vitamin C. Comparable figures for women were 25 percent and 61 percent, respectively. Regular supplement users had just the opposite representation. About 20 percent of the men reported regular use of supplements, and they accounted for less than 2 percent of the group with low serum vitamin C. Among women, regular supplement users totaled about 28 percent of the population and less than 8 percent of the group with low serum vitamin C (Woteki et al., 1986).

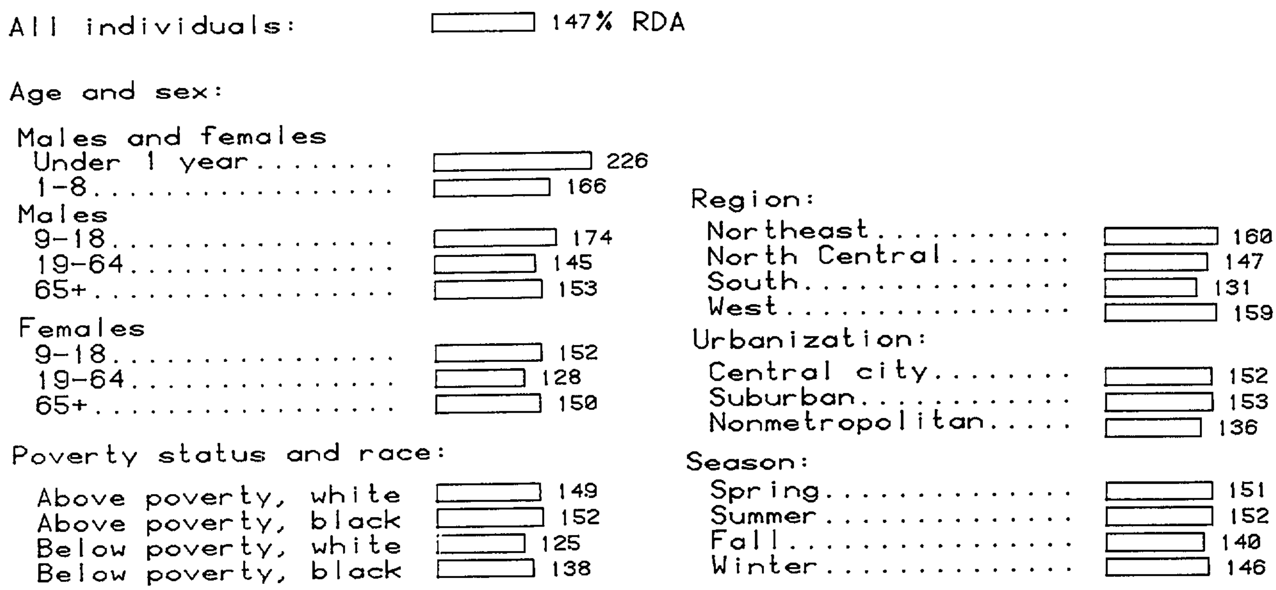
A smaller proportion of the low-income population than the general population reported regular use of vitamin and/or mineral supplements. The proportion of regular supplement users with low serum vitamin C levels was 1 percent or less, regardless of age, sex, or income. However, among irregular users and those who did not use supplements, persons below poverty level had higher prevalences of low serum vitamin C. Men below poverty level who were 45-74 years of age with irregular or no supplement use were the group with the highest prevalence (24 percent).

Although the overall percent of persons in the population 3-74 years of age with low serum vitamin C levels was not large (about 3 percent), there were selected subpopulations for which this was not true. The vitamin C status of children under 12 years of age does not appear to be a public health problem, but some adult subpopulations have lifestyles that place them at high risk of poor vitamin C nutritional status. These people can be generally characterized as one or more of the following:

- Consumers of diets that are low in vitamin C from food and vitamin and/or mineral supplements,
- Cigarette smokers,
- Poor.

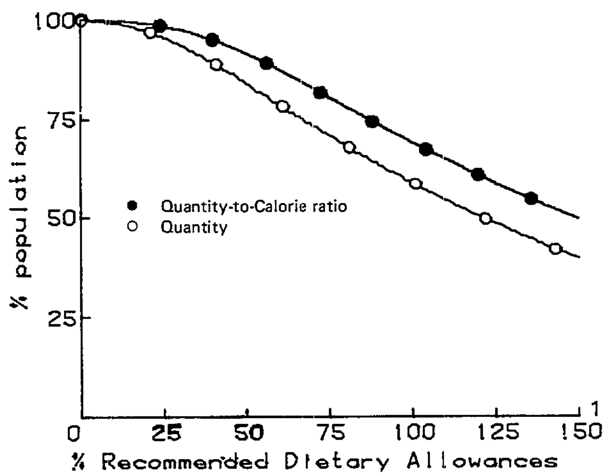
Preliminary analyses indicated that each of these characteristics was significantly related to serum vitamin C levels even when the other factors were controlled.

Vitamin C 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

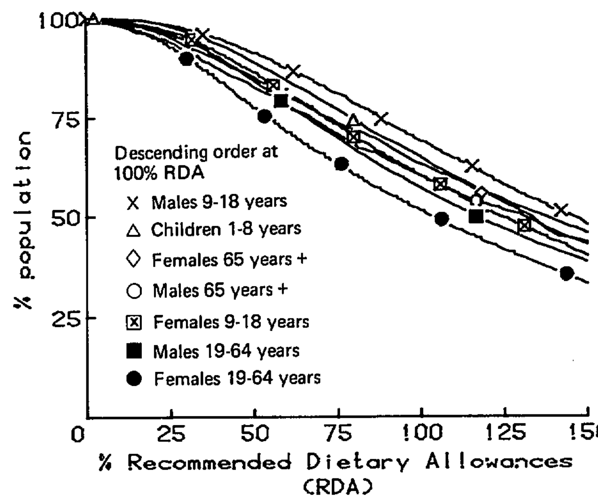
Vitamin C 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)



[1]Truncated at 150% RDA.
Example: 59% of the population had at least 100% RDA by quantity, and 69% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

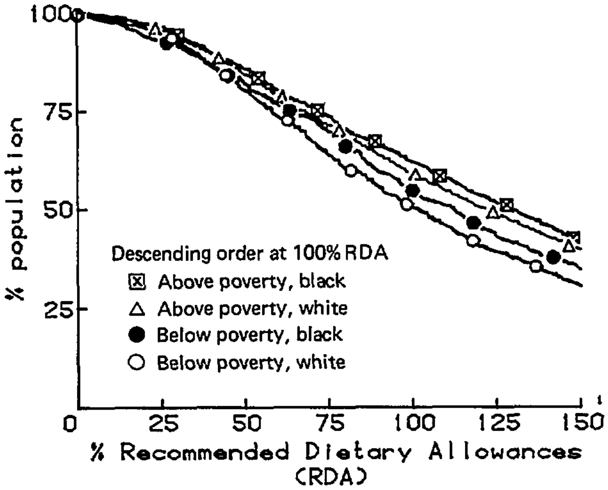
Vitamin C 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



[1]Truncated at 150% RDA.
Example: 70% of males 9-18 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

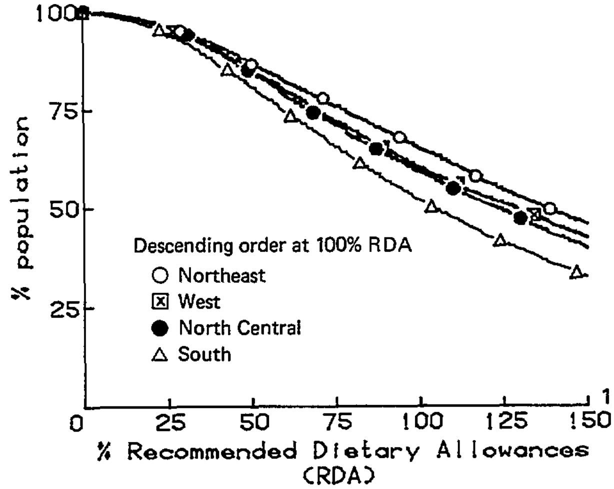
Vitamin C 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)



[1]Truncated at 150% RDA.
Example: 63% of above poverty, black population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

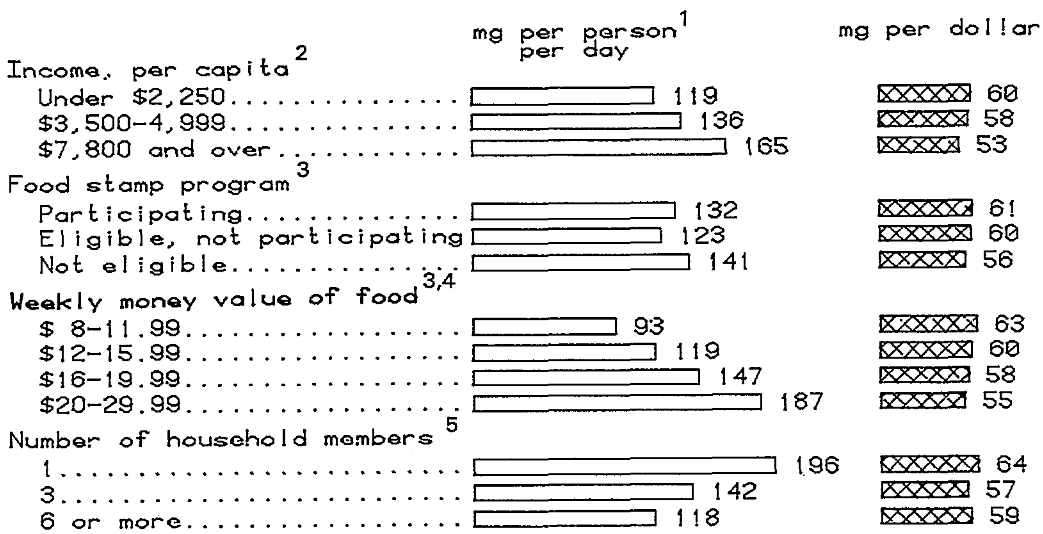
Vitamin C 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)



[1]Truncated at 150% RDA.
Example: 66% of population in the Northeast had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Vitamin C 1-6. Household diets, spring 1977: Milligrams (mg) per person and per dollar's worth of food used at home, by selected characteristics



[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

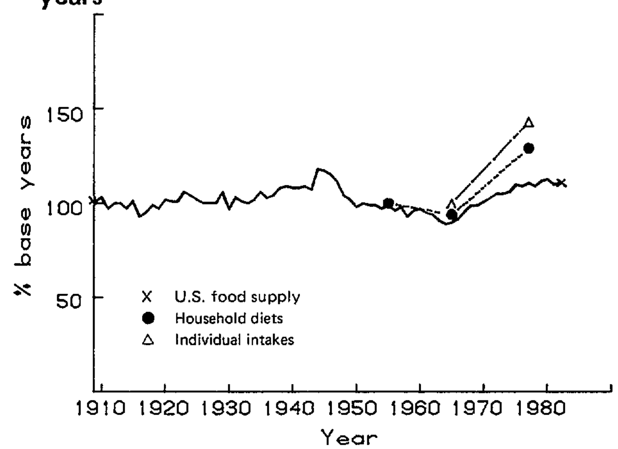
Vitamin C 1-7. Household diets, spring 1977: Contribution of food groups

	% total Vitamin C	milligrams/ 1,000 Calories of food group	milligrams/ dollar's worth of food group	% money value
Fruit	46%	481	350	8%
Vegetables	34%	280	165	12%
Sugar, sweets	10%	47	90	6%
Grain products	6%	11	28	12%
Milk, cream, cheese	3%	11	14	12%
Meat, poultry, fish	1%	1	1	34%
Other protein foods[1]	<1%	<1	<1	4%
Fats, oils	<1%	<1	<1	3%
Miscellaneous[2]	<1%	<1	<1	8%

[1] Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2] Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

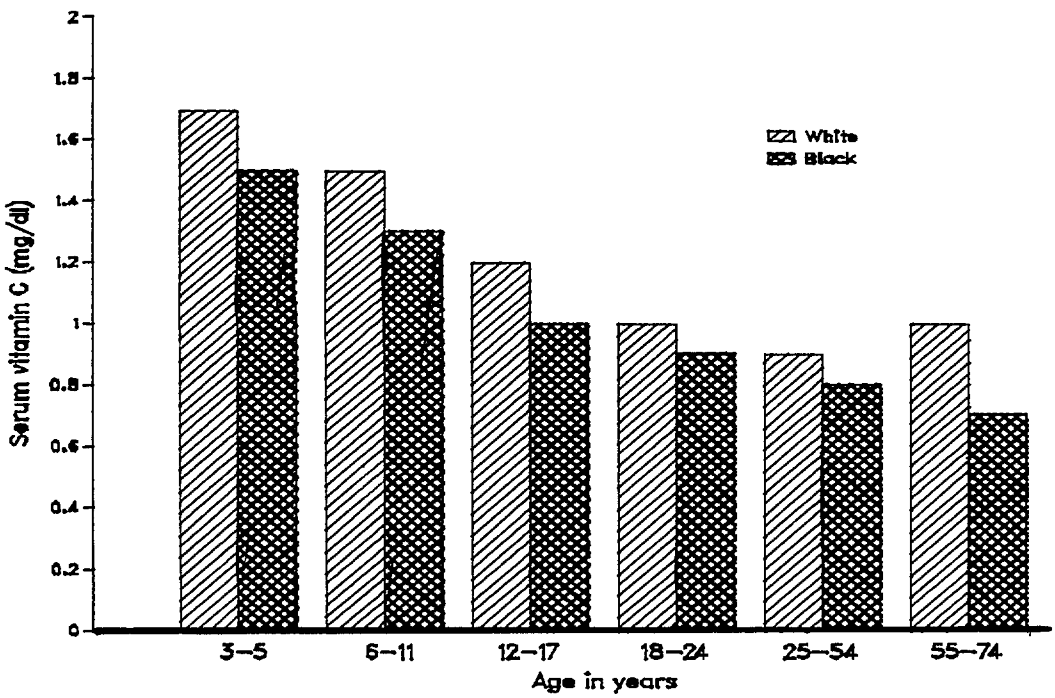
Vitamin C 1-8. U.S. food supply, household diets, and individual intakes: Percent of base years[1]



[1] U.S. food supply, 1909-13=106 milligrams (mg)/capita/day; household, 1955=108 mg/meal-at-home equivalent person/day; individual, 1965=61 mg/individual/day (3-day average).

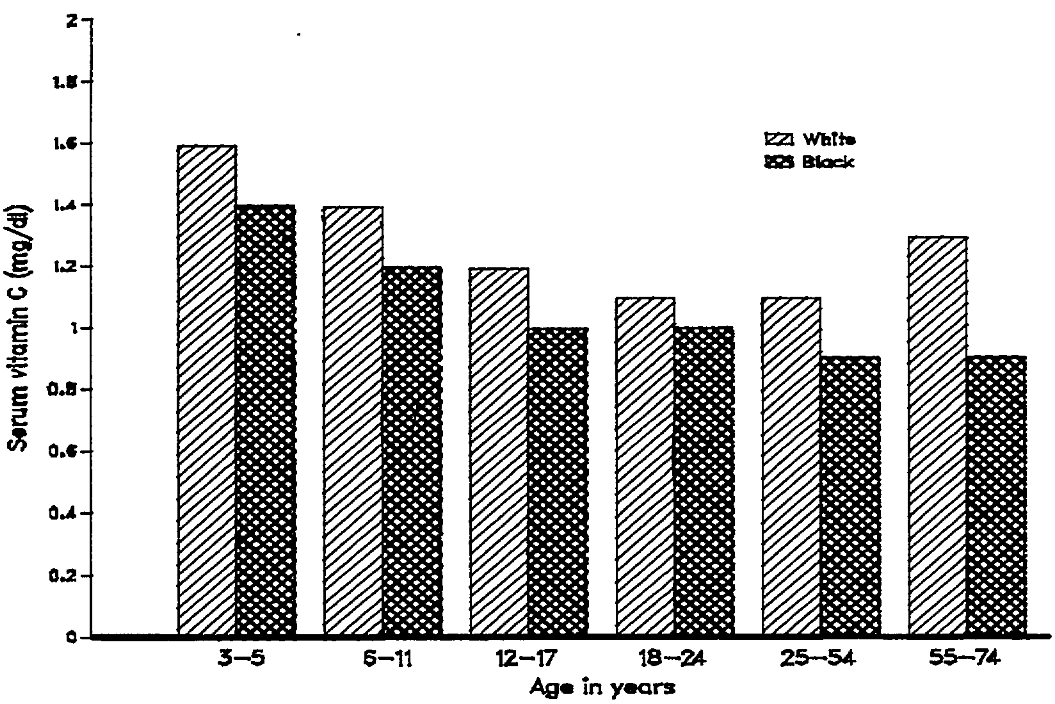
SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

Vitamin C 2—1. Mean serum vitamin C for males, by race and age: 1976-80



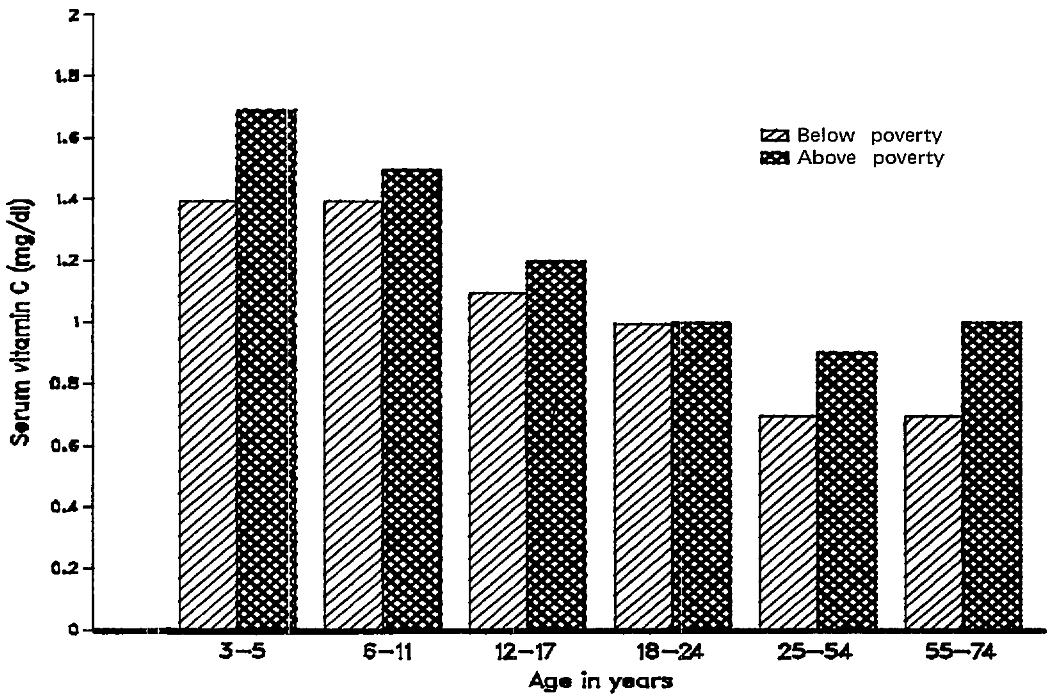
NOTE: Vitamin C measured in milligrams per deciliter (mg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin C 2—2. Mean serum vitamin C for females, by race and age: 1976-80



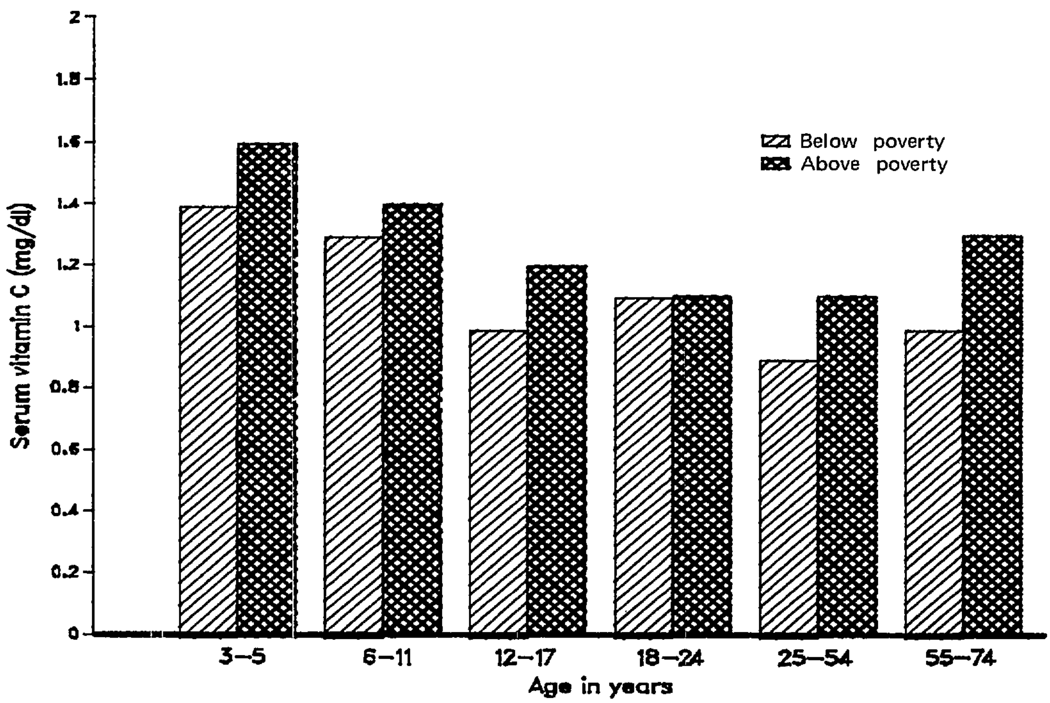
NOTE: Vitamin C measured in milligrams per deciliter (mg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin C 2—3. Mean serum vitamin C for males, by poverty status and age: 1976-80



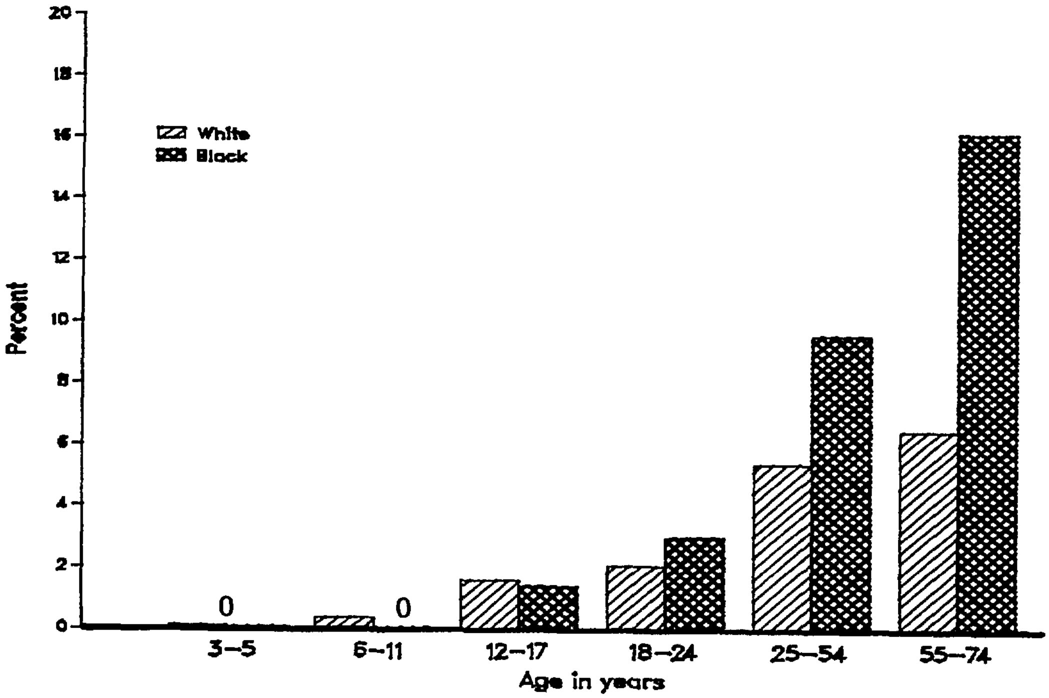
NOTE: Vitamin C measured in milligrams per deciliter (mg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin C 2—4. Mean serum vitamin C for females, by poverty status and age: 1976-80



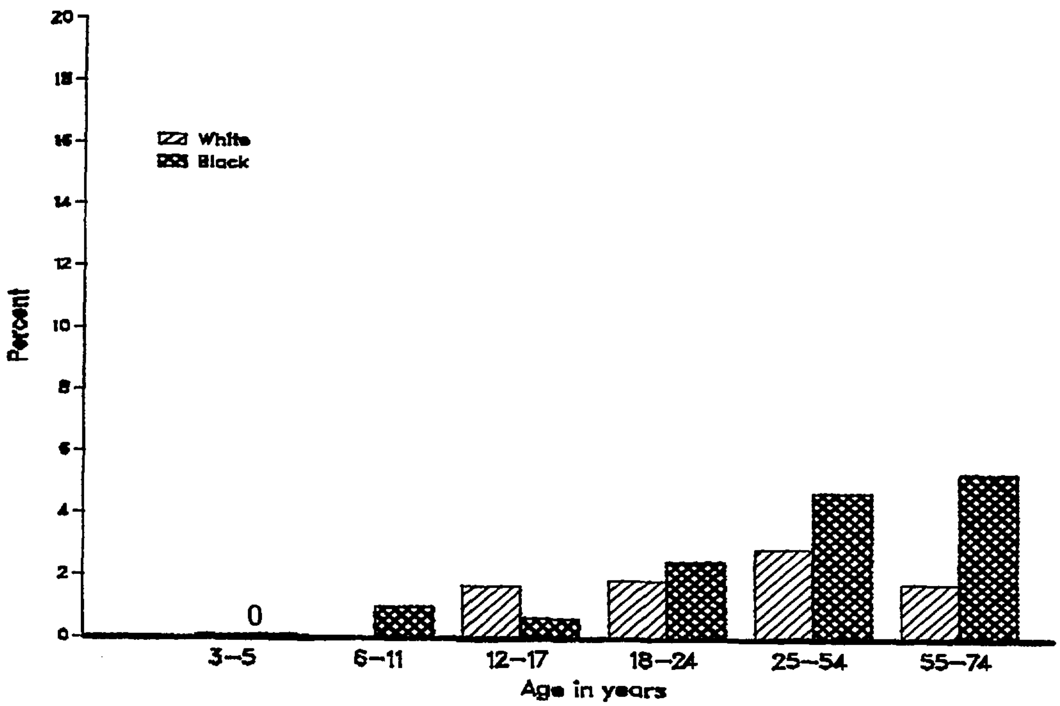
NOTE: Vitamin C measured in milligrams per deciliter (mg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin C 2–5. Percent of males with low serum vitamin C (less than 0.25 mg/dl), by race and age: 1976-80



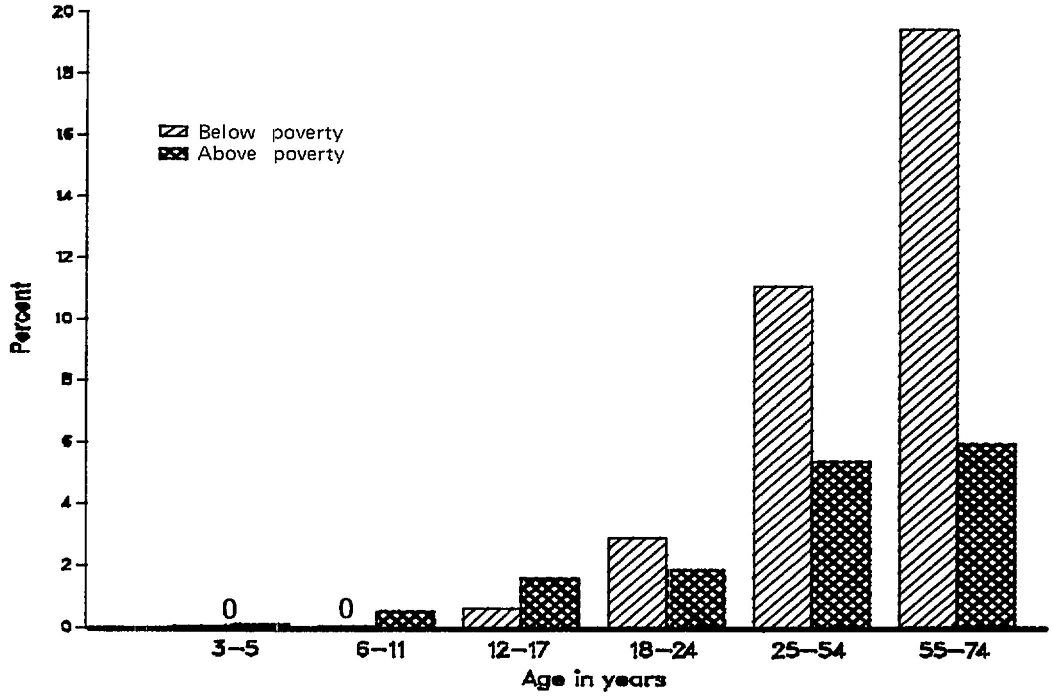
NOTE: Vitamin C measured in milligrams per deciliter (mg/dl). 0 = Quantity zero. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin C 2–6. Percent of females with low serum vitamin C (less than 0.25 mg/dl), by race and age: 1976-80



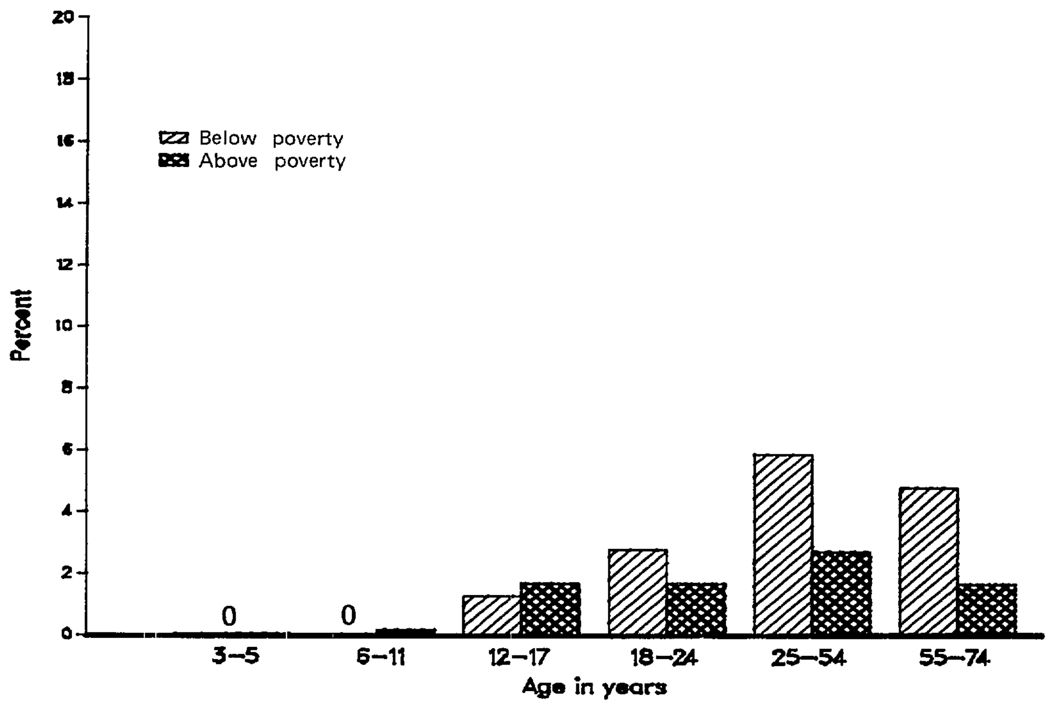
NOTE: Vitamin C measured in milligrams per deciliter (mg/dl). 0 = Quantity zero. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin C 2–7. Percent of males with low serum vitamin C (less than 0.25 mg/dl), by poverty status and age: 1976-80



NOTE: Vitamin C measured in milligrams per deciliter (mg/dl). 0 = Quantity zero. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Vitamin C 2–8. Percent of females with low serum vitamin C (less than 0.25 mg/dl), by poverty status and age: 1976-80



NOTE: Vitamin C measured in milligrams per deciliter (mg/dl). 0 = Quantity zero. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Minerals

Calcium

Description

Calcium, an essential mineral in the diet, is used in the formation of bones and teeth and in the maintenance of bone strength. Calcium is also used in muscle contraction, blood clotting, and maintenance of the integrity of cell membranes. Osteoporosis, a bone disorder characterized by decreased bone mass and increased susceptibility to fractures, is associated with low calcium intake. (See Chapter 3.) However, several other factors, such as age, sex, body weight, hormone use, and physical activity level, also influence the development of osteoporosis. Although osteoporosis is a common condition, good estimates of the prevalence of this disease are lacking.

Dietary intakes of calcium are assessed relative to the 1980 RDA. The usual clinical biochemical indicators for assessing calcium status are not applicable to survey populations, and therefore they are not available from national surveys. For individuals 19 years of age and older, the RDA are 800 milligrams per day. The foods highest in calcium are milk and cheese. Broccoli and dark-green leafy vegetables also contain relatively large amounts of calcium.

Major Findings

- Dietary levels of calcium averaged below the RDA. (See Chapter 3 for a discussion of the association between low calcium intake and osteoporosis.)
- Women had lower dietary levels of calcium than men had. Postmenopausal white women are at greater risk of developing osteoporosis and related fractures than men are.
- Dietary levels of calcium were considerably lower for the black than for the white population, but the prevalence of osteoporosis was lower among the black population. This apparent lack of an association between calcium intake and osteoporosis indicates the importance of factors other than diet in the development of osteoporosis.
- Dietary levels of calcium appeared to be associated with economic status, but race and household composition were also important factors.
- The major and most economical source of calcium in household diets was dairy products.
- Calcium provided by the U.S. food supply was lower in 1982 (860 milligrams per capita per day) than in the mid-1940's but higher than during the early part of the century.

Individual Intake

Calcium intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey averaged 87 percent of the RDA (Calcium 1-1). Thirty-two percent of the survey population had intakes of at least the RDA, and 58 percent had intakes of at least 70 percent of the RDA (chart 1-2). Forty-seven percent of the survey population had diets providing at least the RDA calcium-to-calorie ratios, and 76 percent had intakes of at least 70 percent of the RDA ratios.

Dietary levels of calcium were notably lower for females than for males (charts 1-1 and 1-3). Calcium levels were lower for males 65 years of age and over than for younger males, but not as low as for females.

Dietary levels of calcium differed more by race than by poverty status (charts 1-1 and 1-4). Levels were notably higher for the white than the black population, even when these groups were separated by poverty status.

Among the four regions of the country, calcium levels were highest in the West and lowest in the South (charts 1-1 and 1-5). Levels of calcium differed little by urbanization and season.

Household Food Use

Households with higher income per capita reported using food providing more calcium per person than did lower income households (chart 1-6). However, higher income households paid more for calcium than did lower income households; that is, they obtained less calcium for each food dollar. The amount of calcium per person in household diets differed little by Food Stamp Program eligibility or participation. Among households eligible for the program, calcium return per dollar did not differ by participation. However, eligible households obtained more calcium per dollar than did higher income households that were ineligible for the program.

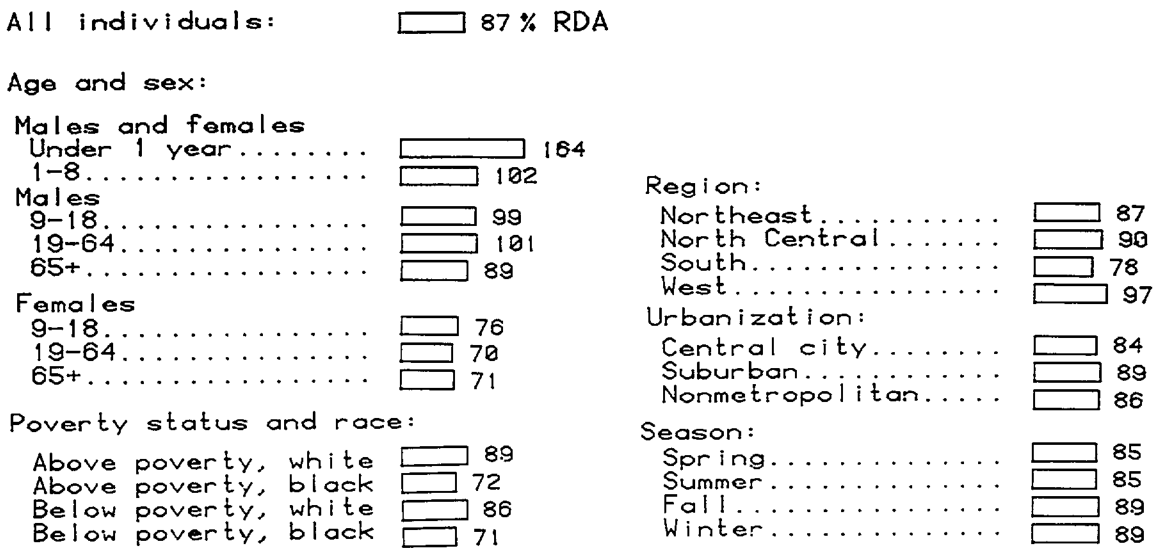
Households using food with higher money value per person averaged more calcium per person but less calcium per dollar than did households with lower food costs. Smaller households used food with slightly more calcium per person but less calcium per dollar than did larger households.

The milk, cream, and cheese (dairy products) group provided 60 percent of the calcium in household diets (chart 1-7). This food group also supplied a large amount of calcium in relation to calorie content and cost--about 3 times as much calcium per 1,000 Calories or per dollar as any other food group.

Historical Trends

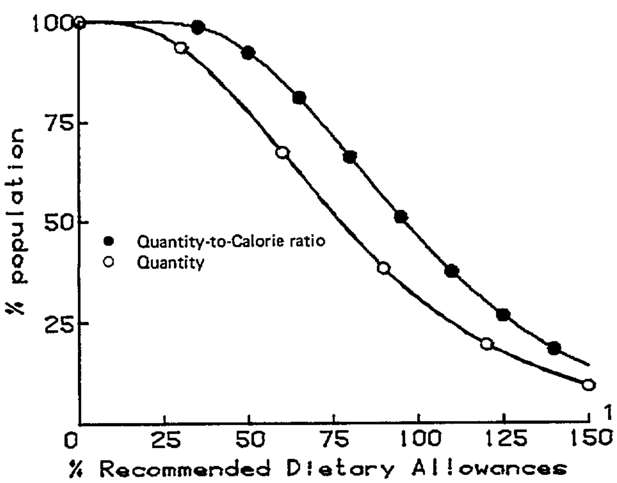
The per capita level of calcium provided by the U.S. food supply was higher in 1982 than at the beginning of the century (chart 1-8). Because a large proportion of dietary calcium comes from dairy products, the calcium level of the food supply has closely followed use of these products. Calcium levels were lowest during the World War I era and highest in the years immediately following World War II. The trend in levels of calcium during the latter half of the century may be related in part to the proportion of children in the population, which increased rapidly in the mid-1940's and thereafter declined. The slight downward trend in the levels of calcium in the U.S. food supply data since 1955 is reflected in data from USDA's food consumption surveys.

Calcium 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

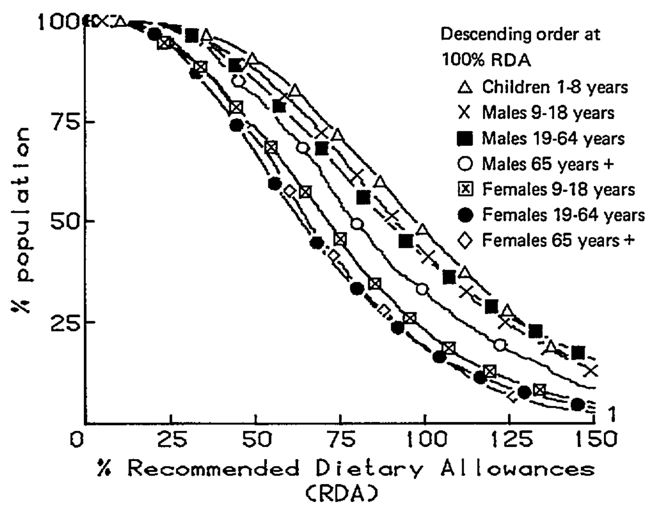
Calcium 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)



[1]Truncated at 150% RDA.
Example: 31% of the population had at least 100% RDA by quantity, and 47% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

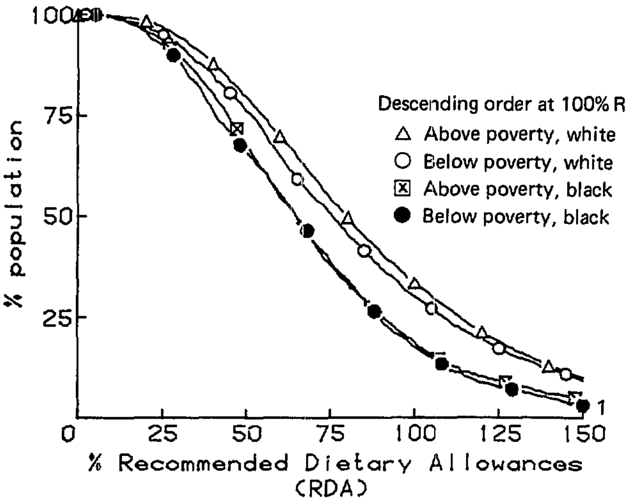
Calcium 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



[1]Truncated at 150% RDA.
Example: 48% of children 1-8 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

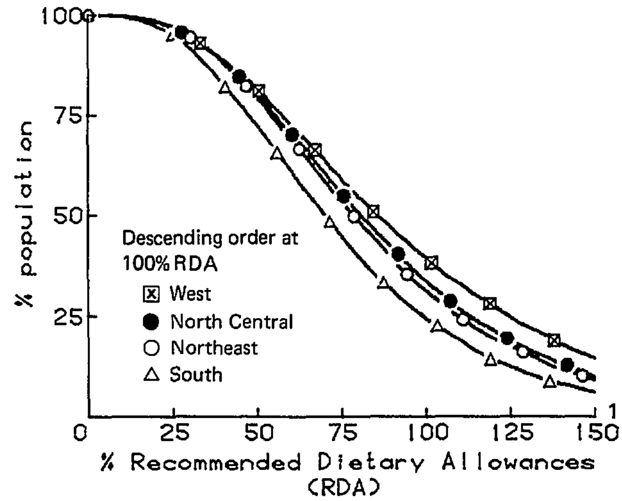
Calcium 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)



[1]Truncated at 150% RDA.
Example: 34% of above poverty, white population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Calcium 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)



[1]Truncated at 150% RDA.
Example: 40% of population in the West had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Calcium 1-6. Household diets, spring 1977: Milligrams (mg) per person and per dollar's worth of food used at home, by selected characteristics

	mg per person[1] per day	mg per dollar
Income, per capita[2]		
Under $2,250	989	502
$3,500-4,999	1096	470
$7,800 and over	1136	367
Food stamp program[3]		
Participating	1075	497
Eligible, not participating	1038	503
Not eligible	1130	447
Weekly money value of food[3,4]		
$ 8-11.99	815	557
$12-15.99	1030	515
$16-19.99	1176	461
$20-29.99	1380	407
Number of household members[5]		
1	1207	395
3	1096	439
6 or more	1097	548

[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

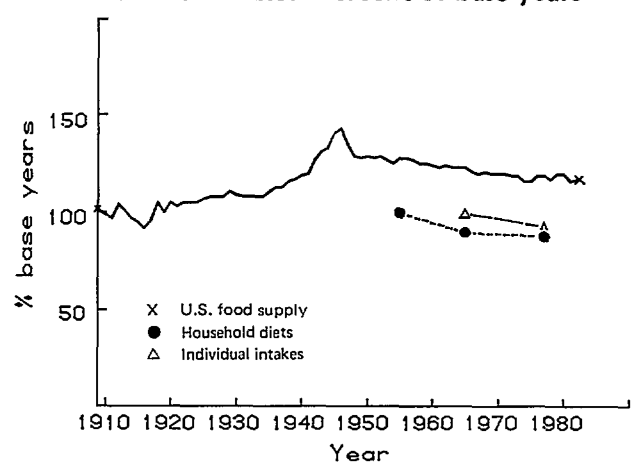
Calcium 1-7. Household diets, spring 1977: Contribution of food groups

	% total calcium	milligrams/ 1,000 Calories of food group	milligrams/ dollar's worth of food group	% money value
Milk, cream, cheese	60%	1726	2231	12%
Grain products	16%	257	632	12%
Vegetables	7%	464	275	12%
Other protein foods[1]	4%	265	394	4%
Meat, poultry, fish	3%	46	42	34%
Fruit	3%	248	180	8%
Miscellaneous[2]	3%	615	165	8%
Sugar, sweets	3%	95	181	6%
Fats, oils	1%	21	100	3%

[1]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Calcium 1-8. U.S. food supply, household diets, and individual intakes: Percent of base years[1]



[1]U.S. food supply, 1909-13=750 milligrams (mg)/capita/day; household, 1955=1,240 mg/meal-at-home equivalent person/day; individual, 1965=793 mg/individual/day (3-day average).

SOURCES: USDA: Data from the U.S. food supply historical series and 1955, 1965, and 1977-78 food consumption surveys.

Phosphorus

Description

Phosphorus is an essential mineral in the diet. Phosphorus forms an insoluble compound with calcium that gives rigidity and strength to bones and teeth. As a part of other compounds, phosphorus is involved in a diversity of chemical reactions, including the release of energy from fat, protein, and carbohydrate; the absorption and transportation of nutrients; and the formation of genetic material, cell membranes, and many enzymes. Dietary deficiencies of phosphorus are very unlikely. Although various experimental studies have suggested that calcium utilization may be decreased when the dietary phosphorus-to-calcium ratio is abnormally high, more recent evidence indicates that this is not a practical concern.

Dietary intakes of phosphorus are assessed relative to the 1980 RDA, but biochemical or other health indicators of phosphorus status were not available from national survey data. For individuals 19 years of age and older, the RDA are 800 milligrams per day. Food sources of protein, such as dairy products, meat, poultry, and fish, are also sources of phosphorus.

Major Findings

- National survey data indicate that the phosphorus intake of the U.S. population is adequate.
- Dietary levels of phosphorus averaged above the RDA. Levels were higher for males and the white population than for females and the black population.
- Dietary levels of phosphorus appeared to be positively associated with economic status.
- The major and most economical source of phosphorus in household diets was dairy products.
- Phosphorus provided by the U.S. food supply was about the same in 1982 (1,470 milligrams per capita per day) as at the beginning of the century.

Individual Intake

Phosphorus intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey averaged 136 percent of the RDA (Phosphorus 1-1). Almost three-fourths of the survey population had intakes of at least the RDA, and 92 percent had intakes of at least 70 percent of the RDA (chart 1-2). Ninety-six percent of the survey population had diets providing at least the RDA phosphorus-to-calorie ratios.

Dietary levels of phosphorus were higher for males than for females (charts 1-1 and 1-3). Levels were highest for children under 1 year of age and males 19-64 years, and they were lowest for females 9-18 years of age.

Phosphorus levels in diets were higher for individuals above poverty than for those below poverty in both the white and black populations (charts 1-1 and 1-4). In both economic groups, levels were higher for the white than for the black population.

Among the four regions of the country, phosphorus levels were highest in the West and lowest in the South (charts 1-1 and 1-5). Levels of phosphorus differed little by urbanization and season.

Household Food Use

Households with higher income per capita reported using food providing more phosphorus per person than did lower income households (chart 1-6). However, higher income households paid more for phosphorus than did lower income households; that is, they obtained less phosphorus for each food dollar. Among households eligible for the Food Stamp Program, participants used food slightly higher in phosphorus per person but similar in phosphorus per dollar to food used by nonparticipants. Compared with higher income households that were ineligible for the program, participating households used food differing little in phosphorus per person but higher in phosphorus per dollar.

Households using food with higher money value per person averaged more phosphorus per person but less phosphorus per dollar than did households with lower food costs. Smaller households used food with more phosphorus per person but less phosphorus per dollar than did larger households.

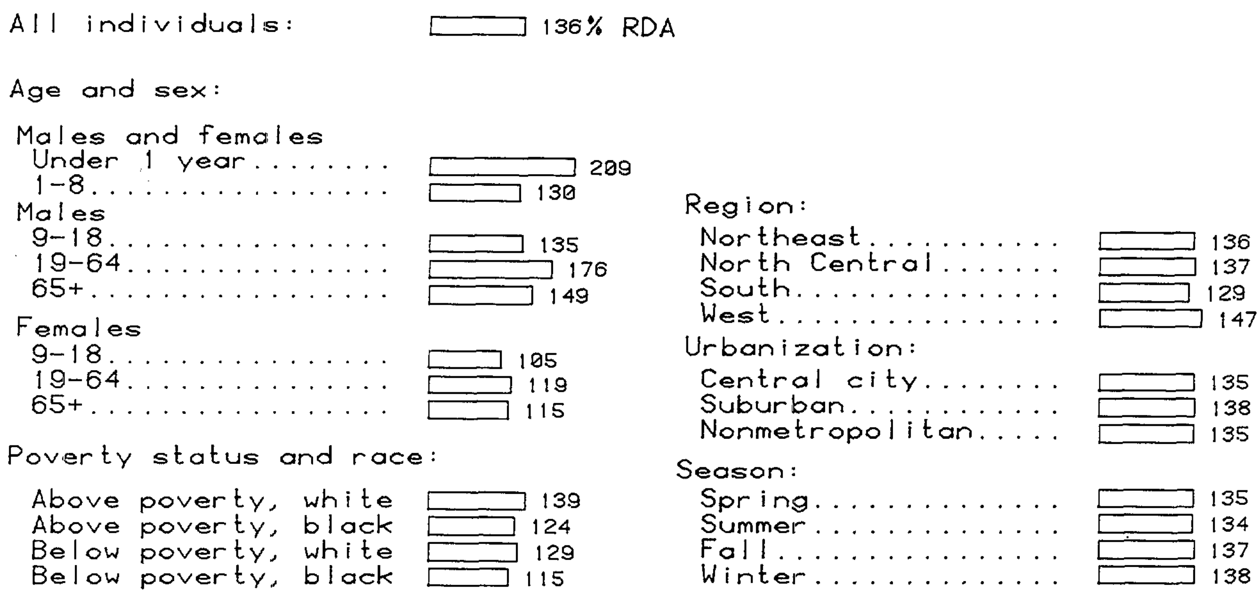
Two food groups--milk, cream, and cheese (dairy products) and meat, poultry, and fish--provided 30 and 27 percent of the phosphorus in household diets, respectively (chart 1-7). Grain products, also an important source, provided 20 percent of the phosphorus. Dairy products supplied the most phosphorus per 1,000 Calories and per dollar of food group. The miscellaneous group is high in phosphorus per 1,000 Calories because certain included foods contain some phosphorus and the group as a whole is very low in calories.

Historical Trends

The per capita level of phosphorus provided by the U.S. food supply remained fairly constant from 1909-13 to 1982 (chart 1-8). Exceptions were low levels during the World War I era and the depression of the 1930's and high levels in the mid-1940's. The phosphorus level peaked at 1,700 milligrams per capita per day in 1946, when use of dairy products was high. A decline in the phosphorus level by 1950 reflected a 10-percent decline in use of dairy products.

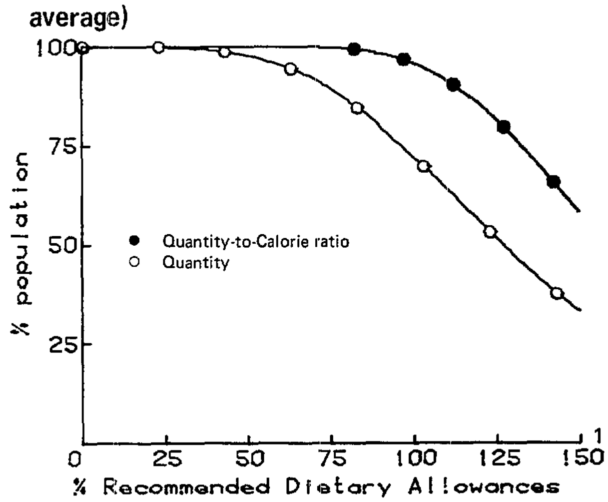
Early in the century, phosphorus was provided primarily by three food groups: 28 percent by grain products, 25 percent by dairy products, and 21 percent by meat, poultry, and fish. Although these food groups remained major sources of phosphorus, their relative contribution changed considerably during the century. Use of grain products was halved; use of dairy products shifted from whole to lowfat milks and more cheese; and use of meat, poultry, and fish increased. As a result, 13 percent of the phosphorus in the 1982 food supply was provided by grain products; 34 percent by dairy products; and 28 percent by meat, poultry, and fish.

Phosphorus 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

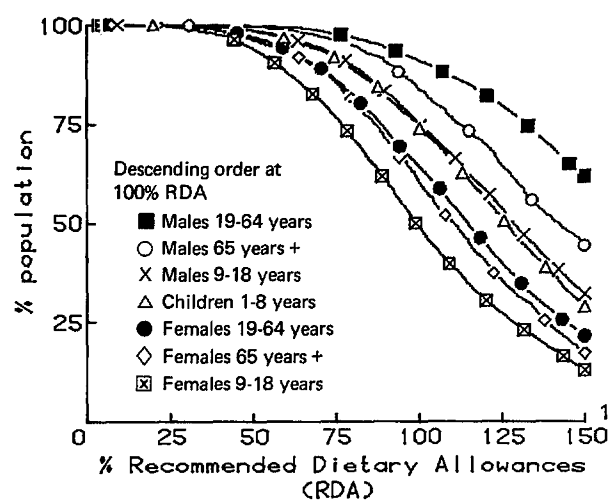
Phosphorus 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)



[1]Truncated at 150% RDA.
Example: 72% of the population had at least 100% RDA by quantity, and 96% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

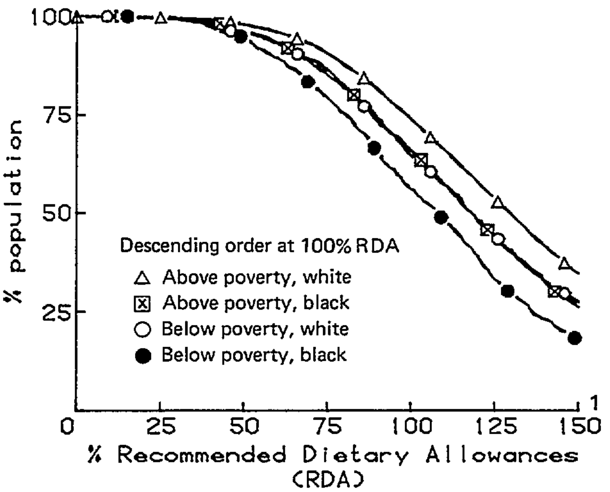
Phosphorus 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



[1]Truncated at 150% RDA.
Example: 91% of males 19-64 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

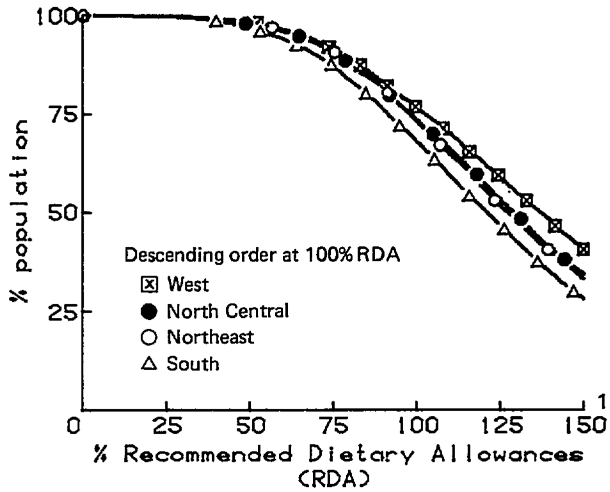
Phosphorus 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)



[1]Truncated at 150% RDA.
Example: 75% of above poverty, white population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Phosphorus 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)



[1]Truncated at 150% RDA.
Example: 77% of population in the West had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Phosphorus 1-6. Household diets, spring 1977: Milligrams (mg) per person and per dollar's worth of food used at home, by selected characteristics

	mg per person[1] per day	mg per dollar
Income, per capita[2]		
Under $2,250	1621	822
$3,500-4,999	1744	747
$7,800 and over	1918	619
Food stamp program[3]		
Participating	1862	860
Eligible, not participating	1731	839
Not eligible	1835	726
Weekly money value of food[3,4]		
$ 8-11.99	1310	895
$12-15.99	1634	818
$16-19.99	1915	750
$20-29.99	2313	683
Number of household members[5]		
1	2011	658
3	1827	732
6 or more	1688	843

[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

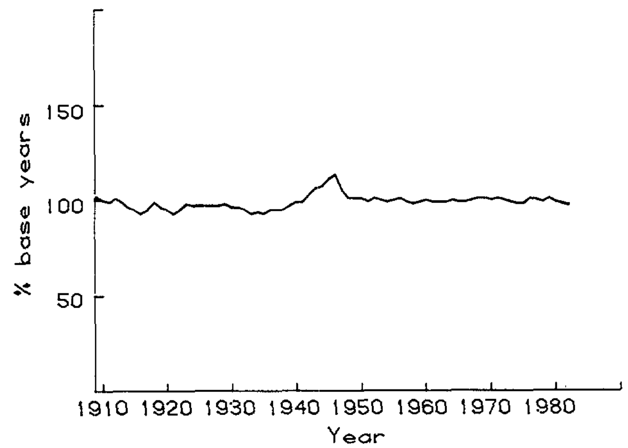
Phosphorus 1-7. Household diets, spring 1977: Contribution of food groups

	% total phosphorus	milligrams/ 1,000 Calories of food group	milligrams/ dollar's worth of food group	% money value
Milk, cream, cheese	30%	1418	1833	12%
Meat, poultry, fish	27%	649	584	34%
Grain products	20%	507	1246	12%
Other protein foods[1]	8%	942	1404	4%
Vegetables	7%	768	454	12%
Miscellaneous[2]	3%	1058	284	8%
Fruit	2%	293	213	8%
Sugar, sweets	2%	98	187	6%
Fats, oils	<1%	21	100	3%

[1]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Phosphorus 1-8. U.S. food supply: Percent of base years[1]



[1]U.S. food supply, 1909-13=1,510 milligrams/capita/day.

SOURCE: USDA: Data from the U.S. food supply historical series.

Magnesium

Description

Magnesium, an essential mineral in the diet, is used to build bones, synthesize proteins, release energy from muscle glycogen, and regulate body temperature and blood pressure. Individuals can apparently adapt to a wide range of magnesium intakes. Deficiency usually results only from conditions which limit absorption or increase excretion, such as alcoholism; prolonged nausea or diarrhea; and prolonged infusion with magnesium-free parenteral fluids, usually in association with prolonged losses of gastrointestinal fluids. Symptoms of deficiency include muscle spasm, tremor, nausea, anorexia, apathy, convulsions, and coma.

Dietary intakes of magnesium are assessed relative to the 1980 RDA, but biochemical or other health indicators of magnesium status were not available from national surveys. The RDA are 350 milligrams per day for males 19 years of age and older and 300 milligrams per day for females of the same age.

Food sources of magnesium include whole-grain products, dry beans, nuts, most dark-green vegetables, and milk. Food composition data for magnesium were less reliable than those for other nutrients in 1977.

Major Findings

- The magnesium intake and status of the U.S. population require further investigation.

- Dietary levels of magnesium averaged below the RDA, but there was no obvious clinical evidence from national surveys of widespread health problems related to magnesium deficiences.

- Dietary levels of magnesium were lower for women and the black population than for men and the white population.

- Dietary levels of magnesium appeared to be positively associated with economic status.

- The major source of magnesium in household diets was grain products, but vegetables, dairy products, and meat, poultry, and fish were also important sources.

- Magnesium provided by the U.S. food supply was about 18 percent lower in 1982 (331 milligrams per capita per day) than at the beginning of the century. Decreased use of grain products was primarily responsible.

Individual Intake

Magnesium intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey averaged 83 percent of the RDA (Magnesium 1-1). Twenty-five percent of the survey population had intakes of at least the RDA, and 61 percent had intakes of at least 70 percent of the RDA (chart 1-2). Forty-four percent of the survey population had diets providing at least the RDA magnesium-to-calorie ratios, and 89 percent had intakes of at least 70 percent of the RDA ratios.

Dietary levels of magnesium were higher for children under 9 years of age than for older individuals (charts 1-1 and 1-3). For all age groups surveyed, magnesium levels were higher for males than for females.

Dietary levels of magnesium differed more by race than by poverty status (charts 1-1 and 1-4). Levels were higher for the white population than for the black population, even when these groups were categorized by poverty status. For both racial groups, levels were slightly higher for individuals above than below poverty.

Magnesium levels were higher in the West than in the South, with the Northeast and North Central regions midway between (charts 1-1 and 1-5). Levels of magnesium differed little by urbanization and season.

Household Food Use

Households with higher income per capita reported using food providing more magnesium per person than did lower income households (chart 1-6). However, higher income households paid more for magnesium than did lower income households; that is, they obtained less magnesium for each food dollar. Among households eligible for the Food Stamp Program, participants and nonparticipants used food differing little in magnesium per person or per dollar. Compared with higher income households that were ineligible for the program, eligible households used food slightly lower in magnesium per person but slightly higher in magnesium per dollar.

Households using food with higher money value per person averaged more magnesium per person but less magnesium per dollar than did households with lower food costs. Compared with larger households, smaller households used food with more magnesium per person but less magnesium per dollar.

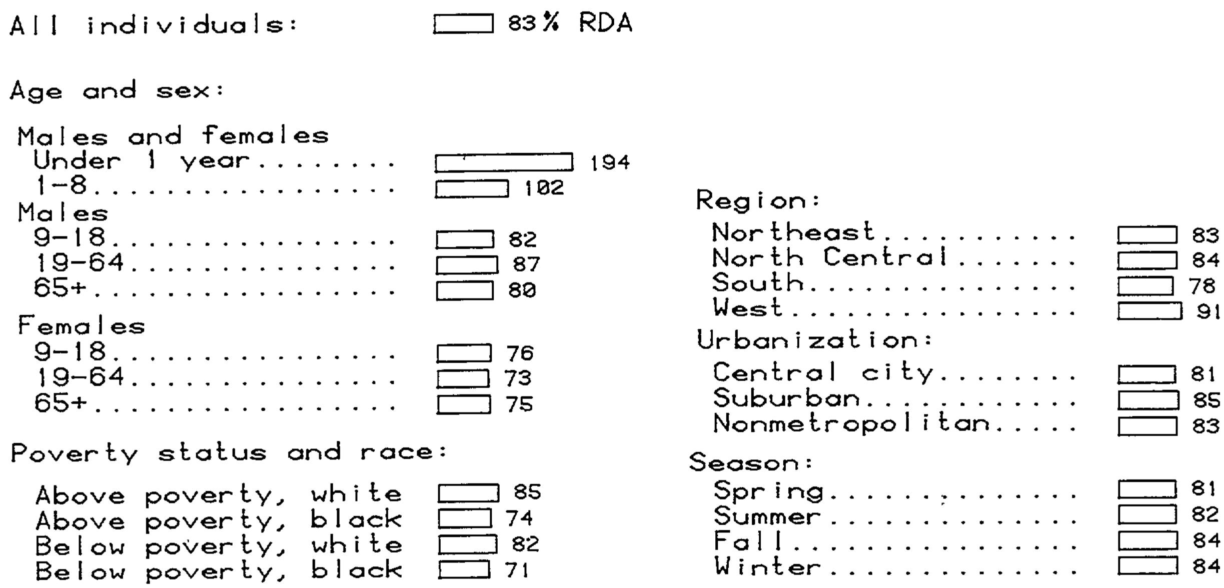
Grain products provided 21 percent of the magnesium in household diets (chart 1-7). The food groups next in importance as sources of magnesium were vegetables; milk, cream, and cheese; and meat, poultry, and fish. The food group called "other protein foods," which includes mixtures of meat, poultry, and fish, as well as eggs, beans, and nuts, was the most economical source of magnesium. The miscellaneous group is high in magnesium per 1,000 Calories because certain included foods contain some magnesium and the group as a whole is very low in calories.

Historical Trends

The level of magnesium provided by the U.S. food supply was highest in 1909, 411 milligrams per capita per day, and almost that high in 1946 (chart 1-8). The early peak in the magnesium level is attributed to high use of grain products, which declined thereafter. The midcentury peak in magnesium level is attributed to high use of dairy products. Thereafter, magnesium in the food supply declined to its lowest level, 330 milligrams per capita per day in 1981.

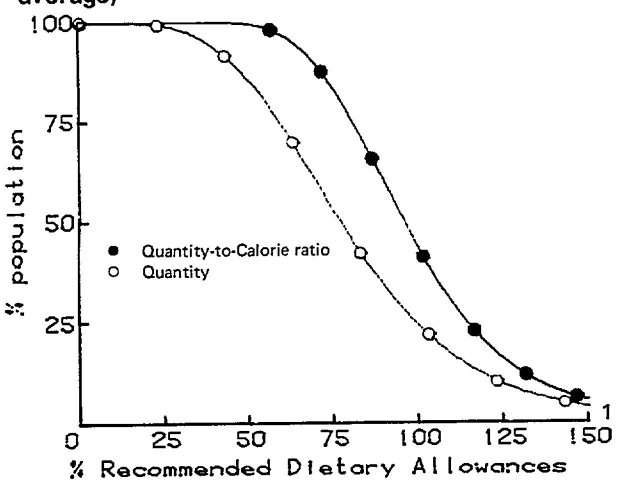
Throughout the century, about 40 percent of the magnesium in the food supply has been provided by grain products and dairy products. From 1909-13 to 1982, magnesium from the use of grain products declined 58 percent. Decreased use of potatoes also contributed to the overall decline. These declines were not offset by increased quantities of magnesium from increased use of the meat, poultry, and fish group and dairy products.

Magnesium 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)



SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Magnesium 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)

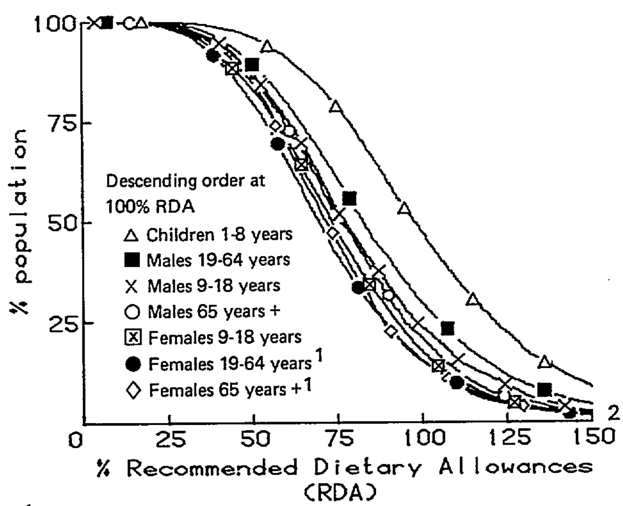


[1]Truncated at 150% RDA.

Example: 25% of the population had at least 100% RDA by quantity, and 44% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Magnesium 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



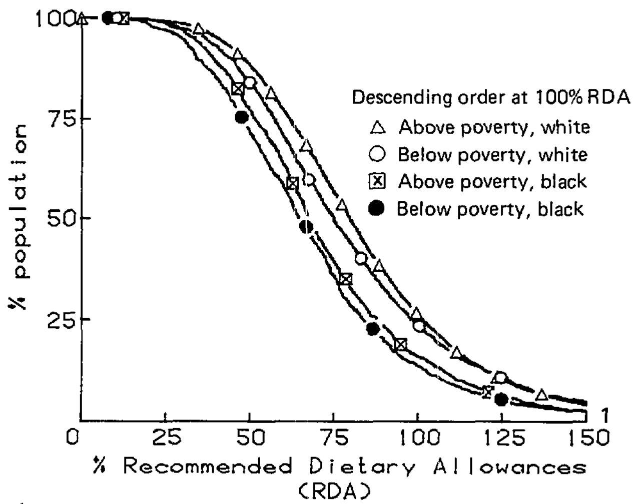
[1]Equal at 100% RDA.

[2]Truncated at 150% RDA.

Example: 48% of children 1-8 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Magnesium 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)

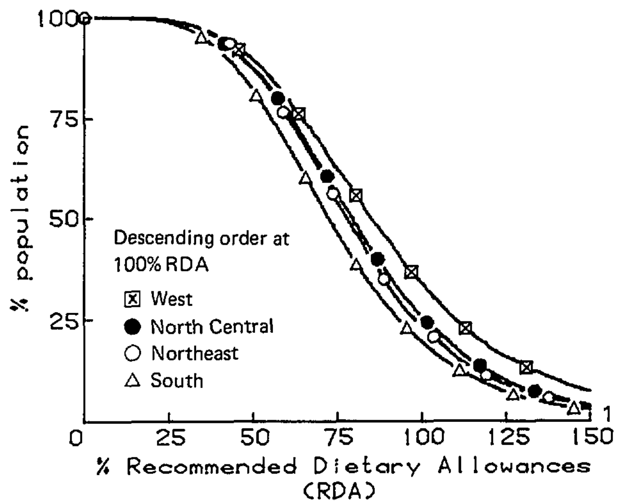


[1]Truncated at 150% RDA.

Example: 27% of above poverty, white population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Magnesium 1-5. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)

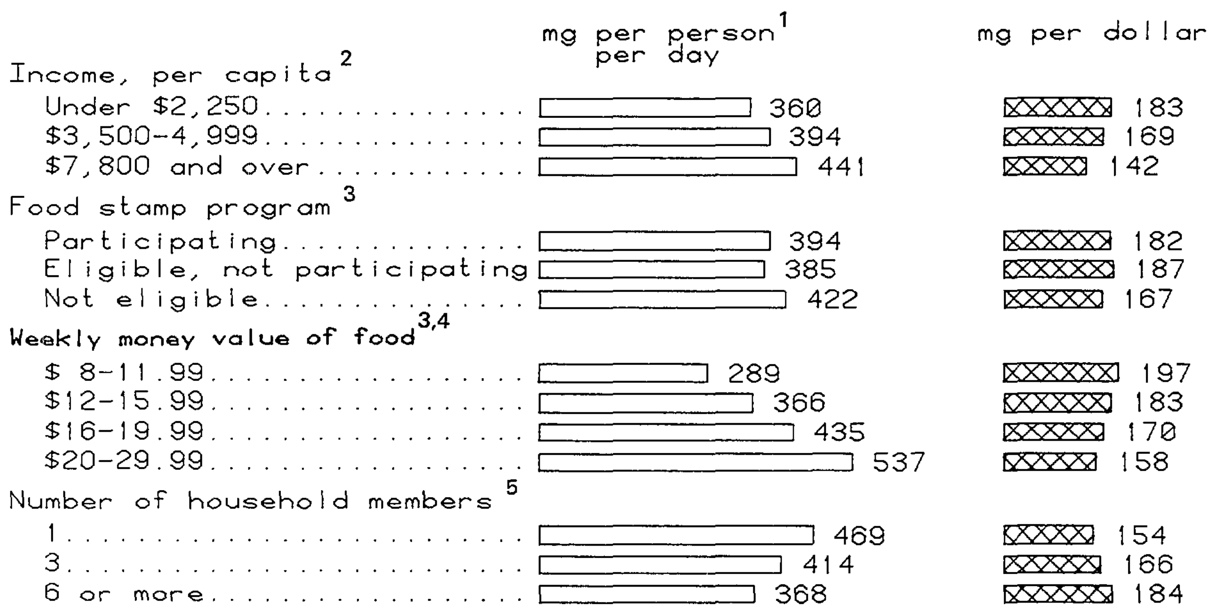


[1]Truncated at 150% RDA.

Example: 35% of population in the West had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Magnesium 1-6. Household diets, spring 1977: Milligrams (mg) per person and per dollar's worth of food used at home, by selected characteristics



[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

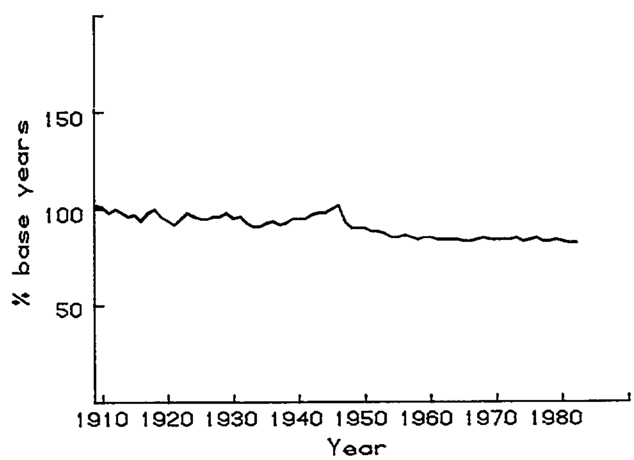
Magnesium 1-7. Household diets, spring 1977: Contribution of food groups

	% total magnesium	milligrams/ 1,000 Calories of food group	milligrams/ dollar's worth of food group	% money value
Grain products	21%	121	298	12%
Vegetables	17%	405	239	12%
Milk, cream, cheese	16%	168	218	12%
Meat, poultry, fish	15%	81	73	34%
Miscellaneous[1]	11%	827	222	8%
Other protein foods[2]	10%	258	385	4%
Fruit	7%	226	164	8%
Sugar, sweets	3%	44	84	6%
Fats, oils	<1%	3	14	3%

[1]Coffee, tea, alcoholic beverages, and foods of little nutritive value.
[2]Meat, poultry, fish mixtures, and eggs, beans, and nuts.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Magnesium 1-8. U.S. food supply: Percent of base years[1]



[1]U.S. food supply, 1909-13=402 milligrams/capita/day.

SOURCE: USDA: Data from the U.S. food supply historical series.

Iron

Description

Iron, an essential mineral in the diet, functions primarily as a carrier of oxygen in the body. As part of hemoglobin, iron carries oxygen in blood; as part of myoglobin, it carries oxygen in muscles. Because iron is a part of hemoglobin, it has an essential role in red blood cell formation.

The most common manifestation of impaired iron status is iron-deficiency anemia, a condition in which the size and number of red blood cells are reduced. This condition may result from inadequate dietary intake or blood loss. Iron intakes high enough to cause harmful effects are unlikely when the diet is composed of conventional foods, but misuse of iron supplements, especially accidental ingestion by young children, can result in poisoning.

Dietary intakes of iron are assessed relative to the 1980 RDA. The RDA are 10 milligrams per day for males 23-50 years of age and 18 milligrams per day for females of the same age. Numerous health indicators are available for assessing the iron status of the population. The following measurements are made on blood: Hemoglobin, hematocrit, red blood cell count, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hematocrit, erythrocyte protoporphyrin, serum iron, total iron-binding capacity, transferrin saturation, and serum ferritin.

Food sources of iron include liver, red meat, whole-grain and enriched grain products, egg yolk, beans, nuts, and dark-green leafy vegetables. However, the ability of the body to absorb and utilize iron from various foods varies considerably. The iron in meat, poultry, and fish is more biologically available--that is, it is absorbed and utilized more readily than iron in other foods--and the presence of these animal products in a meal increases the biological availability of iron from other foods. The presence of ascorbic acid (vitamin C) in a meal also increases iron absorption.

Major Findings

- Dietary levels of iron averaged below the RDA for children 1-8 years, males and females 9-18 years, and females 19-64 years. Estimates of dietary levels of biologically available iron also were low.

- Clinical and biochemical tests of iron status indicated that children 1-5 years, black females 12-17 years, and poor females 25-54 years had the highest prevalences of impaired iron status.

- Dietary iron levels by poverty status and race differed more for males than for females: White males above poverty level had higher levels than black males below poverty had.

- Black individuals tended to have slightly higher prevalences of abnormal biochemical and hematological values than did white individuals.

- Income below the poverty level was associated with higher prevalences of abnormal iron status in children 1-5 years of age and females 25-54 years.

- The major sources of iron in household diets were grain products and the meat, poultry, and fish group.

- Iron provided by the U.S. food supply was higher during the second half of the century than during the first half. In 1982, the iron level was 16.6 milligrams per capita per day.

Individual Intake

Iron intakes by individuals (3-day dietary reports) in the 1977-78 Nationwide Food Consumption Survey averaged 103 percent of the RDA (Iron 1-1). Forty-four percent of the survey population had intakes of at least the RDA, and about two-thirds had intakes of at least 70 percent of the RDA (chart 1-2). Fifty-eight percent of the survey population had diets providing at least the RDA iron-to-calorie ratios, and 85 percent had intakes of at least 70 percent of the RDA ratios.

Children 1-8 years, males 9-18 years, and females 9-64 years of age had iron intakes averaging below the RDA (chart 1-1). Of these groups, children and males had higher average intakes, but less than 40 percent of either group had intakes equal to or above the RDA (charts 1-1 and 1-3). Females 9-18 and 19-64 years of age had the lowest intakes, with fewer than 20 percent in these groups having intakes equal to or above their RDA. Although females 65 years of age and over had average intakes above the RDA, their intakes were considerably lower than intakes of males in the same age group.

Individuals above poverty level had higher dietary levels of iron than individuals of the same race below poverty (charts 1-1 and 1-4). Levels were somewhat higher for the white than for the black population, especially for those below poverty. Dietary iron levels of persons 19-64 years of age differed more by poverty status and race among males than among females (chart 1-5). Levels were higher for males above poverty level than for those below poverty in the same racial group. For both economic groups, white males had higher dietary levels of iron than black males had. Levels were low for all subgroups of females.

Iron levels differed little by region, urbanization, and season (charts 1-1 and 1-6).

Estimates of dietary levels of biologically available iron, taking into account the presence at meals of meat, poultry, and fish and ascorbic acid, are not closer to recommended levels than the iron intake data indicate (Raper et al., 1984).

Household Food Use

Households with higher income per capita reported using food slightly higher in iron per person than did lower income households (chart 1-7). However, higher income households paid more for iron than did lower income households; that is, they obtained less iron from each food dollar. Among households eligible for the Food Stamp Program, participants used food higher in iron per person but similar in iron per dollar to that used by nonparticipants. Compared with higher income households that were ineligible for the program, participating households used food slightly higher in iron per person and also higher in iron per dollar.

Households using food with higher money value per person averaged more iron per person but less iron per dollar than did households with lower food costs. Smaller households used food with more iron per person but less iron per dollar than did larger households.

Grain products and the meat, poultry, and fish group provided 35 and 32 percent of the iron in household diets, respectively (chart 1-8). Grain products supplied the most iron per dollar's worth of food group, about three times as much as the meat, poultry, and fish group. The other protein foods group, which included eggs and beans, was also an economical source of iron.

Historical Trends

The per capita level of iron provided by the U.S. food supply was higher in 1982 than at the beginning of the century (chart 1-9). As use of grain products decreased, the level fluctuated downward in the early part of the century to a low point in 1935. The level rose to a peak in the mid-1940's because of the introduction of enriched flour and bread. This was followed by a decline of about 10 percent by 1950, attributed to continued decreases in the use of grain products and a 10-pound per capita per year decline in use of meat. Thereafter, the level rose slowly because of widespread use of enrichment and fortification and increased use of the meat, poultry, and fish group. Data from USDA's food consumption surveys indicate a very slight increase in the iron level of household diets and intakes by individuals since the mid-1950's.

Impaired iron status

In the 1976-80 National Health and Nutrition Examination Survey (NHANES II), numerous hematological and biochemical assessments related to iron status were performed on subsamples of examined persons. These included hemoglobin, hematocrit, red blood cell count, mean corpuscular volume (MCV), mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, erythrocyte protoporphyrin, serum iron, total iron-binding capacity, transferrin saturation, and serum ferritin.

It is generally agreed that the most common single nutritional deficiency in most countries is iron deficiency. Iron deficiency can result from nutritional causes or from blood loss. Iron deficiency resulting from a dietary intake inadequate to meet normal physiological needs is often cited as the major source of iron deficiency in many subpopulations.

Three stages generally are identified in the process of iron depletion. In the first stage, iron stores are reduced. Plasma or serum ferritin has been shown to be a useful indicator of storage iron in normal subjects. The second stage involves a severe reduction in iron stores resulting in a state of iron-deficient red blood cell production. Transferrin saturation and erythrocyte protoporphyrin are often used as indicators of this moderate degree of iron deficiency. The third and most severe state involves frank anemia with small pale-red blood cells. This latter stage of iron-deficiency anemia is reflected by reduced MCV and hematocrit values and decreased hemoglobin concentrations.

Numerous methods have been used to estimate the prevalence of iron deficiency and iron deficiency anemia in population groups. An expert scientific working group established to assess the iron nutritional status of the U.S. population based on NHANES II data (Life Sciences Research Office, Aug. 1984) concluded that no single biochemical indicator is diagnostic of iron deficiency. The use of several indicators of iron status together provides a much better measure of iron status. The following indicators of iron status are used for the NHANES II data:

- Serum ferritin is used as a measure of iron stores for those 3-74 years of age.
- Transferrin saturation is used as a measure of deficient iron stores.
- MCV is used as a measure of altered erythropoiesis.
- Erythrocyte protoporphyrin is measured because an accumulation of free protoporphyrin in the erythrocytes is associated with a fall in transferrin saturation when iron stores are deficient.

However, these indicators can be affected by inflammation as well as iron deficiency; this is especially true in the older age groups.

The expert scientific working group decided to define impaired iron status as abnormal values for at least two out of three iron status indicators. Two models used to determine the prevalence of abnormal iron status were (1) the ferritin model, in which serum ferritin, transferrin saturation, and erythrocyte protoporphyrin were the indicators used, and (2) the MCV model, in which MCV, transferrin saturation, and erythrocyte protoporphyrin were the indicators used. The ferritin model represents a less severe impairment in iron status because only indicators of the first and second stages of iron deficiency are used. The MCV model reflects the third and most severe stage of altered red cell formation because MCV is used. This model might be expected to produce lower prevalences of two or three abnormal values for iron indicators than the ferritin model does.

The criteria used to assess the iron status of the U.S. population based on NHANES II data and the MCV model are follows:

Age in years	Transferrin saturation (percent)	Erythrocyte protoporphyrin (micrograms per deciliter red blood cells)	Mean corpuscular volume (femtoliters)
1-2	<12	>80	<73
3-4	<14	>75	<75
5-10	<15	>70	<76
11-14	<16	>70	<78
15-74	<16	>70	<80

The working group used several approaches to derive these cutoffs for abnormal values of the various iron status indicators, including evidence based on empirical and clinical studies. The MCV model was selected for this report because (1) the model could be applied to the entire NHANES II population (persons 1-74 years of age, excluding pregnant women), and (2) the model operationally represented the third and most severe state of altered iron status--iron deficiency anemia.

The prevalence of impaired iron status using the MCV model is presented in Iron 2-1 through 2-4. The subgroups with the highest prevalences, young children and females, are those that have been identified in previous studies to be at the highest risk of iron deficiency anemia. All other groups had prevalences less than 4.5 percent, with young adult males having the lowest prevalence, less than 1 percent.

Children 1-2 years of age had the highest prevalence of impaired iron status using the MCV model. Data for this group are shown in the following table. The prevalence of impaired iron status was significantly higher in children 1-2 years of age whose family incomes were below poverty level (20.6 percent) than in the group above poverty (6.7 percent). Black children had a slightly higher prevalence than white children (10.9 vs. 8.4 percent), but the difference is not statistically significant.

Percent of children 1-2 years of age with impaired iron status,[1] by race and poverty status: Second National Health and Nutrition Examination Survey, 1976-80

Race and poverty status	Number examined	Percent with impaired iron status	Standard error of the percent
Race			
White................	434	8.4	1.5
Black................	89	10.9	3.0
Poverty status			
Below poverty level..	121	20.6	4.1
Above poverty level..	409	6.7	1.2

[1]2 or 3 abnormal values for iron status indicators using the mean corpuscular volume model.

SOURCE: Life Sciences Research Office, Aug. 1984.

Charts 2-1 and 2-2 show the prevalence of impaired iron status by age and race. For males, the prevalence of impaired iron status was higher for the black than for the white population except for the age group 18-24 years. For females, no consistent pattern was observed.

Charts 2-3 and 2-4 present the prevalence of impaired iron status by age and poverty status. For the two subgroups with the largest overall prevalence of impaired iron status--children 3-5 years of age and females 25-54 years of age--the prevalence of impaired iron status was higher for the group below poverty level than for the group above poverty level. Among the elderly, the prevalence for the group below poverty level was higher than that for the group above poverty level.

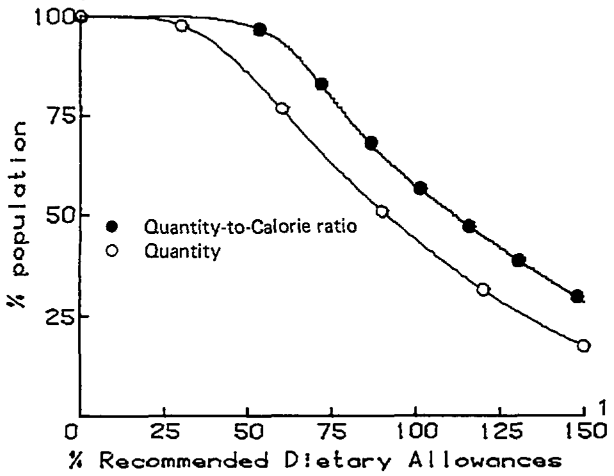
Iron 1-1. Individual intakes, 1977-78: Mean percent of 1980 Recommended Dietary Allowances (RDA), by selected characteristics (3-day average)

	% RDA
All individuals:	103 % RDA
Age and sex:	
Males and females	
Under 1 year	150
1-8	91
Males	
9-18	94
19-64	157
65+	142
Females	
9-18	74
19-64	73
65+	108
Poverty status and race:	
Above poverty, white	103
Above poverty, black	100
Below poverty, white	98
Below poverty, black	91

	% RDA
Region:	
Northeast	101
North Central	103
South	102
West	107
Urbanization:	
Central city	103
Suburban	103
Nonmetropolitan	103
Season:	
Spring	104
Summer	102
Fall	103
Winter	103

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

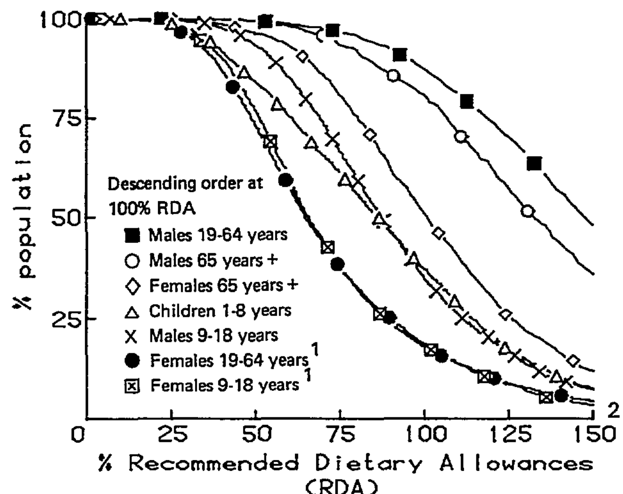
Iron 1-2. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA in terms of quantity and quantity-to-Calorie ratio (3-day average)



[1]Truncated at 150% RDA.
Example: 44% of the population had at least 100% RDA by quantity, and 58% of the population had at least 100% RDA by quantity-to-Calorie ratio.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

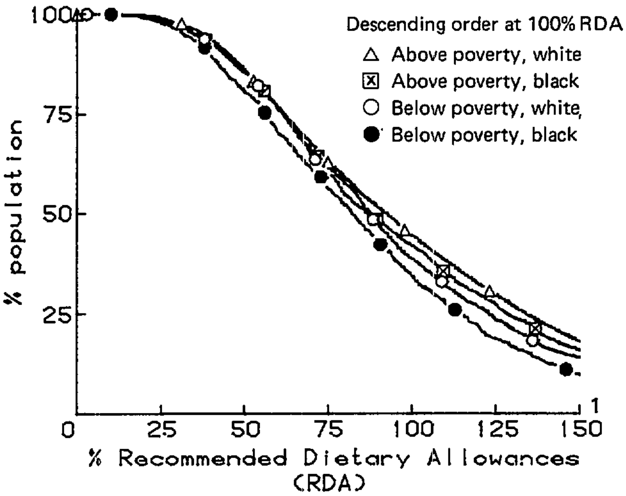
Iron 1-3. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by sex and age (3-day average)



[1]Equal at 100% RDA.
[2]Truncated at 150% RDA.
Example: 88% of males 19-64 years had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Iron 1-4. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by poverty status and race (3-day average)

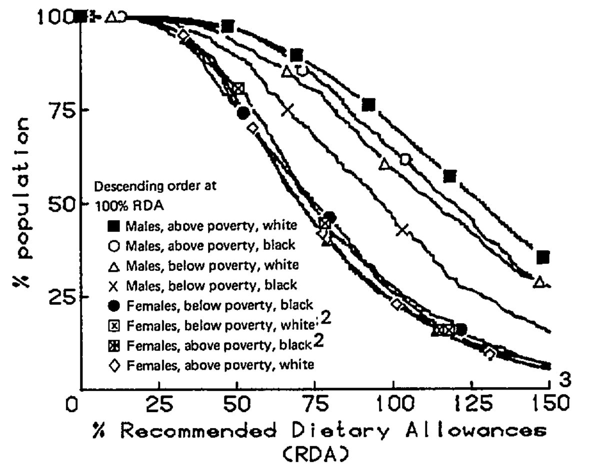


[1]Truncated at 150% RDA.

Example: 45% of above poverty, white population had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Iron 1-5. Individual intakes, 1977-78: Cumulative percent of population[1] having at least specified percents of 1980 RDA, by sex, poverty status, and race (3-day average)



[1]Males and females 19-64 years.

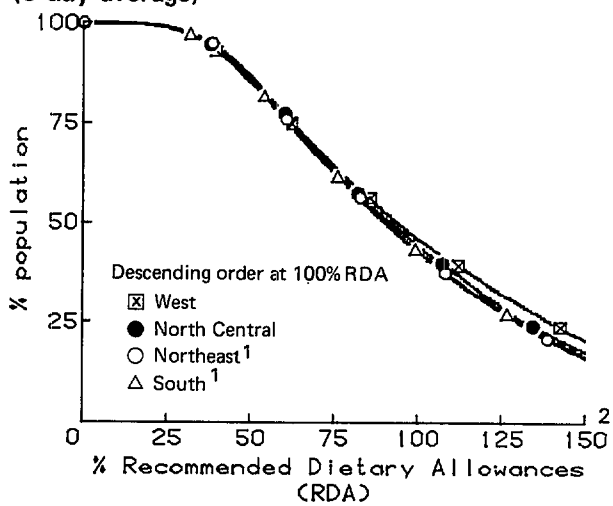
[2]Equal at 100% RDA.

[3]Truncated at 150% RDA.

Example: 71% of above poverty, white males had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Iron 1-6. Individual intakes, 1977-78: Cumulative percent of population having at least specified percents of 1980 RDA, by region (3-day average)



[1]Equal at 100% RDA.

[2]Truncated at 150% RDA.

Example: 46% of population in the West had at least 100% RDA.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Iron 1-7. Household diets, spring 1977: Milligrams (mg) per person and per dollar's worth of food used at home, by selected characteristics

	mg per person[1] per day	mg per dollar
Income, per capita[2]		
Under $2,250	19.6	10.0
$3,500-4,999	19.3	8.3
$7,800 and over	21.2	6.8
Food stamp program[3]		
Participating	22.0	10.2
Eligible, not participating	19.9	9.7
Not eligible	20.6	8.1
Weekly money value of food[3,4]		
$ 8-11.99	15.1	10.3
$12-15.99	18.3	9.2
$16-19.99	21.6	8.5
$20-29.99	25.9	7.7
Number of household members[5]		
1	22.8	7.5
3	21.0	8.4
6 or more	19.5	9.7

[1]Meal-at-home equivalent person.
[2]1976 household income before taxes.
[3]Data for year 1977-78.
[4]Per meal-at-home equivalent person per week.
[5]Excludes roomers, boarders, and employees.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

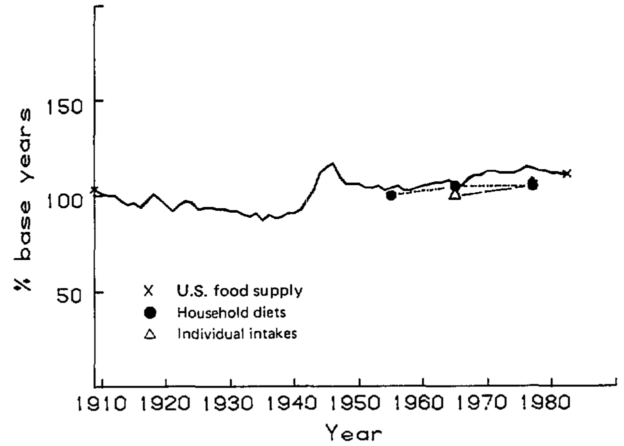
Iron 1-8. Household diets, spring 1977: Contribution of food groups

	% total iron	milligrams/ 1,000 calories of food group	milligrams/ dollar's worth of food group	% money value
Grain products	35%	10.3	25.3	12%
Meat, poultry, fish	32%	8.7	7.8	34%
Vegetables	12%	14.3	8.5	12%
Other protein foods[1]	8%	11	16.3	4%
Fruit	5%	7.5	5.5	8%
Sugar, sweets	3%	2.0	3.9	6%
Milk, cream, cheese	2%	1.3	1.7	12%
Miscellaneous[2]	2%	9.6	2.6	8%
Fats, oils	<1%	0.3	1.4	3%

[1]Meat, poultry, fish mixtures, and eggs, beans, and nuts.
[2]Coffee, tea, alcoholic beverages, and foods of little nutritive value.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

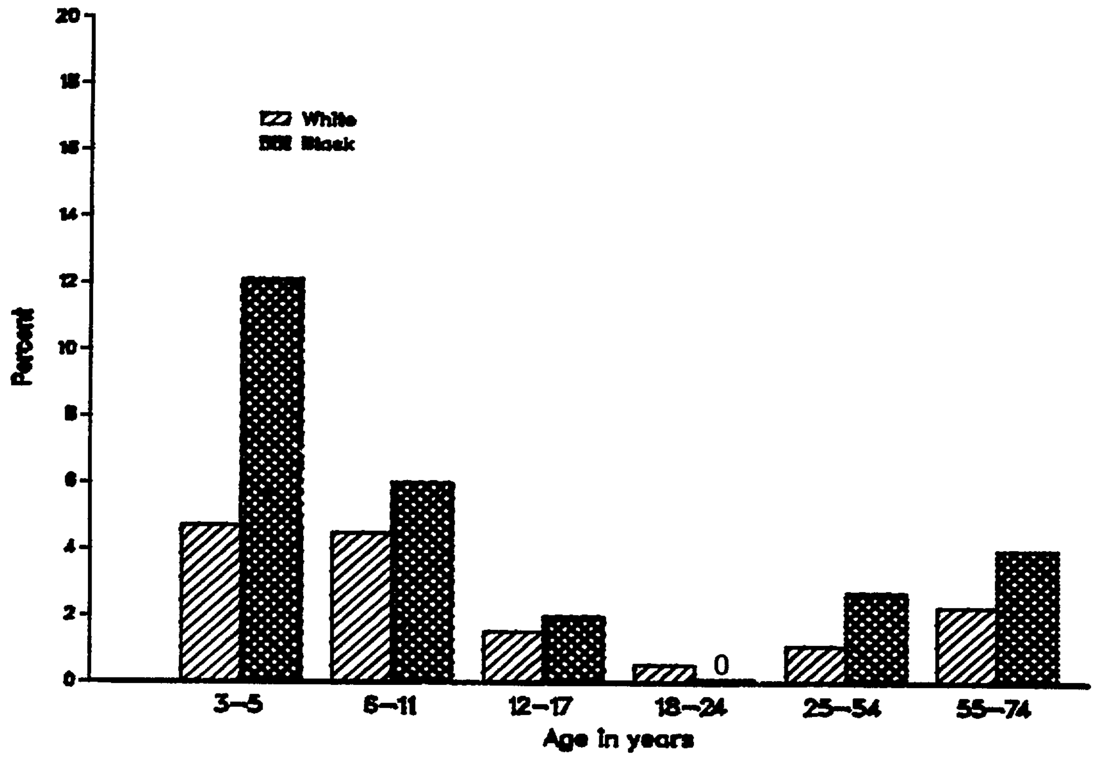
Iron 1-9. U.S. food supply, household diets, and individual intakes: Percent of base years[1]



[1] *U.S. food supply*, 1909-13=15.0 milligrams (mg)/capita/day; household, 1955=19.1 mg/meal-at-home equivalent person/day; individual, 1965=12.1 mg/individual/day (3-day average).

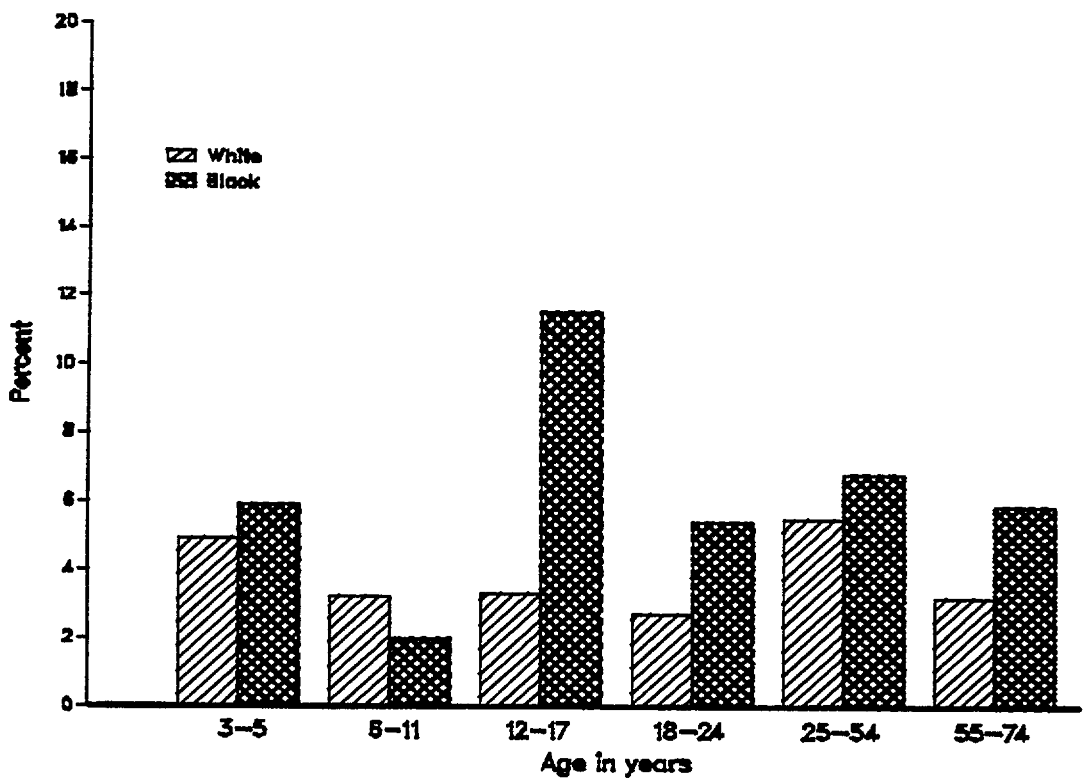
SOURCES: USDA: Data from the U.S. food supply historical series and the 1955, 1965, and 1977-78 food consumption surveys.

Iron 2—1. Percent of males with impaired iron status, by race and age: 1976-80



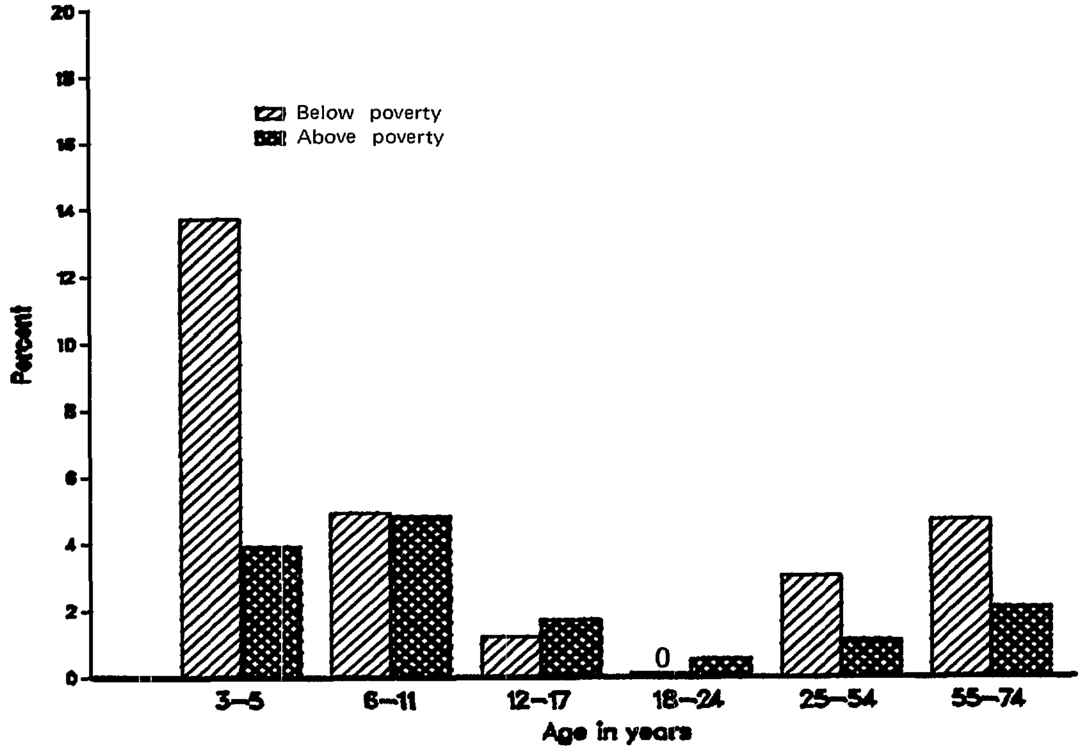
NOTE: 0 = Quantity zero. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Iron 2—2. Percent of females with impaired iron status, by race and age: 1976-80



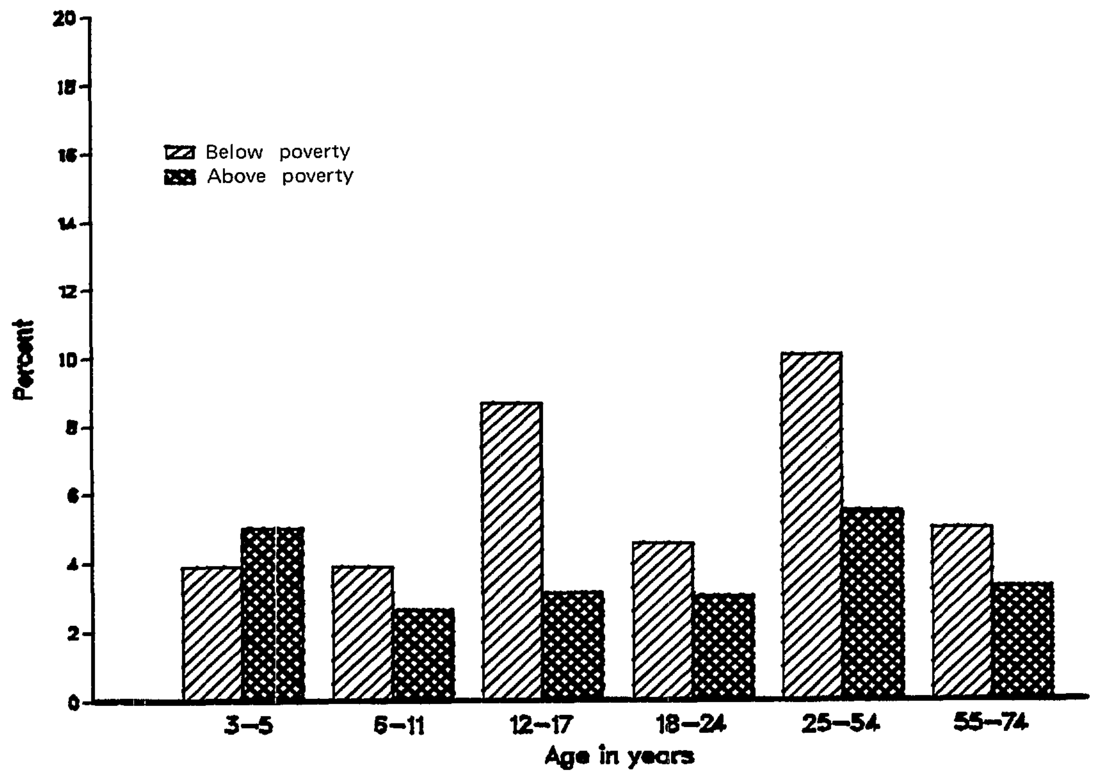
NOTE: Data based on nonpregnant females only. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Iron 2–3. Percent of males with impaired iron status, by poverty status and age: 1976-80



NOTE: 0 = Quantity zero. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Iron 2–4. Percent of females with impaired iron status, by poverty status and age: 1976-80



NOTE: Data based on nonpregnant females only. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Sodium

Description

Sodium is an essential mineral in the diet. It is used in the regulation of body fluid volume and the acid-base balance of blood and in the transmission of nerve impulses. A large proportion of the sodium in the body is in the fluid outside of cells, while the mineral potassium occurs primarily inside of cells. The balance between these minerals helps to maintain fluid balance.

When sodium intake exceeds excretion, the sodium content of the extracellular fluid may rise, causing a compensatory increase in the extracellular fluid volume. This may be noticeable as swelling in the hands, feet, and legs, referred to as edema. Control of hypertension, or high blood pressure, often is assisted by a reduction of dietary intake of sodium. Many other factors, such as obesity and the ratio of sodium to potassium in the diet, also influence the development of this disease.

Consideration of the health risks associated with high intakes of sodium has prompted several groups to recommend that the American public either reduce their sodium intake or avoid too much dietary sodium. Among them are the U.S. Senate Select Committee on Nutrition and Human Needs, 1977; American Heart Association, 1978; American Medical Association, Council on Scientific Affairs, 1979; Office of the Assistant Secretary for Health and the Surgeon General, 1979; National Academy of Sciences, Food and Nutrition Board (National Research Council, 1980b); and the U.S. Departments of Agriculture and Health and Human Services, 1980 and 1985. Safe and adequate ranges of sodium intake have been set for seven age groups by the National Academy of Sciences, Food and Nutrition Board, Committee on Dietary Allowances (National Research Council, 1980a). The upper limit of the ranges for adults is 3,300 milligrams of sodium per day.

Dietary intakes of sodium are difficult to estimate. Varying amounts of sodium may be added to commercially or home-prepared foods in addition to sodium naturally present in food and present in water in variable amounts. Estimates of quantities of salt added at the table are the most difficult to obtain. The Select Committee on Generally Recognized As Safe Substances estimated that total salt (sodium chloride) intake for Americans ranges from 10.4 to 15.5 grams per person per day (Life Sciences Research Office, 1979). This is equivalent to 4,160-6,200 milligrams of sodium per day. Of the total, approximately one-third (3.4-6.5 grams of salt or 1,360-2,600 milligrams of sodium) was considered to be consumer controlled or discretionary. The food industry is responding to concern about sodium intake by offering for sale lower sodium products. Label information allows consumers to make a choice based on the sodium content.

In some areas the sodium content of the water supply may be sufficiently high to make water a major source of sodium, perhaps exceeding that supplied by food. The sodium content of municipal water supplies in the United States averages 2.8 milligrams per 100 milliliters. Many water softeners increase the sodium content of water. Some medications such as antacids are also a source of sodium.

In a special analysis of data from the 1977-78 Nationwide Food Consumption Survey (NFCS), levels of sodium in reported diets were assessed relative to the safe and adequate ranges set by the Food and Nutrition Board of the National Academy of Sciences (National Research Council, 1980a). Biochemical, hematological, or other health indicators directly related to the sodium status of the U.S. population were not available from national surveys. The relationship of hypertension to sodium intake is discussed in Chapter 3.

For convenience, in comparing diets of different calorie levels, sodium levels are expressed per 1,000 Calories. Based on the midpoint of the Recommended Energy Intakes range for adult females (2,000 Calories per day), the upper limit of the sodium range (3,300 milligrams per day) would equate to 1,600 milligrams of sodium per 1,000 Calories. This level was used as a point of comparison for the diets of various groups.

It is important to note that estimates of sodium intake based on the 1977-78 NFCS include only sodium found naturally in food, added during commercial processing, and added to standard recipes. Salt added in other cooking or at the table was not reported. Estimates were not made of sodium intake from water or medicines. Therefore, sodium intake data based on the 1977-78 NFCS underestimate the sodium intake of most individuals.

Dietary sources of sodium are salt (sodium chloride) added at the table or in processing methods such as curing and pickling. Other important sources are condiments and food additives, such as sodium-containing preservatives added to canned products. Sodium is also found naturally in food and water. Animal products are generally higher than vegetable products in sodium content.

Major Findings

- Dietary levels of sodium were considered high even though estimates did not include all sources of dietary sodium.

- A reduction of sodium intake often assists in the control of hypertension. (See the section on cardiovascular disease in Chapter 3.)

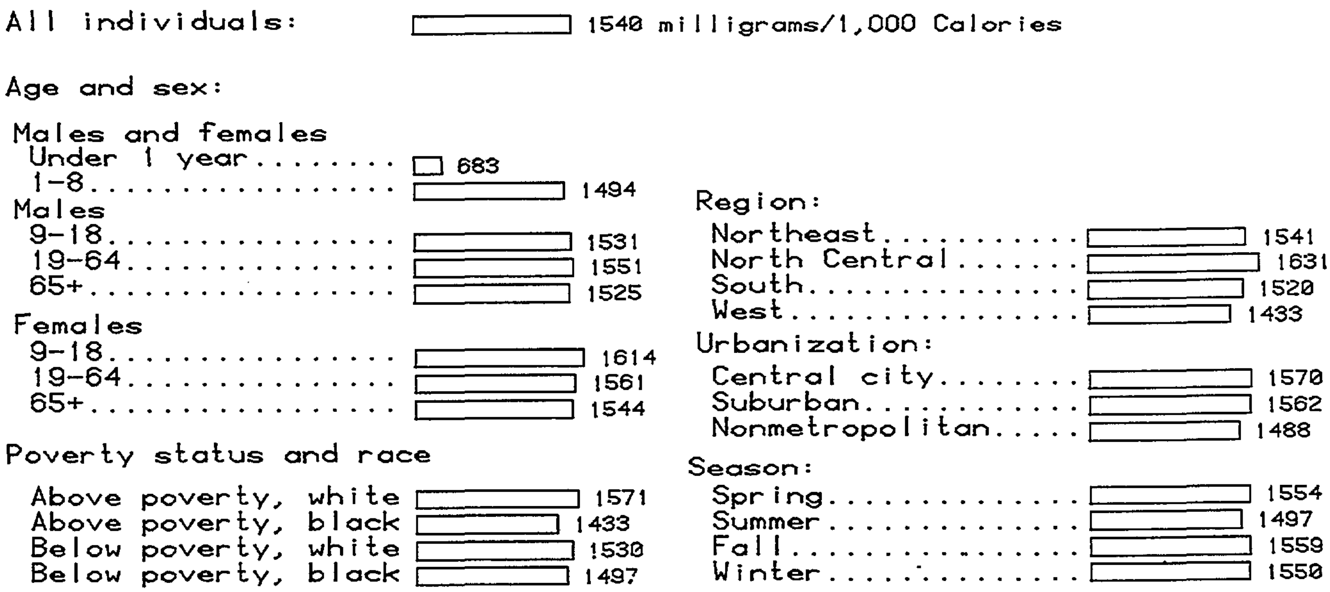
Individual Intake

Sodium intakes by individuals (3-day dietary reports) in the 1977-78 NFCS averaged 1,540 milligrams per 1,000 Calories (Sodium 1-1). One-third of the survey population had intakes above 1,600 milligrams per 1,000 Calories, and 9 percent had intakes above 2,000 milligrams per 1,000 Calories (chart 1-2).

Except for children under 1 year of age, average sodium intakes per 1,000 Calories for the sex and age groups differed little (chart 1-1). About one-fourth of the population in the age groups 1-18 years and over one-third of the population in older age groups had intakes above 1,600 milligrams per 1,000 Calories (chart 1-3).

By race and economic status, dietary sodium levels were lowest for the black population above poverty (charts 1-1 and 1-4). Sodium levels were lowest in the West (charts 1-1 and 1-5). Sodium levels differed little by urbanization and season.

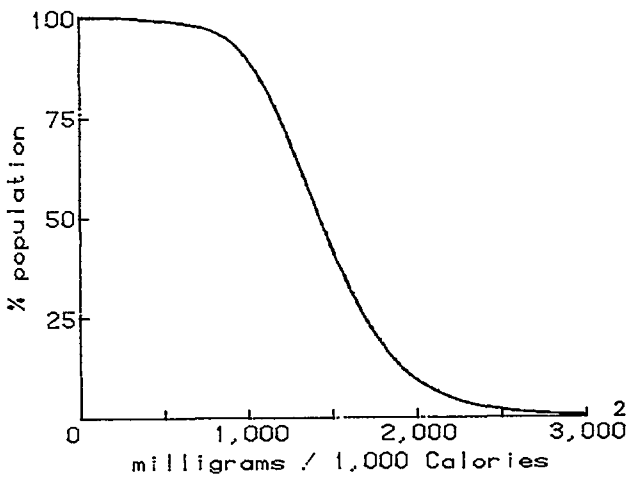
Sodium[1] 1-1. Individual intakes, 1977-78: Mean intakes per 1,000 Calories, by selected characteristics (3-day average)



[1]Does not include salt added at the table.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

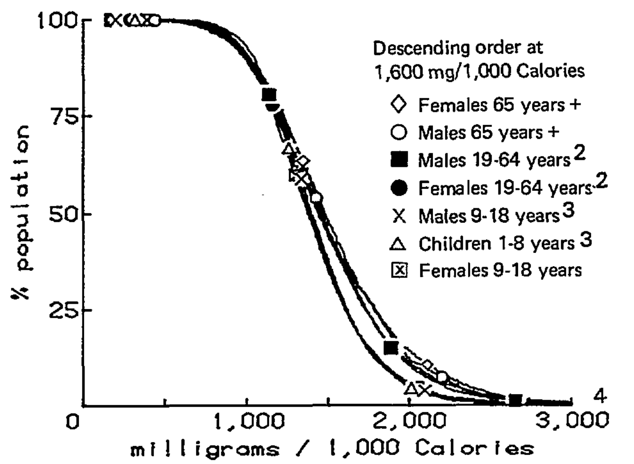
Sodium[1] 1-2. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels (3-day average)



[1]Does not include salt added at the table.
[2]Truncated at 3,000 milligrams (mg)/1,000 Calories.
Example: 33% of population had sodium intakes above 1,600 mg/1,000 Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

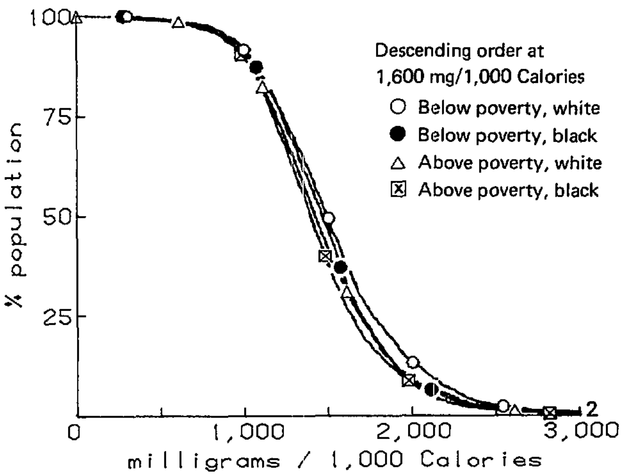
Sodium[1] 1-3. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by sex and age (3-day average)



[1]Does not include salt added at the table.
[2,3]Equal at 1,600 milligrams (mg)/1,000 Calories.
[4]Truncated at 3,000 mg/1,000 calories.
Example: 40% of females 65+ years had sodium intakes above 1,600 mg/1,000 Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

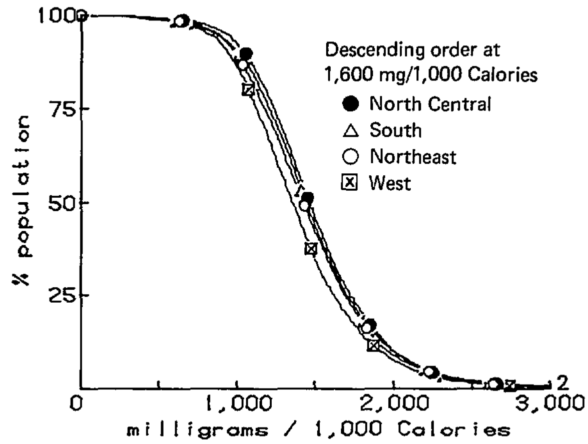
Sodium[1] 1-4. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by poverty status and race (3-day average)



[1]Does not include salt added at the table.
[2]Truncated at 3,000 milligrams (mg)/1,000 Calories.
Example: 39% of below poverty, white population had sodium intakes above 1,600 mg/1,000 Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Sodium[1] 1-5. Individual intakes, 1977-78: Cumulative percent of population having intakes of at least specified levels, by region (3-day average)



[1]Does not include salt added at the table.
[2]Truncated at 3,000 milligrams (mg)/1,000 Calories.
Example: 36% of population in the North Central Region had sodium intakes above 1,600 mg/1,000 Calories.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Zinc

Description

Zinc, an essential mineral in the diet, plays an important role in the formation of protein and thus assists in wound healing, blood formation, and general growth and maintenance of all tissues. Zinc is a component of numerous enzymes and thereby is involved in most metabolic processes. Clinical symptoms of zinc deficiency include growth retardation, poor appetite, mental lethargy, skin changes, and retarded sexual development, which has been studied principally in males.

Dietary intakes of zinc are assessed relative to the 1980 RDA. For individuals 11 years of age and older, the RDA are 15 milligrams per day. Food composition data available in 1977 were insufficient to permit assessment of zinc levels of individual intakes or household diets. However, data were sufficient to estimate per capita levels of zinc provided by the U.S. food supply because these estimates are based on a smaller number of foods.

The level of zinc in serum or plasma is a biochemical indicator of zinc status. However, it lacks complete reliability because several factors can influence the values. Normal and deficient ranges are fairly well defined if fasting morning blood samples are collected and certain other conditions are taken into account. An expert scientific working group established to assess the zinc nutritional status of the U.S. population based on data from the 1976-80 National Health and Nutrition Examination Survey (NHANES II) recommended that "low" be defined as values less than 60-70 micrograms of zinc per deciliter of serum, depending on the time of sample collection and the fasting state of the subject (Life Sciences Research Office, June 1984).

Food sources of zinc include shellfish (especially oysters), meat, poultry, cheese, whole-grain cereals, dry beans, cocoa, and nuts. However, the biological availability of zinc depends on the level of other nutrients and food components in the diet and on the food source of zinc. Generally, more biologically available zinc is supplied by foods of animal origin than by foods of vegetable origin.

Major Findings

- The zinc intake and status of the U.S. population require further investigation.

- Less than 2 percent of males and 3 percent of females 3-74 years of age had low values for serum zinc.

- Data on the nutrient content of the U.S. food supply indicate relatively low levels of zinc available for consumption per capita. In 1982, the U.S. food supply provided 12.0 milligrams of zinc per capita per day--3 milligrams less than the RDA for individuals 11 years of age and older.

- The source of zinc in the U.S. food supply has shifted since the beginning of the century from foods of vegetable origin to foods of animal origin. This change is attributed primarily to decreased use of grain products and increased use of foods in the meat, poultry, and fish group.

Historical Trends

The zinc level provided by the U.S. food supply from 1909-13 to 1982 fluctuated, ranging from 10.5 to 12.8 milligrams per capita per day (Zinc 1-1).

Zinc levels were relatively low from 1920 to 1940 and lowest in the mid-1930's, when economic conditions were depressed and consumption of many foods, especially meat, was low. Zinc levels moved upward in the mid-1940's because dairy product use peaked and beef use increased slightly. Following the early 1960's, zinc levels were close to those during the mid-1940's and at the beginning of the century. The rise and fall of the zinc level in the early 1970's closely followed the trend in beef use.

Marked changes have occurred in the selection of foods providing zinc in the American diet since the beginning of the century. Foods of animal and vegetable origin provided almost equal amounts of zinc in the U.S. food supply until the mid-1930's. As eating patterns changed, foods of animal origin became more important sources of zinc. Since the early 1960's, they have provided at least 70 percent of the total zinc.

The meat, poultry, and fish group has been the primary source of zinc throughout the century. In recent years, it has accounted for almost one-half of total zinc, whereas before 1950 this group accounted for 38 percent or less. The proportion of zinc from grain products has decreased by about one-half since the beginning of the century, when it provided 27 percent of total zinc. In the early 1940's, grain products dropped from second to third place as a source of zinc in the American diet. The proportion of zinc contributed by dairy products increased over the years, making this group the second leading source in the food supply. In recent decades, dairy products have contributed approximately 20 percent of total zinc.

Serum zinc

Serum zinc was measured in NHANES II. Zinc is most frequently measured in serum even though such values are not necessarily accurate indicators of zinc nutritional status. Because zinc is found in relatively high concentrations in red blood cells, any breakdown of blood cells can lead to erroneously high serum zinc levels. In addition, normal ranges for serum zinc are not well defined. The interpretation of low serum zinc is only suggestive of dietary deficiency because several other factors can influence serum values.

An expert scientific working group established to assess the zinc nutritional status of the U.S. population based on data from NHANES II (Life Sciences Research Office, June 1984) recommended the following definition of low serum zinc:

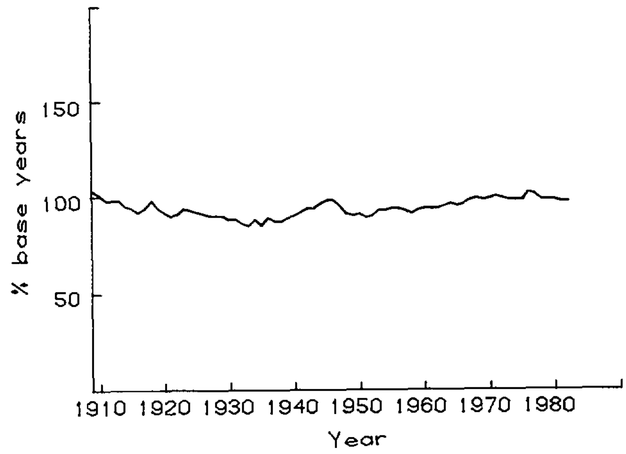
- 70 micrograms per deciliter for fasting persons whose blood was drawn in the morning.
- 65 micrograms per deciliter for nonfasting persons whose blood was drawn in the morning.
- 60 micrograms per deciliter for persons whose blood was drawn the afternoon or evening.

Mean serum zinc values were higher in males than in females for ages 12-74 years (Zinc 2-1 and 2-2). Serum zinc values were highest in males ages 18-24 years and showed a progressive decline with age. The age group 12-17 years had the highest mean serum zinc levels for females, but no significant decrease with age was seen.

Males below poverty level had slightly lower serum zinc levels than males above poverty level had (chart 2-3), but no consistent differences by poverty status were seen in females (chart 2-4).

Using the definitions for low serum zinc based on time of sample collection and fasting status of the subjects, less than 2 percent of males and less than 3 percent of females had low levels of serum zinc. For both males and females 6 years of age and over, a higher proportion of black than white persons had low serum zinc (charts 2-5 and 2-6). The prevalence of low serum zinc was not consistently associated with poverty status in males or females (charts 2-7 and 2-8).

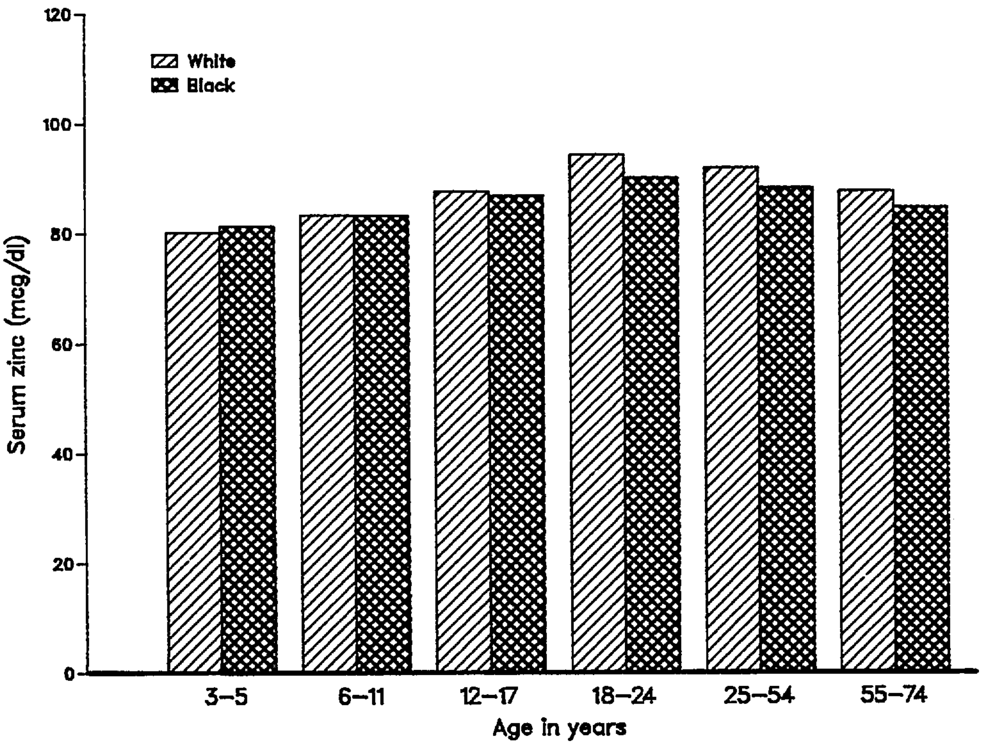
Zinc 1-1. U.S. food supply: Percent of base years[1]



[1]U.S. food supply, 1909-13=12.4 milligrams/capita/day.

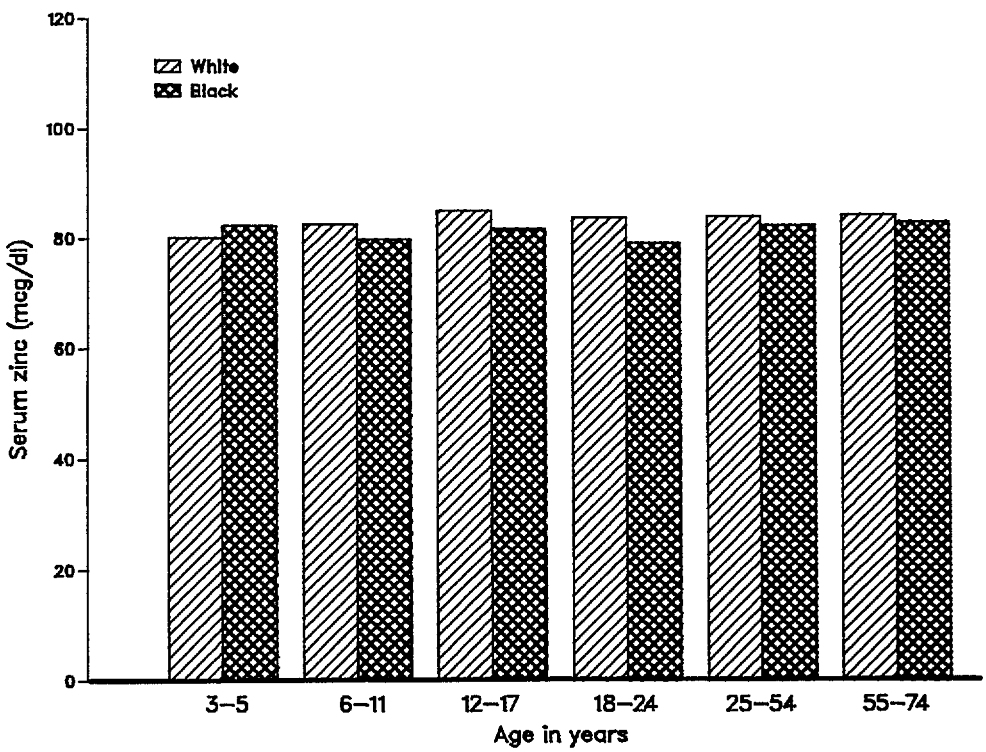
SOURCE: USDA: Data from the U.S. food supply historical series.

Zinc 2—1. Mean serum zinc for males, by race and age: 1976-80



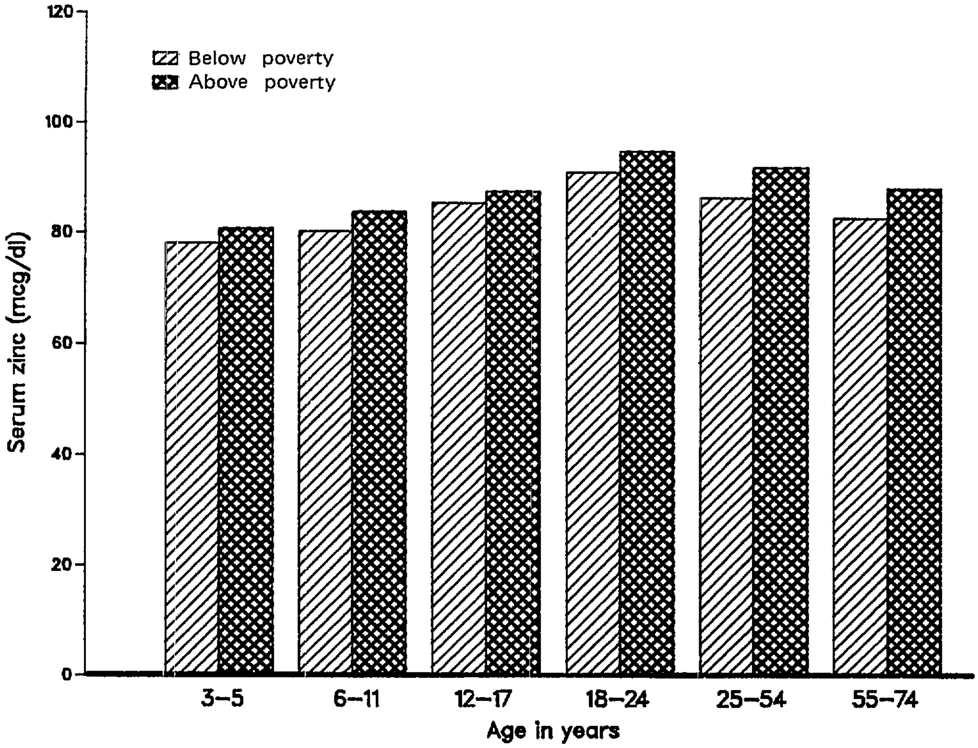
NOTE: Zinc measured in micrograms per deciliter (mcg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Zinc 2—2. Mean serum zinc for females, by race and age: 1976-80



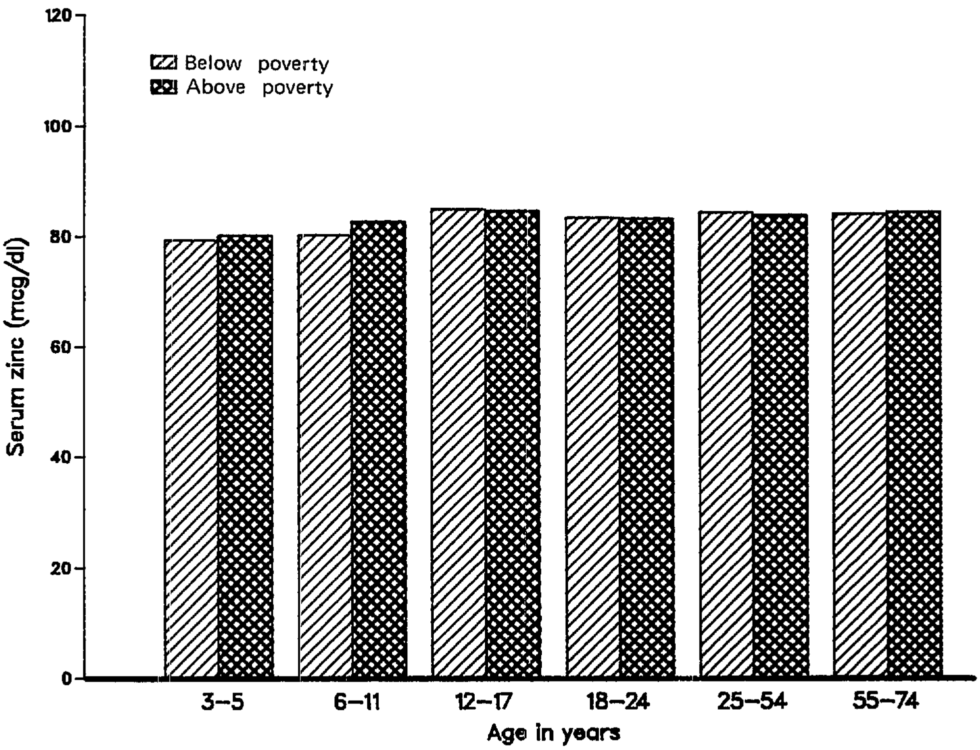
NOTE: Zinc measured in micrograms per deciliter (mcg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Zinc 2–3. Mean serum zinc for males, by poverty status and age: 1976-80



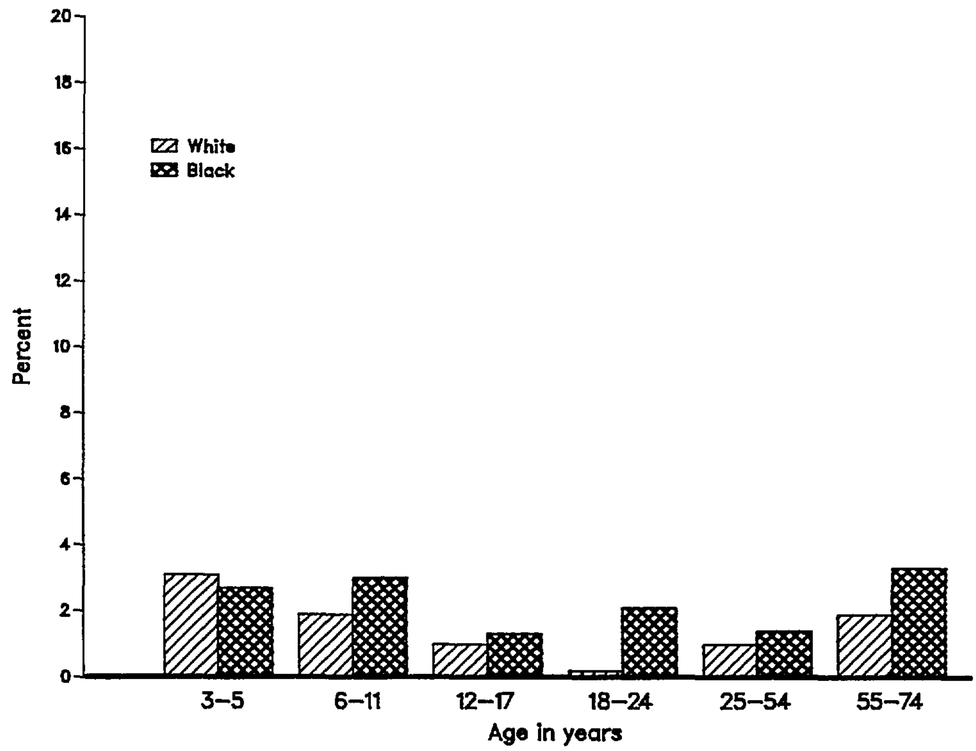
NOTE: Zinc measured in micrograms per deciliter (mcg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Zinc 2–4. Mean serum zinc for females, by poverty status and age: 1976-80



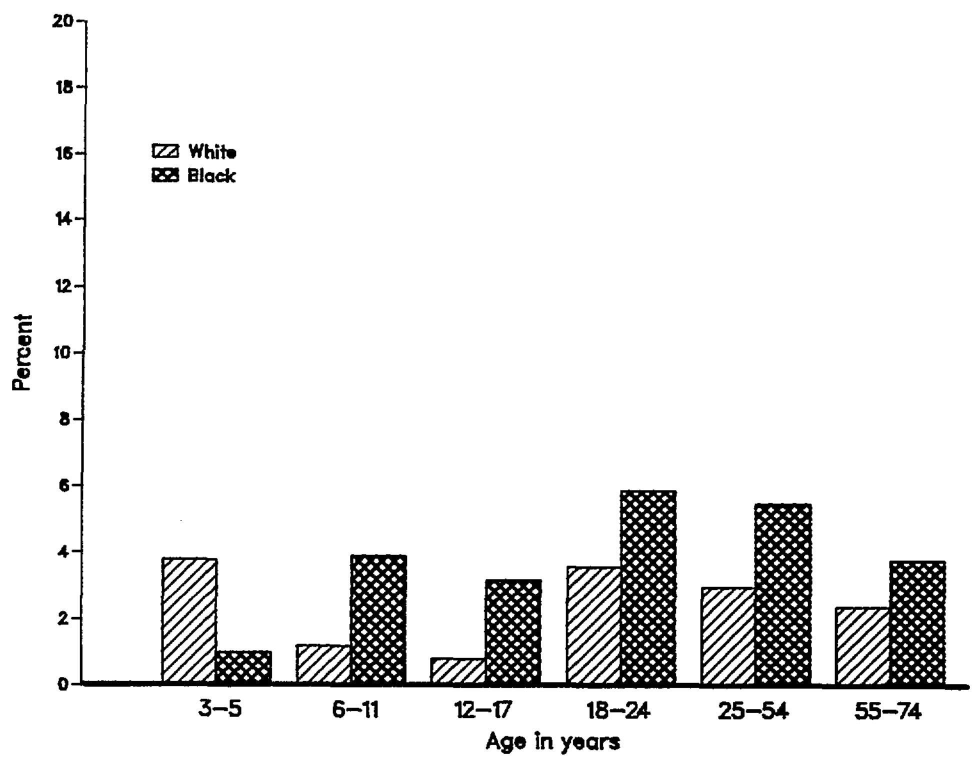
NOTE: Zinc measured in micrograms per deciliter (mcg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Zinc 2–5. Percent of males with low serum zinc, by race and age: 1976-80



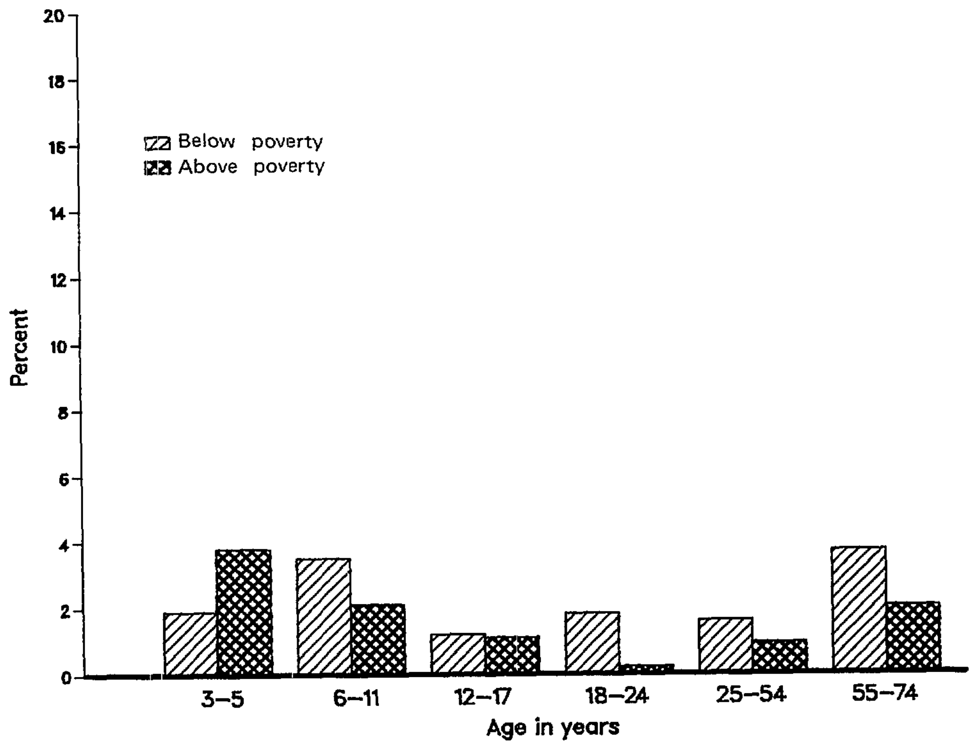
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Zinc 2–6. Percent of females with low serum zinc, by race and age: 1976-80



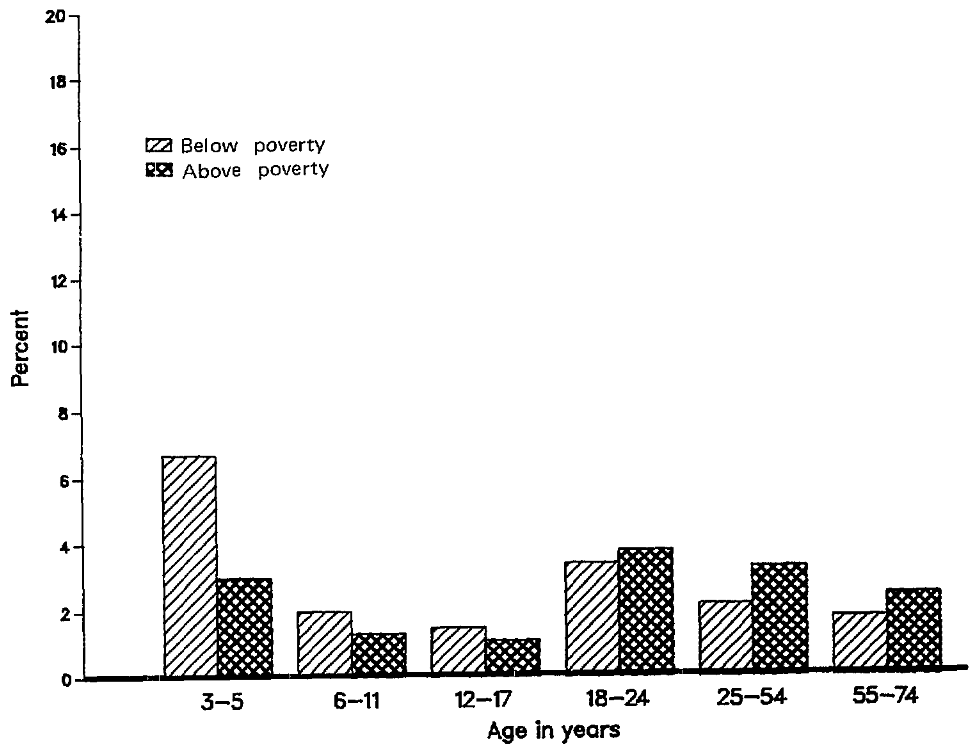
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Zinc 2—7. Percent of males with low serum zinc, by poverty status and age: 1976-80



NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Zinc 2—8. Percent of females with low serum zinc, by poverty status and age: 1976-80



NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

CHAPTER 3

HEALTH CONDITIONS AND BEHAVIORS: RELATIONSHIP TO NUTRITIONAL STATUS

Introduction

This discussion of the nutritional status of the U.S. population would be incomplete without further consideration of the relationship between nutritional status and health. The nutrient-by-nutrient descriptions in Chapter 2 allow examination of the health problems that occur when people have deficits of particular essential nutrients. In this chapter, overall integrators of nutritional status are described, such as children's growth and diseases associated with excesses or deficits of nutrients or food components. While the specifics of many of these relationships are not fully understood, epidemiological, clinical, and animal studies offer insights into the role of nutrition and diet in the maintenance of health and the development of diseases.

This chapter provides a broad overview of current knowledge on diet, nutrition, and selected health conditions and behaviors. A comprehensive review of these topics is beyond the scope of this report. Such a review will be undertaken by the Surgeon General in a report on nutrition and health scheduled for release in 1986.

Nutrition, Mortality, and Morbidity

Diet and nutritional status are associated with several of the leading causes of death in the United States. These include cardiovascular diseases, some cancers, chronic liver disease (notably cirrhosis), and diabetes mellitus. No reliable estimates exist of the extent to which dietary change could reduce morbidity and mortality from these diseases.

The age-adjusted death rates for several selected causes of death declined from 1950 to 1983 (Health 3-1). Because the age distribution of the U.S. population has changed, it is necessary to adjust for age in order to compare death rates in different years. The age-adjusted death rates for cardiovascular diseases (heart disease and cerebrovascular diseases) have declined steadily since 1950 for the white and black populations of both sexes. Age-adjusted death rates for diabetes have decreased since 1950 for white males and females and for black females. However, diabetes death rates have increased for black males, although these rates appear to be leveling off. Age-adjusted death rates for cancer of the respiratory system (associated with cigarette smoking) have increased steadily since 1950 for the white and black populations of both sexes. Death rates for digestive system cancers have decreased for white males and females and for black females but have increased somewhat for black males (National Center for Health Statistics, Dec. 1984).

The downward trend in mortality rates for cardiovascular diseases, diabetes, and digestive system cancers occurred simultaneously with improvements in the diagnosis and treatment of these diseases, growing public awareness of the importance of healthy lifestyles, general improvement in the standard of living, and increased Federal health and nutrition education efforts. The extent to which changes in diet have contributed to this downward trend cannot be quantified.

The Effect of Obesity and Overweight on Health

A recent National Institutes of Health Consensus Development Panel (1985a) on health implications of obesity concluded that the evidence is overwhelming that obesity adversely affects health and longevity. In addition to the psychological burdens associated with obesity, the Consensus Panel found that obesity is clearly associated with hypertension, hypercholesterolemia (elevated or "high-risk" levels of blood cholesterol which put individuals at increased risk of coronary heart disease), non-insulin-dependent diabetes mellitus, certain cancers, and other medical problems.

Obesity is the accumulation of excess body fat. Fat cells increase in size, and in cases of severe obesity the number of fat cells is also increased. The underlying cause of this excessive fat storage is an imbalance between energy intake and energy expenditure. Genetic and environmental factors likely to be involved in the development of obesity include excess energy intake, low physical activity, and metabolic and endocrine abnormalities.

Overweight is excess body weight for height and, for this report, is expressed as body mass index at or above the 85th percentile of the reference population for the second National Health and Nutrition Examination Survey (NHANES II). Overweight estimated this way is an approximation of body fatness.

Data from NHANES II show that the prevalences of diabetes, high-risk serum cholesterol levels, and hypertension are higher among overweight than not overweight persons. The ratio of the prevalence in overweight persons to the prevalence in persons not overweight is called the relative risk. The relative risk of having diabetes, high-risk serum cholesterol level, and hypertension is higher among younger adults (25-44 years of age) who are overweight than among older overweight adults (45-74 years of age). These relative risk estimates, shown in Health 3-2, differ from those used by the Consensus Panel for two reasons. The definitions of high-risk cholesterol levels and hypertension used for the relative risk estimates shown here are the newer definitions discussed in later sections of this chapter. Additionally, the age group of adults discussed in this report (25-74 years) is older than the age group (20-74 years) used by the Consensus Panel.

Diabetes

Diabetes mellitus includes a spectrum of conditions associated with abnormal metabolism of glucose and secretion of insulin. Clinically, insulin-dependent diabetes mellitus (IDDM) is distinguished from non-insulin-dependent diabetes mellitus (NIDDM). Although the usual age of onset, pathology, and treatment of IDDM and NIDDM differ, these distinctions rarely are reflected in available national statistics on diabetes.

Persons with NIDDM are in various demographic and socioeconomic groups, and many factors account for the disorders in their blood sugar regulation. NIDDM has a strong genetic component, but numerous other factors have been linked with its expression, including obesity, drugs (specifically, glucocorticoids and benzothiazide diuretics), and lack of exercise and physical activity. Much research has been conducted to determine how these factors influence the onset of diabetes. Recent research indicates that overeating and weight gain are associated with increased fat cell size and impaired insulin response; starvation and weight loss increase response to insulin (Arky, 1983).

Persons surveyed in NHANES II were considered to have diabetes if results of an oral glucose tolerance test indicated a diabetic condition according to criteria established by the National Diabetes Data Group (1979) or if diabetes was indicated on the participant's medical history. Diabetes prevalence among adults 25-74 years of age was estimated by sex, race, poverty status, overweight status, and age. According to NHANES II data for 1976-80, approximately 7 percent of the total adult population, or an estimated 8.5 million people, were diabetic. Almost all adult diabetics (25-74 years) had NIDDM; IDDM accounted for only one-third of adult diabetics under age 45 and only about 1 percent of adult diabetics age 45 and over. The older age categories had larger percents of diabetics in each of the sex, race, poverty, and overweight categories. The prevalence of diabetes was higher among the following groups: Females (8.2 percent, compared with 6.6 percent for males); the black population (11.2 percent, compared with 7.0 percent for the white population); persons with incomes below poverty level (12.9 percent, compared with 6.8 percent with incomes above poverty level); and overweight persons (13.4 percent, compared with 4.9 percent for persons who were not overweight).

In NHANES II, the percent of adults with diabetes increased from the youngest age group (25-34 years) to the oldest (65-74 years)--from 1.9 to 19.0 percent for males and from 1.5 to 16.5 percent for females (Health 3-3). The prevalence of diabetes was greater among the black than the white population, ranging from 2.3 percent for the youngest black age group to 26.0 percent for the oldest and from 1.3 to 16.9 percent for white persons (Health 3-4). Diabetes was more prevalent among persons with incomes below poverty level (Health 3-5) and overweight persons (Health 3-6).

Cardiovascular Diseases

The term "cardiovascular diseases" pertains to conditions affecting the heart and blood vessels, including coronary heart disease, arteriosclerosis, hypertension, cerebrovascular diseases, and stroke. Heart disease is the leading cause of death in the United States, accounting for more than one-third of all deaths (National Center for Health Statistics, Dec. 1983). Since the mid-1960's, mortality from cardiovascular diseases has declined rapidly (Health 3-7). Many factors have been cited as contributing to this decline--improved medical services, greater availability of coronary care units, advanced surgical and medical treatment of coronary heart disease, improved control of blood pressure, decreased smoking, modified eating habits, and increased exercise.

Epidemiological studies have identified elevated blood cholesterol levels, cigarette smoking, obesity, and elevated blood pressure as major controllable risk factors for coronary heart disease (CHD). A model developed in the Framingham Heart Study (a 30-year prospective study of cardiovascular disease in over 5,000 men and women) was applied to three risk-factor measurements (serum cholesterol, cigarette smoking, and blood pressure) in the first and second National Health and Nutrition Examination Surveys. It appears from survey findings that the joint impact of changes in these three risk factors may account for a substantial portion of the decline in CHD mortality, especially among black individuals (National Center for Health Statistics, Dec. 1983). The Framingham Study has shown obesity to be an independent risk factor for CHD and to affect longevity adversely.

The recently completed Lipid Research Clinics Coronary Primary Prevention Trial (a 7-year double-blind clinical study of 3,800 men with high-risk cholesterol levels) tested the efficacy of lowering cholesterol with drugs to reduce the risk of coronary heart disease (National Heart, Lung, and Blood Institute, 1984). The findings show that treatment reduced total cholesterol by lowering levels of low-density lipoprotein cholesterol. The risk of nonfatal heart attack or death from CHD was significantly reduced as a result of the drug treatment.

In 1979, the American Society for Clinical Nutrition (ASCN) convened a panel of experts to examine all available clinical, human metabolic, epidemiological, and experimental evidence on six dietary components that were thought to bear heavily on the prevalence of cardiovascular diseases in the Western world (American Society for Clinical Nutrition Symposium, 1979). The components investigated were dietary cholesterol, saturated and unsaturated dietary fat, carbohydrate, excess calories, alcohol, and dietary sodium. ASCN and other findings on each of these topic areas will be discussed individually.

- Dietary and serum cholesterol--In comparisons of large population groups, a strong association was found among cholesterol intake, serum cholesterol concentration, and mortality from atherosclerotic disease. It has not been possible to show that any substantial part of this association is due to an independent effect of dietary cholesterol.

  Serum cholesterol levels were measured in NHANES II. Mean serum cholesterol levels for both males and females did not differ by race and differed only slightly by poverty status (Health 3-8 through 3-11).

  High-risk levels of serum cholesterol (Health 3-12 through 3-15) are defined as levels of more than 220 milligrams per deciliter of blood for persons 20-29 years of age, more than 240 for persons 30-39 years, and more than 260 for persons 40 years of age or older. These levels were chosen by a National Institutes of Health Consensus Development Panel (1985a) and represent the serum cholesterol values at or above the 90th percentile in the Lipid Research Clinics Prevalence Study of the National Heart, Lung, and Blood Institute. The prevalence of high-risk serum cholesterol levels was not significantly different by race for either sex. Women, regardless of race, showed the highest prevalences (about 35 percent) in the older age groups, 55-64 and 65-74 years, and lower prevalences at younger ages. The prevalence of high-risk serum cholesterol levels was higher in the group above poverty level than for the group below poverty level for males 35 years and over (about 21 percent vs. 13 percent) and for females 55 years and over (about 36 percent vs. 29 percent). For males 25-34 years, the prevalence was higher in the below-poverty group, and for females 25-54 years, there was little difference in prevalence based on poverty status.

  A comparison of mean values found in three national surveys conducted over 20 years shows a significant decrease in cholesterol levels for both men and women (Health 3-16). Both sexes had lower values in 1971-74 than in 1960-62. Changes in mean cholesterol values from 1971-74 to 1976-80 are not statistically significant for men or women. The 1976-80 data suggest, however, that the downward trend is continuing.

- Dietary fat--In most comparisons of large population groups, a strong association has been found between saturated fat and cholesterol intakes, plasma cholesterol concentrations, and mortality rates from atherosclerotic disease. However, it has not been possible to determine what part of this association is due to an independent effect of dietary fat quality or quantity.

- Carbohydrate--No consistent and independent relationship has been established between the intake of sucrose or other carbohydrates and the incidence or prevalence of coronary heart disease.

- Excess calories--The relationship of obesity to heart disease is complex. Obesity is a risk factor for hypertension and for abnormalities in blood lipids. Since both blood pressure and lipid levels are correlated with heart disease, researchers have not always evaluated the independent correlation of obesity with heart disease. However, statistical analyses have shown a significant independent correlation between obesity and some manifestations of coronary artery disease.

- Alcohol--The association between alcohol intake and atherosclerotic disease is neither strong nor consistent. Some studies have suggested that consumption of up to 2 ounces of alcohol per day may be protective; alcoholism, however, is linked directly to heart disease (Alcohol, Drug Abuse, and Mental Health Administration, 1983).

- Dietary sodium and hypertension--Dietary sodium, calcium, potassium, and several other nutrients may be involved in biochemical mechanisms that regulate blood pressure. The net effect of most nutrients on cardiovascular physiology and hypertension is still unknown.

  The ASCN panel found the relationship between dietary sodium and the prevalence of hypertension to be consistent throughout the world, with the highest hypertension rates found in populations ingesting the most sodium. There was also a strong association between sodium intake and the prevalence of hypertension within population groups.

  The 1984 report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure stated that a diagnosis of hypertension in adults is confirmed when the average of two or more diastolic blood pressures on at least two occasions is 90 millimeters of mercury (mm Hg) or higher and/or the average of multiple systolic blood pressures on at least two occasions is consistently at or higher than 140 mm Hg. In NHANES II, persons were classified as hypertensive if their average systolic or diastolic blood pressures were at or above the 140/90 mm Hg level or if they reported during the medical history interview that they were taking antihypertensive medication. Use of the 140 and 90 mm Hg levels is based mainly on long-term epidemiological studies relating initial blood pressure levels to the development of cardiovascular diseases.

  The factors influencing development of hypertension in adults include the interactions of a large number of genetic and environmental variables as well as nutritional factors. The relationships among these variables are complex and unclear (McCarron et al., 1983; National Heart, Lung, and Blood Institute, 1982).

Hypertension is a clinical condition that affects 60 million Americans (Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure, 1984). The prevalence of hypertension among adults 25-74 years of age has not changed consistently or greatly among the time periods 1960-62, 1971-74, and 1976-80 (Health 3-17).

The principal demographic characteristics of Americans having high blood pressure are well established. The prevalence of hypertension increases with age, and young men are at greater risk than young women (Health 3-18 and 3-19). After age 55, however, the prevalence of hypertension increases more in women than in men. Black persons are at greater risk of hypertension than white persons of the same age and sex. As overweight and obesity increase in a population, so does the risk of hypertension. The higher prevalence of overweight in the population below poverty level may explain the high prevalence of hypertension in that group (Health 3-20 and 3-21).

As a group, hypertensive patients are overweight, averaging about 130 percent of ideal weight. Blair et al. (1984) examined the relationship between blood pressure and the distribution of subcutaneous body fat found in the first National Health and Nutrition Examination Survey among participants aged 30-59 years. Triceps and subscapular skinfolds were used as approximations of peripheral and centrally located body fat, respectively. Findings from this study suggest that the risk of high blood pressure is a function not only of total fatness but also of how fat is distributed on the body. Risk of high blood pressure is higher when excess fat is deposited on the trunk (as measured by the subscapular skinfold thickness) than when it is deposited in more peripheral sites such as arms, legs, and hips (as measured by the triceps skinfold thickness).

Cancer

Cancers (malignant tumors or malignant neoplasms) are populations of cells in the body that multiply and spread without the restraints limiting the growth of normal cells. Cancer is the second leading cause of death in the United States, exceeded only by heart disease. Health 3-22 shows 1950 and 1982 U.S. age-adjusted death rates for malignant neoplasms, by race and sex. There has been a gradual increase in the age-adjusted death rate for the total population from 125.4 deaths per 100,000 in 1950 to 132.5 in 1982 (National Center for Health Statistics, Dec. 1984). Increases in death rates from cancer have been greatest in older age groups and for males. Death rates for females have decreased slightly. Excluding cancer of the respiratory tract (mostly lung cancer), age-adjusted cancer mortality rates have remained stable for the last 30 years.

The most common form of cancer in Western nations is lung cancer, which is related to cigarette smoking. Cancers that have been associated with diet include cancers of the stomach, colon, rectum, pancreas, breast, and uterus. Data on hospital discharges were obtained through the 1982 Hospital Discharge Survey, conducted by the National Center for Health Statistics. Of those cancers that may be diet related, breast, colon, and uterine cancer were the most frequent discharge diagnoses for females; colon, rectum, and stomach cancer were the most frequent discharge diagnoses for males.

Carcinogenesis (the production and growth of cancer) is a multifaceted process influenced by genetics, lifestyle, culture, health status, exposure to specific carcinogens, and other unknown factors. Apart from smoking, the causes of most cancers do not bear a simple and direct relationship to environmental and lifestyle factors.

The relationships of nutrition, diet, and cancer can be viewed from four perspectives: (1) Diet as a possible factor in cancer causation; (2) diet as a possible factor in cancer prevention; (3) the effect of cancer and its treatment on nutritional status; and (4) nutritional management of cancer patients. This discussion is limited to the first area.

Findings from epidemiological, clinical, and laboratory studies have indicated a number of highly suggestive associations between diet and cancer, but there is no absolute proof of a direct cause-effect relationship in humans. An expert committee of the National Research Council (1982) recently reviewed the literature on the relationship between diet and cancer and reached the following conclusions.

- Fat--"Both epidemiological studies and experiments in animals provide convincing evidence that increasing the intake of total fat increases the incidence of cancer at certain sites, particularly the breast and colon, and conversely, that the risk is lower with lower intakes of fat" (National Research Council, 1982).

- Protein--Evidence from both epidemiological and laboratory studies suggests that high protein intake may be associated with increased risk of cancers at certain sites. However, fat and protein intakes are correlated, and the limited data available on protein compared with fat make a judgment on the independent effect of protein difficult. Findings from laboratory studies suggest that protein may affect the initiation phase of carcinogenesis and the subsequent growth and development of neoplasms.

- Carbohydrate--Data are insufficient to draw conclusions regarding the role of sucrose and starch intakes in carcinogenesis. There is no conclusive evidence to indicate that dietary fiber (such as that present in certain fruits, vegetables, grains, and cereals) exerts a protective effect against cancer of the colon and rectum in humans. Laboratory findings suggest that, if there is such an effect, specific components of fiber rather than total fiber are likely to be responsible.

- Vitamins A, C, E, and B-complex--Laboratory evidence indicates that vitamin A and many of the carotenoids (a group of plant pigments found in some flowers, fruits, and vegetables) inhibit chemically induced neoplasia of the breast, urinary bladder, skin, and lung in animals. Epidemiological evidence suggests that consumption of foods rich in carotenes or vitamin A is associated with a reduced risk of cancer. No evidence supports the idea that vitamin A supplements reduce the risk of cancer.

  Limited evidence suggests that vitamin C can inhibit the formation of some neoplasms. The consumption of foods containing vitamin C is associated with a lower risk of cancers of the stomach and esophagus.

  Data are not sufficient to permit firm conclusions about the effect of vitamins E and B-complex on cancer in humans.

- Minerals--Selenium and iron are the only two minerals about which there are enough data to permit conclusions. Data from epidemiological and laboratory studies suggest that selenium may offer some protection against the risk of cancer. However, the range between safe and toxic levels of selenium intake is narrow. Iron deficiency has been related, by indirect mechanisms, to upper alimentary tract cancer and gastric cancer. Results of animal experiments suggest that iron deficiency increases susceptibility to some chemically induced tumors.

The National Research Council committee pointed to epidemiological evidence suggesting that the consumption of certain vegetables is associated with a reduction in the incidence of cancer of the lung, bladder, larynx, esophagus, stomach, colon/rectum, and prostate. The most beneficial vegetables were carotene-rich vegetables (dark green and yellow) and cruciferous vegetables, such as cabbage, broccoli, cauliflower, and brussels sprouts.

Osteoporosis

Osteoporosis is associated with aging and is characterized by decreased bone mass and increased susceptibility to fractures. Although all bones are affected, fractures of the spine, wrist, and hip are typical. Osteoporosis is the most common of the metabolic bone diseases, with more than 90 percent of the cases of unknown origin. Less than 10 percent of osteoporosis cases are associated with causative diseases such as hyperthyroidism, hyperadrenocorticism, scurvy, and hypogonadism (Olson, 1983).

Although osteoporosis is a common condition, good estimates of its prevalence are lacking. In a recent conference on osteoporosis (National Institutes of Health Consensus Development Panel, 1984), it was estimated that as many as 15-20 million Americans may be affected. Approximately 1.3 million fractures attributable to osteoporosis occur each year in people aged 45 years and over. Of people who live to be 90 years old, 32 percent of women and 17 percent of men will suffer a hip fracture, most due to osteoporosis.

Complex cellular, physiological, and metabolic factors may underlie the pathogenesis of osteoporosis. Diet, intestinal function, and renal function influence the mineral balance needed to maintain the skeleton. The formation and resorption of bone are also modified by external physical forces such as those generated by body weight and exercise. Calcium deficiency is implicated in osteoporosis, since research shows that low calcium intake is common among elderly people and calcium supplementation reduces bone loss. The National Institutes of Health Consensus Development Panel suggested that calcium intake be increased to recommended levels, either by diet or by supplements, for both elderly men and middle-aged and elderly women.

Bone mass declines with age in all people. The rate of decline is related to sex, age at menopause, race, and body weight for height. Women are at higher risk than men in that women have less bone mass, and, for several years following natural or induced menopause, the rate of bone mass decline is accelerated. Early menopause is one of the strongest predictors of the development of osteoporosis. Estrogen therapy is very effective in preventing osteoporosis in women because it slows or halts postmenopausal bone loss. White women are at much higher risk than black women, and white men are at higher risk than black men. Women who are underweight are more likely than overweight women to have osteoporosis. Cigarette smoking may be an additional predictor of risk.

Immobilization and prolonged bed rest produce rapid bone loss, while exercise that involves bearing weight has been shown both to reduce bone loss and to increase bone mass. The optimal type and amount of physical activity for prevention of osteoporosis have not been established. Exercise sufficient to induce amenorrhea in young women may lead to decreased bone mass.

The relationship of osteoporosis to hereditary factors and to dietary factors, such as alcohol, vitamins A and C, fluoride, magnesium, and protein, is not firmly established. These factors may act indirectly through their effect on calcium metabolism or body weight.

Low Birth Weight

Most infant deaths occur during the first month of life. Infant deaths are usually the result of premature birth or insufficient fetal growth, as both result in low birth weight. Infants born weighing less than 2,500 grams (about 5.5 pounds) are considered low-birth-weight infants. Low-birth-weight babies are 40 times more likely to die in the first 4 weeks of life than their counterparts of normal birth weight are. The relative risk of death during the first 4 weeks for a baby of very low birth weight (less than 1,500 grams) is nearly 200 times that of a baby of normal birth weight (National Academy of Sciences, Institute of Medicine, 1985).

Low birth weight is also associated with increased morbidity, including higher incidence of poor postnatal growth, congenital abnormalities, and increased susceptibility to infection. Low birth weight can occur in full-term infants as well as those born prematurely. Prematurity (young gestational age) is detrimental in its own right, above and beyond its effect on birth weight.

The proportion of infants born with low birth weight is higher among the black than the white population. This proportion decreased slightly in both races from 1968-70 to 1978-80 (Health 3-23), but the gap between the races has remained the same or widened. In 1982, the rate of low birth weight for total live births was 6.8 percent. The 1982 rate for black infants was 12.4 percent, more than double the rate for white infants--5.6 percent.

In animals, severe food energy and protein deficiencies can lead to fetal death or low birth weight, while lesser nutritional deficits may be compensated for by functional adaptation of the placenta and mobilization of the mother's own tissue stores to nourish the fetus (Munro et al., 1983). The results from human studies are neither as consistent nor as conclusive as those from animal studies. A number of factors may act singly or in combination to cause low birth weight. These include lack of prenatal care, poor nutrition, low maternal weight gain, certain diseases or health conditions, smoking, alcohol and drug abuse, both very young and old maternal age, low socioeconomic status, unmarried status, and short interpregnancy interval (National Academy of Sciences, Institute of Medicine, 1985). These are factors often associated with poverty, which also affects diet.

Studies of the relationship of maternal nutritional status to birth outcome have been complicated by the need to account for these many confounding variables, which are themselves due to lack of prenatal care and poor hygiene and health habits. Thus, the National Academy of Sciences, Institute of Medicine report (1985) on low birth weight concluded that "nutritional intake, estimated directly from dietary surveys, has proved to be inconsistently related to birth outcomes" (p. 66).

Results of prenatal nutritional supplementation intervention studies in the United States have shown little or no increase in infant birth weights. Protein and caloric supplementation have been more effective in underweight women, who are at risk of producing low-birth-weight infants, than in adequately fed women (Stein et al., 1978). In developing countries, where both poor nutrition and low birth weight are more prevalent, dietary supplements can be effective in reducing the incidence of low birth weight.

It seems clear that poor nutritional status before pregnancy and inadequate nutritional consumption during pregnancy, if severe enough, increase the risk of producing a baby of low birth weight. However, this does not appear to be a major cause of low birth weight in the United States.

Dietary Behaviors That May Affect Health

This section includes discussions of breast-feeding trends and vitamin and/or mineral supplement usage. These are only two of many types of behaviors which may affect nutritional status and health. Other such behaviors include exercise, smoking, alcohol consumption, drug use, and, of course, eating disorders such as bulimia and anorexia.

Breast Feeding

For millennia infants have thrived on breast milk. No food has proven more beneficial for healthy babies in their first months of life. In areas where sanitation is poor, full breast feeding is life saving during these first months, and supplemental breast feeding appears to be beneficial for some time thereafter. On the other hand, the Task Force on the Assessment of the Scientific Evidence Relating to Infant Feeding Practices and Infant Health (1984) found that the health benefits associated with breast feeding are modest in populations with good sanitation, nutrition, and medical care. Technological advances in infant formula appear to have made bottle feeding an adequate alternative for those who cannot establish satisfactory breast feeding or who decide in favor of early termination. Previously reported reduction in the rates of respiratory illness among breast-fed infants may be attributable to socioeconomic and other differences (such as parental smoking) between feeding groups rather than to the feeding methods alone. However, protective effects may exist with regard to gastroenteritis, the evidence being somewhat stronger among populations where infant morbidity and mortality are high. Recent investigations also indicate that breast feeding has a protective effect against middle ear infection (otitis media). Thus, the Surgeon General has set a goal to encourage more mothers to breast feed, so that by 1990 at least 75 percent of newborn infants will be breast fed (Office of Disease Prevention and Health Promotion, 1983b). Given present knowledge, the American Academy of Pediatrics, Committee on Nutrition (1980) recommends breast feeding as the sole source of nutrition for the first 6 months of life, supplemented with vitamin D, fluoride, and, after 4 months, iron.

The adequacy of breast milk as the sole food source for babies is related to the mother's diet during pregnancy and lactation; maternal energy reserves in the form of stored fat; fetal nutrient stores (mainly in the liver); gestational stage; and especially the age of the infant. Most nutritional deficiencies in breast-feeding infants occur after 6 months of breast feeding only, at which time complementary feeding should be established. Other reported deficiencies in normal full-term infants breast fed by apparently healthy women consuming conventional diets are very rare (Task Force on the Assessment of the Scientific Evidence Relating to Infant Feeding Practices and Infant Health, 1984). Metabolic defects of the mother or infant which might contraindicate breast feeding are also rare. Beyond its nutritional and immunological benefits, breast feeding provides other advantages, including the promotion of an emotional bond between mother and child.

In the late 1930's about three-fourths of first-born infants were breast fed, but by the late 1960's this proportion had declined to approximately one-fourth (Task Force on the Assessment of the Scientific Evidence Relating to Infant Feeding Practices and Infant Health, 1984). Prior to the 1960's, lower income women were more likely to breast feed than were higher income women. However, the subsequent decline was more rapid among the disadvantaged.

Breast feeding of first-born infants began to increase in the 1970's and since then its incidence has grown steadily, especially among the well-to-do and better educated. This upward trend has not been consistent across income or racial groups. In the 1970's, black women were less likely than white women to breast feed regardless of educational level, employment status, or type of prenatal care.

Market research surveys conducted by Ross Laboratories are the most current source of data on infant feeding practices (Martinez, 1984). They show that more than 60 percent of infants were breast fed in the hospital in 1983 (Health 3-24). The market surveys also show that the proportion of infants who were breast fed for 3 months or more increased to 40 percent in 1983.

Vitamin and/or Mineral Supplement Usage

In the past, eating food was virtually the only way to supply nutrients to the body. In more recent years, nutrients have been sold over the counter as specially formulated tablets, pills, wafers, powders, or liquids containing vitamins, minerals, protein, carbohydrate, lipids, or some combination of these. Because of the high use of supplements, concerns about potential toxicity and nutrient imbalances have increased.

Estimates of supplement use vary extensively, depending on the definition of "supplement" used by the researchers, the wording of the question in relation to time period of ingestion, and the sample population. For example, surveys administered by the Food and Drug Administration found that 55 percent of the sampled population took supplements in 1973-74 and 47 percent in 1975. However, in 1980 pharmaceutical companies estimated that 20 to 30 percent of households used supplements.

Although estimates of the population taking supplements vary, a few generalizations may be made. More women than men take supplements, and the more educated take more supplements than the less educated do. Additionally, it has been found that many older Americans are spending a great deal of money on nutritional supplements (Hale et al., 1982; Garry et al., 1982).

The concern regarding vitamin and/or mineral supplement usage relates to the consumption of high doses of any physiologically active substance. The National Academy of Sciences, Food and Nutrition Board, Committee on Dietary Allowances (National Research Council, 1980a) has stated that no convincing evidence exists to substantiate claims of unique health benefits accruing from consumption of a large excess of any one nutrient. Excessive intake of any supplement by a considerable number of individuals, particularly self-prescribed supplements, is a potential public health concern.

Growth Retardation

Rapid growth is characteristic of healthy well-fed children. To sustain growth, the child's diet must supply essential nutrients in appropriate quantities. Inadequate supplies of protein, fats, carbohydrates, vitamins, or minerals can result in growth retardation. If the dietary inadequacy is chronic and mild, the child's linear growth will be slowed, and his height will be low for his age. This condition is termed "stunting." If energy intake inadequacy is severe, the child will lose weight and will have a low weight-to-height ratio. This condition is termed "wasting," sometimes called "thinness."

Although a nutritionally adequate diet is necessary for growth, diet is not the only determinant of a child's growth. Infections and parasitic diseases can decrease appetite and increase nutrient requirements, compromising an afflicted child's nutritional status. Psychological and social factors, such as sudden cessation of breast feeding or family instability, can also contribute to growth failure in children. Most of these factors cause reduced dietary intake, but some illnesses stunt growth by other mechanisms.

Information on the prevalence of growth retardation among children is available from two activities conducted as part of the National Nutrition Monitoring System--the National Health and Nutrition Examination Survey and the Coordinated State Surveillance System. In both, participating children are actually weighed and measured.

To determine whether a child's growth is retarded, his height and weight are compared with growth charts. The charts used were developed by the National Center for Health Statistics (NCHS) and the Centers for Disease Control (CDC) using data from the Fels Institute, the NCHS Health Examination Surveys, and the first NCHS National Health and Nutrition Examination Survey. The growth charts represent the distribution of heights and weights one would expect to find in a healthy, or reference, population. In population surveys, if more than 5 percent of the children fall below the 5th percentile of height for age, then one would be concerned about stunting. Similarly, if more than 5 percent fall below the 5th percentile of weight for height, then one would be concerned about wasting.

Information on the prevalence of stunting and wasting (Health 3-25 through 3-28) was gathered in the second National Health and Nutrition Examination Survey. Stunting was consistently higher among the population below poverty level than among persons above poverty level (Health 3-26).

NCHS growth curves showing weight-by-height percentiles are available only for prepubescent boys and girls, since the relationship between weight and height is independent of age only in children prior to puberty (National Center for Health Statistics, 1977b). Therefore, it is possible to show the prevalence of wasting for children under 10 years of age only. Wasting seems to be related to race, with more black than white children falling below the 5th percentile (Health 3-27), although the prevalence for both races is quite low. There is no difference in prevalence between the sexes. Poverty status is not consistently related to wasting, but a possible problem area is seen in boys 6-9 years of age below poverty level (Health 3-28).

In 1973, the Centers for Disease Control began working with five States to develop a system for continuous monitoring of the nutritional status of high-risk population groups. This system, the Pediatric Nutrition Surveillance System, is part of the Coordinated State Surveillance System. The data base for the system consists of data obtained from selected health service delivery programs, such as Maternal and Child Health; Early and Periodic Screening, Diagnosis, and Treatment; the Special Supplemental Food Program for Women, Infants, and Children; and Head Start. In the 1980's the Pediatric Surveillance System expanded to over 34 States.

CDC surveillance data on the prevalence of stunting and wasting among children for the years 1976-84 are shown in Health 3-29 through 3-32. In 1984, 7-13 percent of children fell below the 5th percentile, which is the criterion chosen to define "stunting." Substantial variations in stunting occur among ethnic and racial groups. The finding of a higher rate of stunting among Asian children beginning in 1978 (in large part, representing Southeast Asian refugee children) indicates the sensitivity of the CDC Pediatric Nutrition Surveillance System in detecting children with growth stunting.

The norms for determining the prevalence of stunting are based on a racially mixed population, and race-specific growth charts are not available. Therefore, one could question whether race-specific prevalences for the CDC children reflect racial and ethnic differences in body structure instead of differences between the CDC population and the NCHS reference population that are due to environmental factors such as nutritional status, health care, and socioeconomic status. The NCHS growth charts, which are not race specific, have been adopted for use by the World Health Organization and are recommended for use in all racial and ethnic groups. Several researchers have investigated racial or ethnic differences in body size and concluded that, for prepubescent children, genetic differences are insignificant when compared with environmental differences in their effect on average body size (Habicht et al., 1974). Regardless of race, children in foreign countries who are socioeconomically similar to U.S. children have average weights and heights quite similar to those in the NCHS reference population (Stephenson et al., 1983).

If the higher prevalences of stunting found among Asian children in the CDC survey were due to use of reference standards that did not adequately control for racial differences in body structure, one would see a constant difference in the prevalences over the 9-year period shown in Health 3-29 through 3-32. Since the higher prevalences fluctuate over time and seem to coincide with the influx of refugee children from Southeast Asia, it is assumed that the higher rates of stunting in Asian children in the CDC survey are the result of poor health care, inadequate nutrition, and other environmental differences between these Asian children receiving government health services and the other children in the CDC population.

The CDC data are based on children who are in low-income families participating in government-supported service programs, so that group would be less representative of the total U.S. population with respect to poverty status and related characteristics than the NHANES sample was. This fact helps to explain the higher prevalence of stunting seen in the CDC charts as opposed to the NHANES charts and to explain why the CDC surveillance population is at higher risk than the reference population that was used to establish the 5th percentile criterion. The CDC surveillance system seems to be sensitive enough to detect trends in nutritional status among persons seeking health services.

The prevalence of wasting, or low weight for height, for children under 2 years and 2-5 years of age is close to or below 5 percent (Health 3-31 and 3-32). This indicates that wasting does not constitute a significant health problem in the surveillance population as compared with the reference population.

Dental Caries

Dental diseases constitute one of the Nation's most prevalent health problems. The most common oral disease is dental caries (tooth decay), which affects 95 percent of Americans (National Center for Health Statistics, Dec. 1983). Bacterial fermentation of dietary sugars produces acid that dissolves tooth enamel. However, a number of factors operate to limit the acid's destructive capacity. The presence of other bacteria may buffer the acidity change because some bacteria produce alkali rather than acid. Saliva, stimulated by the ingestion of food, both dilutes the food and buffers the acid produced.

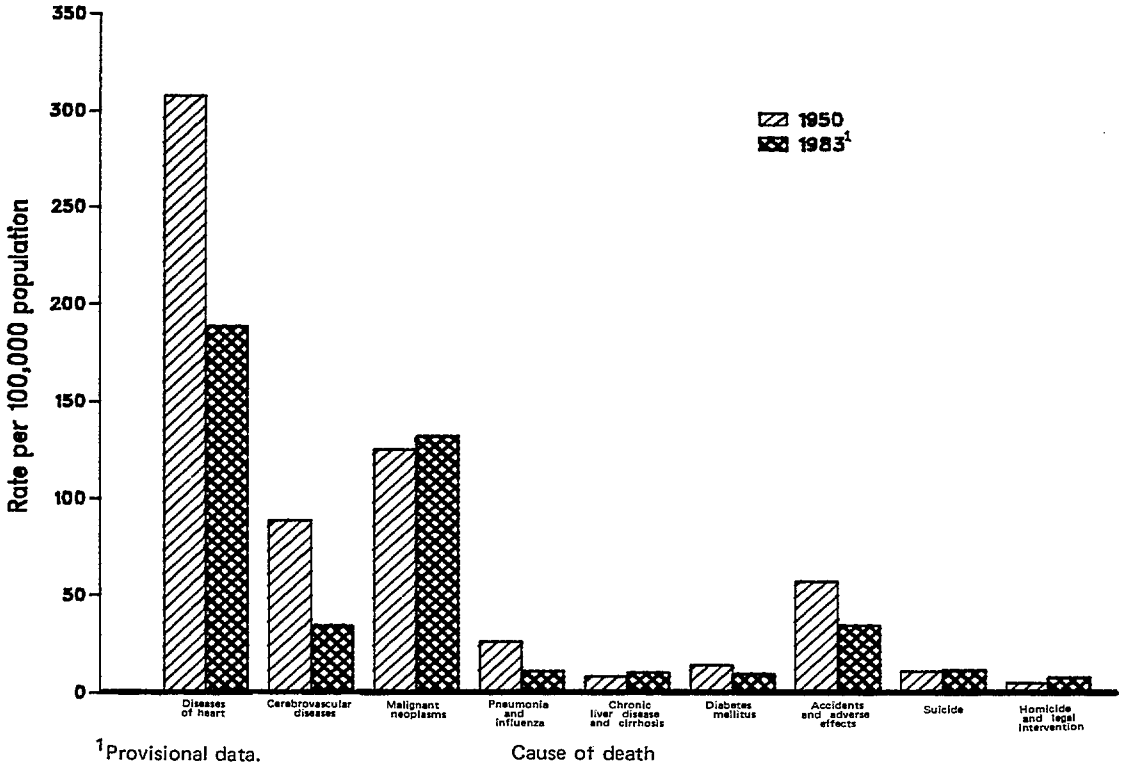
When fluoride from diet, supplements, or topical application is incorporated into the tooth enamel, a harder enamel that is more resistant to acid destruction is produced. Studies in both humans and lower animals have shown that consumption of optimal levels of fluoride during tooth development results in a lower incidence of dental caries after tooth development is completed. Fluoride exists in very small amounts in nearly all foods and water supplies. Seafood and tea leaves contain larger quantities of fluoride than most foods. Fluoride ingested from drinking water, regardless of whether the water was naturally or deliberately fluoridated, has proven to be beneficial in reducing the incidence of tooth decay in persons who drank optimal amounts of fluoridated water during childhood (Goodhart and Shils, 1980). Additionally, susceptibility to dental caries may depend on specific individual immune responses and on the use of antibiotics and antiseptics. Adequate dental health requires proper hygiene, including the regular removal of plaque by mechanical means, such as brushing and using dental floss.

The incidence of caries is highest among children 5-17 years of age (National Institute of Dental Research, 1981). The National Institute of Dental Research conducted a survey of the prevalence of dental caries in a representative sample of school-age children during the 1979-80 school year. The caries prevalence in the permanent teeth of children aged 5-17 years was estimated to be 2.91 decayed, missing, or filled teeth per child, affecting, on the average, 4.77 tooth surfaces.

In the age group 5-17 years, the prevalence of dental caries increased with age (Health 3-33) and was slightly higher in females than males. Of the 45.3 million U.S. children in this age group, 16.6 million (36.6 percent) were estimated to be completely free of dental caries. At the other extreme, 3.5 million (7.7 percent) had nine or more decayed or filled teeth or missing permanent teeth (Health 3-34).

There is a reasonably consistent relationship between the frequency of sucrose consumption and the incidence of dental caries (Bierman, 1979). The National Center for Health Statistics (Jan. 1982) investigated the relationship between diet and dental health using data from the first National Health and Nutrition Examination Survey. No statistically significant relationship was found between the decayed, missing, and filled teeth (DMFT) index and the ratio of calcium to phosphorus in the diet, the calcium-to-phosphorus ratio in blood serum, or the levels of intake of specific nutrients. There was little statistical evidence to support a clinical relationship between DMFT experience and total caloric intake of sugar-rich foods (meaning those ingested both with and between meals). There was, however, a direct, strong, and statistically significant relationship between DMFT experience and the frequency of intake of sugary snacks between meals for all age groups 6-64 years.

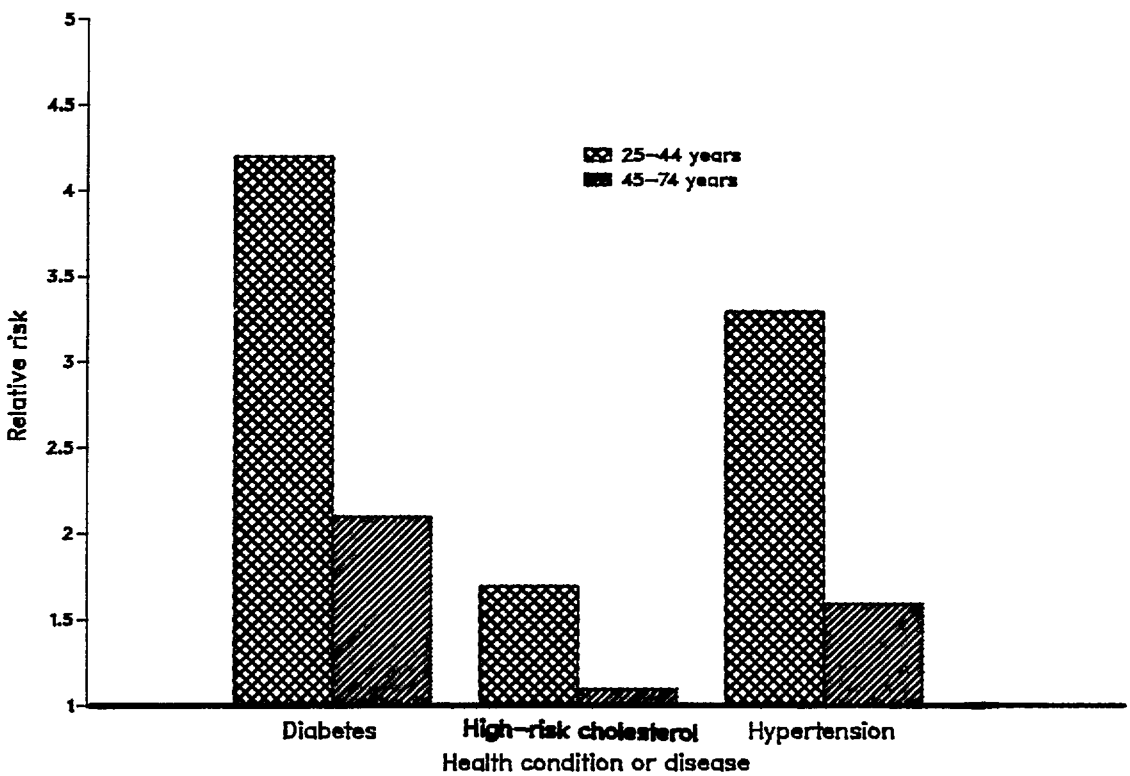
Health 3—1. Age-adjusted death rates for selected causes of death: 1950 and 1983



[1]Provisional data.

SOURCE: USDHHS: Data from the National Vital Statistics System.

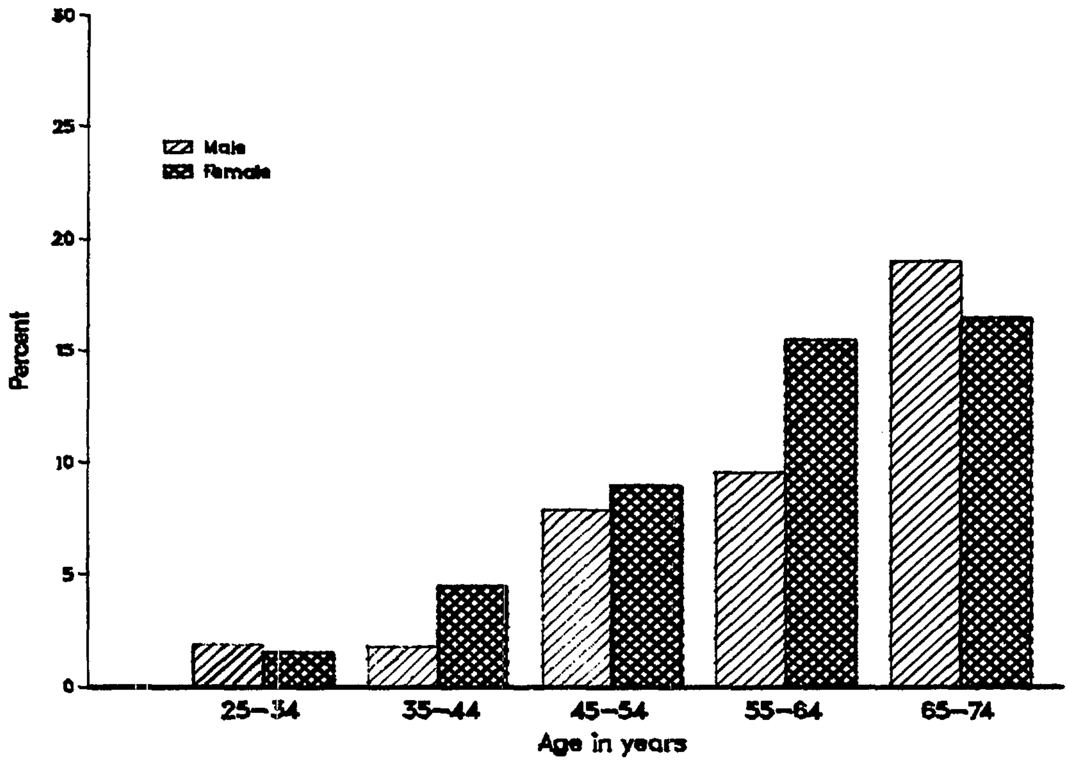
Health 3—2. Relative risk of diabetes, high-risk serum cholesterol level, and hypertension for overweight persons (relative to not overweight persons), by age: 1976-80



NOTE: See text for definitions.

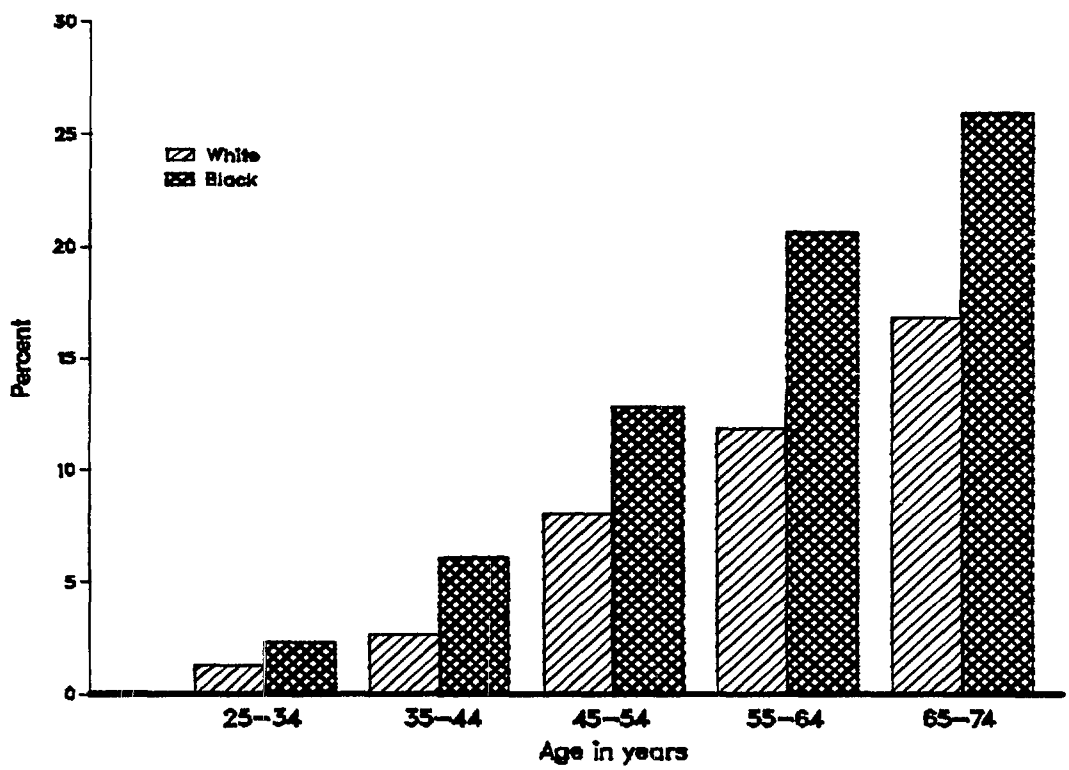
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—3. Percent of adults with diabetes, by sex and age: 1976-80



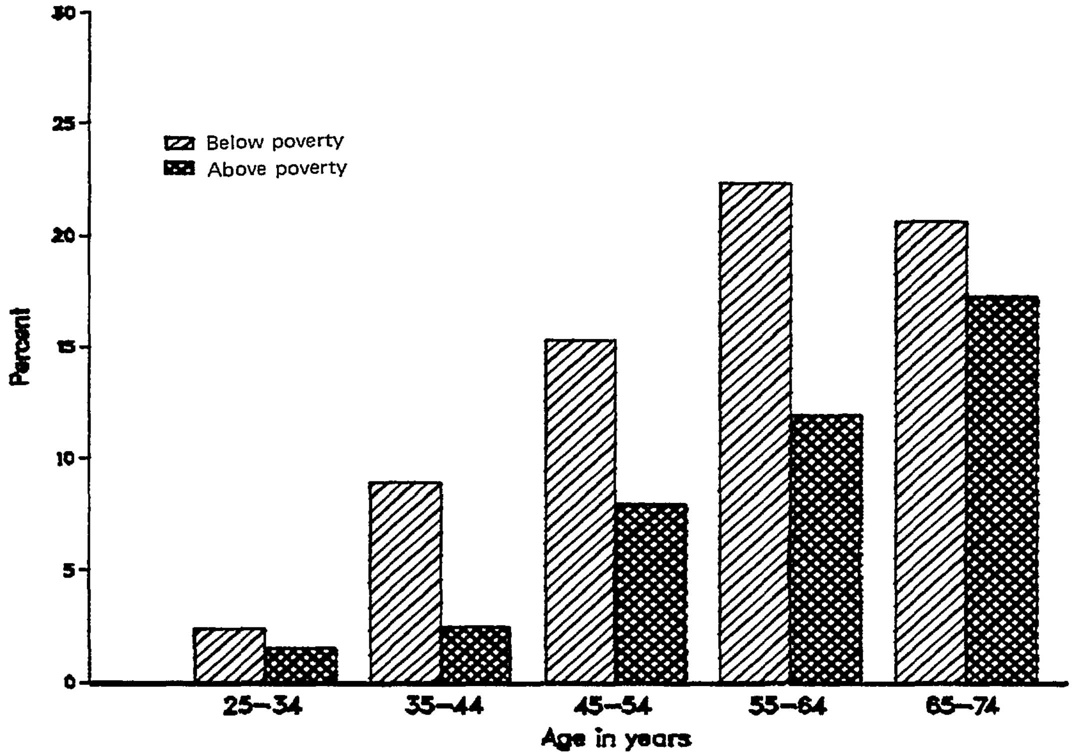
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—4. Percent of adults with diabetes, by race and age: 1976-80



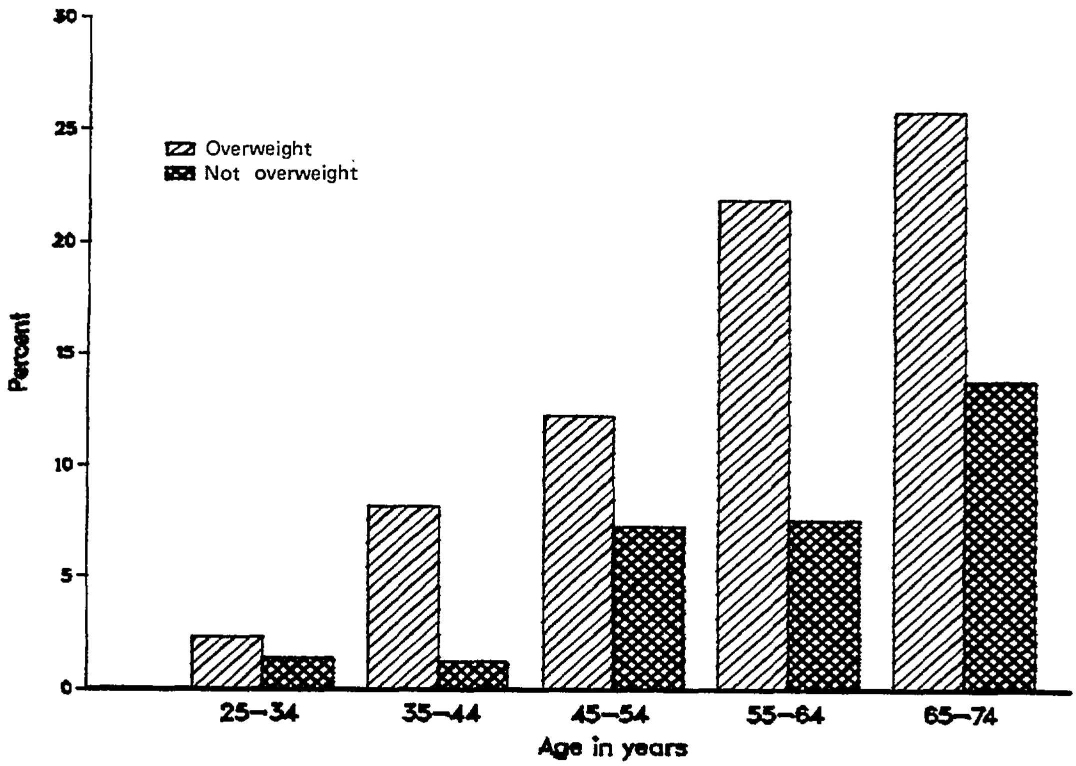
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—5. Percent of adults with diabetes, by poverty status and age: 1976-80



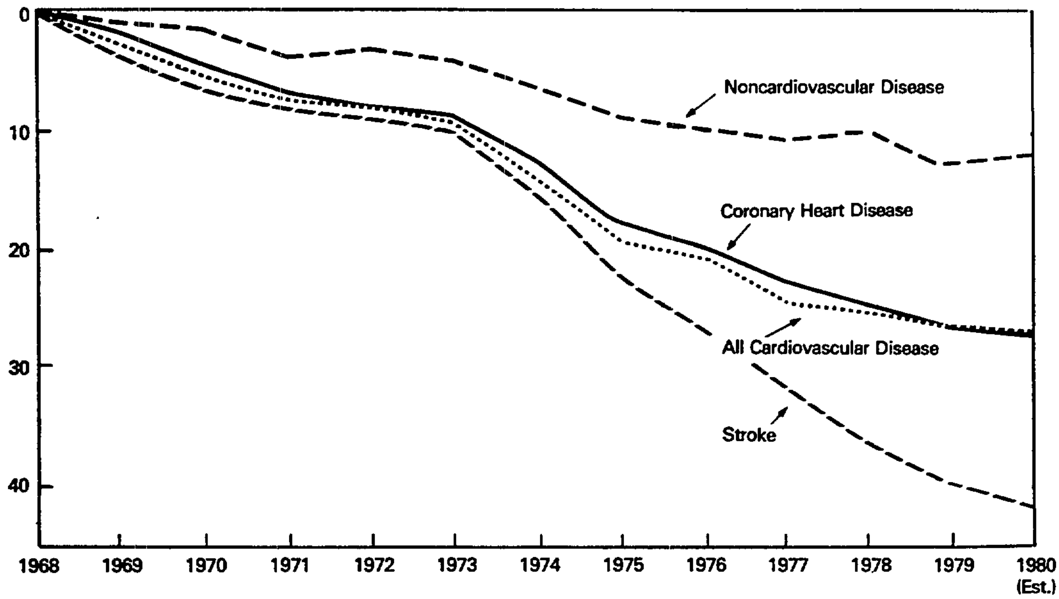
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—6. Percent of adults with diabetes, by overweight status and age: 1976-80



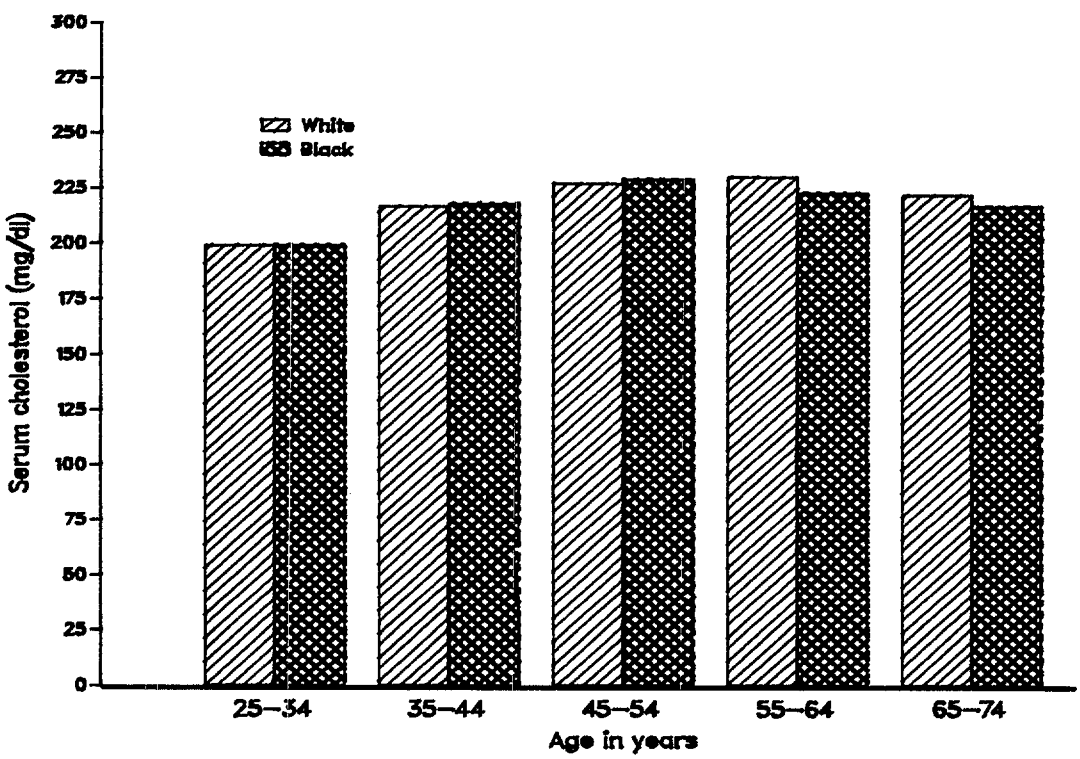
NOTE: Pregnant females are excluded. See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3–7. Trends in cardiovascular disease and noncardiovascular disease, decline by age-adjusted death rates: 1968-80



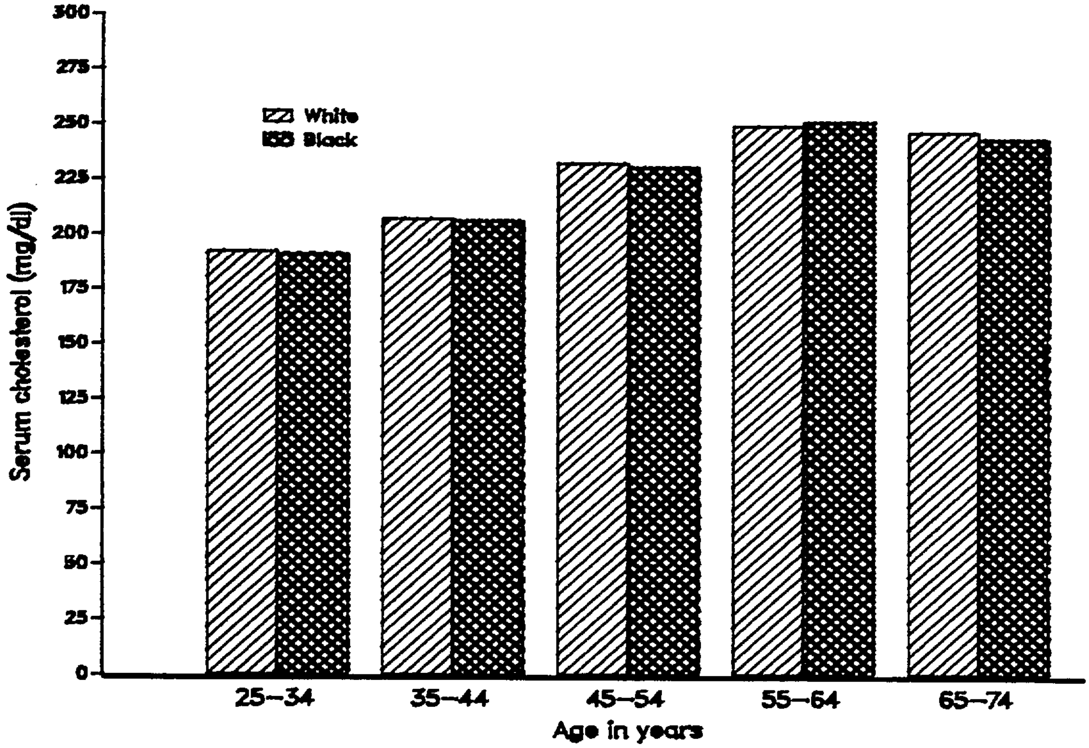
SOURCE: Tenth Report of the Director, National Heart, Lung, and Blood Institute, 1982, based on NCHS data from the National Vital Statistics System.

Health 3–8. Mean serum cholesterol for males, by race and age: 1976-80



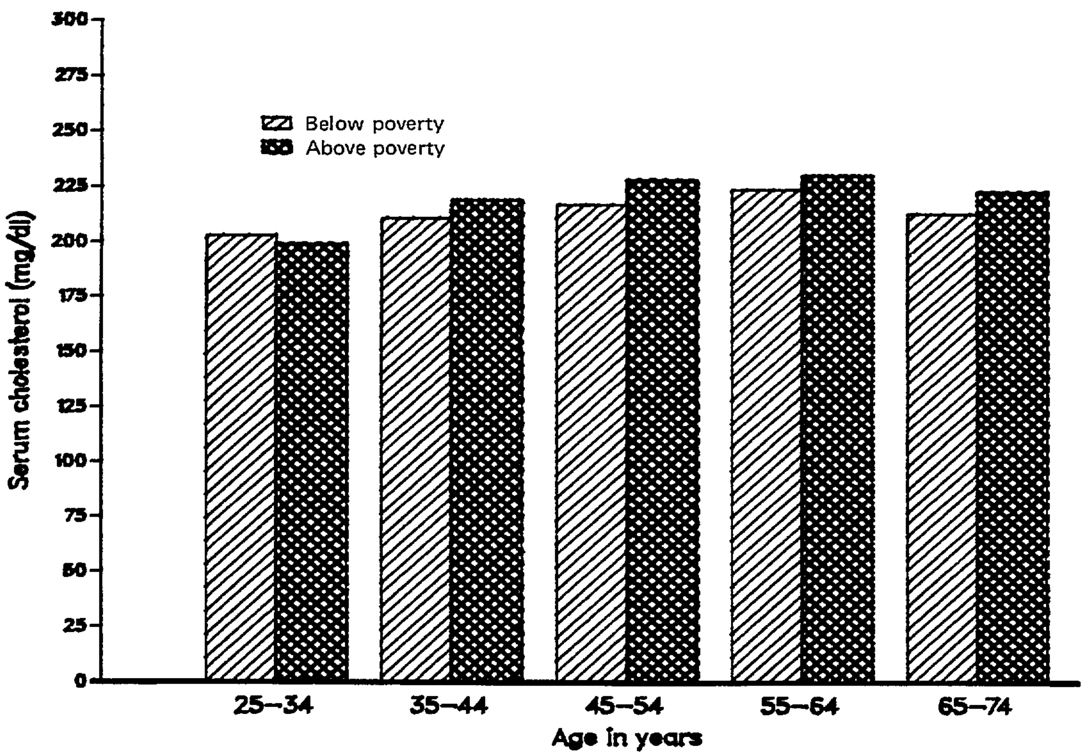
NOTE: Cholesterol measured in milligrams per deciliter (mg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—9. Mean serum cholesterol for females, by race and age: 1976-80



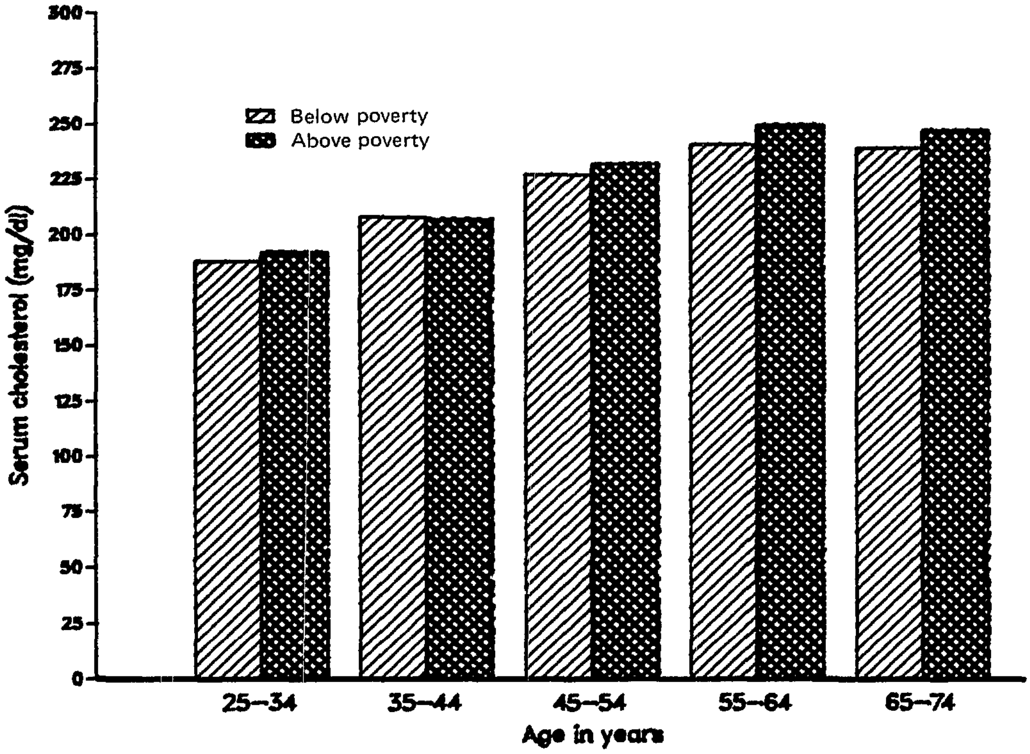
NOTE: Cholesterol measured in milligrams per deciliter (mg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—10. Mean serum cholesterol for males, by poverty status and age: 1976-80



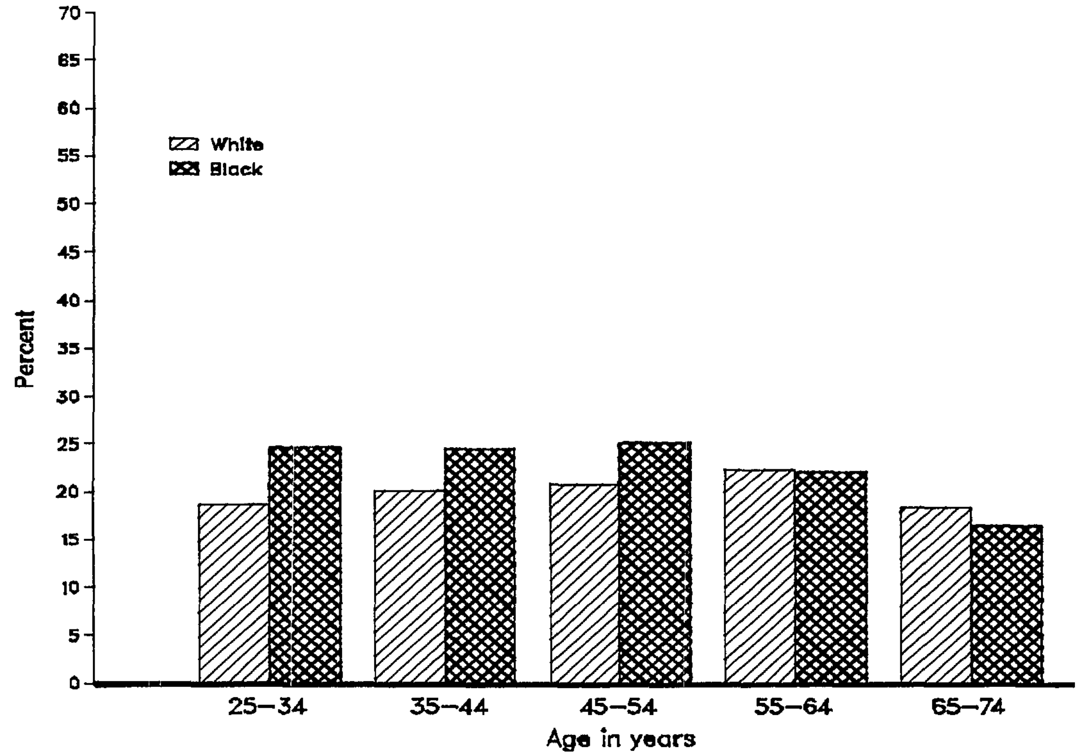
NOTE: Cholesterol measured in milligrams per deciliter (mg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3–11. Mean serum cholesterol for females, by poverty status and age: 1976-80



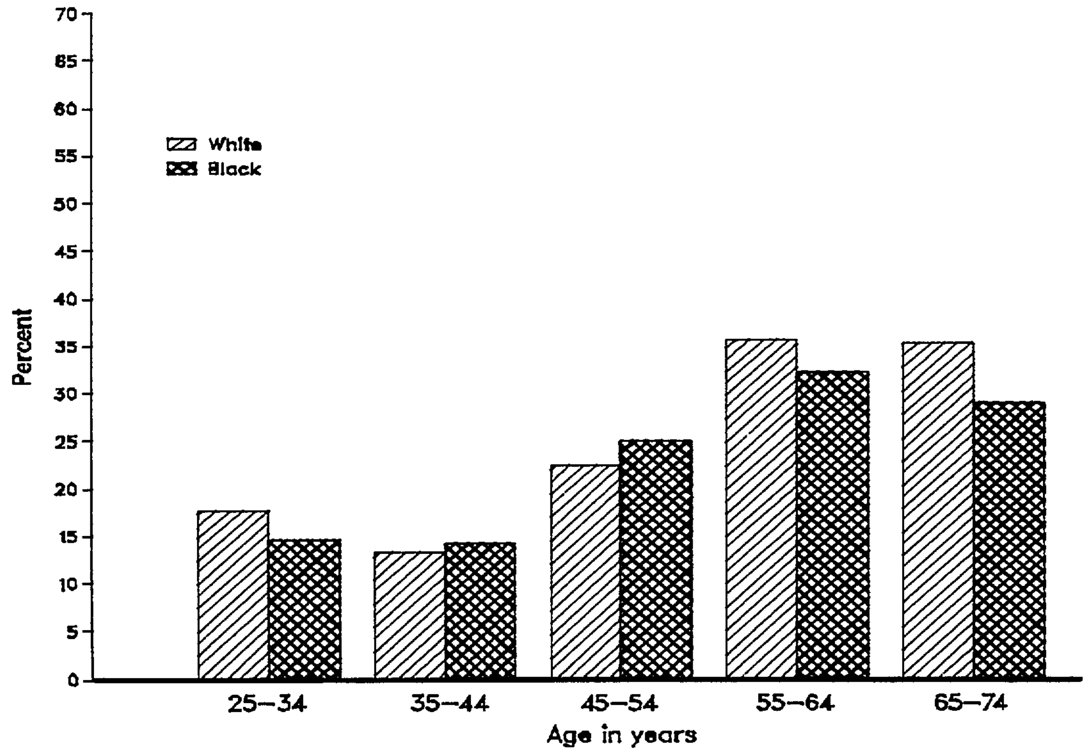
NOTE: Cholesterol measured in milligrams per deciliter (mg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3–12. Percent of males with high-risk serum cholesterol levels, by race and age: 1976-80



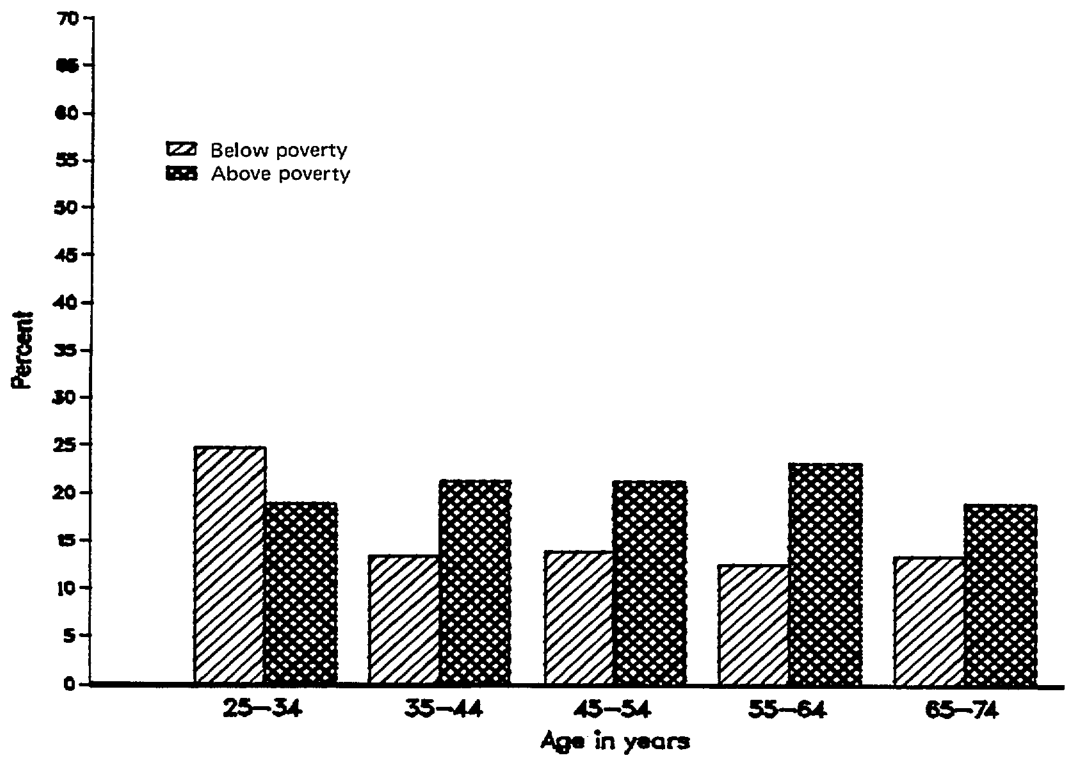
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—13. Percent of females with high-risk serum cholesterol levels, by race and age: 1976-80



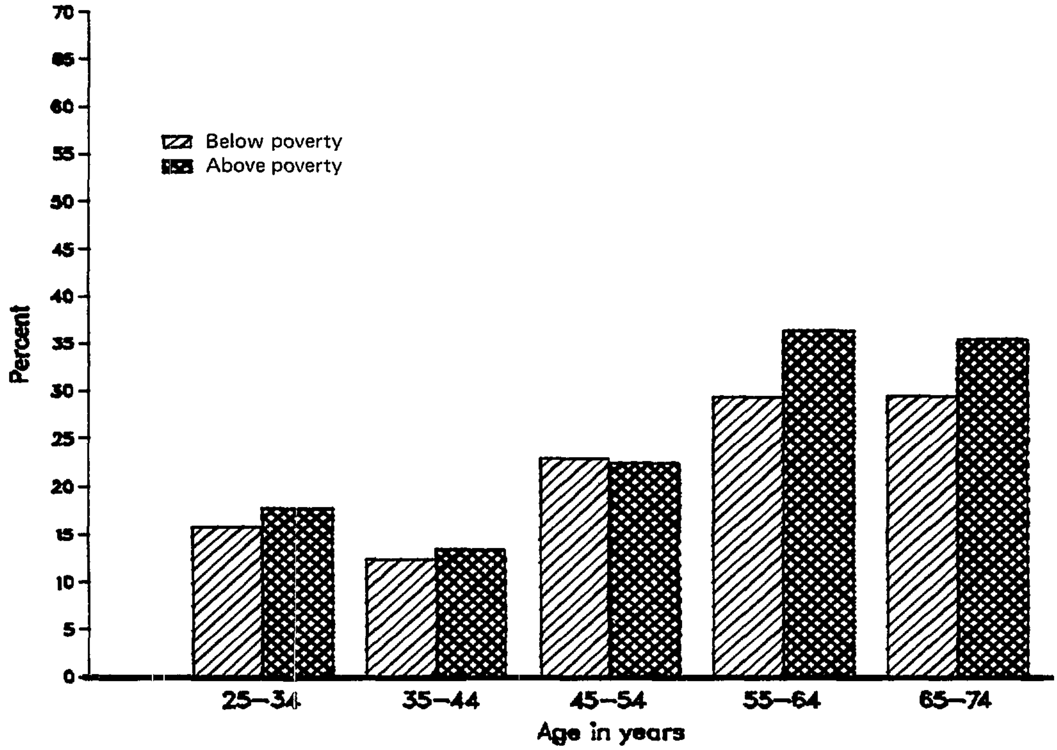
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—14. Percent of males with high-risk serum cholesterol levels, by poverty status and age: 1976-80



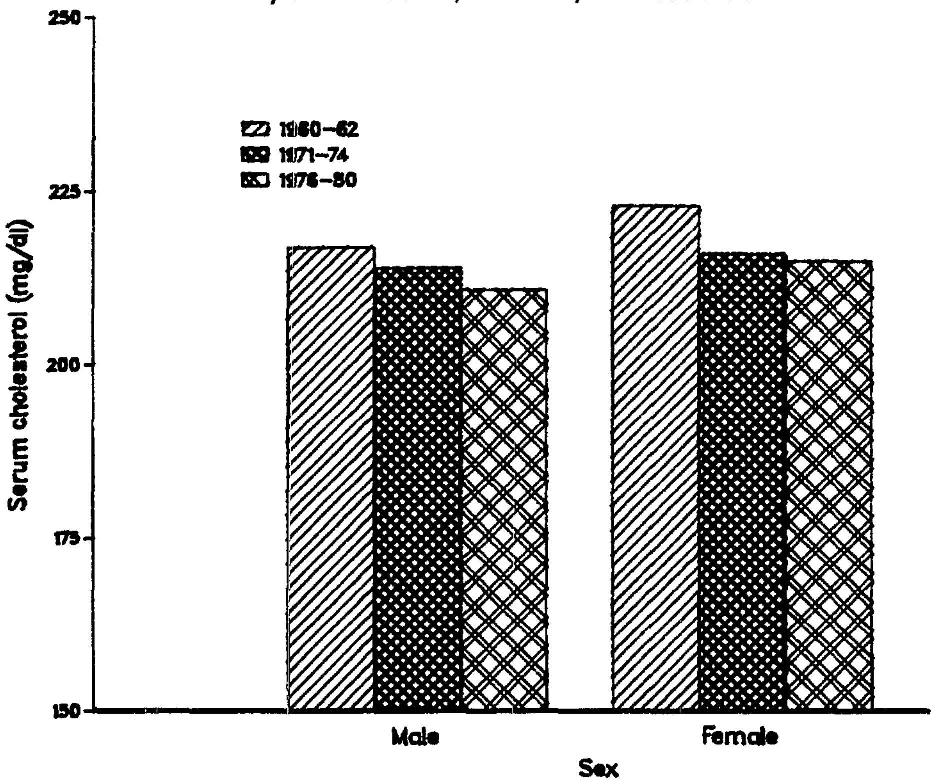
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—15. Percent of females with high-risk serum cholesterol levels, by poverty status and age: 1976-80



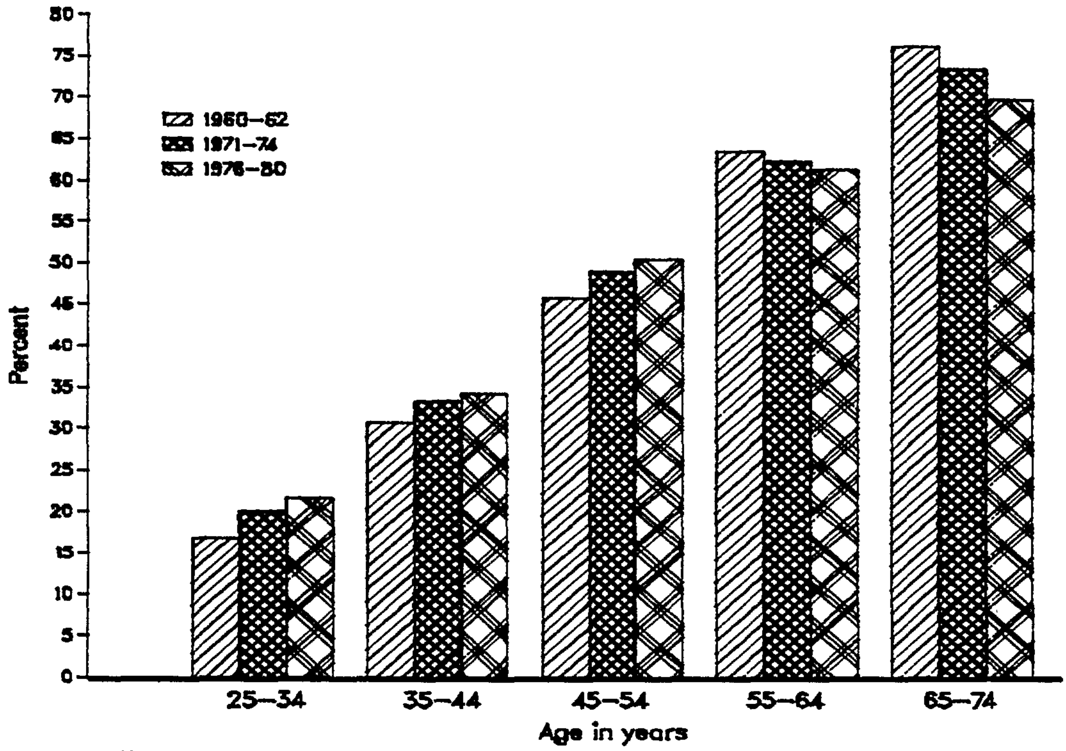
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3-16. Age-adjusted mean serum cholesterol for adults 20-74 years of age, by sex: 1960-62, 1971-74, and 1976-80



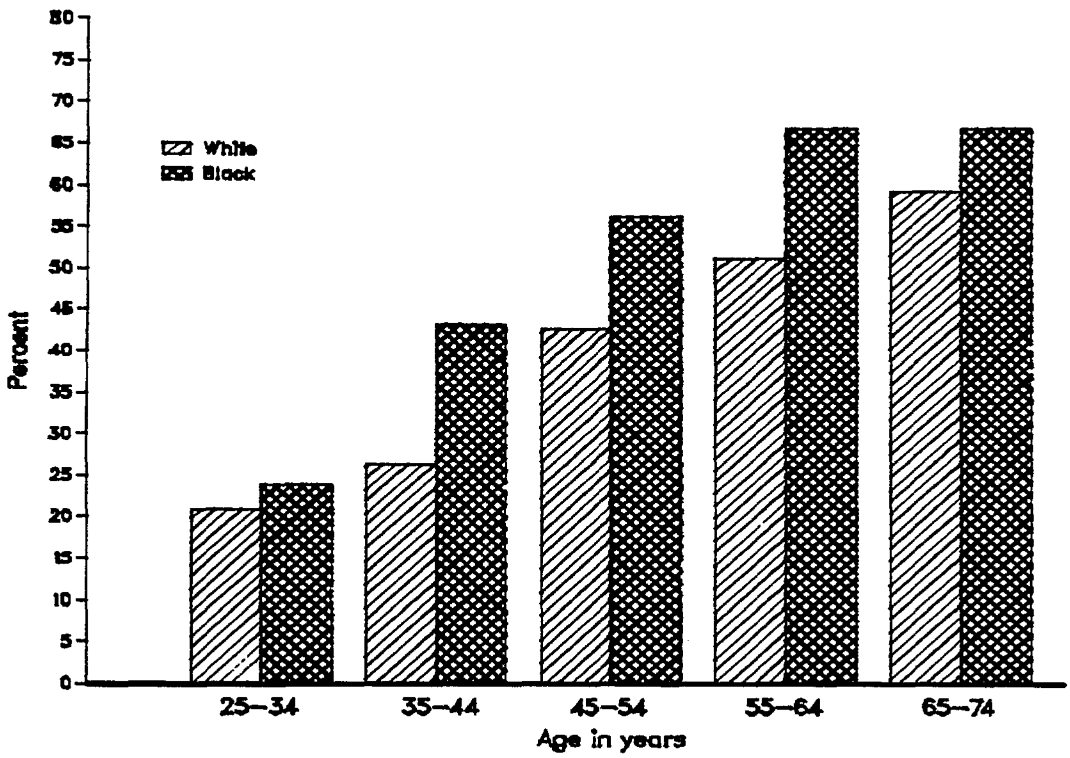
NOTE: Cholesterol measured in milligrams per deciliter (mg/dl). See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Surveys.

Health 3—17. Prevalence of hypertension among males and females, by age: 1960-62, 1971-74, 1976-80



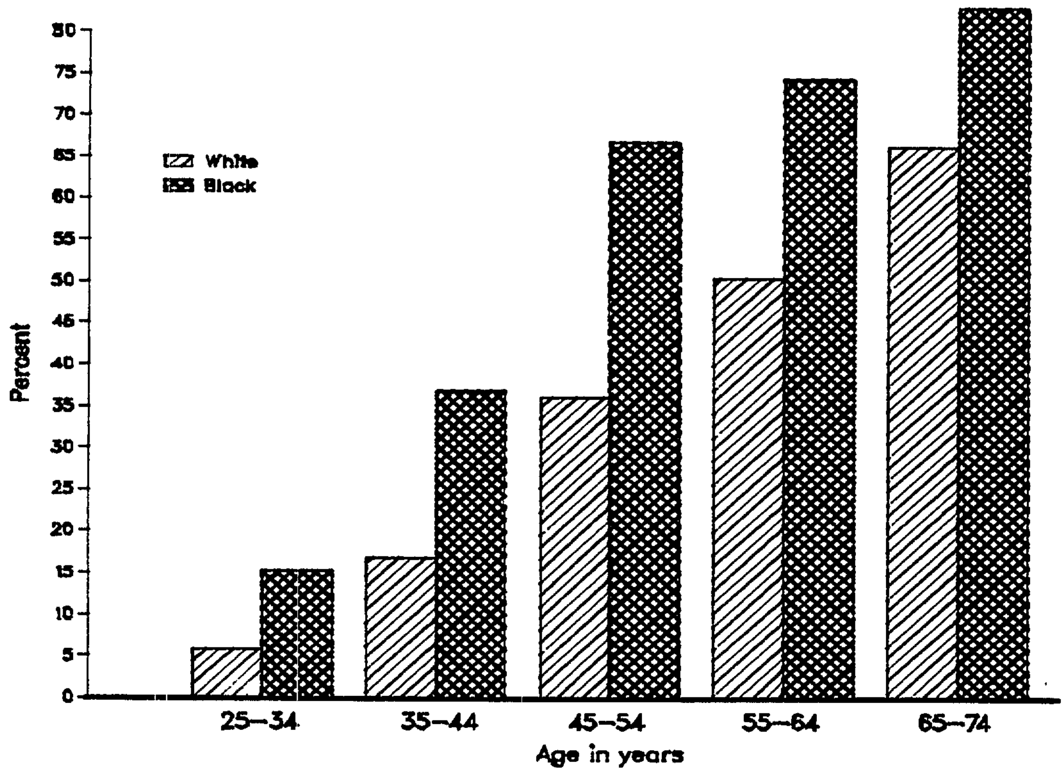
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Surveys.

Health 3—18. Percent of males with hypertension, by race and age: 1976-80



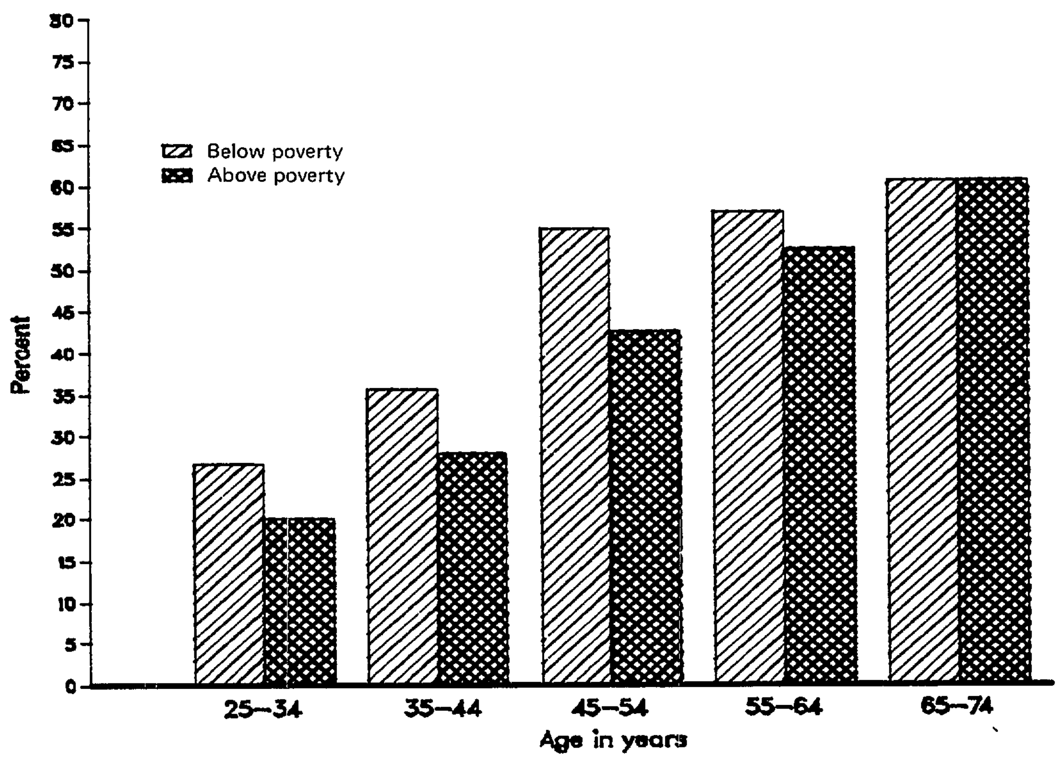
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—19. Percent of females with hypertension, by race and age: 1976-80



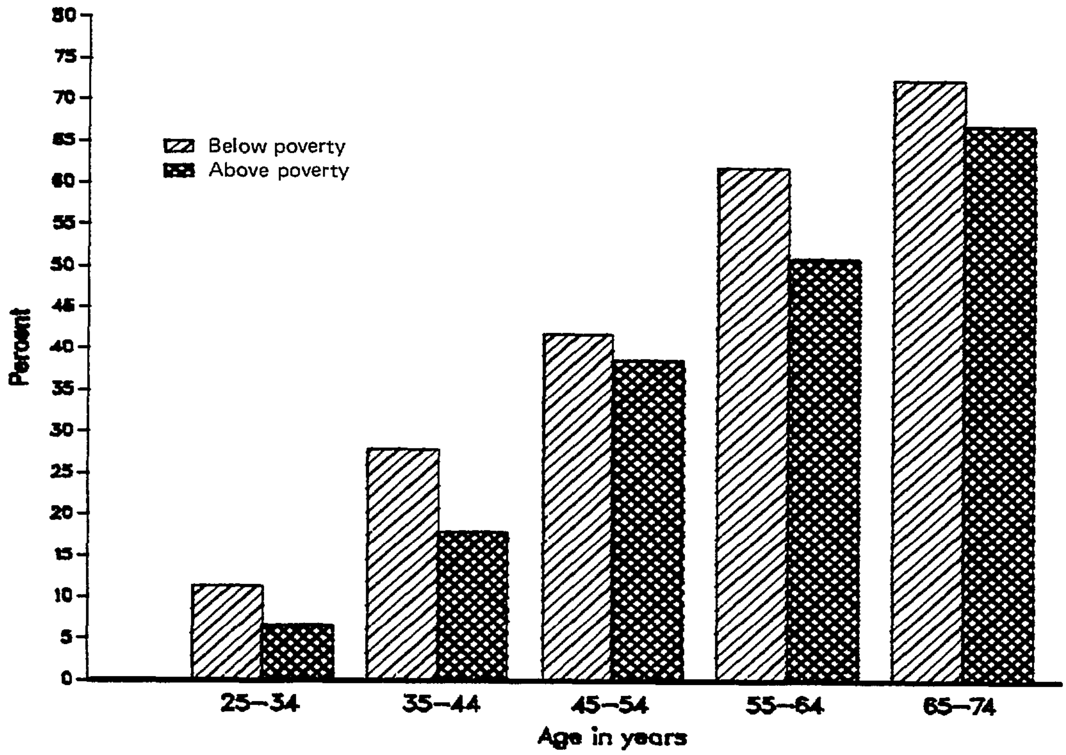
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—20. Percent of males with hypertension, by poverty status and age: 1976-80



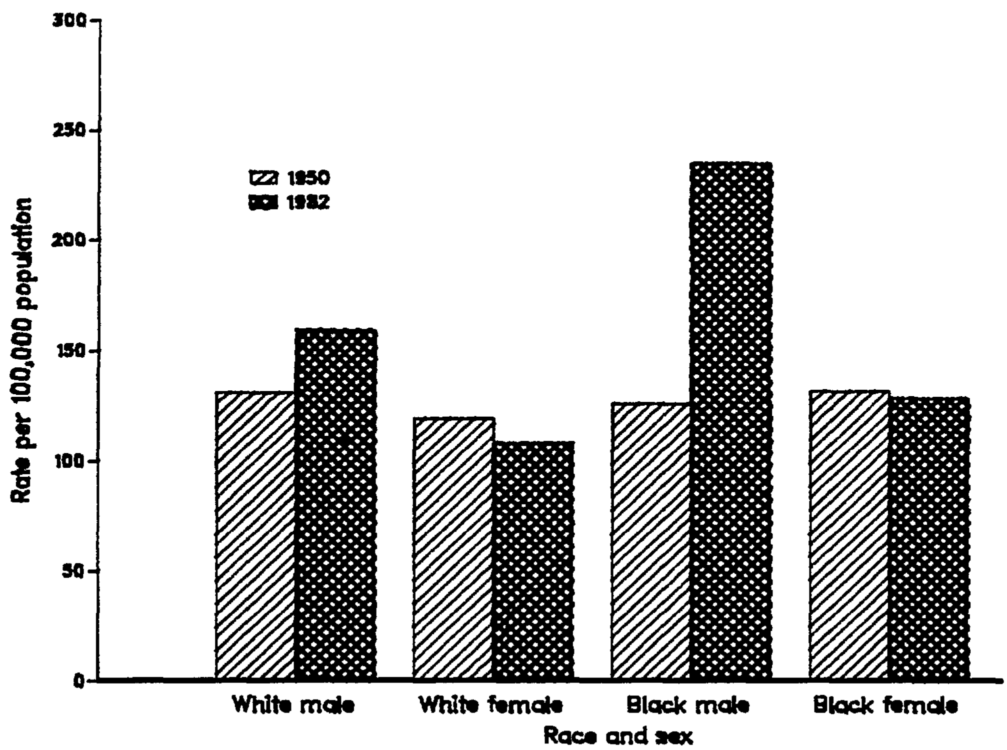
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3–21. Percent of females with hypertension, by poverty status and age: 1976-80



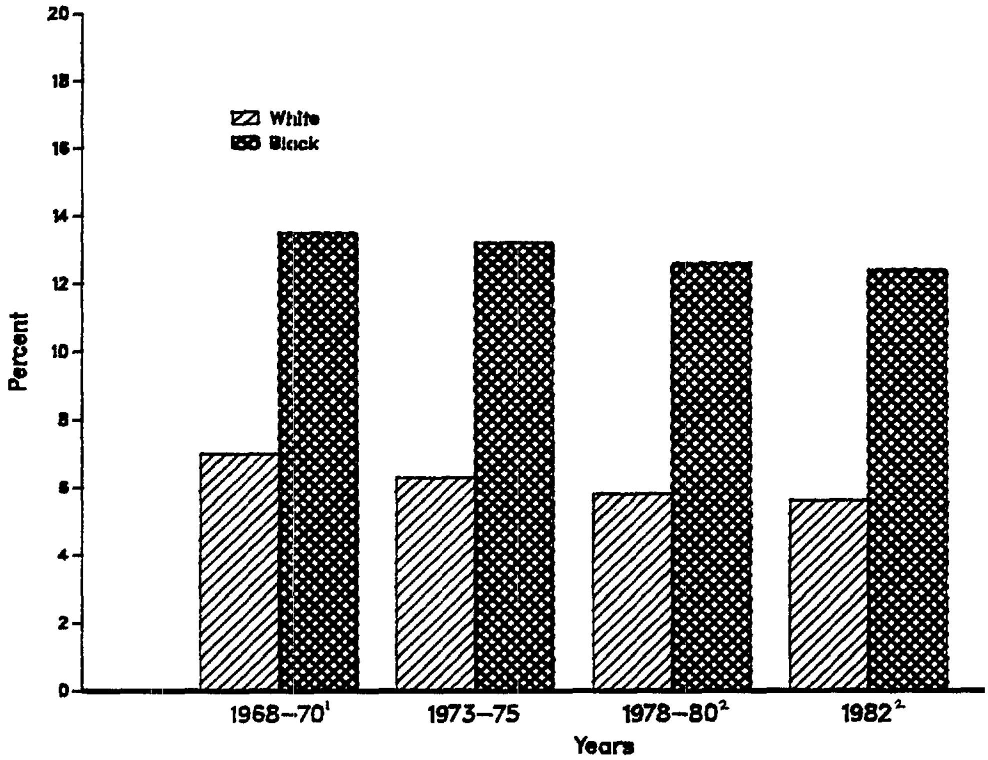
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3-22. Age-adjusted death rates for malignant neoplasms, by race and sex: 1950 and 1982



NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Vital Statistics System.

Health 3—23. Percent of babies with low birth weight (2,500 grams or less), by race: 1968-70, 1973-75, 1978-80, 1982

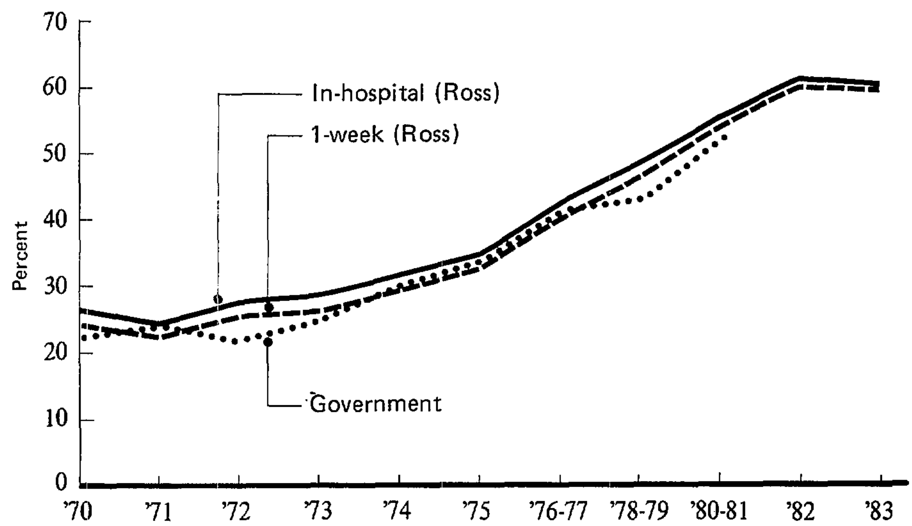


[1] Data by birth weight for the black population are not available for 1968-70. Percentage shown for blacks is actually "All other" racial category, with data combined for blacks and all others in 1968-70.

[2] For 1979 and later, data are for infants weighing less than 2,500 grams at birth. Earlier data are for 2,500 grams or less.

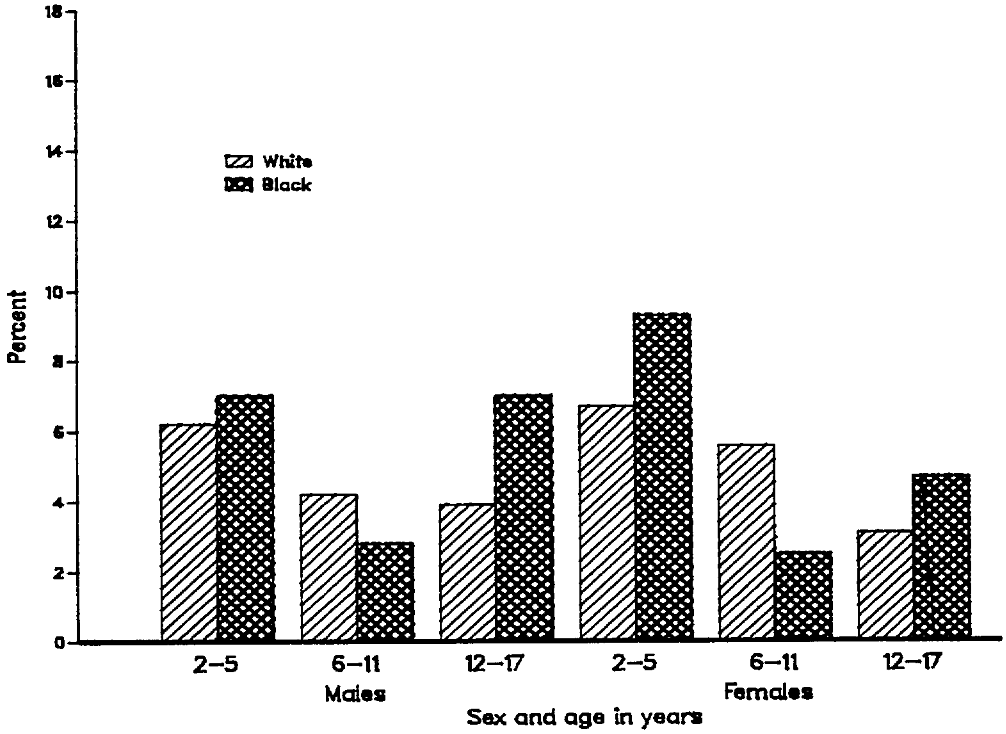
SOURCE: USDHHS: Data from the National Vital Statistics System.

Health 3—24. Percent of infants breastfed, by year: 1970-83



SOURCE: Ross Laboratories National Mothers' Survey; National Survey of Family Growth, NCHS.

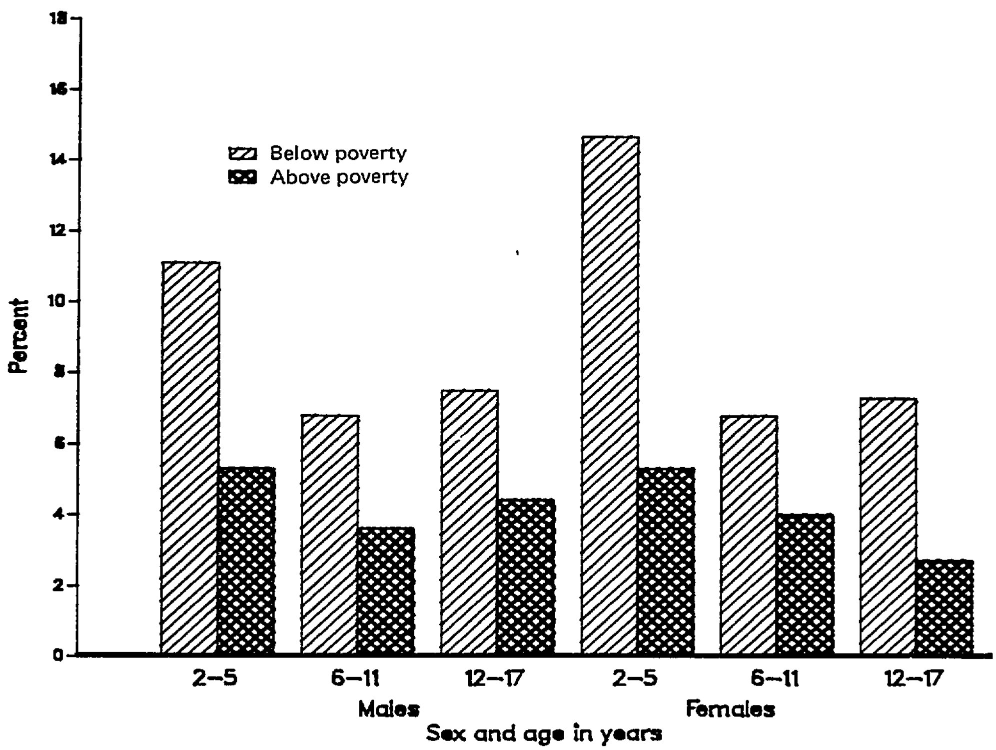
Health 3–25. Percent of children below the NCHS growth chart 5th percentile of height for age, by sex, age, and race: 1976-80



NOTE: See text for definitions.

SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

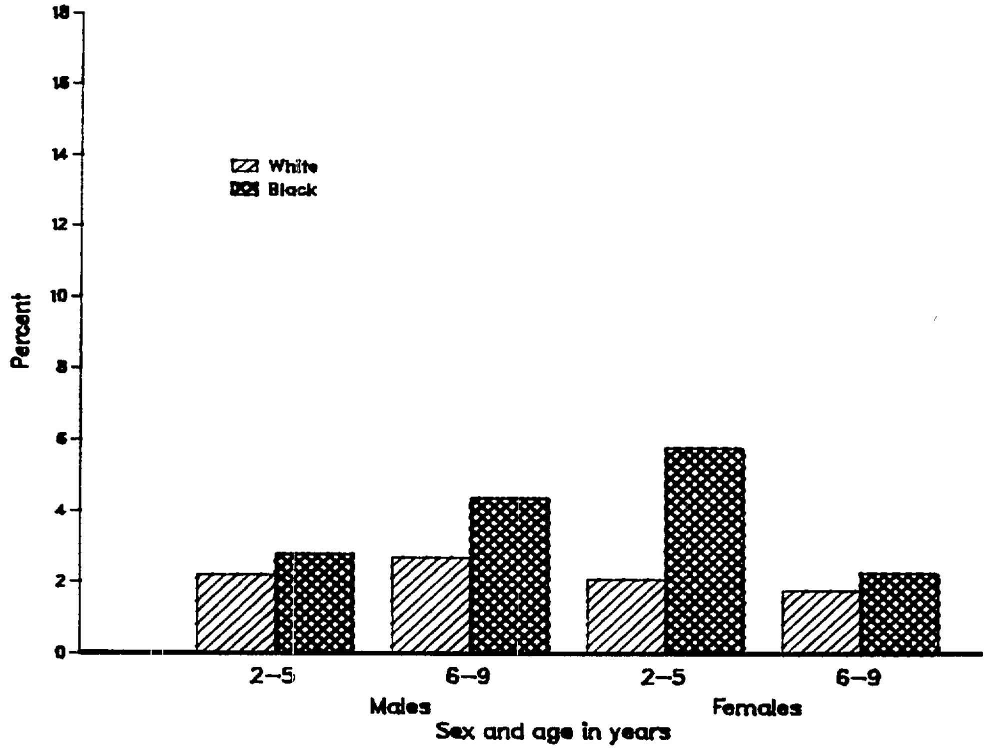
Health 3–26. Percent of children below the NCHS growth chart 5th percentile of height for age, by sex, age, and poverty status: 1976-80



NOTE: See text for definitions.

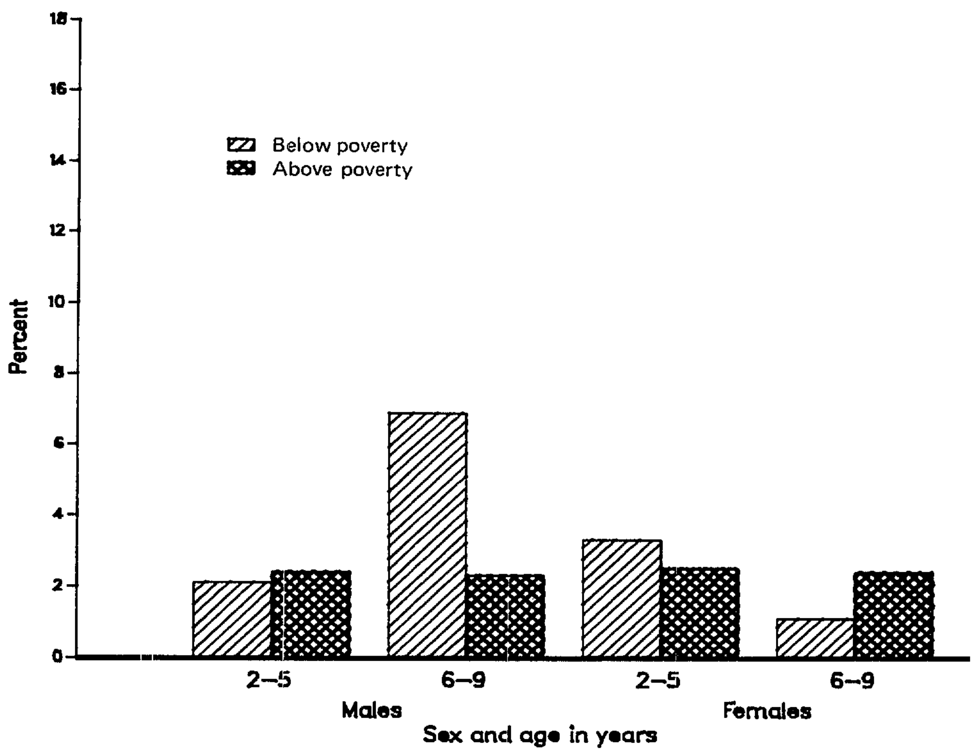
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—27. Percent of children below the NCHS growth chart 5th percentile of weight for height, by sex, age, and race: 1976-80



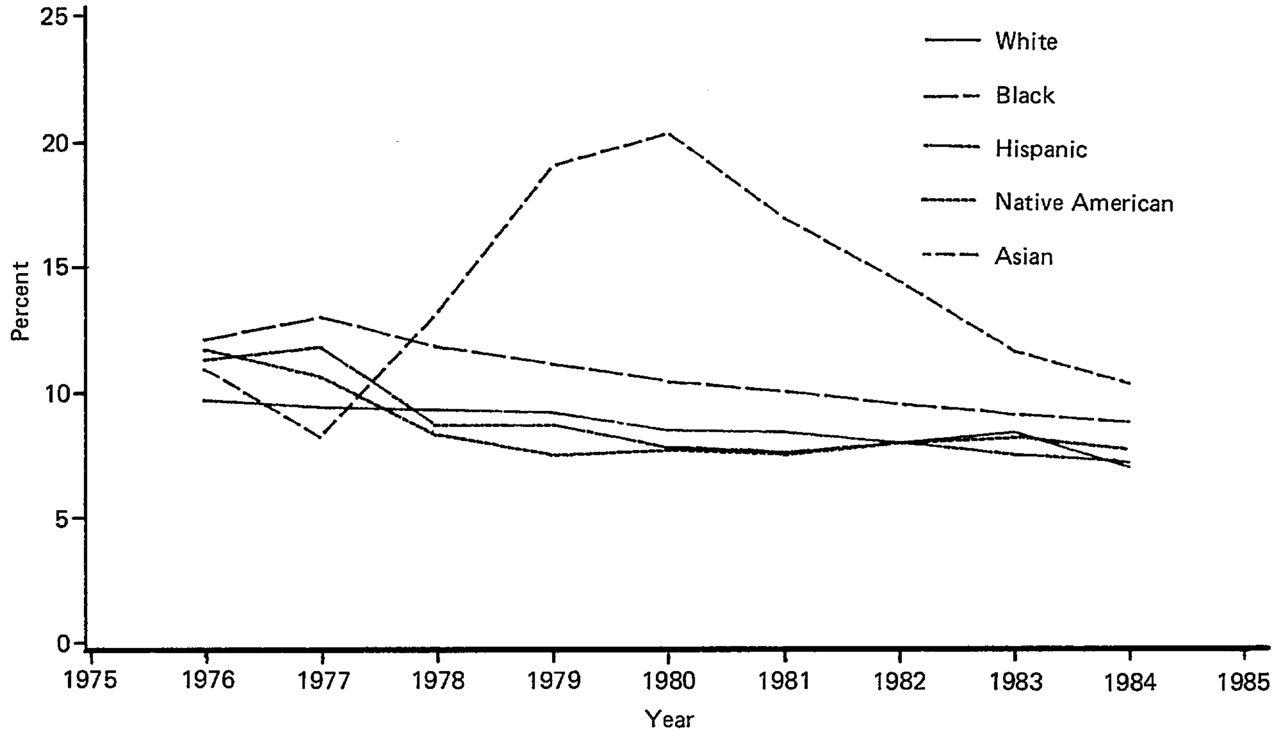
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—28. Percent of children below the NCHS growth chart 5th percentile of weight for height, by sex, age, and poverty status: 1976-80



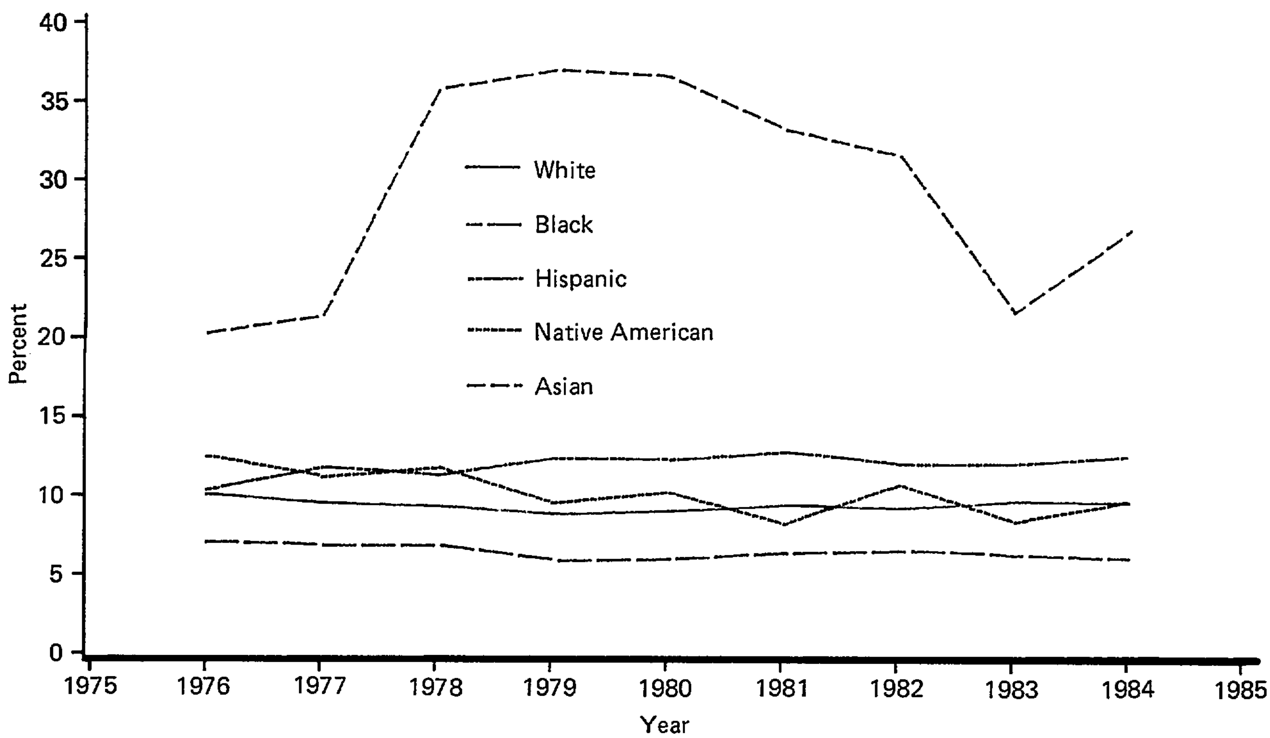
NOTE: See text for definitions.
SOURCE: USDHHS: Data from the National Health and Nutrition Examination Survey.

Health 3—29. Percent of children aged under 2 years below the NCHS growth chart 5th percentile of height for age, by year and race: 1976-84



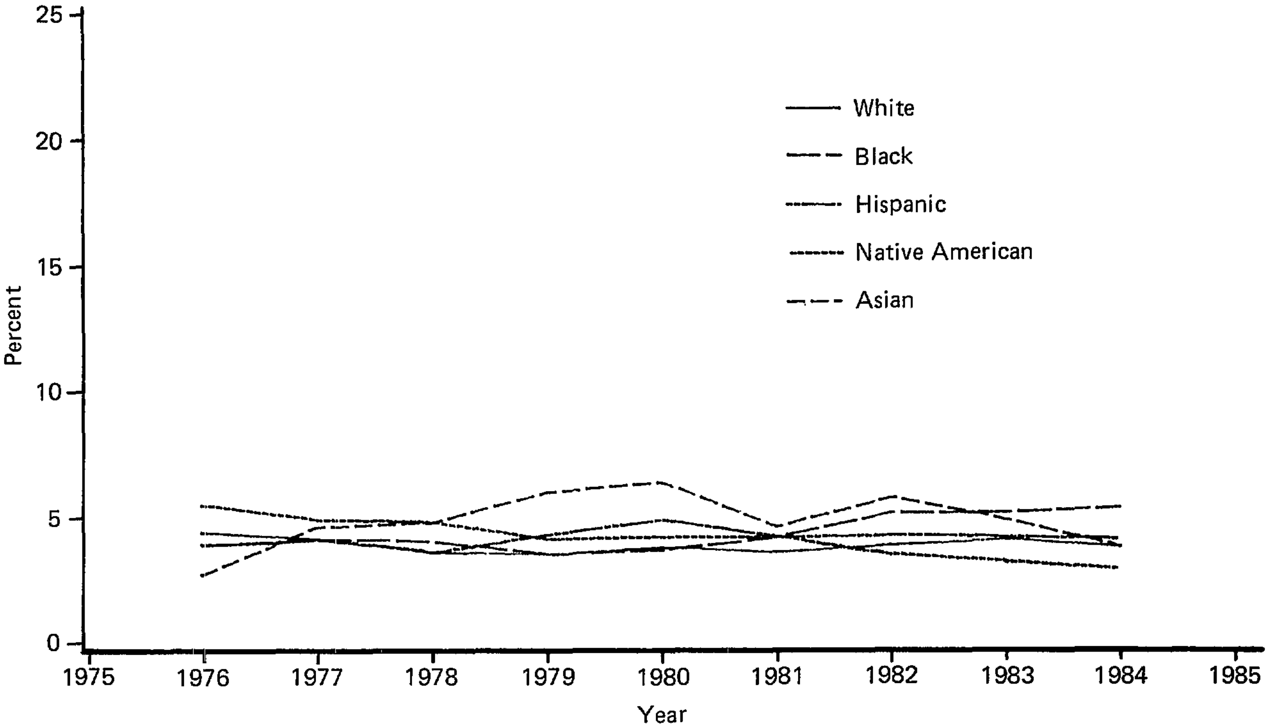
NOTE: Preliminary data, February 1985. See text for definitions.
SOURCE: USDHHS: Data from the CDC Pediatric Nutrition Surveillance System.

Health 3—30. Percent of children aged 2-5 years below the NCHS growth chart 5th percentile of height for age, by year and race: 1976-84



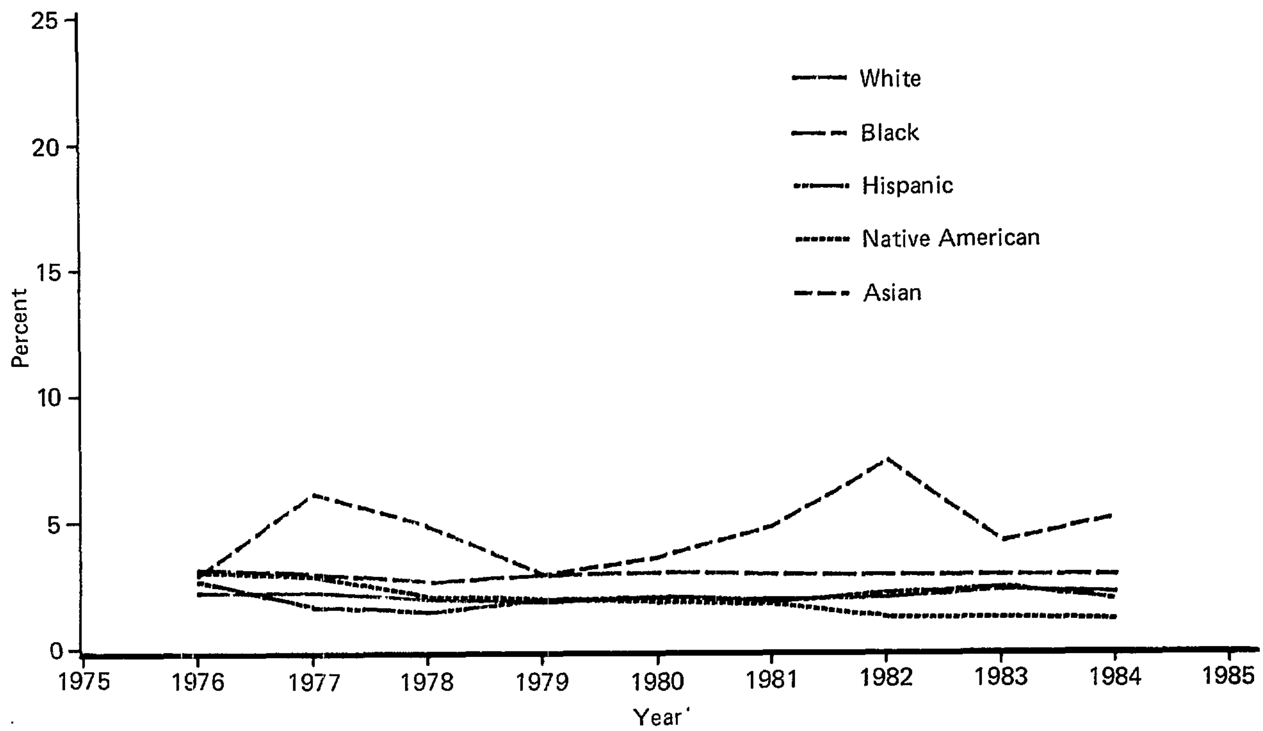
NOTE: Preliminary data, February 1985. See text for definitions.
SOURCE: USDHHS: Data from the CDC Pediatric Nutrition Surveillance System.

Health 3—31. Percent of children aged under 2 years below the NCHS growth chart 5th percentile of weight for height, by year and race: 1976-84



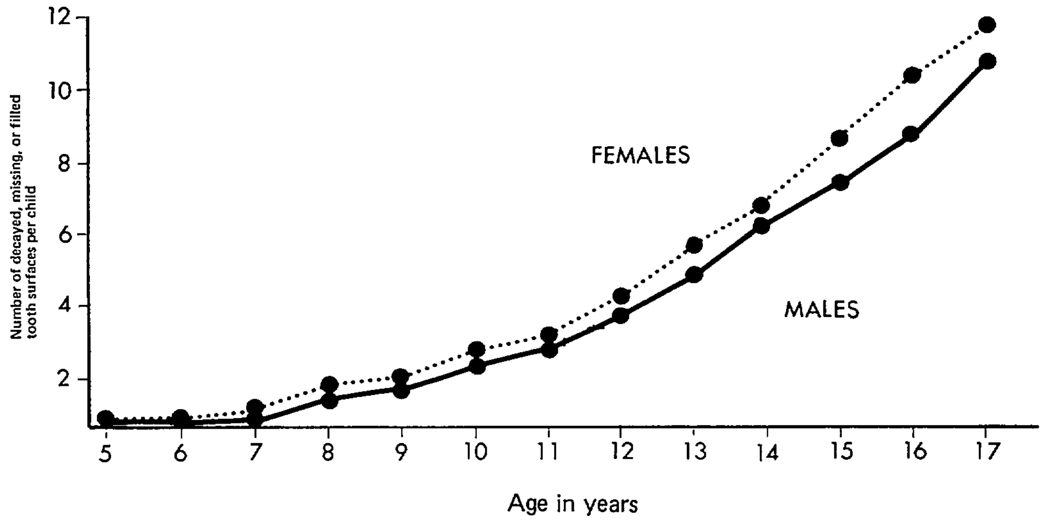
NOTE: Preliminary data, February 1985. See text for definitions.
SOURCE: USDHHS: Data from the CDC Pediatric Nutrition Surveillance System.

Health 3—32. Percent of children aged 2-5 years below the NCHS growth chart 5th percentile of weight for height, by year and race: 1976-84



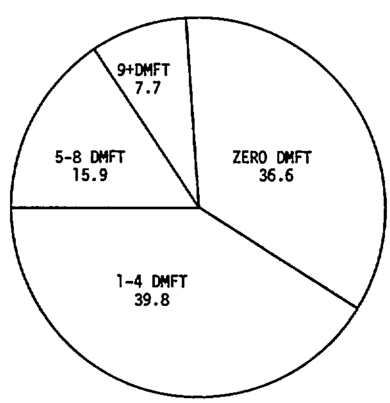
NOTE: Preliminary data, February 1985. See text for definitions.
SOURCE: USDHHS: Data from the CDC Pediatric Nutrition Surveillance System.

Health 3—33. Prevalence of dental caries in permanent teeth, by age and sex: 1979-80



SOURCE: USDHHS: Data from the National Dental Caries Prevalence Survey.

Health 3—34. Percent distribution of children 5-17 years of age, according to the number of decayed, missing, and filled teeth (DMFT): 1979-80



SOURCE: USDHHS: Data from the National Dental Caries Prevalence Survey.

CHAPTER 4

SELECTED FACTORS INFLUENCING FOOD INTAKE AND DIETARY STATUS

Introduction

The assessments of dietary and health indicators of nutritional status presented in Chapters 2 and 3 have been used to identify potential public health problems and concerns as well as the subgroups of the population at greatest risk of poor nutritional status. Examples of these population subgroups include: (1) Postmenopausal women, who have, on average, relatively low calcium intakes and a relatively high prevalence of osteoporosis; (2) low-income and black women, who have a relatively high prevalence of obesity with evidence of health complications; and (3) children 1-5 years, black females 12-17 years, and poor women 25-54 years, whose intakes of iron are low and who have a relatively high prevalence of impaired iron status. The data used in these types of assessments are descriptive and can be used to indicate potential or existing nutritional problems. When possible, the statistical reliability of the findings also can be studied based on the survey designs.

These survey data on dietary and health indicators of nutritional status have also been applied, albeit less comprehensively, in studies designed to determine the major factors that influence nutritional status. This information is important in providing knowledge concerning essential aspects of programs and policies designed to improve the nutritional status of the population or of population subgroups. As changes occur in factors thought to affect nutritional status, such as food and nutrition programs and policy, sophisticated statistical analysis of data from repeated surveys will provide much useful information.

Factors that may influence health indicators of nutritional status, in contrast to dietary status, are not reviewed in this chapter. Some of these factors are discussed in Chapter 3 in relation to specific clinical and biochemical measures of health or to prevalences of disease.

The purpose of this chapter is to review selected studies in which researchers have attempted to determine some of the factors that influence food intake and dietary status. Findings from these studies help to establish a basis for programs or policies designed to improve dietary status. The studies reviewed have in most cases used survey data from the 1977-78 Nationwide Food Consumption Survey (NFCS), which was not designed solely for evaluations of all the factors that might be associated with dietary status. For this reason, these studies have tended to employ rather intricate statistical methods and modeling approaches. Expansion of the National Nutrition Monitoring System to include more data appropriate for analyses of factors influencing dietary status would enhance its value for nutrition policy. Continuous information, especially about populations at risk, may be particularly valuable.

Factors Influencing Dietary Status

A number of researchers have attempted to use multivariate statistical methods to evaluate hypotheses related to the factors influencing dietary status, possibly because of the significant need to assess the effect of food assistance and nutrition education programs in the United States. Results of these analyses can be used to help design health and nutrition policies and evaluate their effects on diet.

This review of the studies is not intended to be comprehensive. Instead, the intent is to identify selected studies and approaches that indicate possibilities for future research efforts to improve our understanding of dietary status and how it can be affected by environmental factors and by food, nutrition, and other policies. Illustrative references for each group of factors influencing dietary status are listed at the end of this chapter. These references are representative of a burgeoning literature on the subject. Most references are for studies pertaining to NFCS and related dietary or food consumption surveys.

Economic Factors

Studies of the economic factors that may influence dietary status have undergone significant change because of recent developments in statistics and theories in which households are viewed as both producing and consuming units. Households are presumed to utilize various inputs--for example, food as purchased and the labor of household members--to produce diets of varying nutrient compositions. This framework provides for the incorporation of socioeconomic variables into integrated statistical analyses of food consumption behavior and dietary status. Research results are accumulating in the areas of household income, household food expenditures, nutrient levels in household and individual diets, efficiency of food use, away-from-home food consumption, and use of convenience foods.

Income was found to have a positive, statistically significant effect on the nutrient levels in household diets and individual intakes for participants in the U.S. Department of Agriculture's 1965-66 food consumption survey, 1977-78 NFCS, and 1977-78 Nationwide Food Consumption Survey-Low Income (NFCS-LI). However, the magnitude of this positive effect is difficult to isolate statistically and is dependent on the data used and subtleties in the specifications of models used in the analyses.

In both NFCS and NFCS-LI it was found that, although dietary levels of nutrients are higher for households with higher incomes, the amount of nutrients per dollar of food expenditure is inversely related to income. An analysis of NFCS-LI data in which tenancy status was used as an indicator of wealth showed that individuals from households that owned their homes reported diets higher in most nutrients.

In general, Government food assistance programs have a positive, statistically significant effect on dietary levels of nutrients. Analysis of data from the NFCS-LI showed the nutrient levels of household diets and individual intakes to be higher for members of households participating in the Food Stamp Program and/or the Special Supplemental Food Program for Women, Infants, and Children than for members of similar nonparticipating households. NFCS data also show that children who participated in school breakfast and/or lunch programs had higher nutrient intakes than nonparticipants had.

Analyses of the 1977-78 NFCS and NFCS-LI have shown that total nutrient levels in household diets tended to be higher when expenditures for food consumed at home were higher. The number of meals eaten and the amount of food consumed at home (compared with the amount eaten away from home) also had a significant positive effect on nutrient levels in household diets and diets of individuals. Nutrient levels in household diets tended to be lower when convenience foods formed a large proportion of the food budget. This may have occurred because convenience foods have high costs per nutrient.

Expenditures for food eaten away from home have been related to several characteristics of households and individuals. NFCS data show that away-from-home food expenditures increased significantly with increased income and number of hours worked by the female head of household but decreased with household size. Consumption of food away from home has also been related to age of household members, race, and the educational level of the female head of household.

Sociodemographic Factors

Easily identifiable sociodemographic factors have been studied in relation to indicators of nutritional status. The results summarized here are from economic models of relationships between dietary indicators of nutritional status and food expenditures. Household size has received wide attention because of its importance in determining eligibility and assistance levels for food assistance programs. Analyses of NFCS and NFCS-LI data have shown that the number of household members is inversely related to nutrient levels in household diets per person and to individual intakes. However, a significant positive association exists between household size and nutrient return per dollar of food expenditure, indicating that the reason for the lower nutrient intakes is probably total food expenditure rather than food selection. Statistical relationships were found between nutrient levels of diets and the following factors.

- Region of the country and level of urbanization--These relationships may reflect geographic differences in food availability, preferences, and prices.

- Race and ethnic origin--Cultural differences in food preferences may be indicated.

- Education and employment status--These relationships may reflect social and economic differences in food use patterns and food preferences.

Eating Patterns

The number of meals eaten per day, frequency of snacking, and variety of foods selected all influence dietary status. Individuals consuming at least three meals per day over a 3-day period (64 percent of NFCS respondents) had higher food energy and nutrient intake levels than did those reporting fewer meals.

Snacking resulted in higher food energy and nutrient levels. Seventy-five percent of the 1977-78 NFCS respondents reported snacking, with three to five being the usual number of snacks over a 3-day period. On average, snacks provided about 20 percent of total food energy and 10-30 percent of other nutrients for those who snacked.

Variety in foods consumed, as indicated by the number of unique foods or food groups represented in the diet, was associated with higher dietary levels of food energy and nutrients. Of course, models of food choice have been used extensively in marketing, advertising, and product development. Statistical modeling techniques from sociology, psychology, marketing, and other disciplines have been used in studies of food choices. The results are not summarized here because specialized, and sometimes proprietary, data bases were employed in many studies.

Health Attitudes

Attitudes or beliefs about food and health affect food intake and dietary status. Data from a nationwide survey by the Economic Research Service of the U.S. Department of Agriculture (USDA) show that consumer health attitudes and nutrition concerns affect food selection. Almost two-thirds of those surveyed said they had adjusted food selection in the 3 years prior to the survey for health or nutrition reasons. Frequently these changes were designed to reduce dietary levels of sugar, fat, cholesterol, sodium, and calories. Households with higher education and/or income levels more often expressed health and nutrition concerns.

The Center for Food Safety and Applied Nutrition of the U.S. Department of Health and Human Services has conducted a number of surveys of the U.S. population. Consistent patterns that have emerged in these surveys include the following.

- Perceptions of food safety--Significant segments of the population are concerned about food additives or contaminants (most frequently preservatives, pesticide residues, artificial colors, and artificial flavors). This concern, heightened temporarily by news releases or government actions on specific substances, is generally neither increasing nor decreasing.

- Diet and cardiovascular disease or cancer--Consumers are increasingly aware of and concerned about food components believed to raise the risk of cardiovascular disease and cancer. Food components mentioned by respondents are sodium, cholesterol, and fats. Interest in informative labeling of these substances is growing. Almost one-quarter of survey respondents reported lowering their sodium and/or fat intakes, and another 12 percent were on medically prescribed low-sodium or low-fat diets.

- Risk avoidance--The public increasingly regards food (and reads food labeling) with a risk-avoidance rather than a benefit-seeking orientation. Interest in "positive" attributes of food is giving way to a focus on "negative" attributes: Calories, sodium, cholesterol, and fats.

- Confidence--Most consumers are generally confident of the safety of the food supply and exhibit optimism that the food supply of the future will be even safer.

Nutrition Education

Nutrition interest, knowledge, and skills may influence nutritional status. Some nutrition educators report that more knowledgeable consumers make "wiser" food choices. However, the term "wiser" is difficult to interpret relative to nutritional status, and more information is required to determine why and how consumers become more knowledgeable or motivated. A Food and Drug Administration study on sodium labeling reports that use of label information by consumers depends on their concerns and interests, educational level, and skills in applying the information.

Nutrition education is more effective in changing dietary practices when instruction is given on how to make dietary improvements. A nutrition course, "Better Eating for Better Health," which was developed by the American Red Cross and USDA, was field tested in 1983. Participants from a variety of backgrounds showed improvements in nutrition knowledge, attitudes, and self-reported food selection and preparation behaviors.

Nutrition education is especially effective when directed toward the household food manager. Home food supplies provided about 80 percent of the food energy in the diets of participants in the 1977-78 NFCS. Analysis of data from USDA's 1965-66 nationwide survey of food consumption indicated a relationship between parents' and children's intakes of food energy and selected nutrients. Further investigation is needed concerning factors that influence the choices of food managers, types of information most useful to them, and the best methods of influencing them.

Summary

Results of the selected studies summarized in this chapter indicate the following.

- Statistically significant relationships exist between dietary levels of nutrients and socioeconomic factors, including income, household size, food assistance program participation, race, ethnic origin, geographic location, education and employment of the household head, tenancy status, and the number of meals consumed at home.

- Relationships between diet and behavior-related factors such as attitudes toward food and nutrition have been demonstrated. Diets are affected by the media, industry advertising, nutrition education, labeling, and other dietary and health-related information.

Future reports of the Joint Nutrition Monitoring Evaluation Committee should develop the issue of dietary status determinants because they are necessary in an effective nutrition monitoring system. These analyses should also incorporate findings on the impact of determinants of dietary intake on biochemical measures of nutritional status. Each change in diet may not necessarily translate into changes in performance, health, or survival, especially in well-nourished populations. A more complete understanding of factors affecting diet and nutritional status is critical to sound and effective public health policy and educational programs. More generally, such understanding is critical to an improved dietary status for the U.S. population.

Selected Studies

Economic and Sociodemographic Factors

Adrian, J., and R. Daniel: Impact of socioeconomic factors on consumption of selected food nutrients in the United States. Am. J. Agric. Econ. 58(1): 31-38, Feb. 1976.

Akin, J., D. Guilkey, and B. Popkin: The School Lunch Program and nutrient intake: A switching regression analysis. Am. J. Agric. Econ. 65(3):477-485, Aug. 1983.

Allen, J. E., and K. E. Gadson: Nutrient consumption patterns of low-income households. Technical Bulletin No. 1685. Washington, D.C. Economic Research Service, U.S. Department of Agriculture, June 1983.

Basiotis, P. P., M. Brown, S. R. Johnson, and K. J. Morgan: Nutrient availability, food costs, and food stamps. Am. J. Agric. Econ. 65(4):685-696, Nov. 1983.

Basiotis, P. P., S. R. Johnson, and K. J. Morgan: Food Stamp Program impacts on food costs, nutrient availability and nutrient intake. Report submitted to the Human Nutrition Information Service, U.S. Department of Agriculture, under cooperative agreement, May 1984.

Blanciforti, L., R. Green, and S. Lane: Income and expenditure for relatively more versus relatively less nutritious food over the life cycle. Am. J. Agric. Econ. 63(2):255-260, May 1981.

Bunch, K., and L. Hall: Factors influencing nutrient consumption. Agricultural Economics Research 83-22. Cornell University, June 1983.

Chavas, J. P., and K. O. Keplinger: Impact of domestic food programs on nutrient intake of low-income persons in the United States. Southern J. Agric. Econ. 15(1):155-163, July 1983.

Gale, S., J. Radzikowski, S. Hanes, et al.: Symposium on National Evaluation of the School Nutrition Programs. Am. J. Clin. Nutr. 40(2) Supp.:363-464, Aug. 1984.

Havlicek, J. Jr., J. M. Axelson, O. Capps, Jr., et al.: Nutritional and Economic Aspects of Convenience and Nonconvenience Foods, in Proceedings of the 1983 Agricultural Outlook Conference. Washington, D.C. U.S. Department of Agriculture, 1982. pp. FE-107--FE-118.

Johnson, S., J. Burt, and K. Morgan: The Food Stamp Program: Participation, food cost, and diet quality for low income households. Food Technol. 35: 58-70, Oct. 1981.

Lippert, A., and D. D. Love: Family Expenditures for Meals Away from Home and Prepared Foods--New Evidence. Paper submitted for publication to Am. J. Agric. Econ.

Price, D. W., and K. Sharma: Economics of Size in Household Food Expenditures. Report No. 5, Contract Number 53-32U4-0-197 for Human Nutrition Information Service, U.S. Department of Agriculture, Unpublished manuscript, 1983.

Smallwood, D., and J. Blaylock: Impact of household size and income on food spending patterns. Technical Bulletin No. 1650. Washington, D.C. Economics and Statistics Service, U.S. Department of Agriculture, May 1981.

Eating Patterns

Crocetti, A., and H. Guthrie: Nutrient Quality of Diets of Respondents from Nationwide Food Consumption Survey 1977-78, in Proceedings of the 1983 Agricultural Outlook Conference, Session #425. Washington, D.C. Agricultural Research Service, U.S. Department of Agriculture, 1982.

Morgan, K. J., B. B. Peterkin, S. R. Johnson, and B. Goungetas: Food energy and nutrients per dollar of food from available home food supplies. Home Economics Research Journal. To be published.

Pao, E., and S. Mickle: Nutrients From Meals and Snacks, in 1981 Agricultural Outlook. Washington. U.S. Government Printing Office, May 1981. p. 243.

Health Attitudes

Food and Drug Administration: The FDA-NHLBI 1982 Sodium/Hypertension Survey. Washington, D.C., 1982.

Heimbach, J. T.: Yesterday, Today and Tomorrow: Consumer Perceptions of Food Safety. Washington, D.C. Food and Drug Administration, 1981.

Heimbach, J. T.: The Public Response to the Labeling of the Sodium Content of Foods. Available from National Technical Information Service, Springfield, Va. NTIS No. PB-83-192583. Washington, D.C., 1983.

Heimbach, J. T.: Cardiovascular disease and diet: The public view. Public Health Reports. Vol. 100, No. 1. Washington. U.S. Government Printing Office, Jan.-Feb. 1985. pp. 5-12.

Heimbach, J. T., and R. D. Stokes: The FDA 1978 Consumer Food Labeling Survey. Washington, D.C. U.S. Department of Health, Education and Welfare, 1979.

Jones, J. L., and J. Weiner: Perspective on Health-Related Food Choices, in Proceedings of 1981 Agricultural Outlook Conference, Session #26. Washington, D.C., Nov. 1980.

National Heart, Lung, and Blood Institute. The Public and High Blood Pressure. DHHS Pub. No. (NIH) 81-2118. Public Health Service. National Heart, Lung and Blood Institute, Bethesda, Md. National Institutes of Health, 1981.

Nutrition Education

Edwards, P. K., A. C. Acock, R. L. Johnston, and K. L. DeMicco: American Red Cross Nutrition Course: Field Test Final Report. Washington, D.C. Virginia Polytechnic Institute and State University, Dec. 1983.

Guenther, P., and C. A. Chandler: Nutrients in Foods at Home and Away, in 1981 Agricultural Outlook, Washington, D.C., May 1981, p. 508. Also published in Fam. Econ. Review, Summer 1981, pp. 9-15.

Heimbach, J. T., and R. D. Stokes: Please see reference under "Health Attitudes."

Pao, E. M.: Food and Nutrient Intake of Individuals Within Families in the South. Unpublished doctoral dissertation. Ohio State University, 1977.

Sims, L.: Further thoughts on research perspectives in nutrition education. J. Nutr. Educ. 13:70-71, 1981.

CHAPTER 5

RECOMMENDATIONS

The charge to the Joint Nutrition Monitoring Evaluation Committee is to review data collected under the National Nutrition Monitoring System and to recommend improvements in the system.

The primary prerequisite for an effective National Nutrition Monitoring System is that the data collected can be transformed into information useful to those responsible for making policy and for planning and operating programs to maintain and improve the nutritional health and well-being of the U.S. population. Transforming data into useful information requires that the data be obtained using designs that will provide the desired results. The step which should precede data collection is the design of a system to meet specific information needs. All data collection agencies have tried in good faith to achieve this objective. However, the associated data collection efforts have not yet yielded data that are widely used for purposes of national nutrition monitoring and evaluation. The Committee, therefore, gives priority to:

- Developing methods by which those responsible for policymaking and program planning can communicate their information requirements to those responsible for obtaining the data supporting the National Nutrition Monitoring System. In addition, those responsible for gathering the data should give special attention to developing more appropriate designs and collection methods and to improving the capacity to process data into information appropriate for those in planning and policymaking.

- Improving the use of presently available data, both for present benefits to the National Nutrition Monitoring System and for providing insights that could lead to improvement in future designs for data collection and analysis.

- Improving data collection methods which, however, do not now present a major problem to the National Nutrition Monitoring System (except for specialized problems such as obtaining information on the homeless).

- Making necessary resources available to carry out these recommendations. The implementation of these recommendations is the responsibility of the Assistant Secretary for Health and the Assistant Secretary for Food and Consumer Services.

Committee review focused on the Nationwide Food Consumption Survey (NFCS) and the National Health and Nutrition Examination Survey (NHANES). Therefore, some recommendations specifically address these two surveys and the Departments which conduct them, the U.S. Departments of Agriculture (USDA) and Health and Human Services (DHHS). Such specific discussion should be considered illustrative of more general issues, however. Recommendations may also apply to other activities under the monitoring system.

Improve Information Exchange Between Data Users and Gatherers

Recommendation 1: Establish a mechanism for learning more about the data needs of users, especially Federal agencies.

Although the purpose of this Committee is to recommend improvements to the National Nutrition Monitoring System (NNMS), no organized mechanism currently exists by which the Committee can accurately determine the data needs of "action" agencies--those Federal agencies responsible for food, nutrition, and health programs and food regulation. Yet without knowing more about the needs of these agencies, the Committee can only speculate about possible improvements. The Committee therefore recommends development of: (1) An inventory of Federal Government programs affecting nutrition, such as those listed in Nutrition Activities of the Department of Health and Human Services (Office of Disease Prevention and Health Promotion, 1983a) and USDA's Directory: Human Nutrition Activities (Committee of Research and Education of the Secretary of Agriculture's Policy and Coordination Council, 1984), and (2) an annotated bibliography of evaluations of these programs to determine the contribution of NNMS data to program design and evaluation.

To this end, each action agency should undertake a review of its research and statistical requirements for program design and evaluation. Such a review would not only increase the agency's understanding of its own complex data needs but also help the Committee and primary data collection agencies identify gaps in the NNMS.

The reviews should include at least the following information.

- Data bases currently in use and reasons for use.
- Program regulation and policy decisions that could be aided by data from the NNMS.
- Assessments of major nutrition monitoring, evaluation, and design questions for current programs.
- Importance of NNMS data in relation to other sources of information.
- Suggestions for improving NNMS data bases, including:

  Availability of relevant information and need for new data collection efforts;

  Generalizability and usefulness of the data for policymaking, regulation, allocation of resources, and meeting agency research goals;

  Quality of the measurements and data being used;

  Accessibility of data;

  Special statistical methodology needs; and

  Manner of data presentation.

Recommendation 2: Sponsor periodic conferences related to survey design and data analysis.

DHHS has initiated the National Health and Nutrition Examination Survey Users Group, which meets approximately three times a year. USDA participates annually in Nutrient Data Bank Conferences. In October 1983, the Departments cosponsored a conference on uses of food consumption survey data under the aegis of the Food and Nutrition Board, National Research Council, National Academy of Sciences. This conference, the first of its kind, drew more than 200 participants.

The Committee recommends that these kinds of activities be conducted on a regular basis to improve survey design and analysis. These conferences would help Federal agencies to gather information for decisionmaking and may have the benefit of helping State and local authorities to plan and conduct surveys. The Committee should periodically review reports of the meetings to gain information on evolving uses of survey data and problems encountered in their use. The Committee also encourages jointly sponsored conferences for current and potential survey data users in which topics of continuing interest are discussed. Such topics might include food consumption data methodology, nutritional status assessment, statistical analysis of complex surveys, improved sampling and measurement methods, and timely topics.

Recommendation 3: Increase the availability of nutrition information from Federal surveys.

Much information on nutrition, including NNMS data, is published in Federal Government reports that are not included in computerized bibliographic data bases. Literature searches yield no citations; therefore, many researchers in Government, the academic community, and the private sector may not know of relevant data and analyses. To make this information more widely available and more easily identifiable, USDA and DHHS should:

- Encourage indexing services such as Index Medicus to include Government reports related to nutrition and health in their printed and computerized bibliographic data bases.

- Request that professional journals identify the survey name in the key words section when publishing articles based on analysis of survey data to facilitate their identification.

- Announce in professional journals when Federal reports related to nutrition are released.

- Utilize new technologies for information dissemination, such as digitally based bibliographies of survey publications and journal articles.

- Identify new professional audiences for survey findings.

Recommendation 4: Establish a listing of data bases, including methods and techniques related to food, nutrition, and health.

Many data bases on food, nutrition, and nutrition-related health issues exist. Some data bases, not part of the NNMS, could nevertheless serve as valuable resources for both Federal agencies and researchers in the academic community and private sector. Unfortunately, no comprehensive list exists. Therefore, the Committee recommends that such a list be established, periodically updated, and disseminated. The following types of data bases would be included.

- National surveys that operate continuously, such as the Total Diet Study, study of the nutrient content of the U.S. food supply, and the Continuing Survey of Food Intakes by Individuals.

- National surveys that operate periodically, such as the presently scheduled National Health and Nutrition Examination Survey and the Nationwide Food Consumption Survey.

- Special-purpose surveys, such as the Hispanic Health and Nutrition Examination Survey and the Nationwide Food Consumption Survey-Low Income.

- Surveys that are conducted at the State and local levels.

- Federally funded surveys conducted under contracts or grants for special purposes.

The list should include at least the following information on each survey.

- Objectives of the survey.

- Sample design and population covered--for example, civilian population.

- Data collection period--for example, 1976-80.

- Data collection method--for example, interview, examination, or laboratory test.

- Measures of nutritional status and/or food consumption.

- Measures of possible determinants of dietary and nutritional status and other measures useful for targeting nutrition programs, such as income, household size, and other sociodemographic variables.

- Control variables--for example, age, race, and sex.

- Accessibility and availability--for example, microdata tapes available through the National Technical Information Service or reports available through the Superintendent of Documents of the U.S. Government Printing Office.

- Contact person or office from which to obtain additional information, if needed.

Increase Use of Data Collected Under the National Nutrition Monitoring System

Recommendation 5: Provide resources for policy-relevant analyses of existing data.

NNMS data frequently are not analyzed in sufficient depth to provide information adequate for policymaking and program management. Possible reasons for this deficiency might be that statistical agencies are not aware of the needs of action agencies; that not all action agencies are aware of the existence of relevant data; or that action agencies, aware of existing data, lack the expertise or resources to analyze survey data. Furthermore, statistical agencies frequently do not have the staff resources to perform such analyses inhouse or the budget to contract for more specialized analytical reports. The Committee therefore recommends that the Assistant Secretary for Health and the Assistant Secretary for Food and Consumer

Services develop a mechanism to provide for indepth analyses of the survey data relative to major program and policy information requirements.

Recommendation 6: Provide adequate and uniform documentation of data files.

As mentioned previously, the two surveys reviewed by the Committee for this report were found to provide high quality data. However, use of data from these and other surveys would be facilitated if public use data tapes were completely documented in a uniform manner. This would help users understand the quality and limitations of the data.

To address these concerns, adequate and more uniform documentation should be provided for each data base and should include descriptions of the sampling and weighting procedures, general population characteristics, imputation procedures, and intraindividual variability (when applicable); information on response rates; and all other information needed to facilitate appropriate use and interpretation and to enhance comparisons of results among component parts of the NNMS, in particular NFCS and NHANES, which form the major components of the NNMS.

Recommendation 7: Improve comparability of data. Mechanisms should be developed through which information from different data systems can be integrated and results reported in a comparable manner.

In addition to adequate documentation of data files, nutrition data should be improved with regard to standardization and comparability. Current efforts should be continued to develop compatible groupings for descriptive and demographic characteristics (age, income, etc.) in future data collection activities and in future publications from NNMS data sources, especially NFCS and NHANES.

Historically, nutrition information systems have been developed to serve the purposes of specific agency programs. Little attention has been paid to the development of standard concepts, terms, definitions, and classifications or to similar methods of data collection, tabulation, and release. The resulting lack of comparable data from different programs presents a significant barrier to the usefulness of this information in broader research and management applications.

USDA has undertaken considerable work in standardizing methods for coding and tabulating data on food composition. Other specific activities that will help overcome barriers imposed by the lack of data comparability are as follows.

- Develop "core questionnaires" to promote the collection and coding of nutrition statistics in accordance with uniform definitions and classifications and to provide baseline quality control standards. The Committeee endorses current efforts to develop a comparable 24-hour recall questionnaire for use in NFCS and NHANES but recommends that both surveys include more extensive assessments of food intake.

- Collect information necessary for linking the National Death Index to the survey data bases to facilitate studies designed to determine relationships between nutrition and chronic diseases such as cancer.

- Develop uniform questionnaires for variables that are related to dietary status, such as school or work absenteeism and medical treatment.

- Use compatible sampling schemes. Make definitions of terms--such as income, region, and household--similar.

- Develop and validate questionnaires to elicit data on "hunger."

Recommendation 8: Improve timely publication of data.

Resources should be made available to improve the timely release of data tapes and publications of survey data. Recommended activities include the following.

- Automate data collection and editing for faster data release. The Committee endorses current efforts to fully automate data collection in NFCS and NHANES.

- Streamline statistical quality control procedures so data tapes can be released sooner.

- As far as possible, outline the computations and analyses to be conducted with survey data early, during the planning phase of the survey. If necessary, plans should be reviewed by outside experts.

- Use standardized tabular presentations with minimal text for rapid data release of certain findings. USDA is currently using this approach to report on the food supply.

- Adopt continuous modes of data collection. Periodic surveys do not fully meet nutrition monitoring needs.

Improve Methods and Techniques for Gathering Information for Assessing Nutritional Status

Recommendation 9: Continue and expand efforts to study the factors that influence food intake and nutritional status, especially among high-risk subgroups.

An understanding of the factors that influence the dietary and health indicators of nutritional status is essential to the development of sound and effective policies and programs for improving nutritional status. The Committee recommends that, in addition to determining nutrient intakes and prevalences of diseases associated with diet, the Departments continue and expand collection of detailed information on such factors as the amounts and types of food consumed; food purchasing and eating behaviors; knowledge and attitudes about food, diet, and health; drug and tobacco use; and socioeconomic factors such as gross and net income, the availability and cost of food and health care, other living expenditures, government and private sector program participation, and family composition. Information on changes in these factors over time may contribute significantly to an understanding of how they affect nutritional status. Epidemiological followup surveys of the type conducted on persons surveyed in the first NHANES should be continued and expanded.

Therefore, the Committee recommends that the Departments continue present efforts to study the factors influencing nutritional status and recommends that resources be increased to expand and refine current efforts. Suggested activities include literature reviews, conferences, workshops, and additional statistical analyses to: (1) Assess currently available information and (2) delineate research questions and needs for the future. Feasibility studies may need to be conducted to determine how to meet future informational needs.

Recommendation 10: Improve coverage of minority and low-income populations in activities of the National Nutrition Monitoring System.

A major focus of this report is whether there are differences in dietary and health status between the poor and nonpoor. NFCS and NHANES provide cross-sectional data permitting comparisons to be made at selected points in time. The Coordinated State Surveillance System of the Centers for Disease Control continuously monitors key indicators of nutritional status in two vulnerable groups--pregnant women and young children. Despite these efforts, some groups considered to be at nutritional risk--for example, the homeless, migrants, and some minority groups such as Native Americans--are not covered. Others, including some racial minority groups, are not sampled in large enough numbers to permit accurate estimates.

The Committee recommends that the Departments improve their current surveillance and monitoring of minority and low-income populations. Possible strategies to consider include special surveys for groups such as the homeless, oversampling of the low-income population in cross-sectional surveys, more extensive use of data obtained through food and health programs, followup surveys to monitor patterns of death from starvation, and expansion of the Coordinated State Surveillance System.

Recommendation 11: Evaluate the feasibility of developing indicators for monitoring changes in food consumption and nutritional status.

USDA and DHHS should explore the feasibility of developing a set of nutrition indicators to monitor changes in food consumption and nutritional status. These could be viewed as analogous to leading economic, environmental, and other sets of indicators that have become feasible because of advances in information collection, processing, and discrimination. Such nutrition indicators could be used for State and national surveillance during the time between major surveys. They would also be useful in policy formulation and management.

A set of nutrition indicators could initially be derived from analyses of existing data files. Development would be a long-range project. Consideration must be given to at least five types of measures:

- Food supply,
- Resources to purchase food,
- Food and nutrient intakes,
- Health and nutritional status, and
- Mortality statistics.

Recommendation 12: Increase research to improve methods for assessing dietary intake and nutritional status.

Basic human nutrition research, carried out by the National Institutes of Health (part of DHHS) and the Agricultural Research Service (part of USDA), has received increased funding. Resources for most applied human nutrition research, however, have remained static or declined.

The Departments identified gaps in the research base as part of the development of a 5-year human nutrition research plan. The Committee recommends that they give top priority to developing a research strategy to facilitate the conduct of food consumption and nutrition surveys and to improve the nutritional assessments made. Increased efforts should be considered in the following areas.

- Research in the biomedical and behavioral sciences with relevance to nutritional assessment--for example, functional consequences of malnutrition; behavioral, cultural, and genetic determinants of group differences in nutritional status; effects of nutrient toxicity and nutrient-drug interactions; pathophysiological consequences of nonnutritive food substances, tobacco, and environmental contaminants; biological significance of trace minerals and other food components (such as fiber); nutritional status and cognitive performance.

- Research in the food sciences--for example, analytical methods for assessing nutrients in food samples; effects of food processing on nutritional quality; standard reference materials for food samples; food composition data for nutrients and nonnutrients of public health interest.

- Research in nutrition monitoring and surveillance--for example, development of strategies to elicit more accurate food intake data; improved standards and statistical methods for interpreting data on dietary and nutritional status; standard reference materials for vitamins and minerals in blood and urine; methods for detecting early stages of nutrient depletion or toxicity; validation of surveillance data as reflections of target populations; telephone survey methodology.

Increase Resources for the National Nutrition Monitoring System

Recommendation 13: Provide adequate resources for the National Nutrition Monitoring System to implement these recommendations and for the Committee, which is charged with interpreting the data collected by this system and also with assessing the need for improvements in the system.

The other recommendations proposed by the Committee will result in added resource requirements for the responsible agencies. The Committee is fully aware of the current constraints on Federal spending. In light of these constraints, the Committee feels it is necessary to point out the requirement for additional personnel as well as funds for data collection and research if these recommendations, which propose increased activities, are to be fully implemented.

This applies as well to the Committee itself, which plays a strategic role as the mechanism both for integrating and evaluating the findings of the National Nutrition Monitoring System and for reporting to Congress on the nutritional well-being of the American people and the status of the monitoring system. The Committee also notes that resources for the preparation of this report were drawn from existing survey program activities and suggests that consideration be given to exploring other avenues of fulfilling its staffing needs to ensure its more effective functioning in the future. For example, if a focus of the next report, as suggested, is to be on factors that influence nutritional status, additional expertise will be required. This might be obtained by appointing to the Committee experts in this area or by calling on them as consultants to the Committee. In addition, considerable effort may need to be expended to gather information on this topic from the several disciplines that have assessed the factors influencing nutritional status from different perspectives. It is not intended that the Committee be responsible for the initial analysis of data.

On the basis of its experience in preparing this report, the Committee also suggests that consideration be given to increasing its membership to 7 to 10 members in order to include a broader range of scientific expertise relevant to the needs of Federal survey data users.

Recommendation 14: Identify potential sources of complementary data for the National Nutrition Monitoring System.

The development of new and better technologies for processing data has led to increased availability of data on food expenditures, food and nutrition program participation, food consumption, nutritional status, and health. Not all of these data sources are part of the NNMS. The Consumer Expenditure Survey (Bureau of Labor Statistics) and the Survey of Income and Program Participation (Bureau of the Census), for instance, are not. Additionally, some data files could serve purposes other than those for which they were designed. All data relating to food costs and expenditures as well as participation in Federal food and health programs are relevant to the Committee mandate. Health and nutrition data available in health centers that serve low-income populations might prove useful as adjuncts to major surveys. Therefore, the Committee recommends that its scope of work be increased to encompass review of these surveys to determine which data should be considered in the National Nutrition Monitoring System.

APPENDIX I

METHODOLOGY FOR THE COLLECTION AND ANALYSIS OF DIETARY DATA

Food Consumption Surveys

Background

The U.S. Department of Agriculture (USDA) has conducted six national food consumption surveys since the mid-1930's. Over the years, the surveys have expanded as more information has been needed and technical capabilities have improved. Information on household food use has been collected in all surveys; since 1965, data on food intakes by individuals also have been collected. The most recent survey, the Nationwide Food Consumption Survey (NFCS), was conducted in the coterminous United States from April 1977 through March 1978. In addition to this basic survey, special surveys were conducted in Alaska, Hawaii, and Puerto Rico, and surveys of the elderly and of low-income households in the 48 coterminous United States also were undertaken. The next comprehensive decennial NFCS is scheduled to begin in 1987. The Continuing Survey of Food Intakes by Individuals, started in April 1985, will collect data on dietary intakes year after year for groups of women 19-50 years of age and children 1-5 years of age. Data from the surveys have been released in numerous USDA publications. (See Bibliography.)

The primary purpose of the food consumption surveys is to obtain data that can be used to monitor the food and nutrient content of U.S. diets and to assess dietary adequacy and the factors affecting dietary status. Information from food consumption surveys is applied to issues relating to food production, processing, and distribution; food safety and regulation; food assistance and other nutrition intervention programs; nutrition education; and health.

1977-78 Nationwide Food Consumption Survey

Description of the Sample

The 1977-78 NFCS actually consisted of two surveys and two target populations. In the first survey, information was collected from 14,930 private households (unweighted count) of one or more members. The households were from a statistically selected sample of all private households in the 48 coterminous States stratified by region, urbanization, and geographic or demographic similarities. In the second survey, data were collected on 30,770 individuals (unweighted count) in the first-survey households. This number represents approximately 90 percent of those that were eligible by the survey design (estimated from spring quarter), and 14,035 households (unweighted count) had at least one member sampled. Excluded from this report are data on about 9 percent, or 2,740 individuals (unweighted count), who did not complete food intake questionnaires for all 3 days.

Design

The household survey was designed to be a self-weighting, multistage, stratified area sample of 15,000 households in the coterminous States. During each quarter, 3,750 households were to be sampled by use of an interpenetrating design. The sampling frame was organized by use of the 1970 Census of Population and Housing. In the spring quarter of the individual survey, all members of the households were eligible to participate. In the other quarters of the individual survey, individuals were selected on the basis of age.

Stratification

The 48 coterminous States were divided into 114 strata on the basis of three levels of stratification--geographic division, urbanization or zone, and demographic or other geographic similarities. Each of the nine census geographic divisions that constitute the four census regions was divided into three census zones.

- Zone I (central city)--The area comprising the central city or cities in standard metropolitan statistical areas (SMSA's).
- Zone II (suburban)--The area in SMSA's outside Zone I.
- Zone III (nonmetropolitan)--Any area not included in Zones I and II.

The two levels of division and zone were then grouped at the third level based on cities or other political entities, economic trading areas, geographic units, and/or size. This procedure resulted in 114 homogeneous strata of approximately 600,000 households each. The distribution of these strata by census geographic divisions and zones is shown in Table I-A.

Table I-A. Geographic location of strata for the 1977-78 Nationwide Food Consumption Survey sample

Census region and division	Total division	Central city, Zone I	Suburban, Zone II	Nonmetro-politan, Zone III
		Number of strata		
Total	114	38	39	37
Northeast:				
New England	7	2	3	2
Middle Atlantic	21	8	9	4
North Central:				
East North Central	22	8	8	6
West North Central	9	2	2	5
South:				
South Atlantic	17	4	6	7
East South Central	7	2	1	4
West South Central	11	4	2	5
West:				
Mountain	5	2	1	2
Pacific	15	6	7	2

Primary Sampling Units

Every stratum was divided into one or more primary sampling units (PSU's). The PSU's were formed from counties, cities, or parts of cities, and each contained at least 10,000 housing units. Twelve strata were represented by only one PSU each, and these PSU's were picked with certainty. (They are Cook Co., Ill.; Kings Co., N.Y.; Los Angeles Co., Calif. (double strata); New York Co., N.Y.; Queens Co., N.Y.; Chicago, Ill. (double strata); Detroit, Mich.; Los Angeles, Calif. (double strata); Philadelphia, Pa.) PSU's from the other 102 strata were drawn with probabilities proportional to size.

Selection of Area Segments Within PSU's

Each PSU drawn was divided into small clusters of housing units called "area segments." The area segments were designed, based on the 1970 Census, to contain 100 or more housing units. In urban areas, area segments usually consisted of one or more city blocks; elsewhere, they consisted of part of a Census enumeration district. From the PSU's, 2,500 area segments were drawn. The number of area segments in a PSU was proportional to the size of the stratum in which the PSU was located. The probability that an individual area segment would be drawn from a PSU was proportional to the ratio of the number of housing units in the area segment to the total number of units in the PSU.

Prelisting of Area Segments

All 2,550 area segments were prelisted to determine the number of occupied housing units. Then the national increase in the number of housing units from 1970 to 1977 was estimated. This information, together with estimates of occupancy and completion rates, permitted calculation of sampling ratios for the area segments that yielded a total of 3,750 households per quarter.

Selection of Sample Housing Units

For the first two quarters, an average sampling ratio of 2.3 households per segment was used. The housing units were ordered within their respective segments. For each quarter, a sample was systematically selected from each segment without replacement after a random start. By the end of the second quarter, the estimated completion rate had been adjusted. and an average sampling ratio of 2.86 households per segment was used for the last two quarters. With the above adjustments, the target sample size of 15,000 households was closely approximated during the year-long survey period. Household questionnaires were completed for about 72 percent (14,930) of the 20,812 households contacted. A questionnaire was considered complete if it permitted nutritional evaluation.

Selection of Eligible Individuals

During the spring quarter, all individuals regularly living in the selected household were eligible to participate in the individual intake phase of the survey. During the other quarters, all individuals under 19 years of age, but only one-half of the individuals 19 years and older, were eligible. The selection was accomplished by using a special form. All individuals over 18 in a given household were entered on the form in the same order in which they were listed in the household survey. Then either odd- or even-numbered persons were selected, depending on information on the form. This selection process was centrally controlled and could not be modified by the interviewers. In one-person households, the household member was always eligible to participate.

If a household member was away from home during the initial interview but was expected to return before the end of the 3-day recording period, intake forms were left to be filled in with the assistance of the household respondent. In households participating in the survey, 94 percent of eligible individuals completed the first-day dietary report, and 85 percent completed all 3 days of dietary reports.

Weights

Although the household survey was designed to be self-weighting, it was determined after the survey ended that the completion rates for the various PSU's differed at a statistically significant level. Therefore, weighting factors were applied to data from completed schedules. Weights were calculated for each quarter for every PSU and were designed to be proportional to the ratio of the expected number of completed schedules in a PSU to the collected number of completed schedules in a PSU. Weights were scaled so that there would be 3,740 completed schedules per quarter.

The weight factor applied to the household was also applied to the records of every individual in that household. In the summer, fall, and winter quarters, the weight factor was doubled for individuals over 18 years of age to adjust for the half-sampling that occurred. In one-person households, however, the weight factor was not doubled, regardless of the age of the individual. After weighting was completed, a few household schedules had to be discarded because of invalid or incomplete data. The weighted and unweighted household and individual counts are shown by season in Table I-B.

Table I-B. Weighted and unweighted numbers of households and individuals in the 1977-78 Nationwide Food Consumption Survey, by quarter

Quarter	Household		Individual	
	Weighted	Unweighted	Weighted	Unweighted
		Number		
Total	14,926	14,930	40,209	30,770
Spring	3,739	3,322	9,811	8,778
Summer	3,728	3,468	10,107	6,584
Fall	3,728	4,071	10,140	7,696
Winter	3,731	4,069	10,151	7,712

Collection Counts

Table I-C shows weighted and unweighted counts of individuals in the 22 sex-age groups distributed by the number of days of dietary intake reported for the year.

Table I-C. Weighted and unweighted numbers of individuals with 1, 2, and 3 days of dietary reports in the 1977-78 Nationwide Food Consumption Survey, by sex and age

Sex and age	Dietary reports: 1 day, Weighted	1 day, Unweighted	2 days, Weighted	2 days, Unweighted	3 days, Weighted	3 days, Unweighted
	Number					
Total	2,870	1,946	1,083	794	36,255	28,030
Males and females:						
Under 1 year	26	23	9	8	524	535
1-2 years	52	46	34	33	1,045	1,064
3-5 years	76	67	56	52	1,719	1,740
6-8 years	94	90	72	64	1,841	1,879
Males:						
9-11 years	50	46	28	26	939	961
12-14 years	42	39	34	32	1,150	1,168
15-18 years	67	63	49	48	1,394	1,399
19-22 years	86	55	36	24	1,030	659
23-34 years	223	133	93	57	2,716	1,750
35-50 years	232	149	82	49	2,571	1,655
51-64 years	182	115	56	35	2,161	1,388
65-74 years	105	64	23	16	1,049	686
75 years and over ..	54	41	9	6	465	326
Females:						
9-11 years	46	45	26	27	1,011	1,034
12-14 years	37	33	35	29	1,148	1,159
15-18 years	60	60	62	57	1,473	1,479
19-22 years	128	74	59	34	1,317	814
23-34 years	374	207	93	51	3,879	2,394
35-50 years	336	193	88	54	3,759	2,322
51-64 years	346	210	64	44	2,936	1,963
65-74 years	153	109	46	26	1,376	1,057
75 years and over ..	101	84	31	22	751	598

Table I-1 shows the weighted number of housekeeping households in the survey by various characteristics. Table I-2 shows the weighted number of individuals in the sample by age and sex, region, poverty status, race, urbanization, and season.

Data Collection

Each household in the sample was sent a letter explaining the purpose of the survey and the importance of participation. Next, at least 1 week in advance of the interview, an interviewer made an appointment with the household member most responsible for food planning and preparation (respondent) and asked the respondent to keep grocery receipts, shopping lists, menus, package labels, or other memory aids to help in recalling the food used during the 7-day survey period.

Household interviews were completed in about $2\frac{1}{2}$ hours on the average. Interviews were conducted by experienced interviewers who had received special training in the NFCS methodology. The interviewer obtained three major types of information.

- Household characteristics--This identifying and descriptive information included number, age, and sex of household members; presence of pregnant or lactating females; number of morning, noon, and evening meals consumed at home and away from home by household members; number of meals and snacks consumed by guests from household food supplies; educational level, employment status, and occupation of male and female household heads; and general food shopping practices.

- Foods used from home food supplies--The interviewer used a detailed food list to help the household respondent recall what foods were used from home food supplies during the previous 7 days. Respondents were asked to recall all food that was "used," whether it was eaten, discarded, or fed to pets as leftovers. Food was reported in the form it entered the kitchen. Forms include fresh, frozen, canned, dried, and ready to eat. Respondents stated the quantity of food used in pounds, quarts or other familiar units that were later converted to pounds. They were also asked the source of food--purchased, home produced, or received as gift or pay. If the food was purchased, the respondent was asked the amount purchased and price paid.

- Household income--Information was obtained about amounts and sources of income during the previous full month for each household member 14 years of age and over and during the previous calendar year for the household unit. Information was also obtained about the type of dwelling and housing costs. Detailed questions were asked about participation in food assistance programs--the Food Stamp Program, including the face value of any Food Stamps received; the National School Lunch and School Breakfast Programs; the Nutrition Programs for the Elderly; and the Special Supplemental Food Program for Women, Infants, and Children.

The individual intake phase of the survey began when the household phase was completed. The interviewer asked each eligible individual present to recall all food eaten during the previous day. Additional questions were asked about water consumption, about the use of vitamin and/or mineral supplements, and about height and weight, health status, and other factors that might influence the individual's eating and drinking behavior, such as being on a reducing or other special diet or being a vegetarian. The household respondent usually provided this information for children under 12 years of age and others unable to answer for themselves. Each 24-hour dietary recall was completed in about 15-20 minutes.

Following the 24-hour dietary recall, the interviewer instructed the household respondent and each individual present in keeping a written record of his or her intake for the day of the interview and for the next day, thus providing 3 consecutive days of dietary information. Respondents also were given a reference booklet to help them describe food and amounts eaten. To help in quantifying portion sizes eaten, each household received measuring cups, measuring spoons, and a ruler. The interviewer returned to the household to review and pick up completed dietary records. For each completed 24-hour dietary recall plus 2-day dietary intake record returned, the household received $1--up to a limit of $10 per household.

The format of the dietary intake form was the same for both the 24-hour dietary recall and the 2-day food record. Information consisted of:

- Name and detailed descriptions of all food and beverages consumed.

- Quantity eaten, usually reported in common household measures, dimensions, number of units, or weights.

- Form as eaten, such as baked, broiled, stewed, or fried.

- Source of food, such as food from home supplies eaten at home, food from home supplies eaten away from home, or food obtained and eaten away from home, such as at someone else's home, restaurant, fast-food place, or school. For food purchased and eaten away from home, information was obtained on the cost and the kind of service (for example, waiter or waitress, counter, cafeteria, vending machine, carryout).

- Eating occasion, identified by time it began and what it was usually called--breakfast, brunch, lunch, dinner, supper, coffee (beverage) break, or snack--and with whom food was eaten (for example, alone, with other household member, with person not from household, or with both household member and another person).

Nutritive Values

Nutritive values for both the household and individual phase of the survey were derived by experts in USDA's Human Nutrition Information Service. Food composition data used, available on tape, include values published in Agriculture Handbook No. 8 and its supplements (listed in Bibliography), and unpublished values and estimates developed by the Nutrient Data Research Branch of the Human Nutrition Information Service. Contents of food energy and of 14 nutrients--protein, fat, carbohydrate, vitamin A value, thiamin, riboflavin, preformed niacin, vitamin B_6, vitamin B_{12}, vitamin C, calcium, phosphorus, magnesium, and iron--were calculated.

Each food and food combination reported in the household phase of the 1977-78 NFCS was assigned one of about 3,900 codes for computer processing. The codes identified food by major and minor marketing groups, nutrition groups, and by processing form. The quantity reported as used was converted to pound weights using standard conversion factors. In addition, special equivalent weights were calculated for such items as dairy products (to equate the calcium in each to the calcium in whole milk), flour in cereals and bakery products, and the single-strength quantity of citrus fruit juice. The nutrient contribution of each food was computed by multiplying the quantity in pounds by the nutritive value of the edible portion of a pound of the food as brought into the household. "Edible portion" excludes parts of food that are clearly inedible, such as bones in meat. For the household phase of the survey, the nutritive values of food were adjusted for vitamin retention during cooking.

Each food and food combination reported in the individual intake phase of the 1977-78 NFCS was assigned one of about 4,500 codes for computer processing. The codes identified food by nine major and numerous minor food groups and indicated, as appropriate, other information such as preparation method. The quantity of each food reported as ingested by an individual was converted to gram weights of the ingested portion of the food using standard conversion factors. The energy and nutrient content of each food reported was calculated using values per 100 grams of food and summed to obtain the content of each day's intake for each individual. After calculation of each individual's 3-day average intakes, weighted averages for the survey population were calculated--for example, by age, sex, race, income, region, urbanization, and season. The standard errors were calculated by a method that takes the survey design into account (Shah, 1981). The data are summarized in Tables I-3 to I-20.

Dietary Standards

The criteria for evaluating much of the dietary data in this report are the Recommended Dietary Allowances (RDA), established by the National Academy of Sciences, Food and Nutrition Board (NAS-FNB), Committee on Dietary Allowances (National Research Council, 1980a). RDA have been established for 17 sex and age groups for 14 of the 25 food components discussed. The RDA are known with greater certainty for some nutrients for specific sex and age groups than for others. All RDA are based on available scientific knowledge and represent the consensus of nutrition experts chosen by the National Academy of Sciences to be part of the Committee on Dietary Allowances. The RDA are revised approximately every 5 years so as to incorporate new information that becomes available. NAS-FNB also has established ranges of Recommended Energy Intakes (REI) and estimated safe and adequate ranges of intake for sodium and certain other food components. Dietary intakes of food components that do not have established RDA, such as fat, cholesterol, and added sweeteners, were compared with dietary guidelines proposed by other authoritative groups.

A special National Academy of Sciences committee was sponsored by USDA to study the issue of criteria for evaluating the dietary intakes of individuals especially when intakes are below the RDA. The Committee's report was released after this report was written (National Research Council, 1986).

When the RDA are used as criteria to aid in the assessment of the adequacy of nutrient intakes, the basic assumptions used in setting the RDA must be considered. Nutrient intakes at RDA levels are expected to support body stores and biochemical and physiological processes in essentially all normal healthy people. The RDA are not intended to meet the special needs of individuals with medical problems. NAS-FNB has specifically cautioned against confusing RDA with nutrient requirements. They state:

> Differences in the nutrient requirements of individuals are ordinarily unknown. Therefore, RDA (except for energy) are estimated to exceed the requirements of most individuals and thereby to ensure that the needs of nearly all in the population are met. Intakes below the recommended allowances for a nutrient are not necessarily inadequate (National Research Council, 1980a).

Because the RDA include a margin of safety above the average requirement, it can be concluded with reasonable certainty that a diet that meets the RDA will meet the requirements of nearly all healthy individuals. This statement of assurance cannot be made for diets that do not meet the RDA. However, the relationships between nutrient intakes and health effects may not be linear. The exact nature of the relationships remains to be determined.

If criteria representing average nutrient requirements were available, individuals with diets providing less than these criteria might be considered at some degree of risk. Inadequate intakes determined by such criteria would be expected to be more closely associated with clinical and biochemical indicators of "poor" nutritional status. Because the RDA do not mark levels below which deficiency is likely to occur, dietary assessments are not by themselves conclusive evidence of nutritional deficiency. Corroborating health data are needed for a diagnosis of nutritional deficiency. However, it is reasonable to assume that the risk of nutritional deficiency is greater the further dietary intakes fall below the RDA and/or the larger the proportion of the population with intakes below the RDA.

The RDA were established as daily allowances. However, NAS-FNB recognizes that if the RDA are not met on a particular day, a surplus consumed shortly thereafter usually compensates. NAS-FNB suggests that averaging intakes of nutrients over a short period of time, such as 5-8 days, is acceptable in assessing dietary intakes. Day-to-day variability in food intake by individuals is also a consideration in the interpretation of survey data. In an effort to decrease effects of intraindividual variability, 3 days of dietary data were collected and averaged for each individual in the 1977-78 NFCS. The extent to which this average represented the "usual" intake of these individuals is unknown.

In assessing data on household diets collected in the 1977-78 NFCS, adjustments were made to take into account the number of persons eating from the household food supply, their age and sex, and the proportion of meals eaten at home. This evaluation provides information on whether food available to the household was adequate to meet the RDA of its members.

Individual intake data provide more direct estimates of nutrient intakes by individuals than household data because food is reported as eaten by each household member both at home and away from home. They also make possible comparisons among sex and age groups. Two methods of comparing intake with the RDA were used. In the first method, each individual's daily intake of each nutrient was compared with the appropriate RDA and expressed as a percentage. In the second method, the ratio of each individual's nutrient-to-calorie intake was expressed as a percentage of the RDA ratio. Daily percentages were then averaged over 3 days for each individual.

The first method of comparing intake directly with the RDA would indicate lower than actual levels of intake if there were underreporting of food by survey respondents. On the other hand, the second method, comparing nutrient-to-calorie ratios of intake to RDA ratios, might indicate an unduly favorable picture of nutrient intakes--that is, higher than actual levels of intake. This would occur if, as is sometimes hypothesized, survey respondents are least likely to report fully those foods that are high in calories and low in vitamins and minerals. The midpoint of the range of the REI was used in calculating the RDA nutrient-to-calorie ratio in the second method. If an individual's actual energy requirement is below the REI midpoint, the RDA nutrient-to-calorie standards will be unduly low and easy to meet for that individual. Conversely, if the individual's energy requirement is above the REI midpoint, the RDA nutrient-to-calorie standards will be unduly high and difficult to meet.

In addition to the conventional use of the RDA as reference points to aid in assessment of the adequacy of individuals' nutrient intakes, they are also used to standardize nutrient intakes among individuals having different nutrient needs, such as individuals of different sex and age. Dietary intakes of food components that do not have established RDA were related to calorie intake as a method of standardization.

In this report, levels of each food component in the American diet are assessed separately (Chapter 2). This approach is used because no adequate methods exist for assessing the nutritional quality of the diet as a whole. Nevertheless, some relatively simple proxy measures of overall diet quality have been developed. Although these measures are of limited value in providing a broad picture of dietary status, they do serve some special purposes. For example, economists sometimes use data on money spent on food as a proxy for food consumption in studies that predict the effect of changes in food prices, wages, and other economic factors. Ethnographers and social scientists focus on food and eating patterns, relating them to beliefs about food and other aspects of culture. Epidemiologists may use the growth performance of children as an overall indicator of the dietary status of populations that suffer from severe malnutrition. Infant mortality is sometimes used as an overall indicator of the health of populations, especially in developing countries.

Nutritionists have developed several methods of measuring the quality of the diet as a whole. However, each method has shortcomings. Some methods reflect the number of nutrients meeting the RDA. Other methods use some proportion of the RDA for nutrients such as 60, 70, or 80 percent. A major problem with these methods is that the health effects of particular levels of intake are generally not known, and the relationship between levels of intake and health effects are not the same for different nutrients. Average intakes of nutrients expressed as percentages of the RDA, truncated at 100 percent, may conceal important differences among intakes of nutrients. Another method, in which the nutrient intake representing the lowest percent of the RDA of any nutrient in the diet is focused on, may put undue emphasis on a single nutrient. Even more complicated are overall measures of diet quality that include food components that do not have established RDA. Excessive intakes rather than low intakes are frequently the concern with food components such as fat and cholesterol. Diets are also sometimes assessed in terms of the frequency with which certain types of foods (food groups) are consumed.

<u>Quality Assurance and Data Validity</u>

Several quality assurance procedures were followed during the 1977-78 NFCS. Interviewers underwent 5-day training sessions, and separate sessions were provided for coders and reviewers. Interviewers, respondents, or both were contacted if responses to key questions were missing or confusing, or if 10 percent or more of the food and beverage descriptions and quantities could not be coded. Coders reviewed and corrected, if necessary, extreme values for amounts consumed. Keypunches were 100-percent verified. After computation of nutrient measures, extreme values in amounts of nutrients were reviewed.

Because of the size and scope of the 1977-78 NFCS, traditional validation procedures such as replication, personal observation, and weighing of food were not practical. Therefore, a number of partial validation procedures were used. These included relatively small-scale validation studies and comparisons with previous nationwide food consumption surveys and other surveys.

Prior to the 1977-78 survey, Burk and Pao (1976) conducted a comprehensive review and evaluation of the literature on methodology for large-scale surveys of household and individual diets. They concluded that the 24-hour recall method had high response rates and seemed to have the highest reliability but that it tended to produce downwardly biased data. On the other hand, the dietary record method tended to produce upwardly biased data. For the five aspects of validity reviewed, no one survey method was clearly better.

Survey planners for the 1977-78 NFCS combined the recall method with the food record method to offset the opposing weaknesses of the two methods. In an analysis of the 1977-78 NFCS data, mean intakes based on 24-hour dietary recalls were not significantly different from mean intakes based on 2 days of dietary records for most nutrients and sex and age groups (Pao et al., 1985).

U.S. Food Supply Series

Background

The Nutrient Content of the U.S. Food Supply is a historical series providing data on amounts of nutrients per capita per day in food available for consumption each year beginning with 1909 (Table I-21). This series is the only source of information by which trends in the levels of nutrients in the American diet can be followed since the beginning of the century. Levels of nutrients per capita per day are rapidly and inexpensively derived indicators of diet quality. They are used to assess the potential of the U.S. food supply to satisfy the nutritional needs of the population. These data also have other uses not presented in this report, such as in epidemiological studies on the relationship between diet and the prevalence of disease and in studies of the effects of technological, economic, and social changes on the U.S. diet and future food production.

Data on the nutrient content of the U.S. food supply are published annually in Agricultural Statistics (U.S. Department of Agriculture, 1984a), Statistical Bulletins on food consumption, prices and expenditures (Economic Research Service, 1984), handbooks of agricultural charts in the Agriculture Handbook series, (1984b), and Statistical Abstract of the United States (U.S. Bureau of the Census, 1985). Interpretive analyses of trends in nutrient levels in the food supply are reported annually in the National Food Review (Economic Research Service, 1986) and frequently in other publications (Welsh and Marston, 1982 and 1983).

Design

Two sources of information within USDA are used to calculate the nutrient content of the U.S. food supply. The Economic Research Service provides estimates of quantities of food available for consumption per capita per year, and the Human Nutrition Information Service provides data on the nutrient content of food. The nutrient content of the U.S. food supply is calculated by multiplying the pounds of each food consumed per capita per year by the nutritive value per pound, totaling the results for all foods, and then converting the total to a per-day basis.

Food Consumption Estimates

The Economic Research Service estimates the quantities of approximately 300-400 foods that "disappear" into the U.S. food distribution system. The methods used have been described in detail previously (Economic Research Service, 1965). In brief, disappearance data are estimated by deducting data on exports, military use, yearend inventories, and nonfood use from data on production, imports, and beginning-of-the-year inventories. The methodology avoids double counting of any food. Data on per capita consumption of food are derived by dividing the weight of food available for use during the year by the population of the 50 States and the District of Columbia, as estimated by the U.S. Bureau of the Census.

Disappearance of all foods is not measured at the same point in the distribution system. Some foods are in a raw or primary form and others are retail products when their disappearance is measured. For example, the disappearance of meat, poultry, fish, flour, eggs, sugar, and fat is measured when they are in a primary state, that is, before they are processed into finished products such as bread, bakery products, soft drinks, and frozen casseroles. On the other hand, quantities of fruit, fruit juices, vegetables, and potatoes are measured in several forms--fresh, canned, frozen, or dehydrated. However, these products too may undergo further processing, for example, into pies and jellies. Food disappearance estimates exclude some sources of nutrients: alcoholic beverages and the sugars and grains used in their manufacture; baking powder, baking soda, yeast, and certain vitamins and minerals added to foods for their functional or flavoring properties; and vitamin and/or mineral supplements in tablet, capsule, and liquid form.

Nutrient Content of Food

HNIS data on the nutrient content of foods has been sufficient to derive estimates for the U.S. food supply series and for the 1977-78 Nationwide Food Consumption Survey for the following food components: Energy, protein, fat, carbohydrate, vitamin A value, thiamin, riboflavin, preformed niacin, vitamin B_6, vitamin B_{12}, vitamin C, calcium, phosphorus, magnesium, and iron. Because the food supply series requires food composition data for a relatively small number of foods and for the primary (uncombined) state of the foods, food composition data have been sufficient to make estimates for these additional food components: Folacin, zinc, cholesterol, total saturated fatty acids, oleic acid, linoleic acid, simple and complex carbohydrates, and crude fiber.

Nutrients added to foods commercially through fortification and enrichment are included in the food supply estimates on the basis of periodic surveys of industry conducted for USDA by the U.S. Bureau of the Census. Therefore, data on the nutrient content of the U.S. food supply include quantities of iron, thiamin, riboflavin, and niacin added to flour and cereal products; vitamin A value added to margarine, milk, and milk extenders; vitamin B_6 added to cereal, meal replacements, and infant formulas; vitamin B_{12} added to cereal; and ascorbic acid added to fruit juices and drinks, flavored beverages, dessert powders, milk extenders, and cereal.

Estimates of the nutrient content of the food supply exclude nutrients from the inedible parts of food, such as bones, rinds, and seeds, but include nutrients from portions of food that are edible but not always eaten. For example, the nutrient values used for meat are for composite retail cuts and include all of the separable fat that is left on retail cuts. Nutrient estimates also include food and nutrients that may be lost after food disappearance is measured, as in processing, marketing, or cooking. In so far as possible, nutrient estimates reflect changes in the composition of individual foods since 1909. For example, the vitamin values applied to fresh potatoes consumed in recent years are higher than vitamin values applied to potatoes consumed at the beginning of the century because of better storage conditions and use of different cultivars. The most recent composition data are used if earlier data are unavailable or considered unreliable.

Table I-1. Household diets, 1977-78: Number of housekeeping households, money value of food used in home per person per week, and household size, by selected characteristics

Characteristic[1]	Number of housekeeping households[2]	Money value of food per person[3] per week	Household size[2,3]
Number of household members[4]			
1	562	$21.38	0.97
3	614	17.47	2.65
6 or more	300	14.02	5.97
Income per capita[4,5]			
Less than $2,250	548	13.80	3.51
$2,250-$3,499	531	15.03	2.97
$3,500-$4,999	495	16.33	2.94
$5,000-$7,799	643	18.42	2.62
$7,800 or more	558	21.68	1.91
Food Stamp Program status			
Participating	996	15.15	3.19
Eligible, not participating	1,909	14.44	2.66
Not eligible	7,667	17.69	2.68
Income as percent of poverty level[5]			
0-99	1,375	14.16	2.77
100-199	2,558	15.36	2.78
200 or more	6,446	18.20	2.75
Weekly money value of food per person[3]			
Less than $8	586	6.50	3.63
$8-$11.99	2,225	10.24	3.32
$12-$15.99	3,527	14.01	3.02
$16-$19.99	3,076	17.86	2.74
$20-$29.99	3,450	23.74	2.34
$30 or more	1,157	37.17	1.79
All households[2]			
Spring quarter	3,473	16.71	2.78
Full year	14,023	16.98	2.76

[1]Counts may not total to number surveyed because of rounding, categories selected, or missing data.
[2]Households with at least 1 person having 10 or more meals from the household food supply during the 7 days prior to interview.
[3]Meal-at-home equivalent person.
[4]Data for spring quarter only.
[5]1976 household income before taxes.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-2. Individual intakes, 1977-78: Number of individuals with 3-day dietary reports, by selected characteristics

Characteristic	Number of individuals
All individuals	36,140
Age and sex	
Males and females:	
Under 1 year	421
1-8 years	4,595
Males:	
9-18 years	3,481
19-64 years	8,478
65 years and over	1,514
Females:	
9-18 years	3,632
19-64 years	11,892
65 years and over	2,127
Poverty status and race	
Above poverty:	
White	20,845
Black	2,097
Below poverty:	
White	1,925
Black	1,174
Region	
Northeast	8,867
North Central	9,719
South	11,209
West	6,345
Urbanization	
Central city	10,461
Suburban	13,736
Nonmetropolitan	11,943
Season	
Spring	8,780
Summer	9,037
Fall	9,196
Winter	9,128

NOTE: Data are weighted to compensate for households that were selected for the sample but did not respond.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-3. Food energy--individual intakes, 1977-78: Mean percent of the 1980 Recommended Energy Intakes (REI), standard errors, and percent of population having specified intakes, by selected characteristics (3-day average)

Characteristic	Mean intake percent of REI[1]		Percent of population having intakes of at least:	
	Percent	Standard error	70 percent of REI	100 percent of REI
All individuals..........	84	0.49	68	24
Age and sex				
Males and females:				
Under 1 year...........	102	2.55	84	47
1-8 years..............	89	0.74	76	31
Males:				
9-18 years.............	87	0.95	74	26
19-64 years............	87	0.70	71	28
65 years and over.......	83	1.29	66	21
Females:				
9-18 years.............	82	0.67	68	21
19-64 years............	79	0.57	60	24
65 years and over.......	82	0.65	66	24
Region				
Northeast................	84	0.70	69	24
North Central............	85	0.95	70	25
South....................	81	0.57	64	22
West.....................	87	1.33	70	29
Poverty status and race				
Above poverty:				
White..................	85	0.41	69	25
Black..................	81	1.72	61	22
Below poverty:				
White..................	81	1.15	63	22
Black..................	78	2.73	57	19
Urbanization				
Central city.............	84	1.26	67	24
Suburban.................	84	1.35	68	24
Nonmetropolitan..........	84	0.94	68	24
Season				
Spring...................	83	0.62	67	24
Summer...................	84	0.52	67	24
Fall.....................	85	0.70	69	25
Winter...................	84	0.63	68	24

[1]Midpoint of range.

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-4. Protein--individual intakes, 1977-78: Mean percent of the 1980 Recommended Dietary Allowances (RDA) and mean percent of calories from protein, standard errors, and percent of population having specified intakes, by selected characteristics (3-day average)

	Mean intake				Percent of population having intakes of at least					
	Percent of RDA		Percent of calories		Percent of RDA		Percent of RDA-to-REI		Percent of calories	
Characteristics	Percent	Standard error	Percent	Standard error	70	100	70	100	15	17
All individuals......	166	1.42	17	0.11	97	88	100	100	66	40
Age and sex										
Males and females:										
Under 1 year.......	185	4.98	14	0.19	97	89	100	99	42	30
1-8 years..........	209	2.28	16	0.15	100	98	100	100	59	30
Males:										
9-18 years.........	196	2.01	16	0.11	99	96	100	100	62	32
19-64 years........	169	1.36	17	0.11	98	92	100	100	70	43
65 years and over..	139	2.22	17	0.16	97	81	100	99	66	42
Females:										
9-18 years.........	163	1.95	16	0.13	97	89	100	100	59	31
19-64 years........	146	1.68	17	0.11	95	82	100	99	69	46
65 years and over..	135	1.61	17	0.18	94	79	100	98	69	45
Region										
Northeast...........	167	2.38	17	0.38	98	90	100	100	67	42
North Central........	165	2.49	16	0.08	98	88	100	100	63	36
South................	161	2.09	17	0.14	96	86	100	99	67	41
West.................	172	3.51	17	0.15	97	89	100	99	67	41

Table I-4. Protein--individual intakes, 1977-78: Mean percent of the 1980 Recommended Dietary Allowances (RDA) and mean percent of calories from protein, standard errors, and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

	Mean intake				Percent of population having intakes of at least					
	Percent of RDA		Percent of calories		Percent of RDA		Percent of RDA-to-REI		Percent of calories	
Characteristics	Percent	Standard error	Percent	Standard error	70	100	70	100	15	17
Poverty status and race										
Above poverty:										
White..............	165	1.05	16	0.09	97	89	100	100	63	37
Black..............	169	4.46	17	0.23	97	88	100	100	74	50
Below poverty:										
White..............	159	2.19	16	0.19	95	82	100	99	62	36
Black..............	167	5.75	17	0.20	95	85	100	100	74	51
Urbanization										
Central city.........	168	2.82	17	0.23	97	88	100	100	70	46
Suburban.............	166	3.25	16	0.12	98	89	100	100	65	38
Nonmetropolitan......	163	1.72	16	0.09	97	87	100	99	64	37
Season										
Spring...............	165	1.58	17	0.13	97	88	100	99	66	42
Summer...............	164	1.61	16	0.13	97	87	100	99	64	39
Fall.................	168	1.81	17	0.12	97	89	100	100	67	39
Winter...............	165	1.71	17	0.10	97	89	100	100	67	39

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-5. Fat--individual intakes, 1977-78: Mean percent of calories from fat, standard errors, and percent of population having specified intakes, by selected characteristics (3-day average)

Characteristic	Mean intake percent of calories: Percent	Mean intake percent of calories: Standard error	Percent of population having intakes above: 30 percent of calories	Percent of population having intakes above: 40 percent of calories
All individuals.........	41	0.15	94	53
Age and sex				
Males and females:				
Under 1 year..........	37	0.52	78	39
1-8 years.............	38	0.14	92	36
Males:				
9-18 years............	40	0.11	96	48
19-64 years...........	42	0.23	96	63
65 years and over.....	41	0.42	93	52
Females:				
9-18 years............	39	0.18	94	46
19-64 years...........	41	0.18	94	57
65 years and over.....	39	0.15	91	45
Region				
Northeast...............	40	0.39	94	52
North Central..........	41	0.20	95	54
South....................	40	0.12	93	50
West.....................	41	0.37	94	56
Poverty status and race				
Above poverty:				
White..................	41	0.16	95	55
Black..................	40	0.20	93	50
Below poverty:				
White..................	40	0.35	93	46
Black..................	39	0.41	90	44
Urbanization				
Central city............	40	0.22	93	51
Suburban................	41	0.26	95	54
Nonmetropolitan.........	40	0.22	95	53
Season				
Spring..................	41	0.17	94	53
Summer..................	41	0.23	94	53
Fall....................	41	0.19	95	53
Winter..................	40	0.18	93	52

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-6. Cholesterol--individual intakes, 1977-78: Mean quantities in milligrams (mg), mean quantities in mg per 1,000 Calories, standard errors, and percent of population having specified intakes, by selected characteristics (3-day average)

Characteristics	Mean intake: Quantity: In mg	Mean intake: Quantity: Standard error	Mean intake: Quantity per 1,000 Calories: In mg	Mean intake: Quantity per 1,000 Calories: Standard error	Percent of population having intakes above: 300 mg	Percent of population having intakes above: 150 mg per 1,000 Calories	Percent of population having intakes above: 250 mg per 1,000 Calories
All individuals......	385	5.18	214	2.83	58	69	29
Age and sex							
Males and females:							
Under 1 year.......	111	4.94	130	5.72	8	32	12
1-8 years..........	289	5.78	194	3.67	39	61	21
Males:							
9-18 years.........	442	8.41	192	2.81	70	63	20
19-64 years........	511	5.70	226	2.68	78	74	34
65 years and over..	461	11.14	251	6.19	71	78	43
Females:							
9-18 years.........	328	6.32	184	2.75	49	58	17
19-64 years........	345	6.61	225	3.35	52	72	32
65 years and over..	316	5.85	227	4.63	47	69	33
Region							
Northeast...........	374	6.54	207	7.26	56	67	26
North Central........	369	7.07	201	2.65	54	64	24
South................	396	11.75	229	6.19	60	73	34
West.................	406	9.69	217	3.80	61	70	30
Poverty status and race							
Above poverty:							
White..............	377	3.67	205	2.24	56	66	26
Black..............	428	18.08	245	6.48	65	81	40
Below poverty:							
White..............	371	5.64	224	4.75	55	69	33
Black..............	401	17.53	256	7.92	61	78	42
Urbanization							
Central city.........	400	10.47	225	6.33	60	72	33
Suburban.............	379	10.98	208	4.00	57	67	27
Nonmetropolitan......	379	4.73	211	5.13	57	68	27
Season							
Spring...............	391	5.64	217	2.74	59	69	30
Summer...............	379	6.98	212	4.40	56	67	28
Fall.................	387	6.83	214	3.45	58	70	28
Winter...............	384	4.81	213	2.45	58	68	28

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-7. Carbohydrate--individual intakes, 1977-78: Mean percent of calories from carbohydrate, standard errors, and percent of population having specifed intakes, by selected characteristics (3-day average)

Characteristic	Mean intake percent of calories		Percent of population having intakes above:	
	Percent	Standard error	40 percent of calories	60 percent of calories
All individuals..........	43	0.19	63	2
Age and sex				
Males and females:				
Under 1 year...........	45	0.82	63	11
1-8 years..............	47	0.27	84	4
Males:				
9-18 years.............	45	0.18	77	2
19-64 years............	40	0.24	48	1
65 years and over......	42	0.45	61	3
Females:				
9-18 years.............	46	0.19	79	2
19-64 years............	41	0.22	55	2
65 years and over......	44	0.29	70	4
Region				
Northeast................	42	0.43	60	2
North Central............	43	0.16	65	2
South....................	43	0.17	66	3
West.....................	42	0.47	59	2
Poverty status and race				
Above Poverty:				
White..................	42	0.25	62	2
Black..................	42	0.33	61	2
Below Poverty:				
White..................	44	0.59	71	3
Black..................	44	0.42	66	3
Urbanization				
Central city.............	42	0.28	62	2
Suburban.................	42	0.40	61	2
Nonmetropolitan..........	43	0.21	66	2
Season				
Spring...................	42	0.23	62	2
Summer...................	43	0.30	63	2
Fall.....................	43	0.21	63	2
Winter...................	43	0.21	64	2

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-8. Added sweeteners--individual intakes, 1977-78: Mean percent of calories from added sweeteners, standard errors, and percent of population having specified intakes, by selected characteristics (3-day average)

Characteristic	Mean intake percent of calories		Percent of population having intakes above:	
	Percent	Standard error	10 percent of calories	15 percent of calories
All individuals	12	0.19	56	29
Age and sex				
Males and females:				
Under 1 year	5	0.40	18	8
1-8 years	14	0.33	67	38
Males:				
9-18 years	14	0.21	68	38
19-64 years	11	0.15	50	23
65 years and over	10	0.23	47	19
Females:				
9-18 years	14	0.23	70	42
19-64 years	12	0.23	53	27
65 years and over	10	0.25	46	20
Region				
Northeast	11	0.45	52	25
North Central	12	0.12	60	32
South	13	0.23	60	32
West	11	0.51	50	24
Poverty status and race				
Above Poverty:				
White	12	0.21	58	30
Black	13	0.44	60	32
Below Poverty:				
White	12	0.24	54	27
Black	11	0.51	55	28
Urbanization				
Central city	12	0.42	54	28
Suburban	12	0.46	56	28
Nonmetropolitan	12	0.23	59	31
Season				
Spring	12	0.19	57	32
Summer	12	0.26	59	32
Fall	12	0.19	56	27
Winter	11	0.20	54	26

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-9. Vitamin A value--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean vitamin A value-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
Characteristic	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
All individuals.........	133	2.82	164	69	50	80	61
Age and sex							
Males and females:							
Under 1 year..........	247	7.28	264	96	87	98	91
1-8 years.............	160	4.84	177	86	67	94	77
Males:							
9-18 years............	126	4.16	146	70	49	81	59
19-64 years...........	123	3.20	149	64	45	74	53
65 years and over.....	144	4.52	182	70	53	83	64
Females:							
9-18 years............	117	2.71	143	66	43	80	57
19-64 years...........	127	2.69	168	63	45	77	59
65 years and over.....	163	7.04	202	75	59	86	71
Region							
Northeast...............	133	3.88	163	70	50	80	61
North Central...........	130	6.64	157	69	49	81	61
South...................	129	4.84	164	64	46	77	58
West....................	147	2.86	175	75	56	85	67
Poverty status and race							
Above poverty:							
White.................	130	2.23	158	69	50	81	61
Black.................	162	4.70	205	70	54	80	66
Below poverty:							
White.................	128	4.23	159	63	44	77	56
Black.................	155	12.45	202	63	48	76	60

Table I-9. Vitamin A value--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean vitamin A value-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

Characteristic	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
Urbanization							
Central city...........	143	2.62	177	70	52	80	63
Suburban................	132	5.27	161	70	51	81	62
Nonmetropolitan.........	127	2.80	155	66	46	78	58
Season							
Spring..................	128	4.37	160	67	47	80	59
Summer..................	137	3.75	169	69	51	81	62
Fall....................	138	2.63	167	70	51	79	61
Winter..................	130	4.19	160	68	49	80	61

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-10. Thiamin--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean thiamin-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

Characteristic	Mean intake: Percent of RDA: Percent	Mean intake: Percent of RDA: Standard error	Mean intake: Percent of RDA-to-REI	Percent of population having intakes of at least: Percent of RDA: 70	Percent of population having intakes of at least: Percent of RDA: 100	Percent of population having intakes of at least: Percent of RDA-to-REI: 70	Percent of population having intakes of at least: Percent of RDA-to-REI: 100
All individuals.........	112	0.82	126	83	55	97	73
Age and sex							
Males and females:							
Under 1 year..........	231	6.01	234	97	92	99	94
1-8 years.............	127	1.43	137	94	71	100	85
Males:							
9-18 years............	122	1.29	131	91	67	99	82
19-64 years...........	111	1.00	119	83	54	95	63
65 years and over.....	114	1.62	130	87	56	97	86
Females:							
9-18 years............	113	1.46	127	87	57	98	75
19-64 years...........	102	1.06	121	76	44	95	72
65 years and over.....	106	1.44	120	81	49	97	66
Region							
Northeast..............	112	1.10	125	83	55	97	73
North Central..........	114	1.97	126	84	56	97	73
South..................	111	1.40	129	83	54	97	77
West...................	113	2.20	121	82	53	95	68
Poverty status and race							
Above poverty:							
White.................	111	0.70	123	83	54	96	71
Black.................	114	3.07	132	84	58	98	80
Below poverty:							
White.................	112	1.35	130	82	52	97	75
Black.................	117	4.01	141	84	59	98	84

Table I-10. Thiamin--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean thiamin-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
Characteristic	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
Urbanization							
Central city...........	114	1.86	127	83	55	97	74
Suburban................	112	1.32	125	83	54	96	72
Nonmetropolitan.........	112	0.84	126	84	55	97	74
Season							
Spring..................	111	1.20	125	83	54	96	72
Summer..................	112	0.99	126	83	54	96	73
Fall....................	114	1.07	126	84	55	97	74
Winter..................	113	1.03	127	83	56	97	74

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-11. Riboflavin--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean riboflavin-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
Characteristic	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
All individuals..........	132	1.11	151	88	66	98	88
Age and sex							
Males and females:							
Under 1 year...........	303	6.26	313	99	99	100	100
1-8 years..............	168	2.06	190	98	90	100	99
Males:							
9-18 years.............	150	2.27	164	95	80	100	94
19-64 years............	126	1.38	139	89	65	98	90
65 years and over......	129	1.76	151	90	66	99	90
Females:							
9-18 years.............	135	1.82	156	91	74	99	90
19-64 years............	112	0.89	136	80	51	97	83
65 years and over......	118	2.35	138	86	56	98	78
Region							
Northeast...............	131	1.70	150	89	66	99	89
North Central...........	135	2.03	153	89	68	99	89
South...................	125	1.26	148	86	62	98	87
West....................	139	3.07	154	89	69	98	88
Poverty status and race							
Above poverty:							
White..................	132	1.12	151	89	67	99	89
Black..................	123	2.55	146	83	59	97	86
Below poverty:							
White..................	132	1.80	157	87	64	99	88
Black..................	130	3.96	162	84	63	99	89

Table I-11. Riboflavin--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean riboflavin-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

Characteristic	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
Urbanization							
Central city.............	131	2.38	151	87	65	98	88
Suburban.................	133	2.86	151	88	66	98	88
Nonmetropolitan..........	131	2.60	151	88	66	99	88
Season							
Spring...................	130	1.53	150	88	65	98	88
Summer...................	132	1.33	151	88	65	98	89
Fall.....................	134	1.19	152	88	67	99	89
Winter...................	131	1.64	151	88	66	98	88

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-12. Preformed Niacin--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean preformed niacin-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
Characteristic	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
All individuals..........	124	0.82	151	91	67	99	91
Age and sex							
Males and females:							
Under 1 year...........	128	4.12	131	79	57	86	63
1-8 years..............	122	1.20	136	91	66	98	85
Males:							
9-18 years.............	122	1.08	143	92	66	100	91
19-64 years............	134	1.17	156	94	75	100	96
65 years and over......	125	1.86	153	93	69	99	92
Females:							
9-18 years.............	112	1.36	136	87	58	99	86
19-64 years............	123	1.12	160	90	66	99	94
65 years and over......	119	1.86	148	89	62	99	88
Region							
Northeast..............	126	1.12	153	92	70	99	92
North Central..........	124	1.78	148	91	67	99	91
South..................	121	1.20	152	90	65	99	92
West...................	127	2.06	149	91	66	98	89
Poverty status and race							
Above poverty:							
White..................	124	0.70	150	91	68	99	91
Black..................	124	2.73	156	91	69	99	95
Below poverty:							
White..................	116	1.52	146	85	59	99	88
Black..................	120	3.51	156	86	59	99	93

Table I-12. Preformed Niacin--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean preformed niacin-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
Characteristic	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
Urbanization							
Central city............	126	1.51	153	91	68	99	92
Suburban................	124	1.98	150	91	67	99	91
Nonmetropolitan..........	123	1.12	149	90	66	99	91
Season							
Spring..................	125	1.23	153	91	67	99	92
Summer..................	125	0.82	152	90	67	99	92
Fall....................	124	1.09	149	91	67	99	91
Winter..................	122	1.12	149	91	67	99	91

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-13. Vitamin B_6--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean vitamin B_6-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

Characteristic	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
All individuals..........	75	0.66	85	49	20	68	25
Age and sex							
Males and females:							
Under 1 year..........	138	2.94	140	94	78	97	85
1-8 years.............	97	1.06	102	76	41	87	45
Males:							
9-18 years............	95	1.14	104	74	38	92	47
19-64 years...........	79	0.65	87	56	21	74	24
65 years and over......	71	1.35	81	44	14	60	18
Females:							
9-18 years............	73	1.06	83	49	17	66	21
19-64 years...........	60	0.70	72	29	7	54	14
65 years and over......	62	1.08	71	32	8	50	10
Region							
Northeast...............	76	0.85	85	50	20	69	25
North Central...........	75	1.07	84	49	20	68	24
South...................	72	0.90	84	45	17	66	24
West....................	80	1.64	87	54	24	71	28
Poverty status and race							
Above poverty:							
White.................	75	0.59	84	50	19	68	24
Black.................	75	1.69	87	50	19	74	26
Below poverty:							
White.................	74	1.21	85	45	19	66	25
Black.................	74	2.70	89	48	19	72	31

Table I-13. Vitamin B_6--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean vitamin B_6-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
Characteristic	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
Urbanization							
Central city............	76	1.43	86	51	21	71	27
Suburban................	76	1.77	85	50	20	69	25
Nonmetropolitan..........	74	1.04	83	47	18	66	23
Season							
Spring..................	75	0.99	86	50	20	70	26
Summer..................	76	0.80	86	50	20	69	26
Fall....................	75	0.66	84	48	20	67	23
Winter..................	74	0.93	84	49	18	67	24

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-14. Vitamin B_{12}--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean vitamin B_{12}-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
Characteristic	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
All individuals........	173	3.43	208	85	66	94	82
Age and sex							
Males and females:							
Under 1 year.........	279	8.87	311	98	93	99	95
1-8 years...........	166	4.66	186	94	79	97	89
Males:							
9-18 years...........	205	6.72	236	96	87	99	97
19-64 years..........	209	5.93	246	93	80	98	90
65 years and over....	192	9.50	240	86	68	96	84
Females:							
9-18 years...........	148	3.41	181	87	68	96	86
19-64 years..........	147	2.90	188	73	48	90	71
65 years and over....	150	11.86	180	70	43	84	60
Region							
Northeast.............	176	6.18	211	87	68	95	83
North Central.........	169	6.70	202	87	69	96	84
South.................	164	6.04	203	80	60	92	78
West..................	191	4.49	222	87	71	95	84
Poverty status and race							
Above poverty:							
White................	172	4.07	204	86	68	95	83
Black................	189	9.84	238	83	63	94	81
Below poverty:							
White................	161	6.74	199	79	61	92	78
Black................	190	14.28	248	78	57	92	79

Table I-14. Vitamin B_{12}--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean vitamin B_{12}-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

Characteristic	Mean intake: Percent of RDA: Percent	Mean intake: Percent of RDA: Standard error	Mean intake: Percent of RDA-to-REI	Percent of population having intakes of at least: Percent of RDA: 70	Percent of population having intakes of at least: Percent of RDA: 100	Percent of population having intakes of at least: Percent of RDA-to-REI: 70	Percent of population having intakes of at least: Percent of RDA-to-REI: 100
Urbanization							
Central city..........	182	4.65	221	86	67	95	82
Suburban..............	171	6.58	206	86	68	95	83
Nonmetropolitan........	168	4.89	201	83	64	94	80
Season							
Spring................	174	6.12	214	85	67	95	82
Summer................	172	5.44	207	84	66	94	82
Fall..................	178	4.60	210	85	67	95	82
Winter................	168	5.42	203	85	66	94	82

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-15. Vitamin C--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean vitamin C-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

Characteristic	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
All individuals........	147	2.38	180	74	59	83	69
Age and sex							
Males and females:							
Under 1 year.........	226	7.37	232	89	82	91	84
1-8 years............	166	4.16	188	80	66	87	74
Males:							
9-18 years...........	174	3.70	203	84	70	91	79
19-64 years..........	145	2.13	175	74	58	82	67
65 years and over....	153	3.98	187	75	62	84	71
Females:							
9-18 years...........	152	3.72	186	77	61	86	72
19-64 years..........	128	2.71	167	66	52	78	63
65 years and over....	150	4.07	187	76	64	84	73
Region							
Northeast............	160	1.28	196	78	66	85	73
North Central.........	147	4.06	177	74	60	83	69
South.................	131	2.91	166	69	53	80	65
West..................	159	6.21	187	75	61	83	70
Poverty status and race							
Above poverty:							
White...............	149	2.54	180	74	59	83	69
Black...............	152	5.48	195	76	63	85	72
Below poverty:							
White...............	125	4.26	159	68	51	80	65
Black...............	138	7.82	182	74	56	85	71

Table I-15. Vitamin C--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean vitamin C-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

Characteristic	Mean intake: Percent of RDA: Percent	Mean intake: Percent of RDA: Standard error	Mean intake: Percent of RDA-to-REI	Percent of population having intakes of at least: Percent of RDA: 70	Percent of population having intakes of at least: Percent of RDA: 100	Percent of population having intakes of at least: Percent of RDA-to-REI: 70	Percent of population having intakes of at least: Percent of RDA-to-REI: 100
Urbanization							
Central city..........	152	3.69	187	75	61	84	71
Suburban...............	153	5.28	185	76	62	84	71
Nonmetropolitan........	136	4.41	167	71	55	80	65
Season							
Spring................	151	3.50	186	75	61	85	71
Summer.................	152	2.09	186	76	61	85	71
Fall...................	140	2.43	168	71	56	80	66
Winter.................	146	3.49	179	73	58	82	67

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-16. Calcium--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean calcium-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

Characteristic	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
All individuals..........	87	1.08	103	58	32	76	47
Age and sex							
Males and females:							
Under 1 year...........	164	4.65	175	95	81	99	93
1-8 years..............	102	1.24	116	75	48	86	61
Males:							
9-18 years.............	99	2.02	112	71	42	88	61
19-64 years............	101	1.18	116	68	41	84	56
65 years and over......	89	1.82	108	61	33	82	50
Females:							
9-18 years.............	76	1.33	91	51	23	69	37
19-64 years............	70	0.93	91	42	19	65	34
65 years and over......	71	0.94	87	44	18	64	30
Region							
Northeast..............	87	2.41	104	59	32	78	47
North Central..........	90	1.18	106	61	34	78	49
South..................	78	1.22	96	50	25	71	39
West...................	97	2.19	111	64	40	80	54
Poverty status and race							
Above poverty:							
White..................	89	1.15	106	60	34	78	49
Black..................	72	1.47	89	44	19	65	31
Below poverty:							
White..................	86	1.90	105	55	30	77	48
Black..................	71	1.87	92	44	18	67	34

Table I-16. Calcium--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean calcium-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

Characteristic	Mean intake: Percent of RDA: Percent	Mean intake: Percent of RDA: Standard error	Mean intake: Percent of RDA-to-REI	Percent of population having intakes of at least: Percent of RDA: 70	Percent of population having intakes of at least: Percent of RDA: 100	Percent of population having intakes of at least: Percent of RDA-to-REI: 70	Percent of population having intakes of at least: Percent of RDA-to-REI: 100
Urbanization							
Central city	84	2.83	101	56	29	75	44
Suburban	89	2.84	105	60	34	78	49
Nonmetropolitan	86	3.24	103	57	32	75	46
Season							
Spring	85	1.33	102	56	31	74	45
Summer	85	1.22	101	55	29	74	43
Fall	89	1.17	105	61	34	78	49
Winter	89	1.47	106	59	33	78	49

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-17. Phosphorus--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean phosphorus-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

Characteristic	Mean intake: Percent of RDA: Percent	Mean intake: Percent of RDA: Standard error	Mean intake: Percent of RDA-to-REI	Percent of population having intakes of at least: Percent of RDA: 70	Percent of population having intakes of at least: Percent of RDA: 100	Percent of population having intakes of at least: Percent of RDA-to-REI: 70	Percent of population having intakes of at least: Percent of RDA-to-REI: 100
All individuals..........	136	1.11	164	92	72	100	96
Age and sex							
Males and females:							
Under 1 year..........	209	5.78	221	98	91	100	99
1-8 years.............	130	1.14	149	94	74	100	93
Males:							
9-18 years............	135	1.84	155	94	75	100	98
19-64 years...........	176	1.51	205	99	91	100	100
65 years and over......	149	1.92	183	97	84	100	100
Females:							
9-18 years............	105	1.12	126	81	49	99	79
19-64 years...........	119	1.08	154	89	64	100	98
65 years and over......	115	1.32	141	89	61	100	91
Region							
Northeast...............	136	1.52	164	93	73	100	96
North Central...........	137	1.53	164	93	74	100	96
South...................	129	1.34	160	90	68	100	95
West....................	147	2.47	171	94	77	100	96
Poverty status and race							
Above poverty:							
White..................	139	1.20	166	93	75	100	96
Black..................	124	3.13	155	88	66	100	94
Below poverty:							
White..................	129	1.86	161	89	65	100	95
Black..................	115	3.78	150	83	57	100	92

Table I-17. Phosphorus--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean phosphorus-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

Characteristic	Mean intake: Percent of RDA: Percent	Mean intake: Percent of RDA: Standard error	Mean intake: Percent of RDA-to-REI	Percent of population having intakes of at least: Percent of RDA: 70	Percent of RDA: 100	Percent of RDA-to-REI: 70	Percent of RDA-to-REI: 100
Urbanization							
Central city............	135	3.05	164	92	72	100	96
Suburban................	138	3.56	165	93	74	100	96
Nonmetropolitan..........	135	2.71	162	92	71	100	95
Season							
Spring..................	135	1.50	164	92	71	100	95
Summer..................	134	1.27	162	91	71	100	95
Fall....................	137	1.15	164	93	74	100	96
Winter..................	138	1.46	166	93	74	100	96

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-18. Magnesium--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean magnesium-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
Characteristic	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
All individuals..........	83	0.79	101	61	25	89	44
Age and sex							
Males and females:							
Under 1 year...........	194	5.32	211	97	87	100	100
1-8 years..............	102	1.10	117	84	48	98	75
Males:							
9-18 years.............	82	1.30	94	61	24	89	34
19-64 years............	87	1.03	102	68	30	94	46
65 years and over......	80	1.11	98	61	22	89	41
Females:							
9-18 years.............	76	0.81	93	56	18	86	33
19-64 years............	73	0.64	96	50	15	84	36
65 years and over......	75	1.10	92	53	15	83	32
Region							
Northeast................	83	1.56	100	62	24	90	42
North Central............	84	0.88	101	64	26	90	45
South....................	78	0.78	98	54	20	87	38
West.....................	91	1.57	107	69	35	92	52
Poverty status and race							
Above poverty:							
White..................	85	0.84	102	64	27	91	46
Black..................	74	1.42	92	47	16	81	28
Below poverty:							
White..................	82	1.46	105	58	25	90	48
Black..................	71	1.85	93	44	14	79	34

Table I-18. Magnesium--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean magnesium-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
Characteristic	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
Urbanization							
Central city............	81	2.17	99	59	23	87	40
Suburban................	85	2.36	103	63	27	90	46
Nonmetropolitan.........	83	1.93	100	61	25	90	43
Season							
Spring..................	81	0.94	100	59	23	89	42
Summer..................	82	0.97	100	60	24	88	42
Fall....................	84	0.81	101	62	26	90	44
Winter..................	84	0.99	102	63	25	91	46

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-19. Iron--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean iron-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)

	Mean intake			Percent of population having intakes of at least:			
	Percent of RDA			Percent of RDA		Percent of RDA-to-REI	
Characteristic	Percent	Standard error	Percent of RDA-to-REI	70	100	70	100
All individuals..........	103	0.57	122	67	44	85	58
Age and sex							
Males and females:							
Under 1 year...........	150	4.80	156	70	58	73	64
1-8 years..............	91	0.71	99	66	38	73	45
Males:							
9-18 years.............	94	0.96	107	74	36	98	57
19-64 years............	157	1.41	183	98	88	100	100
65 years and over......	142	2.09	172	96	82	100	99
Females:							
9-18 years.............	74	0.91	87	45	18	70	26
19-64 years............	73	0.73	94	44	18	75	32
65 years and over......	108	1.53	131	87	53	100	86
Region							
Northeast................	101	0.58	120	67	43	83	57
North Central............	103	1.35	121	68	45	84	57
South....................	102	0.74	125	67	43	87	59
West.....................	107	0.91	122	68	46	84	57
Poverty status and race							
Above poverty:							
White..................	103	0.78	122	68	45	84	57
Black..................	100	3.47	123	66	42	86	56
Below poverty:							
White..................	98	1.75	121	65	39	86	59
Black..................	91	3.59	116	61	35	86	55

Table I-19. Iron--individual intakes, 1977-78: Mean percent of Recommended Dietary Allowances (RDA), standard errors, mean iron-to-calorie intakes as percent of RDA-to-Recommended Energy Intakes (REI), and percent of population having specified intakes, by selected characteristics (3-day average)--Con.

Characteristic	Mean intake: Percent of RDA: Percent	Mean intake: Percent of RDA: Standard error	Mean intake: Percent of RDA-to-REI	Percent of population having intakes of at least: Percent of RDA: 70	Percent of RDA: 100	Percent of RDA-to-REI: 70	Percent of RDA-to-REI: 100
Urbanization							
Central city............	103	1.69	123	68	44	85	59
Suburban................	103	1.82	122	67	44	84	57
Nonmetropolitan..........	103	1.06	122	67	44	85	58
Season							
Spring..................	104	0.88	124	68	45	85	59
Summer..................	102	0.91	122	67	44	85	58
Fall....................	103	0.84	120	67	43	84	56
Winter..................	103	0.91	122	68	44	85	59
Poverty status, race and sex							
Above poverty:							
White males...........	134	1.10	153	89	71	95	82
White females..........	78	0.65	96	50	23	74	37
Black males...........	125	4.40	156	86	64	95	82
Black females..........	79	2.77	97	50	24	78	35
Below poverty:							
White males...........	123	2.51	144	83	59	92	76
White females..........	81	1.68	105	52	24	82	47
Black males...........	104	5.51	136	71	47	91	73
Black females..........	82	2.94	103	54	27	83	44

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Table I-20. Sodium--individual intakes, 1977-78: Mean quantities in milligrams (mg), mean quantities (mg) per 1,000 Calories, standard errors, and percent of population having specified intakes, by selected characteristics (3-day average)

Characteristics	Mean intake: Quantity: In mg	Mean intake: Quantity: Standard error	Mean intake: Quantity per 1,000 Calories: In mg	Mean intake: Quantity per 1,000 Calories: Standard error	Percent of population having intakes above: 1,600 mg per 1,000 Calories	Percent of population having intakes above: 2,500 mg per 1,000 Calories
All individuals.....	2,786	41.60	1,540	24.16	33	9
Age and sex						
Males and females:						
Under 1 year.......	573	24.60	683	26.83	5	1
1-8 years..........	2,296	72.26	1,494	42.70	27	5
Males:						
9-18 years.........	3,535	135.93	1,531	59.27	27	6
19-64 years........	3,516	54.18	1,551	25.91	36	10
65 years and over	2,846	47.66	1,525	23.87	37	12
Females:						
9-18 years.........	2,840	125.12	1,614	98.93	26	6
19-64 years........	2,400	71.88	1,561	45.01	36	11
65 years and over..	2,163	29.41	1,544	16.16	40	14
Region						
Northeast..........	2,822	80.17	1.541	31.90	33	9
North Central.......	2,957	91.12	1,631	65.23	36	10
South..............	2,664	68.08	1,520	26.31	34	10
West...............	2,688	46.39	1,433	40.03	26	8
Poverty status and race						
Above poverty:						
White..............	2,878	67.09	1,571	39.22	32	9
Black..............	2,518	106.19	1,433	26.23	28	8
Below poverty:						
White..............	2,581	56.28	1,530	18.49	39	13
Black..............	2,372	91.24	1,497	30.52	35	8
Urbanization						
Central city........	2,818	80.80	1,570	32.06	33	10
Suburban............	2,845	87.41	1,562	59.62	32	9
Nonmetropolitan.....	2,688	58.70	1,488	17.79	34	9
Season						
Spring..............	2,864	93.20	1,554	40.57	32	10
Summer..............	2,693	79.02	1,497	36.67	30	8
Fall................	2,791	52.16	1,559	40.89	34	10
Winter..............	2,797	75.77	1,550	49.26	35	10

SOURCE: USDA: Data from the Nationwide Food Consumption Survey.

Appendix I - 21. U.S. Food Supply; Food energy and nutrient content, per capita per day, 1909 - 82

Year	Food energy	Protein	Fat	Cholesterol	Carbohydrate	Fiber	Vitamin A value	Thiamin	Riboflavin	Preformed niacin	Vitamin B_6	Vitamin B_{12}	Folacin	Vitamin C	Calcium	Phosphorus	Magnesium	Iron	Zinc
	Calories	Grams	Grams	Milligrams	Grams	Grams	I.U.	Milligrams	Milligrams	Milligrams	Milligrams	Micrograms	Micrograms	Milligrams	Grams	Grams	Milligrams	Milligrams	Milligrams
1909	3,510	102	126	502	495	6.2	8,100	1.66	1.82	19.5	2.22	8.5	320	107	0.76	1.54	411	15.4	12.8
1910	3,460	100	124	504	493	6.2	8,000	1.62	1.77	19.2	2.20	8.1	318	109	.74	1.51	405	15.1	12.5
1911	3,470	100	126	526	487	6.0	7,900	1.62	1.76	18.6	2.12	8.3	315	103	.73	1.49	394	15.0	12.2
1912	3,440	100	123	507	488	6.2	7.900	1.63	1.81	18.9	2.16	8.2	317	106	.78	1.52	404	15.0	12.2
1913	3,440	98	123	496	487	6.0	7,700	1.61	1.77	18.6	2.14	8.0	311	106	.76	1.49	395	14.6	12.1
1914	3,420	96	125	484	481	6.0	7,600	1.56	1.71	18.1	2.04	7.7	304	103	.73	1.45	386	14.3	11.8
1915	3,390	95	124	492	476	6.1	8,000	1.58	1.69	18.3	2.06	7.7	306	107	.71	1.44	388	14.4	11.6
1916	3,340	94	124	489	467	5.7	7,800	1.54	1.66	17.8	1.95	7.8	296	99	.69	1.41	378	14.1	11.4
1917	3,300	94	120	464	466	6.0	8,200	1.53	1.68	18.2	1.99	7.7	302	101	.72	1.44	395	14.5	11.7
1918	3,360	96	127	480	462	6.1	8,200	1.59	1.79	18.3	2.09	8.0	307	105	.79	1.50	403	15.1	12.1
1919	3,400	94	128	489	475	5.8	8,400	1.53	1.73	18.4	1.99	8.1	299	103	.75	1.45	385	14.7	11.7
1920	3,270	92	122	490	456	5.7	8,400	1.51	1.76	17.5	1.96	8.0	300	108	.79	1.44	378	14.2	11.4
1921	3,170	89	120	487	439	5.4	8,400	1.50	1.72	17.1	1.94	7.7	291	107	.77	1.40	371	13.8	11.1
1922	3,410	92	129	510	478	5.7	8,900	1.52	1.77	17.4	1.97	8.0	301	107	.79	1.44	381	14.2	11.3
1923	3,430	95	135	528	465	5.8	8,800	1.61	1.81	18.4	2.06	8.2	307	112	.79	1.48	392	14.5	11.6
1924	3,440	95	134	525	472	5.8	8,400	1.59	1.80	18.2	2.01	8.2	308	110	.79	1.47	386	14.4	11.5
1925	3,440	94	134	517	473	5.7	8,400	1.53	1.80	17.8	2.00	8.0	306	108	.80	1.46	380	14.0	11.4
1926	3,450	94	134	529	476	5.8	8,700	1.51	1.81	17.6	1.94	7.9	306	106	.81	1.46	382	14.1	11.3
1927	3,450	94	134	531	475	5.7	8,900	1.54	1.80	17.7	1.97	8.0	309	106	.81	1.47	385	14.1	11.2
1928	3,470	93	135	524	480	5.8	8,600	1.56	1.80	17.7	1.97	7.8	306	106	.81	1.47	385	14.0	11.1
1929	3,450	93	136	522	469	5.8	9,000	1.56	1.82	17.8	2.00	7.8	311	112	.83	1.48	392	14.0	11.2
1930	3,430	91	134	517	472	5.7	8,700	1.53	1.80	17.2	1.92	7.6	302	103	.82	1.45	380	13.8	10.9
1931	3,380	91	135	519	459	5.8	8,900	1.54	1.80	17.6	1.92	7.5	307	109	.81	1.45	384	13.8	10.9
1932	3,310	90	133	507	446	5.5	9,200	1.52	1.79	17.2	1.89	7.5	301	107	.81	1.43	374	13.5	10.7
1933	3,260	89	133	496	435	5.3	8,800	1.50	1.76	17.0	1.86	7.5	291	106	.81	1.41	365	13.3	10.6
1934	3,250	90	134	493	428	5.4	9,000	1.47	1.77	17.2	1.91	7.7	297	108	.81	1.42	367	13.6	10.9
1935	3,190	87	127	464	435	5.6	8,900	1.38	1.74	16.6	1.87	7.1	296	112	.83	1.40	373	13.1	10.5
1936	3,280	90	134	482	437	5.5	8,700	1.42	1.79	17.3	1.89	7.6	299	109	.85	1.44	378	13.5	11.0
1937	3,240	89	133	494	431	5.5	9,000	1.41	1.80	16.9	1.89	7.7	298	110	.85	1.43	371	13.2	10.8
1938	3,250	90	133	495	431	5.5	9,000	1.44	1.81	17.0	1.89	7.6	301	114	.87	1.44	375	13.3	10.8
1939	3,330	91	139	509	438	5.6	9,200	1.49	1.85	17.3	1.90	7.8	304	116	.88	1.47	381	13.6	11.0
1940	3,340	93	143	524	428	5.5	9,100	1.54	1.88	17.8	1.92	8.1	304	114	.89	1.49	381	13.7	11.1
1941	3,400	94	144	519	442	5.5	9,300	1.63	1.91	18.2	1.94	8.3	303	114	.90	1.50	383	14.0	11.4
1942	3,310	96	140	528	424	5.6	9,700	1.83	2.00	18.7	1.94	8.7	317	116	.95	1.55	390	14.7	11.6
1943	3,360	100	142	551	428	5.4	10,300	2.05	2.16	19.9	1.99	9.2	321	113	.98	1.60	392	15.4	11.7
1944	3,360	99	142	564	426	5.5	10,500	2.09	2.41	22.4	2.04	9.7	326	125	1.00	1.61	395	16.8	11.9
1945	3,310	103	139	596	418	5.6	10,800	2.07	2.50	22.7	2.04	9.6	335	124	1.06	1.67	404	17.2	12.2
1946	3,320	102	144	578	411	5.5	10,200	2.15	2.49	23.1	2.04	9.4	325	122	1.07	1.70	409	17.5	12.1
1947	3,290	97	143	583	412	5.0	9,600	1.94	2.35	21.5	1.96	9.2	304	118	1.01	1.58	375	16.5	11.8
1948	3,190	94	140	573	396	4.8	9,200	1.89	2.27	20.7	1.86	8.8	396	110	.97	1.53	363	15.9	11.3
1949	3,190	94	140	570	397	4.8	9,000	1.88	2.26	20.7	1.85	8.7	292	108	.96	1.52	361	15.9	11.2
1950	3,250	94	145	578	400	4.8	8.900	1.90	2.28	20.4	1.84	8.7	293	104	.97	1.53	360	15.9	11.3
1951	3,140	92	139	574	391	4.7	8,500	1.90	2.26	20.1	1.82	8.6	290	106	.96	1.50	354	15.6	11.0
1952	3,180	93	142	576	387	4.5	8,500	1.90	2.29	20.3	1.81	8.7	290	105	.97	1.52	352	15.6	11.2
1953	3,150	94	141	571	384	4.5	8,600	1.84	2.28	20.7	1.84	9.0	287	105	.95	1.51	348	15.7	11.5
1954	3,130	94	141	567	377	4.4	8,500	1.80	2.25	20.3	1.83	8.9	284	103	.94	1.50	340	15.5	11.5
1955	3,150	94	144	568	376	4.4	8,600	1.86	2.28	20.6	1.85	9.1	286	105	.96	1.51	342	15.6	11.6
1956	3,160	95	145	572	376	4.4	8,600	1.86	2.29	21.0	1.84	9.2	288	102	.96	1.52	345	15.8	11.7
1957	3,090	94	140	559	370	4.3	8,500	1.82	2.26	20.8	1.83	8.9	286	104	.95	1.50	342	15.5	11.5
1958	3,100	93	140	549	373	4.3	8,300	1.81	2.24	20.9	1.80	8.7	280	99	.94	1.48	338	15.4	11.3
1959	3,150	95	145	553	373	4.3	8,400	1.87	2.26	21.2	1.83	8.9	284	102	.94	1.50	342	15.6	11.5
1960	3,160	96	147	544	373	4.3	8,000	1.91	2.25	21.6	1.85	8.9	281	103	.93	1.51	340	15.8	11.6
1961	3,160	96	146	538	372	4.2	7.700	1.89	2.24	21.7	1.85	8.9	277	101	.92	1.50	338	15.9	11.7
1962	3,170	96	147	538	372	4.2	7,700	1.92	2.26	21.9	1.83	8.9	277	100	.93	1.50	337	16.0	11.6
1963	3,180	96	149	532	369	4.2	7,700	1.91	2.25	22.0	1.84	9.0	272	96	.92	1.50	336	16.1	11.8
1964	3,220	98	152	535	370	4.1	7,600	1.91	2.27	22.3	1.85	9.3	271	94	.92	1.51	337	16.2	11.9
1965	3,190	96	150	523	370	4.1	7,500	1.84	2.21	22.3	1.82	8.9	267	95	.92	1.49	334	15.9	11.8
1966	3,220	97	152	522	370	4.1	7,600	1.84	2.21	22.6	1.88	9.1	267	97	.91	1.50	335	15.8	11.9
1967	3,260	98	155	532	374	4.1	7,700	1.94	2.26	23.3	1.92	9.3	275	102	.90	1.51	338	16.4	12.1
1968	3,300	99	158	534	377	4.2	8,000	1.95	2.27	23.6	1.94	9.4	276	105	.91	1.52	341	16.7	12.3
1969	3,310	99	157	524	381	4.2	8,000	1.95	2.25	23.7	1.95	9.6	275	105	.90	1.52	337	16.7	12.2
1970	3,330	100	160	526	379	4.1	7,900	1.95	2.26	24.0	1.97	9.6	275	107	.90	1.51	336	16.9	12.3
1971	3,360	101	161	531	381	4.1	7,800	1.99	2.28	24.1	1.99	9.6	278	109	.90	1.52	337	17.0	12.4
1972	3,340	100	161	522	381	4.0	7,900	1.94	2.26	24.1	1.97	9.5	278	111	.89	1.51	337	16.8	12.3
1973	3,310	99	156	496	380	4.2	7,800	1.91	2.23	23.7	1.94	9.1	282	111	.89	1.50	342	16.8	12.1
1974	3,290	99	157	499	377	4.0	7,900	1.97	2.25	24.4	1.95	9.4	278	112	.87	1.48	332	16.8	12.2
1975	3,260	99	152	484	380	4.2	7,800	1.97	2.28	24.6	1.96	9.2	283	117	.87	1.48	336	16.9	12.2
1976	3,370	102	158	488	391	4.2	7,900	2.11	2.40	26.1	2.00	9.4	285	116	.89	1.52	342	17.3	12.6
1977	3,350	101	156	485	391	4.2	7.700	2.09	2.37	25.8	2.01	9.4	286	118	.89	1.51	335	17.1	12.5
1978	3,340	100	158	487	387	4.1	7,700	2.07	2.35	25.8	1.98	9.0	280	116	.88	1.49	333	16.9	12.2
1979	3,420	101	162	496	396	4.2	8,000	2.15	2.40	26.2	2.02	9.2	287	119	.90	1.52	339	17.0	12.2
1980	3,410	100	163	490	392	4.1	7,600	2.16	2.36	25.7	2.00	9.0	284	120	.90	1.50	333	16.8	12.1
1981	3,410	100	164	486	391	4.1	7,700	2.12	2.30	25.8	1.97	9.1	282	117	.87	1.48	330	16.8	12.0
1982	3,380	99	162	479	388	4.0	7,800	2.07	2.28	25.6	1.97	8.7	283	118	.88	1.47	331	16.6	12.0

SOURCE: USDA; Data from the U.S. food supply historical series.

APPENDIX II

METHODOLOGY FOR THE COLLECTION AND ANALYSIS OF HEALTH SURVEY DATA

The National Health and Nutrition Examination Survey

Introduction

Data were collected in the second National Health and Nutrition Examination Survey (NHANES II) from February 1976 through February 1980. NHANES II, conducted by the National Center for Health Statistics, was a survey of the civilian noninstitutionalized U.S. population (including Alaska and Hawaii) 6 months through 74 years of age. Both interview and examination procedures were used to collect a broad spectrum of demographic, socioeconomic, and morbidity data and related medical and nutritional information. During household interviews, demographic, socioeconomic, and some medical history data were obtained from sample persons. Specially designed mobile examination centers, transported to each sample location, provided standardized conditions and equipment for the dietary interview, medical examination, and related clinical tests and procedures.

Survey Design

In NHANES II, a stratified multistage design was utilized that provided for the selection of samples at each stage with a known probability. In hierarchical order, the stages of selection were primary sampling units, or PSU's (a PSU is a county or a small group of contiguous counties); census enumeration districts (ED's); segments (a segment is a cluster of households); households; eligible persons; and, finally, sample persons.

The first-stage sampling units selected in the previous National Health Examination Survey and in the first National Health and Nutrition Examination Survey (NHANES I) were subsets of the sample PSU's in the National Health Interview Survey (NHIS), another major data collection program of the National Center for Health Statistics. In NHIS the United States is subdivided into 1,924 PSU's, with 376 PSU's being selected for the sample. Sixty-five of these 376 sample PSU's were selected as the NHANES I sample. The PSU's used in previous examination surveys were defined either as a single county or as a group of contiguous counties (except in certain parts of New England). Many of the larger PSU's were defined as standard metropolitan statistical areas (SMSA's) and often contained several counties. The PSU's that contained several counties and covered a large area were not ideally suited for an examination survey. Attempting to survey large geographic areas from a centrally located examination center created a number of logistical problems. Some examinees had been asked to travel more than 50 miles to be examined, and others had been asked to travel through very congested areas. Many people were reluctant to travel under such conditions. The cost of followup visits to the households was also a function of the distance or time from the examination center. The results of an analysis of the response rates for several locations in NHANES I supported these assumptions about the effect of travel conditions on response. The use of small-area PSU's would reduce both the average distance traveled to the examination center by examinees and the cost of the fieldwork. These considerations were the basis for redefining and restratifying the PSU's in NHANES II. These changes do not affect the comparability of weighted population estimates from NHANES I and II.

In NHIS, 156 of the 376 PSU's are self-representing SMSA's. It was these 156 self-representing SMSA's in the NHIS design that were redefined and restratified for the NHANES II design.

For NHANES II, the self-representing PSU's in NHIS were first split along county boundaries. Within each region, each of the counties was classified as being either a self-representing or a non-self-representing PSU. The non-self-representing PSU's were further combined into homogeneous classes or strata equal in size to the NHIS strata containing non-self-representing PSU's.

The effect of subdividing the 156 self-representing PSU's in NHIS and redefining the PSU's by using county boundaries resulted in a total of 397 PSU's, of which 198 were defined as self-representing and 199 were defined as non-self-representing. The latter were used to form 43 non-self-representing strata, which were combined with the other 220 non-self-representing PSU's in NHIS. The average population of a self-representing PSU was reduced from 838,000 to 584,000. The average size of these PSU's was reduced more than 60 percent in area, from 2,185 square miles to 855 square miles.

These 461 first-stage units (NHIS strata) were further stratified into a total of 64 superstrata, and one PSU was selected from each of the superstrata using a modified Goodman-Kish controlled selection technique (Goodman and Kish, 1950). These 64 PSU's represented the geographic locations visited by the mobile examination center during the survey period.

The U.S. Bureau of the Census had the major responsibility for selecting households and sample persons within each of the PSU's. Two sampling frames of housing units were used to select the sample within each PSU. The larger frame was based on the 1970 census of the population. A smaller sampling frame was used to supplement the first frame and consisted of all housing units built since the 1970 census.

The first stage of the design consisted of the selection of clusters of households (segments) within ED's. An ED is a geographical area that contains approximately 300 housing units. To oversample persons with low incomes, the ED's within each PSU were stratified into a poverty stratum and a nonpoverty stratum. The poverty strata contained ED's with 13 percent or more of persons below the poverty level as determined by the 1970 census, and the nonpoverty strata contained ED's with less than 13 percent of persons below the poverty level. ED's within each stratum were selected proportional to their measures of size. To ensure sampling reliability, clusters of 16 listed addresses were drawn from the sampling frames and then systematically subsampled at a rate of 1 out of 2 to produce a final segment of 8 household address listings.

At the third stage of sampling, a list of all eligible sample persons was made within each selected segment. The sample of persons to be examined was selected so that the younger and older age groups were oversampled and so that approximately one person per sample household was selected. The sampling rates by age are as follows.

Age	Rate
6 months-5 years....................	3/4
6-59 years..........................	1/4
60-74 years.........................	3/4

Of the 27,801 persons included in the NHANES II sample, 20,322 (73.1 percent) were interviewed and examined. The NHANES II sample size and response data by age, sex, and race are shown in Table II-1. The number of examined persons and population estimates are shown in Tables II-3 through II-27.

A more complete description of the survey design is included in Vital and Health Statistics, Series 1, No. 15 (National Center for Health Statistics, July 1981).

Data Collection Techniques

Questionnaires

Household questionnaire--For each household member, this questionnaire included questions on family relationships; certain demographic items such as age, sex, and race; selected housing information; items such as occupation, income, and veteran status; and an indication of participation in the Food Stamp Program.

Medical history questionnaires--For each sample person aged 6 months through 11 years, a questionnaire included items on birth weight, prematurity, developmental congenital conditions, medication, neurological conditions, lead poisoning, accidents, hospital care, disability, diarrhea, pica, vision, and a variety of chronic conditions. In addition, there were major sections on allergies, kidney and bladder disease, anemia, speech and hearing, lung and chest conditions, and participation in school lunch or similar programs.

Two questionnaires (medical history and health history supplement) for each sample person aged 12-74 years included items on medication; hospital care; tuberculosis; nutrition; a variety of acute and chronic diseases; tobacco, tea, and coffee usage; physical activity; weight; height; vision disability; exposure to pesticides; gastrointestinal problems; and for females, a menstrual and pregnancy history. In addition, there were major sections on anemia, diabetes, respiratory conditions, hearing and speech, liver and gallbladder conditions, kidney and bladder disease, allergies, hypertension, cardiovascular conditions, stroke, arthritis (stressing middle and upper back and neck problems), and participation in school meal programs.

Dietary questionnaires--A trained dietary interviewer recorded the quantity of every item of food or drink consumed during the previous day, by each sample person. After computer calculation, the data yielded measures of calories, cholesterol, fat, unsaturated fats, protein, carbohydrate, and specific vitamins and minerals consumed during the recall period.

In a food frequency interview, the usual pattern of food consumption over the prior 3 months was ascertained. The interviewer recorded whether or not any foods in various groupings--including milk, meat, fish, eggs, fats and oils, legumes and nuts, cereals, fruits, vegetables, and alcoholic beverages--were included. The number of times each food was consumed was reported, and the use of salt and vitamin and mineral supplements was noted.

Medications and vitamin usage questionnaire--A history of usage of any medicines, vitamins, or minerals during the preceding week was elicited for all examined persons.

Dietary supplement interview form--The history of special diets, prior medications, and barriers to purchasing groceries or eating foods was recorded for examined persons aged 12-74 years.

Behavior questionnaire--Data on behavior possibly associated with coronary heart disease were elicited for examined persons 25-74 years of age.

Examination by physician

A physician performed and recorded a medical examination, giving special attention to specified findings related to nutrition; hearing; the thyroid gland; and the cardiovascular, respiratory, neurological, and musculoskeletal systems. Details of the examination procedures can be found in NHANES II Examination Staff Procedures Manual for the Health and Nutrition Examination Survey, 1976-1979, part 15a (National Center for Health Statistics, Aug. 1979).

Special clinical procedures and tests

A specially trained health technician carried out the following tests and procedures on examined persons in the designated age ranges.

Spirometry trials--These were digitized and recorded on magnetic tape for examined persons 6-24 years of age. Trials were conducted for various pulmonary function indicators, such as forced vital capacity, forced expiratory volume in 1 second, and peak flow rate.

Blood pressure--Three blood pressure readings were taken by a physician: the first at the beginning of the examination with the examinee sitting, the second at the end of the physician's examination with the examinee supine, and the third immediately after the second with the examinee sitting on the edge of the examination table. The following guidelines, based on Recommendations for Human Blood Pressure Determinations by Sphygmomanometers (American Heart Association, Committee to Revise Standarization of High Blood Pressure Readings, 1951), were generally observed:

- The cuff was at least 20 percent wider than the diameter of the arm or covered approximately two-thirds of the arm. (An adult 13-centimeter (cm) cuff and a pediatric 9.5-cm cuff were provided.)

- The manometer was at eye level with the physician.

- The meniscus of the mercury instruments was checked weekly for zero-level calibration.

- While measuring, the rate of falling pressure was maintained at 2-3 millimeters of mercury (mm Hg) per heartbeat, which was slow enough to detect the first and last sounds but sufficiently rapid to avoid the intermittent trapping of blood between systolic and diastolic levels.

- For diastolic pressure, the level was recorded at the point of complete cessation of Korotkoff's sounds or, if there was no cessation, the point of muffling.

- Measurements were recorded to the nearest 2 mm on the scale.

Electrocardiograms--Digitized and recorded on magnetic tape for examined persons 25-74 years of age, electrocardiograms provided normative data on amplitudes and durations and permitted diagnostic interpretations of heart disease.

Body measurements--The measurements made on examinees included standing height, body weight, triceps and subscapular skinfolds, and several others.

The following procedures were used for weight and height measurements, used in this report to define overweight and growth retardation.

1. Weight
   a. Examinees who weighed 250 pounds or less:
      (1) Examinee was asked to stand still on the scale (in slippers).
      (2) Examiner waited until the scale pointer stopped moving.
      (3) The bottom of the body measurement page on the case record was inserted in the slot at the front of the scale's printer.

(4) The bar on the front of the printer was depressed to record the weight on the record to the nearest one-quarter of a pound.
(5) The recorded weight was checked for legibility.
(6) Weight was recorded on the body measurement form in the space provided (Item 10) near the bottom of the form. The weight was recorded in five digits, and blank spaces were filled in with zeroes as appropriate (e.g., 98.5 was entered as 098.50).

b. Examinees who weighed more than 250 pounds:
Because the scale printer would print to only 250 pounds, the following procedure was followed if an examinee weighed more.
(1) If the examinee weighed more than 250 pounds but no more than 350 pounds:
(a) The bottom weight on the notched bar on the front of the scale was moved to 100 pounds.
(b) The examinee was weighed and his case record stamped just as though he weighed 250 pounds or less.
(c) The 100 pounds were added to the stamped weight total on the body measurement page.
(d) The total weight (stamped weight plus 100 pounds) was recorded in the proper space on the body measurement page.
(2) If the examinee weighed more than 350 pounds but no more than 400 pounds:
(a) The bottom weight on the notched bar was moved to 100 pounds.
(b) The top weight on the numbered bar was moved to 50 pounds.
(c) The examinee was weighed and his case record stamped just as though he weighed 250 pounds or less.
(d) The 150 pounds were added to the stamped weight total on the body measurement page.
(e) The total weight (stamped weight plus 150 pounds) was recorded in the proper space on the body measurement page.
(3) If the examinee weighed more than 400 pounds, he was asked to estimate his weight.

2. Height (for examinees aged 2 years and over)
a. The examinee was told to stand erect with his back and heels against the upright bar of the height scale ("Stand up tall" or "Stand up straight") with feet together and head in the Frankfort Horizontal Plane ("Look straight ahead"). The examinee was grasped under the mastoid processes and stretched gently upward.
b. The horizontal bar was brought down snugly to the examinee's head.
c. One of the sample number labels was stuck next to the tape on the upright bar so the number label could be read when the height scale was photographed.
d. The height measurement was photographed and the examinee asked to step aside.
e. The film was processed, and the sample number label from the height scale was placed on the photo.
f. The standing height was recorded on the body measurement form as read from the photograph in the space provided.) This was recorded in four digits to the nearest mm. If there were fewer than four digits, blank spaces were filled in with zeroes as appropriate (e.g., 99.0 was entered as 099.0). When the measurement was exactly at the halfway point between two millimeters, the last digit was

rounded up if the preceding whole number was odd and rounded down if even.

Pure tone audiometry--This test, carried out on examined persons aged 4-19 years, permitted determination of threshold levels of hearing for frequencies of 500, 1,000, 2,000, and 4,000 hertz for right and left ears.

Speech recording--This involved the use of a tape recording of the subject's repetition of specially developed sentences. It was carried out on examined persons aged 4-6 years, permitting interpretations that gave an indication of problems with articulation and language development.

Allergy tests--Skin tests (the prick test) with eight common allergens (house dust, alternaria, cat fur, dog fur, ragweed, oak, rye grass, and Bermuda grass) were made on examined persons aged 6-74 years to obtain degrees of skin reaction.

X-rays

For examined persons 25-74 years of age, two X-rays were made. No X-rays were done on pregnant women, and no lumbar X-rays were done on women under 50 years of age.

X-ray of cervical and lumbar spine--This provided evidence of osteoarthritis and degenerative disc disease.

X-ray of chest--The chest X-ray was used in the diagnosis of respiratory diseases and served as a measure of left ventricular enlargement.

Urine tests

The following tests were performed on casual samples of urine.

N-Multistix tests--These urinary dipstick tests for qualitative protein, glucose, ketones, bilirubin, blood, urobilinogen, hydrogen-ion concentration (pH), and bacteriuria (nitrite test) were done for examined persons 6-74 years of age.

Urinary sediments--Sediments, including red cells, white cells, and casts, were measured for a subsample of examined adults 20-74 years of age.

Gonorrhea cultures--Cultures of urinary sediments were performed for male and female examined persons 12-40 years of age. However, of females who received the glucose tolerance test, only those 20-24 years of age had the gonorrhea test performed.

Analyses for pesticide levels--Urine samples from a subsample of examined persons 12-74 years of age were tested for the presence of alkyl phosphate residues and metabolites, carbamate residues, phenolic compound residues, and malathion metabolites.

Tests on blood samples

Samples of blood provided a broad range of information related to health and nutrition. The particular tests performed varied with the specific target condition and age group. More detailed descriptions of these tests are found in Vital and Health Statistics, Series 1, No. 15 (National Center for Health Statistics, July 1981).

Glucose tolerance test--A one-half sample of persons 20-74 years of age was scheduled for examination in the morning. The examinees were instructed not to eat anything after 11:00 p.m. on the evening before the test. On the morning of the examination, after a fasting venal blood specimen had been drawn and a urine specimen had been analyzed for glucose, the examinee was given 7 ounces of caffeine-free cola (Glucola) to drink, which contained an equivalent of 75 grams of glucose. Two more specimens of blood were drawn at 1- and 2-hour intervals.

The tests were done only in the morning because glucose tolerance decreases later in the day. In general, health conditions, known to alter carbohydrate metabolism such as pregnancy, were not grounds for exclusion from testing. The test was also given to individuals who had been told by their physicians that they were diabetic and whose condition was controlled by diet or by oral hypoglycemic medication. The test was not given to insulin-dependent diabetics.

The blood was processed in the examination center laboratory, and the frozen plasma was shipped to the Centers for Disease Control in Atlanta, Ga. There the plasma was analyzed by the Hexokinase/glucose-6-phosphate dehydrogenase Procedure, using an automated modification of the National Glucose Reference Method developed at the Centers for Disease Control.

Tests related to liver function--The postprandial liver bile acid test measured the ability of the liver to remove bile acids from the blood following consumption of a food preparation that induced the eventual addition of bile acids to the blood via contraction of the gallbladder. Biochemical liver tests performed included bilirubin, serum glutamic-oxaloacetic transaminase, and alkaline phosphatase.

Anemia-related laboratory tests--The tests made to diagnose anemia consisted of protoporphyrin, iron, total iron-binding capacity, zinc, copper, red cell folates, serum folates, serum ferritin, vitamin B_{12}, and the determination of abnormal hemoglobin.

Other biochemical nutritional tests--These tests included albumin, vitamin A, and vitamin C.

Serum lipids--Determinations were made of cholesterol, triglycerides, and high-density lipoprotein because of their relevance to cardiovascular disease. Laboratory analysis was performed by the Lipid Research Clinic, George Washington University, Washington, DC, and is described in detail in *Vital and Health Statistics*, Series 11 (National Center for Health Statistics, to be published-b).

Biochemical tests for body burden from environmental exposures--Determinations were made of the levels of lead and organochlorine pesticide residues and metabolites. Tests were also performed for carboxyhemoglobin, which reflects environmental exposure to carbon monoxide and the individual's smoking habits.

Hematology--The hematology included determinations of hemoglobin, hematocrit, red blood cell count, white blood cell count and differential analysis, and red blood cell morphology.

Kidney function--The only test for kidney function performed on blood samples was the serum creatinine test.

Syphilis--The serology determinations for syphilis included qualitative and quantitative automated reagin test, a fluorescent treponemal antibody-absorbance, and a micro-hemagglutination assay-treponema pallidum.

Analytical Methods: Hematology and Nutritional Biochemistry

Hematology

The hemoglobin determinations were performed on a Coulter hemoglobinometer. Hematocrit determinations were performed by the spun microhematocrit method.

Cell counts were performed on a Coulter Model FN. The hematologic indexes--mean corpuscular volume (MCV), mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration--were computer generated using the spun microhematocrit value. MCV values derived by electronic counter (Coulter) are measured directly and are likely to give somewhat different results from those presented in this report. More detailed descriptions of these methods have been published (Centers for Disease Control, 1977; Dacie and Lewis, 1975).

Nutritional biochemistry

The methodology described in the sections on erythrocyte protoporphyrin, serum iron and total iron-binding capacity, transferrin saturation, serum albumin, serum vitamin C, serum zinc and copper, serum vitamin A, and plasma glucose are loosely excerpted from a Centers for Disease Control (CDC) manual (Centers for Disease Control, 1981). Some wording has been altered, and references have been changed to match this report's list of references. The serum cholesterol procedure is the same method used by the Lipid Research Clinic to analyze plasma cholesterol and is described in more detail in the Manual of Laboratory Operations (Lipid Research Clinics Program, 1982).

Erythrocyte protoporphyrin:

Principle--Erythrocyte protoporphyrin is measured by a modification of the method of Sassa and Granick (Sassa et al., 1973). Protoporphyrin is extracted from ethylene-diamine tetra-acetic acid-whole blood into a 2:1 (volume/volume, or v/v) mixture of ethyl acetate-acetic acid, then back-extracted into dilute hydrochloric acid (HCL). The protoporphyrin in the aqueous phase is measured fluorometrically at excitation and emission wavelengths of 404 and 655 nanometers (nm), respectively. Calculations are based on a processed protoporphyrin IX (free acid) standard curve. The final concentration of protoporphyrin in a specimen is expressed as micrograms per deciliter of packed red blood cells (mcg/dl RBC); a correction for the individual hematocrit is made.

CDC modifications--The following modifications of the original methods are based on CDC optimization experiments: (a) Sample size is increased from 2 microliters (mcl) to 10 mcl; (b) ethyl acetate-acetic acid and 0.43 mol/liter HCl volumes are increased from 0.3 milliliter (ml) to 1.0 ml; (c) processed protoporphyrin IX standards are used; (d) hydrolysis time for the dimethyl ester is decreased from 48 hours to 3 hours on the basis of previous studies (Culbreth et al., 1979); and (e) 0.43 mol/liter HCl was chosen for maximum fluorescent intensity of the extracted protoporphyrin IX.

Serum iron and total iron-binding capacity:

Principle--Serum iron and total iron-binding capacity (TIBC) are measured by a modification of the automated Technicon AAII-25 method, which is based on previous studies (Giovanniello et al., 1968; Ramsey, 1957). Iron is quantitated by measuring the intensity of the violet complex formed in the reaction between ferrozine and iron in the divalent form in pH 4.7 acetate buffer at 562 nm.

CDC modifications--The following modifications to the Technicon AAII-25 method are noted: (a) The reagent concentrations used and their ratios are based on procedures developed at CDC; (b) two standard Technicon AutoAnalyzer I type C dialysis plate assemblies are connected in series to increase the efficiency of dialysis; (c) ferrozine is incorporated into the acetate buffer; and (d) a 50-mm flow-cell is used in the colorimeter to maximize sensitivity.

Transferrin saturation:

The transferrin saturation values were computer generated using the examinee's serum iron and TIBC values as follows:

$$\text{Transferrin saturation (in percent)} = \frac{\text{serum iron}}{\text{TIBC}} \times 100$$

Serum albumin:

Principle--This automated method is a direct adaptation of the Technicon AutoAnalyzer II Bromcresol Green method (Technicon Instruments Corp., 1973), which is based on previous studies (Doumas et al., 1971). Bromcresol green (BCG) dye binds selectively to albumin in human serum. The final dilution of the sample to BCG dye in pH 4.2 succinate buffer is 1:800. The albumin-BCG complex is measured at 630 nm.

CDC modifications--The following modifications to the original method are noted: (a) A 60 samples per hour (60/h) 1:1 cam was substituted on the Technicon Sampler IV for the 60/h 9:1 cam specified in the BCG-Albumin AutoAnalyzer II methodology; and (b) all standards are prepared from 99.5-percent purity human albumin, fraction V, and all quality control materials are prepared from human serum.

Serum vitamin C:

Principle--The vitamin C method is a modification of the ascorbic acid methodology of Roe and Kuether (Roe, 1967; Roe et al., 1943) and measures total vitamin C. Serum is diluted 1:5 (v/v) with metaphosphoric acid to preserve ascorbic acid and to precipitate proteins. Ascorbic acid is converted to dehydroascorbic acid in the presence of thiourea and copper sulfate. Dehydroascorbic acid couples with 2,4-dinitrophenylhydrazine in 9.0 mol/liter sulfuric acid to form a bis-2,4-dinitrophenylhydrazine derivative. When treated with 65 percent (v/v) sulfuric acid, this derivative yields a stable brownish-red color, which is measured with a spectrophotometer at 520 nm.

CDC modifications--The following modifications to the original method are based on optimization studies performed at CDC: (a) The concentration of sulfuric acid was reduced from 85 percent to 65 percent; (b) the incubation temperature was decreased from 37^{o}Celsius (C) to 27^{o}C; and (c) the time of incubation was increased from 4 hours to 20 hours (overnight).

Serum zinc and copper:

Principle--Serum zinc and copper are measured by atomic absorption spectroscopy by using a CDC-optimized method based on procedures from Instrumentation Laboratory, Inc. and Perkin-Elmer Corp. (Instrumentation Laboratory, Inc., 1972; Perkin-Elmer Corp., 1973). Quantitation is based on the measurement of light absorbed at 213.9 and 324.7 nm, respectively, by ground-state atoms of zinc and copper from hollow-cathode lamp light sources. Serum specimens, standards, and quality control samples are diluted 1:10 with 6-percent (v/v) n-butanol in 0.05 mol/liter HCl. The diluted samples are aspirated directly into a flame, and the concentration of zinc or copper is measured by the Perkin-Elmer Model 306 or 4000 atomic absorption spectrophotometer, which is calibrated with zero and 150 mcg/dl standards to read directly in concentration units. All lots of materials used for collecting and processing samples were screened for zinc and copper contamination, and all processing work was performed under laminar-flow hoods.

CDC modifications--The following modifications to the standard method are based on CDC optimization experiments: (a) HCl diluent concentration is changed from 0.1 to 0.05 mol/liter; (b) for the Model 4000 AAS, 0.25 ml Triton X-100 is added per liter of diluent to enhance nebulization; (c) dilution of sample is 1:10 rather than 1:4 to reduce protein clogging of the nebulizer and burner; and (d) a single-slot rather than triple-slot burner is used.

Serum vitamin A:

Principle--Serum vitamin A is quantitated by a modification of Roels and Trout's adaptation of the method of Neeld and Pearson (Roels and Trout, 1972; Neeld and Pearson, 1963). Serum is mixed with ethanolic potassium hydroxide to precipitate the proteins and saponify the retinyl esters. Retinol and carotenoids are then extracted in n-hexane and measured spectrophotometrically at 450 nm for quantitation of beta-carotene. Then the solvent of the extract is evaporated and the residue is dissolved in chloroform. Trifluoroacetic acid is added to this solution and the intensity of the resulting transient blue color is measured at 620 nm. Correction is made for the contribution of carotene at 620 nm.

CDC modifications--The following modifications to the method of Roels and Trout were made: (a) The saponification step was changed from 30 minutes at 60°C to 10 minutes at 50°C; (b) evaporation temperature was changed from 60°C to 25°C; (c) one drop of acetic anhydride was not added to each tube containing chloroform; (d) readings at 620 nm after trifluoroacetic acid was added were made at 8-10 seconds instead of 30 seconds; (e) standard curves were run by the method of addition to a serum pool; and (f) all volumes in the procedure were scaled up by a factor of 2.

Serum Cholesterol:

Cholesterol was measured simultaneously in two steps. First, serum was extracted with isopropanol and then treated with zeolite mixture to remove phospholipids, glucose, bilirubin, and other substances that could interfere with the determination. Second, cholesterol was determined by use of the Technicon Autoanalyzer II. Colorimetric determination of cholesterol with the Autoanalyzer II was based on the formation of a color developed at 60°C with a Liebermann-Burchart reagent. The reagent was prepared from acetic anhydride, glacial acetic acid, and sulfuric acid 6:3:1 (volume/volume/volume).

Plasma Glucose:

Glucose is measured by a microadaptation of the National Glucose Reference Method (Centers for Disease Control, 1976) on an Abbott ABA-100 Analyzer (Abbott Laboratories, 1976). The determination is based on the enzymatic coupling of hexokinase and glucose-6-phosphate dehydrogenase and has been optimized for D-glucose. Specificity is enhanced by using sample deproteinization with barium hydroxide and zinc sulfate (Somogyi reagents) to remove kinases and oxidoreductases that utilize the coenzymes, carbohydrate modifying enzymes, ultraviolet absorbing proteins, and other possibly interfering chemicals which coprecipitate.

Hexokinase and excess adenosine triphosphate are added to the supernatant, and in the presence of magnesium ions, phosphorylate the glucose to glucose-6-phosphate (G-6-P). In the presence of nicotinamide adenine dinucleotide (NAD), G-6-P is oxidized by glucose-6-phosphate dehydrogenase (G-6-PD) to 6-phosphoglucono-delta-lactone and nicotinamide adenine dehydrogenase (NADH). Spontaneous hydrolysis of the unstable lactone occurs at the pH of the test, and the reaction sequence goes virtually to completion. The glucose present in the filtrate is measured by the reduction of NAD to NADH measured to 340 nm.

Estimation Procedures

Because the design of NHANES is a complex multistage probability sample, national estimates are derived through a multistage estimation procedure. The procedure has three basic components: (1) Inflation by the reciprocal of the probability of selection, (2) adjustment for nonresponse, and (3) post-stratification by age, sex, and race. A brief description of each component follows.

Inflation by the reciprocal of the probability of selection--The probability of selection is the product of the probabilities of selection from each stage of selection in the design: PSU, segment, and sample person.

Adjustment for nonresponse--The estimates are inflated by a multiplication factor that brings estimates based on examined persons up to a level that would have been achieved if all sample persons had been examined. The nonresponse adjustment factor was calculated by dividing the sum of the reciprocals of the probability of selection for all selected sample persons within each of five income groups (less than $6,000, $6,000-$9,999, $10,000-$14,999, $15,000-$24,999, and $25,000 or more); three age groups (6 months-5 years, 6-59 years, and 60-74 years); four geographic regions; and within or outside SMSA's by the sum of the reciprocals of the probability of selection for examined sample persons in the same income, age, region, and SMSA groups. The percent distribution of the nonresponse adjustment factors is as follows.

Size of factor	Percent distribution
Total	100.0
1.00-1.24	26.8
1.25-1.49	54.8
1.50-1.74	10.9
1.75-1.99	4.4
2.00-2.49	2.2
2.50-2.99	0.9

Poststratification by age, sex, and race--The estimates were ratio adjusted within each of 76 age-sex-race cells to independent estimates, provided by the U.S. Bureau of the Census, of the population as of March 1, 1978, the approximate midpoint of the survey. The ratio adjustment used a multiplication factor in which the numerator was the U.S. population and the denominator was the sum of the weights adjusted for nonresponse for examined persons. This ratio estimation process brings the population estimates into close agreement with the Census Bureau's estimates of the civilian noninstitutionalized population of the United States and, in general, reduces sampling errors of NHANES II estimates.

Nonresponse Bias

In any health examination survey, there exists the potential for three levels of nonresponse: (1) Household interview nonresponse, (2) examination nonresponse, and (3) item nonresponse. Household interview nonresponse occurs when the household medical history questionnaire is not completed. Examination nonresponse occurs when sample persons who respond to the household questions do not come to the examination center for an examination. Item nonresponse results when sample persons do not complete some portion of either the household interview questionnaires or the examination protocol. Intense efforts were undertaken during NHANES II to develop and implement procedures and inducements that would reduce all types of nonresponse and thereby reduce the potential for bias in the survey estimates (National Center for Health Statistics, July 1981).

In NHANES II there was a 9-percent (Table II-1) medical history interview nonresponse, and, despite intense efforts to reduce the number of examination nonrespondents, 27 percent of the 27,801 persons selected for NHANES II were not examined. A comparison was made of 1976 National Health Interview Survey (NHIS) and NHANES II data. The close agreement of selected interview items in NHANES II data with comparable items in the 1976 NHIS data suggests that there is not a large nonresponse bias in several health-related variables (National Center for Health Statistics, Nov. 1977a; Forthofer, 1983). The 1976 NHIS data were used for comparison because that survey included questions on diabetes (of interest in NHANES II) and because the nonresponse was 4 percent. It is assumed that the 4-percent nonresponse was randomly distributed.

In NHANES II, the nonresponse rate for the oral glucose tolerance test (OGTT) was higher than rates for other items. Estimates of the prevalence of diabetes depend on data collected on the medical history questionnaire as well as the OGTT section of the physical examination. The nonresponse rates were 12 percent for medical history, 21 percent for physical examination, and 23 percent for the OGTT item. An investigation of the potential bias of the diabetes data due to nonresponse is discussed in a National Center for Health Statistics report (to be published-c.)

Data from earlier studies also suggest no substantial nonresponse bias. An analysis of data on examined and nonexamined (but interviewed) persons was done using the first 35 locations of NHANES I (Department of Health, Education, and Welfare, 1974). It was found that the two groups were quite similar with respect to the health characteristics being compared. In another study of examined and nonexamined persons selected for participation in NHANES I, no differences were found between the two groups with respect to health-related variables (Health Services and Mental Health Administration, 1975). Factors relating to response in cycle I of the National Health Examination Survey were also investigated (National Center for Health Statistics, Aug. 1969).

In another study of cycle I (National Center for Health Statistics, June 1974), comparisons between two extreme groups were made based on numerous selected examination and questionnaire items. Persons who participated in the survey with no persuasive effort and those who participated only after a great deal of persuasive effort were compared, and data indicated that differences between the two groups generally had little effect on estimates. This was interpreted as evidence that no large bias exists between the two groups for the items investigated and was offered as further support for the belief that little bias is introduced to the findings because of differences in health characteristics between examined and non-examined persons.

Missing Data

Examination surveys are subject to a loss of information not only through the failure to examine all sample persons but also from the failure to obtain and record all items of information for examined persons. Table II-2 presents the percent of missing values in NHANES II by blood assessment and age group.

The missing data are the result of several problems, such as unsuccessful venipuncture, loss of blood in shipping, broken equipment, and laboratory values out of quality control limits. Unsuccessful venipunctures occurred most frequently in children ages 6 months-5 years. Unacceptable laboratory data for one or more stands (PSU's) occurred for the following determinations: Serum albumin, serum vitamin A, and serum total iron-binding capacity.

Imputation

Three variables in this report were imputed when values were missing. In all other instances, data are based only on cases for which valid measurements were available. For details about imputation procedures, see the referenced publication.

Health Condition and How It was Measured	Publication
1. Hypertension (blood pressure)	National Center for Health Statistics, to be published-a.
2. High-risk cholesterol level (serum cholesterol)	National Center for Health Statistics, to be published-b.
3. Impaired iron status (transferrin saturation)	Life Sciences Research Office, Aug. 1984.

Measures of Variability

Because the statistics presented in this report are based on a sample, they will differ somewhat from the figures that would have been obtained had a complete census been taken using the same survey instruments, instructions, interview and examination personnel, and procedures. The probability design of this survey permits the estimation of standard deviations and errors that correspond to the use of weighted estimates derived from the highly clustered, multistage probability sample of the U.S. civilian noninstitutionalized population. Estimates of variances and standard errors from this type of design are different from and generally larger than standard errors calculated under the assumption of simple random sampling.

The standard error is primarily a measure of sampling variability--that is, the variations that might occur by chance because only a sample of the population is surveyed. As calculated for this report, the standard error also reflects part of the variation that arises in the measurement process. Estimates of any bias in the data are not included. The chances are about 68 out of 100 that an estimate from the sample using the same procedures and instruments would differ from a complete census by less than the standard error. The chances are about 95 out of 100 that the difference would be less than twice the standard error and about 99 out of 100 that it would be less than 2½ times as large.

Estimates of the standard errors of the means used in this report are shown in the appropriate appendix table. Standard errors of the differences (assuming independence of the estimated means) can be calculated in the following way. Let SE_1 and SE_2 be the estimated standard errors of two subpopulation means $\bar{X}_1$ and $\bar{X}_2$. Let $\hat{d} = \bar{X}_1 - \bar{X}_2$ be the estimate of the difference between the two subpopulation means. The standard error of $\hat{d}$ is estimated by:

$$SE_{\hat{d}} = \sqrt{SE_1^2 + SE_2^2}$$

These estimates have been prepared by a balanced repeated replication technique (National Center for Health Statistics, March 1975 and March 1977) that yields overall variability through observation of variability among random subsamples of the total sample. However, standard errors of the age-adjusted means were calculated using a Taylor series linearization method (Holt, 1982). This process approximates the variance of nonlinear or linear statistics (for example, means and proportions) using the first two terms of a Taylor series expansion. If the higher order terms of the expansion are negligible and the sample is of a reasonable size for the domains of interest, then this approximation provides variance estimates as reliable as those from the pseudoreplication method adapted for use in the analysis of NHANES II data (Woodruff, 1971).

The estimated standard errors do not reflect any residual bias that might still be present after the correction for nonresponse. The need for the balanced repeated replication or linearization technique for estimating standard errors arises because of the complexity of the NHANES II sample survey design, which makes it inappropriate to calculate standard errors by a technique that does not take into consideration a complex sample design. It should be noted that the estimates of standard errors are themselves subject to errors that may be large when the number of cases is small or when the number of strata with observations in both paired PSU's is small.

Data Presentation and Reliability

The following statistical guidelines (National Center for Health Statistics, Dec. 1982) were used in reporting means, standard errors of the means, percents, and standard errors of the percents. Tables II-3 through II-27 contain more detailed information to supplement the charts showing data from the National Center for Health Statistics (NCHS) surveys.

1. Means
   a. If the sample size was less than 25, the value of the estimated sample mean is not reported.
   b. If the sample size was 25-44, the sample mean is reported to give an impression of the observed distribution, but an asterisk is placed beside it to indicate that the statistic does not meet the reliability standard because the distribution of the sampling error may not be normal in some cases.
   c. If the sample size was 45 or more, the sample mean is presented without caveat.

2. Standard errors of the means
   a. If the sample size was less than 25, no estimated values for the standard error of the mean are presented.
   b. If the sample size was 25 or more and the observations were distributed among the PSU's so that fewer than 12 pseudostrata had observations in both of the paired PSU's, the values are presented, but asterisks are placed beside them to indicate that the estimator may be very unstable.
   c. If the sample size was 25 or more and the observations were distributed among the PSU's so that 12 or more pseudostrata had observations in both of the paired PSU's, the standard error of the mean is presented without caveat.

3. Percents and standard errors of the percents
   a. Criteria for reporting percents are the same as those given for means. (See number 1.)
   b. Criteria for reporting the standard errors of the percents are the same as those given for standard errors of the means. (See number 2.)

The Pediatric Nutrition Surveillance System

In 1973, the Centers for Disease Control (CDC) began working with five States (Arizona, Kentucky, Louisiana, Tennessee, and Washington) to develop a system for continuously monitoring the nutritional status of specific high-risk population groups. These States recognized the need for timely nutrition-related data on populations served by them for use in program planning and evaluation. The system is based on utilization of readily available data from selected health service delivery programs.

Once this nucleus of States demonstrated that the surveillance mechanism was practical and workable, a gradual expansion into other States occurred. During 1985, CDC worked with 34 States in an expanding nutritional status surveillance program aimed primarily at selected high-risk pediatric populations.

Nutritional status indicators were selected from those utilized in nutritional status surveys. The indexes utilized, which relate to the most widely prevalent nutritional problems, are inexpensively and routinely obtained by local clinic staff.

Reference standards for the evaluation of surveillance data are derived principally from those used in national surveys conducted by NCHS. Although data obtained from surveillance activities may not reflect the same ethnic and geographic composition as the sample drawn for national surveys, the data obtained from national samples still serve as a useful reference point in evaluating surveillance findings.

The principal sources of nutrition surveillance data are programs--such as Maternal and Child Health; the Early and Periodic Screening, Diagnosis, and Treatment Program; the Special Supplemental Food Program for Women, Infants, and Children; and Head Start--which have been implemented to improve the health and well-being of high-risk children, particularly minority preschoolers, disadvantaged schoolchildren, and pregnant adolescents. Program administrators require up-to-date information on the prevalence and distribution of nutrition-related problems for effective program management.

Nearly all health-oriented programs for children require that they be weighed and measured and a hemoglobin or hematocrit done. These simple and inexpensive determinations are relevant to assessment of the three most common nutrition-related problems documented by major U.S. nutrition surveys: retardation of linear growth, overweight, and anemia.

Data on other important characteristics, such as age, sex, and ethnic background, are also readily available and can be incorporated into the surveillance mechanism with minimal additional cost and effort. In addition, some health agencies are already engaged in measuring serum cholesterol and free erythrocyte protoporphyrin levels in the pediatric population so that these indicators can be used in surveillance. Additional items can be added to nutrition surveillance provided they meet the following criteria: (1) General agreement that the item is indicative of or related to poor nutritional status or is predictive of changes in nutritional status and (2) amenability to quality control.

The basic analyses performed are conceptually simple. Each child's height and weight values are compared with the NCHS values for the reference population and with a set of age- and sex-specific cutoff values for hemoglobin and hematocrit. These comparisons form the basis for the determination of prevalence estimates for anemia, growth retardation, or overweight. The data are then sent back to the States for use at the State, district, and local levels.

Table II-1. Sample size and response rates for the Second National Health and Nutrition Examination Survey, by age, sex, and race: United States, 1976-80

Age, sex, and race	Total sample size	Interview and examination status			
		Interviewed[1]		Examined	
		Number	Percent	Number	Percent
Total	27,801	25,286	90.95	20,322	73.10
Age					
6-11 months	444	431	97.07	356	80.18
1-5 years	4,625	4,445	96.11	3,762	81.34
6-11 years	2,085	1,963	94.15	1,725	82.73
12-17 years	2,438	2,304	94.50	1,975	81.01
18-24 years	2,713	2,537	93.51	2,054	75.71
25-34 years	3,031	2,773	91.49	2,237	73.80
35-44 years	2,236	2,005	89.67	1,589	71.06
45-54 years	2,149	1,866	86.83	1,453	67.61
55-64 years	3,868	3,330	86.09	2,556	66.08
65-74 years	4,212	3,632	86.23	2,615	62.09
Sex					
Female	14,395	13,122	91.16	10,339	71.82
Male	13,406	12,164	90.74	9,983	74.47
Race					
White	23,537	21,350	90.71	17,105	72.67
Black	3,653	3,389	92.77	2,763	75.64
Other	611	547	89.53	454	74.30

[1]Completed medical history interview.

Table II-2. Percent of examined persons with missing blood assessments, by assessment and age: Second National Health and Nutrition Examination Survey, 1976-80

Age	Number of examined persons	Assessment				
		Hemoglobin	Hematocrit	Red blood cell count	White blood cell count	Mean corpuscular volume
		Percent				
Total...........	20,322	6.6	6.6	7.3	7.2	7.5
6-11 months......	356	41.9	41.9	43.3	43.3	43.3
1-2 years........	1,417	30.9	30.9	31.5	31.3	31.7
3-5 years........	2,345	17.4	17.4	18.0	18.0	18.0
6-8 years........	843	10.9	10.9	11.5	11.6	11.5
9-11 years.......	882	5.4	5.4	6.8	6.6	6.9
12-14 years......	991	4.3	4.3	4.8	5.0	4.9
15-17 years......	984	1.9	1.9	3.2	2.8	3.3
18-24 years......	2,054	2.0	2.0	2.6	2.5	2.6
25-34 years......	2,237	1.0	1.0	1.7	1.6	1.9
35-44 years......	1,589	0.9	0.9	1.8	1.6	1.9
45-54 years......	1,453	0.6	0.6	1.2	1.1	1.4
55-64 years......	2,556	1.2	1.2	1.8	1.8	2.1
65-74 years......	2,615	1.1	1.1	1.9	1.6	2.1

Age	Assessment--Con.				
	Mean corpuscular hemoglobin	Mean corpuscular hemoglobin concentration	Erythrocyte protoporphyrin	Serum iron	Serum total iron-binding capacity
	Percent--Con.				
Total...........	9.8	9.4	10.3	13.6	22.8
6-11 months......	44.7	43.8	60.4	91.6	93.3
1-2 years........	34.1	33.8	44.4	61.7	67.9
3-5 years........	20.5	19.9	23.3	32.9	42.7
6-8 years........	13.9	13.4	14.0	19.8	30.7
9-11 years.......	10.2	9.2	9.0	10.9	20.9
12-14 years......	8.1	7.8	5.9	7.3	18.9
15-17 years......	6.0	5.3	3.2	3.9	19.0
18-24 years......	5.0	4.6	3.9	4.1	12.5
25-34 years......	4.5	4.2	3.3	3.1	11.2
35-44 years......	3.8	3.1	2.8	2.5	11.1
45-54 years......	3.7	3.4	2.9	2.8	11.6
55-64 years......	4.2	4.1	3.3	3.2	12.8
65-74 years......	4.1	3.5	3.5	3.7	12.8

Table II-2. Percent of examined persons with missing blood assessments, by assessment and age: Second National Health and Nutrition Examination Survey, 1976-80--Con.

Age	Assessment--Con.					
	Transferrin saturation	Serum zinc[1]	Serum copper[1]	Serum vitamin C[1]	Serum albumin[1]	Serum vitamin A[2]
	Percent--Con.					
Total............	22.9	20.4	21.1	14.8	16.7	38.4
6-11 months......	93.5	...	...	...	...	...
1-2 years........	67.9	...	...	...	...	...
3-5 years........	42.8	49.6	49.8	47.7	55.9	44.9
6-8 years........	30.8	33.9	33.6	36.7	49.3	33.8
9-11 years.......	21.0	24.8	24.3	29.6	44.6	25.3
12-14 years......	19.1	20.7	23.1	12.1	10.6	...
15-17 years......	19.0	15.8	17.3	8.0	7.6	...
18-24 years......	12.8	16.2	17.9	7.4	7.4	...
25-34 years......	11.3	13.0	13.8	6.9	5.5	...
35-44 years......	11.4	12.5	13.1	5.9	5.2	...
45-54 years......	11.7	12.5	12.9	6.6	5.3	...
55-64 years......	13.0	13.7	14.4	6.7	6.7	...
65-74 years......	13.1	15.2	15.1	7.5	7.1	...

[1]Data collected only on ages 3-74 years.
[2]Data collected only on ages 3-11 years.

Table II-3. Overweight persons aged 25-74 years, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent over-weight	Standard error of the percent
MALE				
White				
25-34 years...........	901	13,864	20.9	1.58
35-44 years...........	653	9,808	28.2	1.82
45-54 years...........	617	9,865	30.5	1.73
55-64 years...........	1,086	8,642	28.6	1.67
65-74 years...........	1,045	5,576	25.8	1.45
Black				
25-34 years...........	139	1,546	17.5	*3.08
35-44 years...........	70	1,112	40.9	*5.20
45-54 years...........	62	1,044	41.4	*7.48
55-64 years...........	129	801	26.0	*5.37
65-74 years...........	128	555	26.4	4.67
FEMALE				
White				
25-34 years...........	957	13,808	17.9	1.55
35-44 years...........	718	10,470	24.8	1.18
45-54 years...........	647	10,369	29.9	2.53
55-64 years...........	1,176	9,601	34.8	1.58
65-74 years...........	1,245	7,329	36.5	1.45
Black				
25-34 years...........	140	1,909	33.5	*5.22
35-44 years...........	103	1,415	40.8	*5.66
45-54 years...........	100	1,215	61.2	*6.35
55-64 years...........	135	959	59.4	*5.62
65-74 years...........	152	733	60.8	4.82

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk (excluding pregnant women).

NOTE: See text for definitions.

Table II-4. Overweight persons aged 25-74 years, by sex, poverty status, and age: United States, 1976-80

Sex, poverty status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent over-weight	Standard error of the percent
MALE				
Below poverty				
25-34 years...........	91	1,106	20.3	3.77
35-44 years...........	63	821	24.0	6.10
45-54 years...........	46	645	28.5	*7.56
55-64 years...........	129	779	26.0	4.19
65-74 years...........	168	759	20.9	3.44
Above poverty				
25-34 years...........	945	14,355	20.5	1.52
35-44 years...........	658	10,195	29.3	1.79
45-54 years...........	603	9,738	31.4	1.84
55-64 years...........	1,048	8,443	27.8	1.64
65-74 years...........	987	5,312	25.8	1.61
FEMALE				
Below poverty				
25-34 years...........	158	1,960	30.8	3.76
35-44 years...........	118	1,531	49.1	4.13
45-54 years...........	82	1,115	54.1	8.22
55-64 years...........	188	1,181	44.1	3.76
65-74 years...........	256	1,245	46.1	4.25
Above poverty				
25-34 years...........	938	13,782	18.4	1.48
35-44 years...........	695	10,275	23.7	1.52
45-54 years...........	655	10,424	30.3	2.53
55-64 years...........	1,071	8,934	35.5	1.82
65-74 years...........	1,080	6,507	37.0	1.58

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk (excluding pregnant women).

NOTE: See text for definitions.

Table II-5. Overweight persons aged 25-74 years, by sex, age, and survey period: United States, 1960-80

Sex, age, and survey period	Number of examined persons[1]	Estimated population in thousands[2]	Percent over-weight	Standard error of the percent
MALE				
25-34 years				
1960-62.............	675	10,281	22.0	1.76
1971-74.............	799	12,991	23.6	2.24
1976-80.............	1,067	15,895	20.4	1.52
35-44 years				
1960-62.............	703	11,373	23.2	1.76
1971-74.............	665	10,663	29.4	2.32
1976-80.............	745	11,367	28.9	1.76
45-54 years				
1960-62.............	547	10,034	28.1	2.59
1971-74.............	767	11,195	27.6	2.07
1976-80.............	690	11,114	31.0	1.79
55-64 years				
1960-62.............	418	7,517	27.2	2.70
1971-74.............	592	8,971	24.8	1.90
1976-80.............	1,227	9,607	28.1	1.64
65-74 years				
1960-62.............	265	4,972	23.8	3.08
1971-74.............	1,655	5,470	23.0	1.34
1976-80.............	1,199	6,297	25.2	1.55
FEMALE				
25-34 years				
1960-62.............	689	10,450	15.9	1.34
1971-74.............	1,802	13,323	17.6	.89
1976-80.............	1,121	16,104	20.0	1.48
35-44 years				
1960-62.............	770	12,093	24.4	1.97
1971-74.............	1,654	11,527	27.3	1.26
1976-80.............	836	12,170	27.0	1.26

See footnotes at end of table.

Table II-5. Overweight persons aged 25-74 years, by sex, age, and survey period: United States, 1960-80--Con.

Sex, age, and survey period	Number of examined persons[1]	Estimated population in thousands[2]	Percent over-weight	Standard error of the percent
FEMALE--Con.				
45-54 years				
1960-62.............	705	10,542	30.9	1.92
1971-74.............	832	12,180	32.3	2.05
1976-80.............	763	11,918	32.5	2.19
55-64 years				
1960-62.............	443	8,121	43.6	2.97
1971-74.............	670	9,998	38.5	1.90
1976-80.............	1,329	10,743	37.0	1.61
65-74 years				
1960-62.............	299	6,192	43.3	3.22
1971-74.............	1,811	7,138	38.0	1.73
1976-80.............	1,416	8,198	38.5	1.52

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk (excluding pregnant women).

NOTE: See text for definitions.

Table II-6. Severely overweight persons aged 25-74 years, by sex, age, and survey period: United States, 1960-80

Sex, age, and survey period	Number of examined persons[1]	Estimated population in thousands[2]	Percent severely over-weight	Standard error of the percent
MALE				
25-34 years				
1960-62.............	675	10,281	5.4	.75
1971-74.............	799	12,991	9.1	1.22
1976-80.............	1,067	15,895	6.7	.72
35-44 years				
1960-62.............	703	11,373	6.9	.89
1971-74.............	665	10,663	7.8	1.22
1976-80.............	745	11,367	8.9	1.05
45-54 years				
1960-62.............	547	10,034	7.9	1.14
1971-74.............	767	11,195	9.0	1.26
1976-80.............	690	11,114	10.7	1.30
55-64 years				
1960-62.............	418	7,517	5.3	1.14
1971-74.............	592	8,971	9.7	1.22
1976-80.............	1,227	9,607	9.2	1.00
65-74 years				
1960-62.............	265	4,972	8.7	2.07
1971-74.............	1,655	5,470	6.7	.71
1976-80.............	1,199	6,297	8.4	1.00
FEMALE				
25-34 years				
1960-62.............	689	10,450	5.2	.85
1971-74.............	1,802	13,323	8.0	.74
1976-80.............	1,121	16,104	8.8	.89
35-44 years				
1960-62.............	770	12,093	8.6	1.10
1971-74.............	1,654	11,527	11.7	.92
1976-80.............	836	12,170	12.1	1.05

See footnotes at end of table.

Table II-6. Severely overweight persons aged 25-74 years, by sex, age, and survey period: United States, 1960-80--Con.

Sex, age, and survey period	Number of examined persons[1]	Estimated population in thousands[2]	Percent severely over-weight	Standard error of the percent
FEMALE--Con.				
45-54 years				
1960-62.............	705	10,542	11.4	1.45
1971-74.............	832	12,180	11.9	1.52
1976-80.............	763	11,918	12.9	1.18
55-64 years				
1960-62.............	443	8,121	15.9	2.07
1971-74.............	670	9,998	12.5	1.45
1976-80.............	1,329	10,743	14.2	1.18
65-74 years				
1960-62.............	299	6,192	13.5	2.07
1971-74.............	1,811	7,138	12.3	1.05
1976-80.............	1,416	8,198	13.3	1.14

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk (excluding pregnant women).

NOTE: See text for definitions.

Table II-7. Serum albumin status of persons aged 3-74 years, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Mean albumin level in grams per deciliter	Standard error of the mean in grams per deciliter	Percent with low albumin values	Standard error of the percent
MALE						
White						
3-5 years........	471	3,789	4.7	.02	.6	.42
6-11 years.......	404	8,768	4.8	.02	-	*
12-17 years......	784	10,133	4.9	.01	.1	.13
18-24 years......	777	11,442	5.0	.02	-	*
25-54 years......	2,058	33,538	4.8	.01	.1	.05
55-74 years......	1,994	14,218	4.6	.01	.3	.12
Black						
3-5 years........	91	718	4.6	*.03	-	*
6-11 years.......	55	1,554	4.8	*.05	-	*
12-17 years......	140	1,718	4.7	*.04	-	*
18-24 years......	111	1,533	4.9	*.03	-	*
25-54 years......	255	3,702	4.7	.02	-	*
55-74 years......	239	1,357	4.5	.02	1.2	.88
FEMALE						
White						
3-5 years........	362	3,666	4.7	.02	-	*
6-11 years.......	358	8,496	4.8	.02	-	*
12-17 years......	682	9,893	4.8	.01	-	*
18-24 years......	831	11,919	4.7	.02	-	*
25-54 years......	2,234	35,446	4.6	.01	.1	.05
55-74 years......	2,246	16,930	4.6	.01	-	*
Black						
3-5 years........	74	703	4.7	*.04	-	*
6-11 years.......	74	1,540	4.6	*.04	-	*
12-17 years......	150	1,717	4.6	.05	-	*
18-24 years......	138	1,873	4.5	*.05	-	*
25-54 years......	335	4,583	4.5	.02	-	*
55-74 years......	263	1,692	4.5	.04	.3	.25

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-8. Serum albumin status of persons aged 3-74 years, by sex, poverty status, and age: United States, 1976-80

Sex, poverty status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Mean albumin level in grams per deciliter	Standard error of the mean in grams per deciliter	Percent with low albumin values	Standard error of the percent
MALE						
Below poverty						
3-5 years........	150	910	4.7	.02	-	*
6-11 years.......	84	1,754	4.8	.03	-	*
12-17 years......	159	1,865	4.8	.03	-	*
18-24 years......	169	2,237	5.0	.03	-	*
25-54 years......	186	2,572	4.8	.02	-	*
55-74 years......	282	1,537	4.5	.03	1.6	.99
Above poverty						
3-5 years........	421	3,683	4.7	.02	.6	.45
6-11 years.......	378	8,575	4.8	.02	-	*
12-17 years......	753	9,843	4.9	.01	.1	.13
18-24 years......	706	10,508	5.0	.02	-	*
25-54 years......	2,093	34,288	4.8	.01	.1	.05
55-74 years......	1,903	13,754	4.6	.01	.2	.10
FEMALE						
Below poverty						
3-5 years........	110	945	4.7	.03	-	*
6-11 years.......	112	1,981	4.7	.03	-	*
12-17 years......	176	2,171	4.7	.03	-	*
18-24 years......	235	3,072	4.7	.04	-	*
25-54 years......	339	4,655	4.6	.02	-	*
55-74 years......	420	2,426	4.5	.02	.4	.33
Above poverty						
3-5 years........	328	3,419	4.7	.02	-	*
6-11 years.......	315	7,913	4.8	.03	-	*
12-17 years......	634	9,172	4.8	.01	-	*
18-24 years......	724	10,505	4.7	.02	-	*
25-54 years......	2,215	35,282	4.6	.01	.1	.05
55-74 years......	1,983	15,441	4.6	.01	0.0	.03

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-9. Serum vitamin A status of persons aged 3-11 years, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Mean vitamin A level in micrograms per deciliter	Standard error of the mean in micrograms per deciliter	Percent with low vitamin A values	Standard error of the percent
MALE						
White						
3-5 years........	572	3,789	33.9	.60	2.9	.82
6-8 years........	230	4,357	32.6	.58	2.5	.74
9-11 years.......	283	4,411	35.6	.54	1.6	1.00
Black						
3-5 years........	103	718	30.1	*.94	5.9	*2.51
6-8 years........	32	787	*38.1	*3.72	-	*
9-11 years.......	50	767	31.5	*1.33	5.1	*4.29
FEMALE						
White						
3-5 years........	483	3,666	31.4	.54	6.1	1.58
6-8 years........	227	4,014	33.1	.68	2.5	.96
9-11 years.......	266	4,482	34.5	.56	.8	.63
Black						
3-5 years........	92	703	30.1	*.82	3.0	*1.61
6-8 years........	52	729	30.7	*1.06	3.3	*3.25
9-11 years.......	46	811	36.0	*1.22	-	*

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-10. Serum vitamin A status of persons aged 3-11 years, by sex, poverty status, and age: United States, 1976-80

Sex, poverty status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Mean vitamin A level in micrograms per deciliter	Standard error of the mean in micrograms per deciliter	Percent with low vitamin A values	Standard error of the percent
MALE						
Below poverty						
3-5 years........	170	910	32.5	1.26	5.0	2.00
6-8 years........	47	900	34.2	*1.96	4.1	*2.57
9-11 years.......	61	854	33.9	1.32	6.1	3.53
Above poverty						
3-5 years........	516	3,683	33.4	.61	3.1	.84
6-8 years........	217	4,254	33.0	.77	1.9	.62
9-11 years.......	270	4,321	35.3	.50	1.3	.81
FEMALE						
Below poverty						
3-5 years........	135	945	30.2	.65	4.6	1.48
6-8 years........	65	869	30.0	*1.04	4.5	*4.36
9-11 years.......	70	1,113	32.8	.91	2.3	1.67
Above poverty						
3-5 years........	435	3,419	31.4	.58	6.6	1.67
6-8 years........	216	3,864	33.1	.80	3.8	1.30
9-11 years.......	237	4,049	35.2	.65	.6	.64

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-11. Serum vitamin C status of persons aged 3-74 years, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Mean vitamin C level in milligrams per deciliter	Standard error of the mean in milligrams per deciliter	Percent with low vitamin C values	Standard error of the percent
MALE						
White						
3-5 years........	551	3,789	1.7	.08	.1	.09
6-11 years.......	491	8,768	1.5	.03	.4	.26
12-17 years......	780	10,133	1.2	.04	1.6	.55
18-24 years......	781	11,442	1.0	.03	2.1	.55
25-54 years......	2,039	33,538	.9	.02	5.4	.79
55-74 years......	2,002	14,218	1.0	.02	6.5	.85
Black						
3-5 years........	96	718	1.5	*.07	-	*
6-11 years.......	69	1,554	1.3	*.05	-	*
12-17 years......	133	1,718	1.0	*.05	1.4	*1.00
18-24 years......	104	1,533	.9	*.05	3.0	*1.41
25-54 years......	240	3,702	.8	.05	9.6	2.59
55-74 years......	234	1,357	.7	.08	16.2	2.88
FEMALE						
White						
3-5 years........	452	3,666	1.6	.03	-	*
6-11 years.......	466	8,496	1.4	.03	-	*
12-17 years......	686	9,893	1.2	.03	1.7	.69
18-24 years......	836	11,919	1.1	.03	1.9	.57
25-54 years......	2,235	35,446	1.1	.02	2.9	.46
55-74 years......	2,246	16,930	1.3	.03	1.8	.39
Black						
3-5 years........	87	703	1.4	*.05	-	*
6-11 years.......	101	1,540	1.2	*.04	1.0	*.97
12-17 years......	137	1,717	1.0	.04	.6	.60
18-24 years......	134	1,873	1.0	*.05	2.5	*1.10
25-54 years......	313	4,583	.9	.04	4.7	1.26
55-74 years......	247	1,692	.9	.03	5.3	1.90

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-12. Serum vitamin C status of persons aged 3-74 years, by sex, poverty status, and age: United States, 1976-80

Sex, poverty status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Mean vitamin C level in milligrams per deciliter	Standard error of the mean in milligrams per deciliter	Percent with low vitamin C values	Standard error of the percent
MALE						
Below poverty						
3-5 years........	169	910	1.4	.06	-	*
6-11 years.......	96	1,754	1.4	.13	-	*
12-17 years......	158	1,865	1.1	.15	.6	.61
18-24 years......	162	2,237	1.0	.06	2.9	1.10
25-54 years......	180	2,572	.7	.04	11.1	2.32
55-74 years......	276	1,537	.7	.07	19.5	2.83
Above poverty						
3-5 years........	489	3,683	1.7	.08	.1	.09
6-11 years.......	467	8,575	1.5	.04	.5	.26
12-17 years......	744	9,843	1.2	.03	1.6	.52
18-24 years......	710	10,508	1.0	.03	1.9	.52
25-54 years......	2,065	34,288	.9	.02	5.4	.77
55-74 years......	1,911	13,754	1.0	.02	6.0	.82
FEMALE						
Below poverty						
3-5 years........	129	945	1.4	.05	-	*
6-11 years.......	142	1,981	1.3	.04	-	*
12-17 years......	168	2,171	1.0	.04	1.3	.81
18-24 years......	231	3,072	1.1	.05	2.8	1.05
25-54 years......	336	4,655	.9	.04	5.9	1.55
55-74 years......	408	2,426	1.0	.03	4.8	1.55
Above poverty						
3-5 years........	407	3,419	1.6	.03	-	*
6-11 years.......	417	7,913	1.4	.03	.2	.19
12-17 years......	635	9,172	1.2	.03	1.7	.76
18-24 years......	727	10,505	1.1	.03	1.7	.62
25-54 years......	2,194	35,282	1.1	.02	2.7	.49
55-74 years......	1,983	15,441	1.3	.03	1.7	.36

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-13. Iron status of persons aged 3-74 years, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent with impaired iron status	Standard error of the percent
MALE				
White				
3-5 years...........	673	3,789	4.7	.86
6-11 years..........	615	8,768	4.5	.97
12-17 years.........	812	10,133	1.5	.37
18-24 years.........	803	11,442	.5	.20
25-54 years.........	2,085	33,538	1.1	.19
55-74 years.........	2,046	14,218	2.3	.42
Black				
3-5 years...........	130	718	12.0	*3.26
6-11 years..........	102	1,554	6.0	*3.02
12-17 years.........	140	1,718	2.0	*.99
18-24 years.........	114	1,533	-	*
25-54 years.........	257	3,702	2.7	.88
55-74 years.........	244	1,357	4.0	1.38
FEMALE				
White				
3-5 years...........	591	3,666	4.9	1.14
6-11 years..........	577	8,496	3.2	.85
12-17 years.........	697	9,810	3.3	.63
18-24 years.........	807	11,370	2.7	.53
25-54 years.........	2,221	34,647	5.5	.52
55-74 years.........	2,293	16,930	3.2	.33
Black				
3-5 years...........	117	703	5.9	*1.73
6-11 years..........	119	1,540	2.0	*1.00
12-17 years.........	147	1,699	11.5	3.02
18-24 years.........	128	1,732	5.4	*2.32
25-54 years.........	322	4,539	6.8	1.05
55-74 years.........	265	1,692	5.9	1.64

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S population at the midpoint of the survey; that is, estimates of the population at risk (excluding pregnant women).

NOTE: See text for definitions.

Table II-14. Iron status of persons aged 3-74 years, by sex, poverty status, and age: United States, 1976-80

Sex, poverty status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent with impaired iron status	Standard error of the percent
MALE				
Below poverty				
3-5 years...........	207	910	13.7	3.17
6-11 years..........	131	1,754	4.9	2.19
12-17 years.........	166	1,865	1.2	.88
18-24 years.........	168	2,237	-	*
25-54 years.........	191	2,572	3.0	1.45
55-74 years.........	283	1,537	4.7	1.18
Above poverty				
3-5 years...........	607	3,683	3.9	1.05
6-11 years..........	588	8,575	4.8	1.14
12-17 years.........	771	9,843	1.7	.32
18-24 years.........	734	10,508	.5	.22
25-54 years.........	2,115	34,288	1.1	.22
55-74 years.........	1,957	13,754	2.1	.44
FEMALE				
Below poverty				
3-5 years...........	170	945	3.9	1.18
6-11 years..........	169	1,981	3.9	1.48
12-17 years.........	178	2,136	8.7	2.12
18-24 years.........	230	2,973	4.6	1.41
25-54 years.........	337	4,606	10.1	1.87
55-74 years.........	425	2,426	5.0	1.14
Above poverty				
3-5 years...........	531	3,419	5.0	1.18
6-11 years..........	520	7,913	2.6	.82
12-17 years.........	643	9,107	3.1	.62
18-24 years.........	696	9,990	3.0	.62
25-54 years.........	2,187	34,480	5.5	.49
55-74 years.........	2,025	15,441	3.3	.36

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S population at the midpoint of the survey; that is, estimates of the population at risk (excluding pregnant women).

NOTE: See text for definitions.

Table II-15. Serum zinc status of persons aged 3-74 years, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Mean zinc level in micrograms per deciliter	Standard error of the mean in micrograms per deciliter	Percent with low zinc values	Standard error of the percent
MALE						
White						
3-5 years........	535	3,789	80.2	.66	3.1	.89
6-11 years.......	512	8,768	83.3	.74	1.9	.51
12-17 years......	722	10,133	87.6	.90	1.0	.41
18-24 years......	721	11,442	94.2	1.11	.2	.24
25-54 years......	1,915	33,538	91.8	.54	1.0	.15
55-74 years......	1,829	14,218	87.6	.60	1.9	.28
Black						
3-5 years........	90	718	81.3	*2.07	2.7	*1.90
6-11 years.......	87	1,554	83.2	*1.67	3.0	*2.70
12-17 years......	120	1,718	86.8	*1.76	1.3	*.91
18-24 years......	89	1,533	90.0	*1.82	2.1	*1.58
25-54 years......	221	3,702	88.2	1.17	1.4	.98
55-74 years......	204	1,357	84.6	2.04	3.3	1.05
FEMALE						
White						
3-5 years........	437	3,666	80.1	.95	3.8	.78
6-11 years.......	496	8,496	82.6	.73	1.2	.52
12-17 years......	610	9,893	85.0	.78	.8	.40
18-24 years......	760	11,919	83.8	.80	3.6	.85
25-54 years......	2,099	35,446	84.0	.45	3.0	.48
55-74 years......	2,095	16,930	84.2	.49	2.4	.37
Black						
3-5 years........	84	703	82.3	*2.26	1.0	*.95
6-11 years.......	99	1,540	79.8	*1.49	3.9	*1.82
12-17 years......	124	1,717	81.8	1.44	3.2	1.30
18-24 years......	113	1,873	79.2	*1.30	5.9	*2.49
25-54 years......	273	4,583	82.4	1.91	5.5	2.02
55-74 years......	223	1,692	83.0	.80	3.8	1.55

[1] Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2] Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-16. Serum zinc status of persons aged 3-74 years, by sex, poverty status, and age: United States, 1976-80

Sex, poverty status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Mean zinc level in micrograms per deciliter	Standard error of the mean in micrograms per deciliter	Percent with low zinc values	Standard error of the percent
MALE						
Below poverty						
3-5 years........	160	910	78.1	1.02	1.9	1.48
6-11 years.......	105	1,754	80.2	1.42	3.5	1.67
12-17 years......	142	1,865	85.3	1.37	1.2	.81
18-24 years......	140	2,237	90.9	2.30	1.8	1.34
25-54 years......	179	2,572	86.2	1.39	1.6	.90
55-74 years......	252	1,537	82.5	1.45	3.7	1.52
Above poverty						
3-5 years........	475	3,683	80.7	.88	3.8	.96
6-11 years.......	495	8,575	83.7	.79	2.1	.73
12-17 years......	690	9,843	87.4	.99	1.1	.42
18-24 years......	659	10,508	94.6	.95	.2	.19
25-54 years......	1,931	34,288	91.7	.56	.9	.18
55-74 years......	1,735	13,754	87.8	.65	2.0	.30
FEMALE						
Below poverty						
3-5 years........	123	945	79.4	1.70	6.7	2.83
6-11 years.......	147	1,981	80.3	1.11	2.0	1.05
12-17 years......	152	2,171	84.9	1.23	1.5	.77
18-24 years......	209	3,072	83.4	.91	3.4	1.26
25-54 years......	307	4,655	84.3	1.03	2.2	.91
55-74 years......	376	2,426	84.0	.76	1.8	.77
Above poverty						
3-5 years........	391	3,419	80.2	1.01	3.0	.57
6-11 years.......	441	7,913	82.7	.87	1.3	.56
12-17 years......	565	9,172	84.6	.74	1.1	.47
18-24 years......	653	10,505	83.1	.85	3.8	.95
25-54 years......	2,052	35,282	83.8	.47	3.3	.52
55-74 years......	1,848	15,441	84.3	.51	2.5	.45

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-17. Diabetes among persons aged 25-74 years, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent with diabetes	Approximate standard error of the percent
Male				
25-34 years...........	343	15,895	*1.9	.76
35-44 years...........	236	11,367	*1.8	.63
45-54 years...........	222	11,114	7.9	1.53
55-64 years...........	442	9,607	9.6	1.20
65-74 years...........	416	6,297	19.0	1.57
Female				
25-34 years...........	380	16,856	1.5	.38
35-44 years...........	296	12,284	4.5	1.06
45-54 years...........	282	11,918	9.0	1.32
55-64 years...........	434	10,743	15.5	2.01
65-74 years...........	463	8,198	16.5	1.06
White				
25-34 years...........	631	28,357	1.3	.31
35-44 years...........	469	20,392	*2.7	.81
45-54 years...........	449	20,235	8.1	1.06
55-64 years...........	782	18,243	11.9	1.36
65-74 years...........	793	12,906	16.9	.96
Black				
25-34 years...........	71	3,499	2.3	.62
35-44 years...........	50	2,527	*6.0	*2.56
45-54 years...........	44	2,259	12.9	*3.41
55-64 years...........	85	1,760	20.5	*4.52
65-74 years...........	73	1,288	26.0	*4.17

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-18. Diabetes among persons aged 25-74 years, by poverty status, overweight status, and age: United States, 1976-80

Poverty status, overweight status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent with diabetes	Approximate standard error of the percent
Below poverty				
25-34 years...........	59	3,103	*2.4	1.36
35-44 years...........	55	2,364	*8.9	4.38
45-54 years...........	43	1,760	*15.3	4.72
55-64 years...........	90	1,960	22.3	4.82
65-74 years...........	124	2,003	20.6	2.86
Above poverty				
25-34 years...........	642	28,837	1.5	.42
35-44 years...........	466	20,572	2.5	.56
45-54 years...........	444	20,161	8.0	1.00
55-64 years...........	758	17,376	11.9	1.29
65-74 years...........	715	11,819	17.3	1.05
Overweight				
25-34 years...........	149	6,459	*2.3	.82
35-44 years...........	145	6,571	*8.2	2.71
45-54 years...........	167	7,312	12.3	2.33
55-64 years...........	280	6,682	21.9	2.69
65-74 years...........	283	4,744	25.8	2.01
Not overweight				
25-34 years...........	563	25,540	*1.3	.49
35-44 years...........	384	16,966	*1.2	.37
45-54 years...........	337	15,720	7.3	1.16
55-64 years...........	596	13,668	7.6	.96
65-74 years...........	596	9,752	13.8	1.36

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk (excluding pregnant women for estimates by overweight status).

NOTE: See text for definitions.

Table II-19. Serum cholesterol status of persons aged 25-74 years, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Mean cholesterol level in milligrams per deciliter	Standard error of the mean in milligrams per deciliter	Percent with high-risk cholesterol values	Standard error of the percent
MALE						
White						
25-34 years......	901	13,864	199	1.72	18.7	1.84
35-44 years......	653	9,808	217	1.75	20.1	1.52
45-54 years......	617	9,865	227	1.82	20.8	1.64
55-64 years......	1,086	8,642	230	1.97	22.4	1.82
65-74 years......	1,045	5,576	222	2.03	18.4	1.64
Black						
25-34 years......	139	1,546	199	*4.13	24.8	*3.77
35-44 years......	70	1,112	218	*8.33	24.5	*7.48
45-54 years......	62	1,044	229	*7.14	25.3	*7.68
55-64 years......	129	801	223	*4.84	22.1	*4.26
65-74 years......	128	555	217	4.22	16.6	3.49
FEMALE						
White						
25-34 years......	1,000	14,494	192	1.50	17.8	1.26
35-44 years......	726	10,584	207	1.94	13.3	1.10
45-54 years......	647	10,369	232	2.65	22.5	2.41
55-64 years......	1,176	9,601	249	1.72	35.7	1.79
65-74 years......	1,245	7,329	246	1.71	35.4	1.73
Black						
25-34 years......	145	1,953	191	*4.14	14.6	*3.46
35-44 years......	103	1,415	206	*4.48	14.3	*4.77
45-54 years......	100	1,215	230	*7.21	25.0	*6.27
55-64 years......	135	959	251	*7.99	32.2	*5.46
65-74 years......	152	733	243	4.16	29.0	3.89

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-20. Serum cholesterol status of persons aged 25-74 years, by sex, poverty status, and age: United States, 1976-80

Sex, poverty status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Mean cholesterol level in milligrams per deciliter	Standard error of the mean in milligrams per deciliter	Percent with high-risk cholesterol values	Standard error of the percent
MALE						
Below poverty						
25-34 years......	91	1,106	203	4.78	24.7	4.78
35-44 years......	63	821	211	5.09	13.5	3.53
45-54 years......	46	645	217	*8.36	13.9	*5.53
55-64 years......	129	779	224	5.25	12.6	3.95
65-74 years......	168	759	213	3.89	13.4	3.18
Above poverty						
25-34 years......	945	14,355	199	1.58	18.9	1.70
35-44 years......	658	10,195	219	2.12	21.3	1.79
45-54 years......	603	9,738	228	1.97	21.3	2.05
55-64 years......	1,048	8,443	230	1.96	23.2	1.95
65-74 years......	987	5,312	223	2.12	19.0	1.73
FEMALE						
Below poverty						
25-34 years......	162	1,997	188	3.59	15.9	3.92
35-44 years......	119	1,543	208	4.70	12.4	2.92
45-54 years......	82	1,115	227	5.66	23.0	5.54
55-64 years......	188	1,181	241	4.52	29.3	3.53
65-74 years......	256	1,245	239	4.28	29.6	4.33
Above poverty						
25-34 years......	982	14,482	192	1.72	17.8	1.45
35-44 years......	702	10,377	207	1.91	13.5	1.22
45-54 years......	655	10,424	232	2.22	22.5	2.35
55-64 years......	1,071	8,934	250	1.71	36.3	1.82
65-74 years......	1,080	6,507	247	1.67	35.5	1.79

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-21. Hypertension among persons aged 25-74 years, by age and survey period: United States, 1960-80

Age and survey period	Number of examined persons[1]	Estimated population in thousands[2]	Percent with hyper-tension[3]	Standard error of the percent
25-34 years				
1960-62.............	1,413	21,573	16.8	1.18
1971-74.............	2,674	26,933	20.0	1.05
1976-80.............	2,237	32,752	21.6	1.26
35-44 years				
1960-62.............	1,470	23,697	30.6	1.41
1971-74.............	2,317	22,240	33.1	1.64
1976-80.............	1,589	23,651	34.2	2.02
45-54 years				
1960-62.............	1,228	20,576	45.6	1.84
1971-74.............	1,589	23,375	48.8	1.76
1976-80.............	1,453	23,032	50.3	1.95
55-64 years				
1960-62.............	854	15,638	63.4	1.87
1971-74.............	1,255	18,969	62.3	1.76
1976-80.............	2,556	20,350	61.3	1.67
65-74 years				
1960-62.............	554	11,164	76.2	2.02
1971-74.............	3,446	12,608	73.3	1.26
1976-80.............	2,615	14,496	69.6	1.18

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.
[3]First blood pressure readings were used to ensure similar measurements for all 3 surveys.

NOTE: See text for definitions.

Table II-22. Hypertension among persons aged 25-74 years, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent with hyper-tension[3]	Standard error of the percent
MALE				
White				
25-34 years...........	901	13,864	20.9	1.95
35-44 years...........	653	9,808	26.3	2.57
45-54 years...........	617	9,865	42.6	2.05
55-64 years...........	1,086	8,642	51.2	1.97
65-74 years...........	1,045	5,576	59.4	2.07
Black				
25-34 years...........	139	1,546	23.7	*3.15
35-44 years...........	70	1,112	43.2	*7.62
45-54 years...........	62	1,044	56.2	*8.47
55-64 years...........	129	801	66.8	*4.96
65-74 years...........	128	555	66.7	3.41
FEMALE				
White				
25-34 years...........	1,000	14,494	5.8	.87
35-44 years...........	726	10,584	16.8	1.38
45-54 years...........	647	10,369	36.1	2.21
55-64 years...........	1,176	9,601	50.3	2.24
65-74 years...........	1,245	7,329	66.1	1.73
Black				
25-34 years...........	145	1,953	15.2	*3.45
35-44 years...........	103	1,415	36.8	*4.41
45-54 years...........	100	1,215	66.8	*4.73
55-64 years...........	135	959	74.3	*3.31
65-74 years...........	152	733	82.9	4.13

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.
[3]The average of 3 blood pressure readings was used for this table.

NOTE: See text for definitions.

Table II-23. Hypertension among persons aged 25-74 years, by sex, poverty status, and age: United States, 1976-80

Sex, poverty status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent with hyper-tension[3]	Standard error of the percent
MALE				
Below poverty				
25-34 years...........	91	1,106	26.8	4.87
35-44 years...........	63	821	35.7	6.24
45-54 years...........	46	645	54.8	*8.72
55-64 years...........	129	779	56.8	4.82
65-74 years...........	168	759	60.5	4.65
Above poverty				
25-34 years...........	945	14,355	20.1	1.90
35-44 years...........	658	10,195	27.8	2.63
45-54 years...........	603	9,738	42.6	2.53
55-64 years...........	1,048	8,443	52.3	2.14
65-74 years...........	987	5,312	60.5	2.12
FEMALE				
Below poverty				
25-34 years...........	162	1,997	11.3	2.70
35-44 years...........	119	1,543	27.8	5.08
45-54 years...........	82	1,115	41.8	5.63
55-64 years...........	188	1,181	61.9	4.80
65-74 years...........	256	1,245	72.5	2.59
Above poverty				
25-34 years...........	982	14,482	6.5	.76
35-44 years...........	702	10,377	17.9	1.55
45-54 years...........	655	10,424	38.7	2.19
55-64 years...........	1,071	8,934	51.0	2.21
65-74 years...........	1,080	6,507	66.9	1.92

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.
[3]The average of 3 blood pressure readings was used for this table.

NOTE: See text for definitions.

Table II-24. Percent of children aged 2-17 years below the National Center for Health Statistics growth chart 5th percentile of height for age, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent with low height for age	Standard error of the percent
MALE				
White				
2-5 years...........	1,253	4,984	6.2	.94
6-11 years..........	725	8,768	4.2	.73
12-17 years.........	847	10,083	3.9	.75
Black				
2-5 years...........	280	950	7.0	1.58
6-11 years..........	136	1,554	2.8	1.41
12-17 years.........	157	1,718	7.0	*2.10
FEMALE				
White				
2-5 years...........	1,179	4,846	6.7	.79
6-11 years..........	672	8,496	5.6	1.00
12-17 years.........	750	9,774	3.1	.67
Black				
2-5 years...........	248	929	9.3	1.90
6-11 years..........	152	1,540	2.5	*1.30
12-17 years.........	161	1,681	4.7	1.90

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-25. Percent of children aged 2-17 years below the National Center for Health Statistics growth chart 5th percentile of height for age, by sex, poverty status, and age: United States, 1976-80

Sex, poverty status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent with low height for age	Standard error of the percent
MALE				
Below poverty				
2-5 years...........	370	1,157	11.1	2.10
6-11 years..........	170	1,754	6.8	2.12
12-17 years.........	177	1,850	7.5	2.32
Above poverty				
2-5 years...........	1,181	4,910	5.3	1.05
6-11 years..........	692	8,575	3.6	.77
12-17 years.........	812	9,807	4.4	.80
FEMALE				
Below poverty				
2-5 years...........	345	1,215	14.7	2.41
6-11 years..........	197	1,981	6.8	2.53
12-17 years.........	190	2,156	7.3	2.45
Above poverty				
2-5 years...........	1,067	4,557	5.3	.67
6-11 years..........	615	7,913	4.0	.86
12-17 years.........	698	9,043	2.7	.63

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk.

NOTE: See text for definitions.

Table II-26. Percent of children aged 2-9 years below the National Center for Health Statistics growth chart 5th percentile of weight for height, by sex, race, and age: United States, 1976-80

Sex, race, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent with low weight for height	Standard error of the percent
MALE				
White				
2-5 years..........	1,146	4,545	2.2	.51
6-9 years..........	471	5,698	2.7	.81
Black				
2-5 years..........	241	827	2.8	1.48
6-9 years..........	75	998	4.4	3.64
FEMALE				
White				
2-5 years..........	1,023	4,178	2.1	.48
6-9 years..........	394	5,008	1.8	.62
Black				
2-5 years..........	217	787	5.8	2.55
6-9 years..........	94	886	2.3	*1.87

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk. Includes boys 90-146 centimeters in height and girls 90-138 centimeters in height only.

NOTE: See text for definitions.

Table II-27. Percent of children aged 2-9 years below the National Center for Health Statistics growth chart 5th percentile of weight for height, by sex, poverty status, and age: United States, 1976-80

Sex poverty status, and age	Number of examined persons[1]	Estimated population in thousands[2]	Percent with low weight for height	Standard error of the percent
MALE				
Below poverty				
2-5 years...........	323	1,002	2.1	.82
6-9 years...........	104	1,117	6.9	3.68
Above poverty				
2-5 years...........	1,081	4,487	2.4	.55
6-9 years...........	447	5,616	2.3	.73
FEMALE				
Below poverty				
2-5 years...........	292	1,009	3.3	1.34
6-9 years...........	111	1,056	1.1	1.10
Above poverty				
2-5 years...........	933	3,947	2.5	.62
6-9 years...........	370	4,757	2.4	.69

[1]Includes persons for whom usable measurements or values for the criteria variables were obtained. The criteria variables differ for each nutrient or condition assessed and are discussed elsewhere in this report.
[2]Total persons in the U.S. population at the midpoint of the survey; that is, estimates of the population at risk. Includes boys 90-146 centimeters in height and girls 90-138 centimeters in height only.

NOTE: See text for definitions.

APPENDIX III

GLOSSARY

Age. Age was defined as age at time of interview. In the National Health and Nutrition Examination Survey, each sample person's birth date and age were asked, and the interviewer verified the reported age from the birth date. In the Nationwide Food Consumption Survey, respondents reported age and birth date.

Age-adjusted death rate. This type of rate results from applying a death rate for a given year to a standardized age distribution. The adjustment permits comparisons with death rates for other years and eliminates differences between age-specific rates that result simply because of differences in the age distributions of the populations at various points in time.

Arteriosclerotic-related diseases. These diseases are clinical manifestations of the arteriosclerotic process: Coronary heart disease, cerebrovascular disease, and other diseases of arteries.

Body mass index (BMI). Body mass index is a measure of body weight adjusted for height. It is calculated as weight in kilograms divided by height in meters squared.

Calcium equivalent weight. This is the weight of fluid whole cow's milk that has the same quantity of calcium as is contained in the reported milk product. For example, the calcium in 2 ounces of cheddar cheese (411 milligrams) is the same as in 348 grams of fluid whole milk; therefore, the calcium equivalent of 2 ounces of cheddar cheese is 348 grams of fluid whole cow's milk.

Cancer. Cancer includes any of the various types of malignant neoplasms.

Cardiovascular disease. This disease group is comprised of heart diseases, cerebrovascular disease, rheumatic fever, other diseases of the arteries and veins, and (in some tabulations) congenital anomalies of the heart and circulatory system.

Complex carbohydrates. Complex carbohydrates are carbohydrates composed of many saccharide units (polysaccharides). A saccharide unit is a short chain of carbon, hydrogen, and oxygen atoms. Starches and components of dietary fiber, such as cellulose, are polysaccharides.

Composite retail cuts of meat. This term includes all cuts of meat obtained from a carcass and trimmed for sale in markets to consumers.

Dietary intake. See "Food intake."

Disability. Disability is any temporary or long-term reduction of a person's activity as a result of an acute or chronic condition.

Eating occasion. Any individual's report of eating or drinking--breakfast, lunch, brunch, dinner, supper, snack, coffee or beverage break, or another such event--was considered an eating occasion. The time each eating occasion began was recorded on the Nationwide Food Consumption Survey dietary intake record, and each change in time reported was considered to be a separate eating occasion.

Edible portion. The entire food item except those parts that are clearly inedible, such as bones in meat, is considered edible portion.

Elderly households. Elderly households are defined as households with at least one member who is 65 years of age or older.

Enrichment. Enrichment is the addition of nutrients to a food already containing these nutrients, usually in amounts sufficient to meet a legal standard. For example, bread and flour may be enriched with iron, thiamin, niacin, and riboflavin.

Food disappearance. Food disappearance is a measure of the quantity of food available for consumption in the United States. Quantities of such foods are derived by subtracting data on exports, military use, yearend stocks, and nonfood use from data on production, imports, and beginning-of-year stocks. (This term is used in reference to the U.S. Department of Agriculture's historical series on the U.S. food supply.)

Food group. Food items categorized for purposes of analysis and description constitute a food group.

Food ingestion. See "Food intake."

Food intake. Food intake includes all food and beverages, except water, that are eaten or drunk. In this report, food intake represents the food reported to have been eaten by individuals in 1-day dietary recalls and 2-day dietary records in the Nationwide Food Consumption Survey.

Food Stamp Program. The Food Stamp Program is a Federal food assistance program which provides eligible needy households with coupons that are exchanged for food at authorized stores. Participants receive coupons depending on household size. Eligibility is determined by assets and income. At the time of the 1977-78 Nationwide Food Consumption Survey, households may have been required to pay a fraction of the value of the coupons, depending on financial circumstances.

Fortification. Fortification is the addition to a food of nutrients not naturally present in the food, such as the addition of vitamin D to milk.

Heart attack (coronary). A heart attack is an occurrence of clinical or subclinical manifestations of coronary heart disease (other than angina pectoris without other clinical manifestations). A heart attack can be a myocardial infarction (overt or unrecognized), an episode of coronary insufficiency syndrome, or a death from coronary heart disease, whether sudden or not.

Hematocrit (packed cell volume). This is a measure of the volume of red blood cells in a given volume of blood. Hematocrit level is often used as a diagnostic screening tool for nutritional or iron deficiency. This measurement alone is not conclusive in detection of iron deficiency, but it is useful in the diagnosis of anemia, which results from many causes besides iron deficiency.

Home food production. See "Home-produced food."

Home food supplies. All food and beverages brought into the home and, during the specified time frame, either consumed at home or carried from the home and eaten elsewhere, such as picnics or packed lunches, constitute home food supplies. See "Household diet."

Home-produced food. Food raised for home use, processed at home, or obtained by hunting, fishing, and gathering from the wild is categorized as home-produced food.

Household. A household consists of all persons who regularly occupy a house, an apartment, or a room or group of rooms that constitute a housing unit. Group quarters such as rooming houses, military barracks, and institutions are not included in the Nationwide Food Consumption Survey. In the National Health and Nutrition Examination Survey, military barracks and institutions were not included, but rooming houses, group homes, and dormitories were in the survey.

Household diet. Food and beverages (alcoholic and nonalcoholic) from the household food supply "used" during the 7 days before the survey interview constitute household diet. Food and beverages ingested at home by household members or guests, carried from the home in packed meals, or thrown away, as well as leftovers fed to household pets, are included. Food obtained with cash, credit, or Food Stamps; home produced; received as a gift or as payment for goods and services; or received through Federal assistance programs or welfare agencies is included. Household food given away for use outside the home--such as food sent to friends and relatives, gifts of food donated to church suppers, and food given to household help to take home--is not considered to be food used by the household.

Generally, food used at home was reported in the form in which it was brought into the kitchen. Homemade mixtures used during the week were reported either as ingredients (if prepared during the week) or as the product (if prepared before the survey week).

Household food use. See "Household diet."

Household income. The respondent's estimate of the household's total money income (before the deduction of State and Federal income taxes) from all sources (such as earnings, Social Security, Aid to Families with Dependent Children, and pensions) by all household members 14 years of age and over constitutes household income. In the 1977-78 Nationwide Food Consumption Survey, household income was reported for the last month and for the previous calendar year. In the National Health and Nutrition Examination Survey, household income was reported for the 12-month period preceding the interview. Income from all sources was included regardless of the age of the household member contributing it.

Household members. See "Household."

Housekeeping households. A household with at least one person consuming 10 or more meals from the household food supply during the 7 days prior to the interview is considered a housekeeping household. Data for nonhousekeeping households were collected in the 1977-78 Nationwide Food Consumption Survey for the first time but are not presented in the household data in this report.

Hunger. In the scientific, clinical sense, hunger means the actual physiological effects of extended nutritional deprivation. As a social phenomenon, it is the inability, even occasionally, to obtain adequate food and nourishment.

Hypertension. Hypertension, or high blood pressure, is currently defined as a condition occurring in a person whose systolic blood pressure reading was 140 millimeters of mercury (mm Hg) or higher or whose diastolic reading was 90 mm Hg or higher or who was taking antihypertensive medication.

Incidence. Incidence is the number of occurrences (new or recurrent) of a specified disease event in a defined population during a specified period of time (usually 1 year). It is commonly expressed as a rate per 1,000 persons at risk in that population.

Lactating female. Lactating females, identified by household respondents, are females nursing a child 2 years old or younger.

Low-income households. For data from the 1977-78 Nationwide Food Consumption Survey, low-income households were defined as households receiving Food Stamps or public welfare assistance or those meeting asset and income eligibility standards for participation in the Food Stamp Program during 1977-78.

Meal-at-home equivalent person. The number of meal-at-home equivalent persons in the household was calculated, with one equivalent person considered equal to 21 meals at home in a week (based on one person consuming 3 meals a day for a week, or 21 meals a week). In counting the meals from household food supplies, the following procedures were used.

- When the number of meals at home and away for a household member did not total 21, skipped meals or additional meals were assumed to be eaten at home or away in the same proportion as reported meals in order to sum to 21 meals in a week. Refreshments and snacks of household members were assumed to be part of the 3 daily meals. The maximum number of meals counted per household member per week was 21.

- Meals served to guests were counted as home meals. Refreshments (not full meals) served to guests were counted as one-fourth or one-half of a home meal depending on the number of items served.

- Food carried from home supplemented by only a beverage from other sources was counted as a home meal.

- Home food equally supplemented by food from other sources was counted as one-half of a meal.

Mean corpuscular volume (MCV). This is the average volume of red blood cells (RBC) in a sample of blood. MCV is expressed in femtoliters (10^{-15} l) and is calculated as follows:

$$MCV = \frac{\text{hematocrit (in percent)}}{\text{RBC per liter X 100}}$$

Money value of food used at home. Expenditures for bought food and the money values of home-produced food plus food received free of cost that were used during the survey week are included in this category. Expenditures for bought food are prices reported as paid (excluding sales tax), regardless of the time of purchase. Food bought at unreported prices; home produced; and received as a gift, as payment for goods and services, or through Federal assistance programs or welfare agencies is valued at the average price per pound paid for comparable food by survey households in the same region and season.

Morbidity. Morbidity is a measure of the presence or occurrence of illness in terms of prevalence, incidence, limitation of activity, hospitalizations, physician office visits, Social Security disability allowances, or disability days.

Mortality. Mortality statistics are derived from a tabulation of death certificates by cause of death during a certain time period, usually 1 year. Mortality is commonly expressed as a death rate per 100,000 persons in the population.

National Academy of Sciences. The National Academy of Sciences is a private organization created by congressional charter and dedicated to the furtherance of science and its use for the general welfare. By the terms of its charter, the Academy acts as an official and independent adviser to the Federal Government in matters of science and technology. The Academy assembles the highest caliber of scientific talent to apply study procedures to questions and problems, thus ensuring objectivity and maximal credibility.

Nutrient per dollar's worth of food group. This value is the amount of a nutrient received from each dollar allocated to a selected food group in the household diet. For example, the amount of iron from a dollar's worth of grain products is the average amount of iron coming from grain products in the household diet divided by the average money value of grain products in the household diet.

Nutrient-to-calorie ratio. The nutrient-to-calorie ratio of each individual's intake is calculated by dividing his or her nutrient intake by his or her calorie intake. The result is compared to the individual's RDA ratio, which is the Recommended Dietary Allowance for the nutrient divided by the average Recommended Energy Intake for an individual in a specified sex-age category.

Overweight. Overweight is a condition in which a person's body weight substantially exceeds the norm or a standard population value. For this report, overweight was defined as a body mass index (BMI) equal to or higher than the BMI of 85 percent of the men and nonpregnant women aged 20-29 years who were examined in the second National Health and Nutrition Examination Survey. Severe overweight was defined as a BMI equal to or greater than 95 percent of this same reference population.

Per capita food consumption. Per capita food consumption is the total amount of food available for consumption per year in the 50 States and the District of Columbia (see "Food disappearance") divided by the population.

Per capita levels of nutrients. Per capita nutrient levels are the quantities of food energy (calories), protein, fat, carbohydrate, vitamins, minerals, and other dietary substances in food available for consumption per day. See "Per capita food consumption."

Poverty income ratio (PIR). In defining poverty status, the poverty income ratio (PIR) is used. Ratios of less than 1.0 can be described as "below poverty level," and ratios equal to or greater than 1.0 are "at or above poverty level." The PIR is a measure of the income status of an individual relative to the poverty index.

The numerator of the PIR is total household income. For incomes of $7,000 or more, total household income is calculated as the median for the income group; for incomes less than $7,000, it is the sum of the component parts of the income questions. The denominator of the PIR is a multiple of the total income necessary to maintain a family with given characteristics on a nutritionally adequate food plan.

The dollar value of the denominator of the PIR is constructed from a food plan (economy plan), developed in the early 1960's, that was considered sufficient to maintain Recommended Dietary Allowances at a very low cost level. For families of three or more persons, the poverty level was set at three times the cost of the economy plan. For smaller families and persons living alone, the cost of the economy food plan was adjusted by the relatively higher fixed expenses of these smaller households.

The denominator, or poverty income cutoff, adjusts the family poverty income maintenance requirements by family size, sex of the family head, age of the family head in families with one or two members, and place of residence (farm or nonfarm). Annual revisions of the poverty income cutoffs are based on changes in the average cost of living as reflected in the Consumer Price Index.

Poverty thresholds are computed on a national basis only. No attempt has been made to adjust these thresholds for regional, State, or other variations in the cost of living (except for the farm-nonfarm difference). No noncash public welfare benefits, such as Food Stamp bonuses, are included in the income of low-income families receiving these benefits. The PIR has been adjusted by year and accounts in some part for inflation (National Center for Health Statistics, Dec. 1982).

Poverty status. The Office of Management and Budget's Poverty Income Guidelines for 1977 were used to define poverty status for households in the 1977-78 Nationwide Food Consumption Survey. Individuals were considered to be living in poverty if household income before taxes was below specific levels based on family unit size: one member--$2,970, two members--$3,930, three members--$4,890, four members--$5,850, five members--$6,810, and six members--$7,770. For family units with more than six members, $960 was added for each additional member. For definition of poverty status in the National Health and Nutrition Examination Survey, see "Poverty income ratio."

Prevalence. Prevalence is the estimated number of persons who have a particular disease at a particular point (or period) of time and is commonly expressed as a rate per 1,000 persons in the population. Prevalence statistics should be based on physical examinations, but they are often based on health interviews.

Preformed niacin. Preformed niacin includes nicotinic acid and nicotinamide present in foods. It does not include niacin converted from tryptophan in the body.

Pregnant female. In the Nationwide Food Consumption Survey, pregnant females, identified by household respondents, are females 15-50 years of age who were 4 or more months pregnant at the time of the interview. Information about the pregnancy status of females under 15 or over 50 years of age was not obtained in the Nationwide Food Consumption Survey questionnaire. In the National Health and Nutrition Examination Survey, pregnant females were those who said they were pregnant at the time of the interview.

Race. The race of the respondent was marked by observation, and the race of all related persons was assumed to be the same as that of the respondent. The race categories were "white", "black", and "other". In the National Health and Nutrition Examination Survey, if the appropriate category could not be marked by observation, then a question on race was asked.

Recommended Dietary Allowances (RDA). Recommended Dietary Allowances are the levels of intake of essential nutrients considered to be adequate to meet the known nutritional needs of practically all healthy persons. The RDA are presented as daily allowances, but for most nutrients it is acceptable to average intakes over a 5-8 day period.

Recommended Energy Intakes (REI). Recommended Energy Intakes are estimates of the average energy needs of population groups. They are dependent on a variety of assumptions, including assumptions about average daily physical activity level.

Red blood cell (RBC). A red blood cell, or erythrocyte, is a deformable biconcave disk containing the oxygen-carrying pigment, hemoglobin. Mature erythrocytes do not contain nuclei. Red blood cell count is the number of red blood cells in a given volume of blood.

Region. In this report, the 48 coterminous States and the District of Columbia are grouped into four regions that correspond to those defined by the U.S. Department of Commerce in the 1970 Census of Population. The four Census Regions are:

- Northeast--Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
- North Central--Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
- South--Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
- West--Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Requirement for a nutrient. This is the quantity of a nutrient that must be ingested over a specified time to prevent a specified impairment to health.

Respondent. In the Nationwide Food Consumption Survey, the household member usually responsible for food planning and preparation provided information on household characteristics, foods used from home food supplies, home food production, household income, and individual intakes for herself or himself and for children under 12 years of age and others unable to answer for themselves.

Season. The seasons, or quarters, of the year are spring (April, May, June); summer (July, August, September); fall (October, November, December); and winter (January, February, March).

Serum albumin. Serum albumin is the chief protein found in blood serum and human lymphatic fluids.

Serum cholesterol. This is one of the classes of lipids found in blood serum.

Serum total iron-binding capacity (TIBC). This is a measure of the maximum amount of iron a given serum sample can contain. Use of this measure permits some distinction to be made between iron deficiency, in which values are usually elevated, and infectious chronic inflammatory diseases and neoplastic diseases, in which values are often depressed.

Serum vitamin A. This is a fat-soluble nutrient present in human blood serum which is used to assess the nutritive status of persons with respect to vitamin A. This nutrient is important for good vision and normal development of epithelial tissues, such as those lining the respiratory and digestive tracts, glands and their ducts, and the eye surface.

Serum vitamin C. Serum vitamin C, also known as ascorbic acid, is a water-soluble nutrient present in human blood serum and is an indicator of the nutritive status of a person with respect to vitamin C. This nutrient is used in iron transport and as a regulatory cofactor in the metabolism of some amino acids and folacin. It is essential in the synthesis of connective tissue constitutents, such as collagen and intercellular substances.

Serum zinc. This is a mineral, sometimes called a trace element, which is found in human blood serum in very small amounts. Serum zinc indicates the overall zinc status of persons. Zinc is important in preventing growth retardation and hypogonadism and is a component of many enzymes.

Sex. Sex was observed and recorded by the interviewers.

Simple carbohydrates. Simple carbohydrates are carbohydrates composed of one (mono) or two (di) saccharide units. A saccharide unit is a short chain of carbon, hydrogen, and oxygen atoms. Glucose and fructose are examples of monosaccharides. Sucrose, lactose, and maltose are examples of disaccharides.

Single-strength fruit juice weight. This quantity is the weight of fresh fruit juice in a blend or the quantity that would be provided by a concentrate.

Special Supplemental Food Program for Women, Infants, and Children. The Special Supplemental Food Program for Women, Infants, and Children is a Federal food assistance program, often referred to as WIC, that provides nutritious foods and nutrition education for pregnant, lactating, and post-partum women, as well as for infants and children under 5 years of age who have been individually certified as "nutrition risks" because of dietary need and inadequate income. Participants receive prescribed packages of foods high in protein, iron, calcium, vitamin A, and vitamin C directly at WIC clinics, by home delivery, or through vouchers exchanged for specified items at authorized stores.

Standard error. The standard error is a statistical measure of the variability of an estimate due to sampling from a population. It is commonly expressed as a percent of the estimate (relative standard error), indicating the percent of error. Errors due to inaccuracy in measurement are not included.

Supplements. Supplements are specific food components, such as vitamins and minerals, that respondents ingested in a form other than as food or beverage. Supplements are not included in nutrient intake data in this report.

Three-day dietary report. Information on 3 consecutive days of food intake, including an interviewer-administered 24-hour dietary recall and a self-administered 2-day dietary record, constitutes a 3-day dietary report.

Transferrin saturation. Transferrin saturation is an estimate of the degree of saturation of the iron transport protein. This determination is more useful than serum iron or total iron-binding capacity alone in the detection of iron deficiency. In iron deficiency anemia, the percent transferrin saturation is usually low; in infections, which often show a low serum iron value, the percent transferrin saturation value is more likely to be only moderately depressed.

Twenty-four hour dietary recall. A 24-hour dietary recall is a recall by a survey participant (or by the individual answering for him or her) of all food and beverages ingested from 12:00 a.m. to 11:59 p.m. of the day preceding the interview.

Two-day dietary record. A 2-day dietary record is a diary of food and beverage intake kept by a survey participant (or by the individual answering for him or her) on the day of the interview and the following day.

U.S. food supply. The U.S. food supply is a measure of the total food available for consumption in the United States per capita per year.

Urbanization. The classification of households into central city, suburban, and nonmetropolitan areas was based on the "standard metropolitan statistical area" (SMSA), defined by the U.S. Department of Commerce in the 1970 Census of Population. Urbanization categories are defined as:

- Central city--Population of 50,000 or more and main or core city within SMSA.

- Suburban--Generally within the boundaries of SMSA but not within legal limits of central city SMSA.

- Nonmetropolitan--Not within SMSA.

Vegetarians. Respondents who identified themselves as vegetarians are included in this category.

Vitamin A value. Vitamin A value is the vitamin A activity derived from preformed vitamin A (retinol) in animal products and from provitamin A (carotenoids) in plant products. It is expressed as International Units (IU). One IU equals 0.3 micrograms of retinol or 0.6 micrograms of beta-carotene.

REFERENCES

Abbott Laboratories: Instruction Manual for the ABA-100 Bichromatic Analyzer, Rev. 3. South Pasadena, Calif., 1976.

Alcohol, Drug Abuse, and Mental Health Administration: Fifth Special Report to the U.S. Congress on Alcohol and Health From the Secretary of Health and Human Services. DHHS Pub. No. (ADM) 84-1291. Public Health Service. Washington. U.S. Government Printing Office, 1983.

American Academy of Pediatrics, Committee on Nutrition: Encouraging breastfeeding. Pediatrics 65:657-658, 1980.

American Cancer Society: Nutrition and cancer, Cause and prevention, An American Cancer Society special report. Ca-A Cancer Journal for Clinicians 34(2), 1984.

American Council on Science and Health: Diet Modification, Can it Reduce the Risk of Heart Disease? New York, 1982.

American Heart Association, Committee to Revise Standardization of High Blood Pressure Readings: Recommendations for Human Blood Pressure Determinations by Sphygmomanometers. New York, Oct. 1951.

American Heart Association: Diet and coronary heart disease. Circulation. 58:762A-765A, 1978.

American Heart Association: Rationale of the diet-heart statement of the American Heart Association, Report of Nutrition Committee. Circulation 65(4):839A-854A, 1982.

American Medical Association, Council on Scientific Affairs: Concepts of nutrition and health. JAMA 242(21):2335-2338, 1979.

American Society for Clinical Nutrition Symposium: The evidence relating six dietary factors to the nation's health, Consensus statements. Am. J. Clin. Nutr. 32(13) Supp., Dec. 1979.

Arky, R. A.: Prevention and therapy of diabetes mellitus. Nutr. Rev. 41(6):165-173, 1983.

Bierman, E. L.: Carbohydrate and sucrose intake in the causation of atherosclerotic heart disease, diabetes mellitus, and dental caries. Am. J. Clin. Nutr. 32(13):2644-2647, 1979.

Blair, D., J. P. Habicht, E. A. H. Sims, et al.: Evidence for an increased risk for hypertension with centrally located body fat and the effect of race on this risk. Am. J. Epidemiol. 119(4):526-540, 1984.

Burk, M. C., and E. M. Pao: Methodology for large-scale surveys of household and individual diets. Home Economics Research Report, No. 40. Agricultural Research Service, U.S. Department of Agriculture. Washington. U.S. Government Printing Office, 1976.

Centers for Disease Control, J. W. Neese, P. Duncan, D. Bayse, et al.: Development and Evaluation of the Hexokinase/Glucose-6-Phosphate Dehydrogenase Procedure for Use as a National Glucose Reference Method. DHEW Pub. No. (CDC) 77-8330. Public Health Service. Atlanta, Ga., 1976.

Centers for Disease Control: Hematology Procedures Manual. Public Health Service. Atlanta, Ga., 1977.

Centers for Disease Control, E. W. Gunter, W. E. Turner, J. W. Neese, D. D. Bayse: Laboratory Procedures Used by the Clinical Chemistry Division, Centers for Disease Control, for the Second National Health and Nutrition Examination Survey (NHANES II), 1976-80. Public Health Service. Atlanta, Ga., 1981.

Committee of Research and Education of the Secretary of Agriculture's Policy and Coordination Council: Directory: Human Nutrition Activities. Washington, D.C. U.S. Department of Agriculture, 1984.

Culbreth, G. W., R. Carter, and C. Burtis: Separation of protoporphyrins and related compounds by reversed-phase liquid chromatography. Clin. Chem. 25:605-610, 1979.

Dacie, V., and S. M. Lewis: Practical Hematology, Vol. 5. Edinburgh. Churchill Livingston, 1975.

Doumas, B. T., W. Watson, and H. C. Biggs: Albumin standards and the measurements of serum albumin with bromcresol green. Clin. Chim. Acta 31:87-96, 1971.

Economic Research Service: U.S. Food consumption. Statistical Bulletin, No. 364. U.S. Department of Agriculture. Washington. U.S. Government Printing Office, 1965.

Economic Research Service: Food consumption, prices and expenditures, 1963-83. Statistical Bulletin, No. 713. U.S. Department of Agriculture. Washington. U.S. Government Printing Office, 1984.

Economic Research Service, R. M. Marston and S. O. Welsh: Nutrient content of the food supply. National Food Reviews, No. NFR-32. Washington. U.S. Department of Agriculture, 1986.

Forthofer, R. N.: Investigation of nonresponse bias in NHANES II. Am. J. Epidemiol. 117(4):507-515, 1983.

Garry, P. J., J. S. Godwin, W. C. Hunt, et al.: Nutritional status in a healthy elderly population, Dietary and supplemental intakes. Am. J. Clin. Nutr. 36:319-331, 1982.

Giovanniello, J. T., G. Bendetto, D. W. Palmer, and T. Peters: Fully and semiautomated methods for the determination of serum iron and total iron-binding capacity. J. Lab. Clin. Med. 71:874, 1968.

Goodhart, R. S., and M. E. Shils, eds.: Modern Nutrition in Health and Disease, 6th ed. Philadelphia. Lea and Febiger, 1980.

Goodman, R., and L. Kish: Controlled selection--A technique in probability sampling. J. Amer. Statist. Assoc. 45:350-372, 1950.

Habicht, J. P., R. Martorell, C. Yarbrough, et al.: Height and weight standards for preschool children, How relevant are ethnic differences in growth potential? Lancet 1:611-615, 1974.

Hale, W. E., R. B. Stewart, J. J. Cerda, et al.: Use of nutritional supplements in an ambulatory elderly population. American Journal of Geriatric Society 30:401-403, 1982.

Health Services and Mental Health Administration: The NHANES Study. Final report prepared by Institute for Survey Research, Temple University. Philadelphia, Apr. 1975.

Holt, M.: SURREGR--Standard Errors of Regression Coefficients From Sample Survey Data, Rev. Research Triangle Park, N.C. Research Triangle Institute, Apr. 1982.

Instrumentation Laboratory, Inc.: Clinical Applications of Atomic Absorption/Emission Spectroscopy. Lexington, Mass., 1972.

Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure: The 1984 report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure. Arch. Intern. Med. 144:1045-1057, 1984.

Life Sciences Research Office: Evaluation of the Health Aspects of Sodium Chloride and Potasium Chloride as Food Ingredients. Pub. No. PB 298139. Bethesda, Md. Federation of American Societies for Experimental Biology, 1979.

Life Sciences Research Office: Assessment of the Zinc Nutritional Status of the U.S. Population Based on Data Collected in the Second National Health and Nutrition Examination Survey, 1976-1980. Bethesda, Md. Federation of American Societies for Experimental Biology, June 1984.

Life Sciences Research Office: Assessment of the Iron Nutritional Status of the U.S. Population Based on Data Collected in the Second National Health and Nutrition Examination Survey, 1976-1980. Bethesda, Md. Federation of American Societies for Experimental Biology, Aug. 1984.

Life Sciences Research Office: Assessment of the Folate Nutritional Status of the U.S. Population Based on Data Collected in the Second National Health and Nutrition Examination Survey, 1976-1980. Bethesda, Md. Federation of American Societies for Experimental Biology, Oct. 1984.

Lipid Research Clinics Program, A. Hainline, Jr., J. Karon, and K. Lippel: Manual of Laboratory Operations, Lipid and Lipoprotein Analysis, 2d ed. National Heart, Lung, and Blood Institute, Public Health Service. Bethesda, Md. National Institutes of Health, 1982.

Martinez, G. A.: Trends in Breastfeeding in the United States, in Report of the Surgeon General's Workshop on Breastfeeding and Human Lactation. DHHS Pub. No. HRS-D-MC84-2. Health Resources and Services Administration, Public Health Service. Washington, D.C., 1984.

McCarron, D. A., J. Stanton, H. Henry, and C. Morris: Assessment of nutritional correlates of blood pressure. Ann. Intern. Med. 98, Part 2:715-719, 1983.

Moriyama, I., D. E. Krueger, and J. Stamler: Cardiovascular Diseases in the United States. Cambridge, Mass. Harvard University Press, 1971.

Munro, H. N., S. J. Pilistine, and M. E. Fant: The placenta in nutrition. Annual Review of Nutrition 3:97-124, 1983.

National Academy of Sciences, Institute of Medicine: Preventing Low Birthweight. Washington, D.C. National Academy Press, 1985.

National Cancer Institute: Cancer Prevention. DHHS Pub. No. 84-2671. Public Health Service. Bethesda, Md. National Institutes of Health, 1984.

National Center for Health Statistics, H. W. Miller, and P. Williams: Factors related to response in a health examination survey, United States, 1960-62. Vital and Health Statistics. Series 2, No. 36. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, Aug. 1969.

National Center for Health Statistics, W. L. Schaible: Memorandum to A. J. McDowell, Division of Health Examination Statistics. Public Health Service. Rockville, Md., June 1974.

National Center for Health Statistics, J. A. Bean: Distribution and properties of variance estimators for complex multistage probability samples, An empirical distribution. Vital and Health Statistics. Series 2, No. 65. DHEW Pub. No. (HRA) 75-1339. Health Resources Administration. Washington. U.S. Government Printing Office, March 1975.

National Center fore Health Statistics, G. Jones: HES Variance and Cross-Tabulation Program, Version 2, p. 11. March 1977. Unpublished document.

National Center for Health Statistics, E. R. Black: Current estimates from the Health Interview Survey, United States, 1976. Vital and Health Statistics. Series 10, No. 119. DHEW Pub. No. (PHS) 78-1547. Public Health Service. Washington. U.S. Government Printing Office, Nov. 1977a.

National Center for Health Statistics, P. V. V. Hamill, T. A. Drizd, C. L. Johnson, et al.: NCHS growth curves for children, birth-18 years, United States. Vital and Health Statistics. Series 11, No. 165. DHEW Pub. No. (PHS) 78-1650. Public Health Service. Washington. U.S. Government Printing Office, Nov. 1977b.

National Center for Health Statistics: NHANES II Examination Staff Procedures Manual for the Health and Nutrition Examination Survey, 1976-1979, Part 15a. Public Health Service. Hyattsville, Md., Aug. 1979.

National Center for Health Statistics, A. McDowell, A. Engel, J. T. Massey, and K. Maurer: Plan and operation of the second National Health and Nutrition Examination Survey, 1976-80. Vital and Health Statistics. Series 1, No. 15. DHHS Pub. No. (PHS) 81-1317. Public Health Service. Washington. U.S. Government Printing Office, July 1981.

National Center for Health Statistics, B. A. Burt, S. A. Eklund, J. R. Landis, et al.: Diet and dental health, a study of relationships, United States, 1971-74. Vital and Health Statistics. Series 11, No. 225. DHHS Pub. No. (PHS) 82-1675. Public Health Service. Washington. U.S. Government Printing Office, Jan. 1982.

National Center for Health Statistics, R. Fulwood, C. L. Johnson, J. D. Bryner, et al.: Hematological and nutritional biochemistry reference data for persons 6 months-74 years of age, United States, 1976-80. Vital and Health Statistics. Series 11, No. 232. DHHS Pub. No. (PHS) 83-1682. Public Health Service. Washington. U.S. Government Printing Office, Dec. 1982.

National Center for Health Statistics, Health, United States, 1983. DHHS Pub. No. (PHS) 84-1232. Public Health Service. Washington. U.S. Government Printing Office, Dec. 1983.

National Center for Health Statistics, Health, United States, 1984. DHHS Pub. No. (PHS) 85-1232. Public Health Service. Washington. U.S. Government Printing Office, Dec. 1984.

National Center for Health Statistics, Health, United States, 1985. DHHS Pub. No. (PHS) 86-1232. Public Health Service. Washington. U.S. Government Printing Office, Dec. 1985.

National Center for Health Statistics, T. A. Drizd, A. L. Dannenberg, and A. Engel: Blood pressure levels in persons 18-74 years of age, 1976-80, and trends in blood pressure, 1960-80, United States. Vital and Health Statistics. Series 11, No. 234. Public Health Service, DHHS, Hyattsville, Md. To be published-a.

National Center for Health Statistics, R. Fulwood, W. Kalsbeek, R. Muesing, et al.: Total serum cholesterol levels of adults 20-74 years of age, United States, 1976-80. Vital and Health Statistics. Series 11, No. 236. Public Health Service, DHHS, Hyattsville, Md. To be published-b.

National Center for Health Statistics, W. Hadden and M. I. Harris: Prevalence of diagnosed diabetes, undiagnosed diabetes, and impaired glucose tolerence, United States, 1976-80. Vital and Health Statistics. Series 11. Public Health Service, DHHS, Hyattsville, Md. To be published-c.

National Diabetes Data Group: Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance. Diabetes 28:1039-1057, 1979.

National Heart, Lung, and Blood Institute: Tenth Report of the Director, Vol. 2, Heart and Vascular Disease. DHHS Pub. No. (NIH) 84-2357. Public Health Service. Bethesda, Md. National Institutes of Health, 1982.

National Heart, Lung, and Blood Institute: The Lipid Research Clinics Coronary Primary Prevention Trial results. JAMA 251(3):351-374, 1984.

National Institute of Dental Research: The Prevalence of Dental Caries in United States Children, 1979-1980. DHHS Pub. No. (NIH) 82-2245. Public Health Service. Bethesda, Md. National Institutes of Health, 1981.

National Institutes of Health: A Guide to Nutrition Terminology for Indexing and Retrieval. Public Health Service. Washington. U.S. Government Printing Office, 1970.

National Institutes of Health Consensus Development Panel: National Institutes of Health Consensus Development Statement on Osteoporosis. Vol. 5, No. 3. Bethesda, Md., 1984.

National Institutes of Health Consensus Development Panel: National Institutes of Health Consensus Development Statement on Health Implications of Obesity. Vol. 5, No. 9. Bethesda, Md., 1985a.

National Institutes of Health Consensus Development Panel: National Institutes of Health consensus development statement on lowering blood cholesterol to prevent heart disease. JAMA 253(14):2080-2086, 1985b.

National Research Council: Recommended Dietary Allowances, 9th ed., rev. National Academy of Sciences. Washington, D.C. National Academy press, 1980a.

National Research Council: Toward Healthful Diets. National Academy of Sciences. Available from National Technical Information Service, Springfield, Va. NTIS No. PB-83-152280. Washington, D.C., 1980b.

National Research Council: Diet, Nutrition, and Cancer. National Academy of Sciences. Washington, D.C. National Academy Press, 1982.

National Research Council: Nutrient Adequacy, Assessment Using Food Consumption Surveys. National Academy Press, 1986.

Neeld, J. B., Jr., and W. N. Pearson: Macro- and micromethods for the determination of serum vitamin A using trifluoroacetic acid. J. Nutr. 79:454-462, 1963.

Office of the Assistant Secretary for Health and the Surgeon General: Healthy People, The Surgeon General's Report on Health Promotion and Disease Prevention, 1979. DHEW Pub. No. (PHS) 79-5507. Public Health Service. Washington. U.S. Government Printing Office, July 1979.

Office of Disease Prevention and Health Promotion: Nutrition Activities of the Department of Health and Human Services. DHHS Pub. No. (PHS) 83-50203. Public Health Service. Washington. U.S. Government Printing Office, 1983a.

Office of Disease Prevention and Health Promotion: Promoting health/preventing disease, Public Health Service implementation plans for attaining the objectives for the Nation. Public Health Reports. Sept.-Oct. Supp. DHHS Pub. No. (PHS) 83-50193A. Washington. U.S. Government Printing Office, 1983b.

Olson, R. E., ed.: Osteoporosis and calcium balance. Nutr. Rev. 41(3):83-85, March 1983.

Pao, E. M., S. J. Mickle, and M. C. Burk: One- and three-day nutrient intakes by individuals, Nationwide Food Consumption Survey findings, spring 1977. J. Am. Diet. Assoc. 85(3), March 1985.

Perkin-Elmer Corp.: Analytical Methods for Atomic Absorption Spectroscopy. Norwalk, Conn., 1973.

President's Task Force on Food Assistance: Report of the President's Task Force on Food Assistance. Washington, D.C. (Available from the Food and Nutrition Service of the U.S Department of Agriculture.) January 10, 1984.

Ramsey, W. N. M.: The determination of the total iron-binding capacity of serum. Clin. Chim. Acta 2:221, 1957.

Raper, N. R., J. C. Rosenthal, and C. E. Woteki: Estimates of available iron in diets of individuals 1 year old and older in the Nationwide Food Consumption Survey. J. Am. Diet. Assoc. 84(7):783-787, July 1984.

Roe, J. H.: Ascorbic Acid, in P. Gyorgy and W. N. Pearson, eds., The Vitamins, Physiology, Pathology, Methods. 7(2):27-49. New York. Academic Press, Inc., 1967.

Roe, J. H., H. Joseph, and C. A. Kuether: The determination of ascorbic acid in whole blood and urine through the 2, 4-dinitrophenylhydrazine derivative of dehydro-ascorbic acid. J. Biol. Chem. 147:399-407, 1943.

Roels, O. A., and M. Trout: Vitamins A and Carotene, in G. Cooper, ed., Standard Methods of Clinical Chemistry. 7:215-230. New York. Academic Press, Inc., 1972.

Sassa, S., J. L. Granick, A. Kappas, and R. D. Levere: Micro-analysis of erythrocyte protoporphyrin levels by spectrophotometry in the detection of chronic lead intoxication in the subclinical range. Biochem. Med. 8:135-148, 1973.

Sauberlich, H. E., R. P. Dowdy, and J. H. Skala: Laboratory Tests for the Assessment of Nutritional Status. Boca Raton, Fla. CRC Press, Inc., 1974.

Shah, B. V.: Standard Errors Program for Computing Standardized Rates From Sample Survey Data. Research Triangle Park, N.C. Research Triangle Institute, Apr. 1981.

Stein, Z., M. Susser, and D. Rush: Prenatal nutrition and birth weight, Experiments and quasi-experiments in the past decade. J. Reprod. Med. 21:287-297, 1978.

Stephenson, L. S., M. C. Latham, and A. Jansen: A comparison of growth standards, Similarities between NCHS, Harvard, Denver and privileged African children and differences with Kenyan rural children. Cornell International Nutrition Monograph Series. No. 12. Ithaca, N.Y., 1983.

Task Force on the Assessment of the Scientific Evidence Relating to Infant Feeding Practices and Infant Health: Report of the Task Force on the Assessment of the Scientific Evidence Relating to Infant Feeding Practices and Infant Health. Pediatrics 74(4), Part 2:579-762, 1984.

Technicon Instruments Corp.: Technicon AutoAnalyzer II and SMA AutoAnalyzer systems bromcresol green (BCG) albumin method. Albumin Technicon Information Bulletin, No. TN3-0160-20. Tarrytown, N.Y., March 1973.

Underwood, D.: Vitamin A in Animal and Human Nutrition, in M. B. Sporn, A. B. Roberts, and D. S. Goodman, eds., The Retenoids, Vol. 1. New York. Academic Press, 1984.

U.S. Bureau of the Census: Statistical Abstract of the United States, 1985, 105th ed. Washington. U.S. Government Printing Office, 1984

U.S. Department of Agriculture: Agricultural Statistics, 1984. Washington. U.S. Government Printing Office, 1984a.

U.S. Department of Agriculture: 1984 handbook of agricultural charts. Agriculture Handbook, No. 637. Washington, D.C., 1984b.

U.S. Departments of Agriculture and Health and Human Services: Nutrition and Your Health: Dietary Guidelines for Americans. Home and Garden Bulletin. No. 232. Washington. U.S. Government Printing Office, 1980.

U.S. Departments of Agriculture and Health and Human Services: Nutrition and Your Health: Dietary Guidelines for Americans, 2d ed. Home and Garden Bulletin. No. 232. Washington. U.S. Government Printing Office, 1985.

U.S. Departments of Health and Human Services and Agriculture: Joint Implementation Plan for a Comprehensive National Nutrition Monitoring System. Unpublished document, August 19, 1981.

U.S. Department of Health, Education, and Welfare: A Comparison and Analysis of Examined and Nonexamined Persons on Medical History Characteristics for the First Round of the Health and Nutrition Examination Survey. Prepared by Westat, Inc. Contract No. HSM-110-73-371. Rockville, Md., Jan. 1974.

U.S. Senate Select Committee on Nutrition and Human Needs: Dietary Goals for the United States, 2d ed. No. 052-070-04376-8. Washington. U.S. Government Printing Office, 1977.

Welsh, S. O., and R. M. Marston: Review of trends in food use in the United States, 1909 to 1980. J. Am. Diet. Assoc. 81(2):120, 1982.

Welsh, S. O., and R. M. Marston: Trends in Levels of Zinc in the U.S. Food Supply, 1909-1981, in Nutritional Bioavailability of Zinc, G. Inglett, ed. Washington, D.C. American Chemical Society, 1983.

Woodruff, R. S.: Simple method for approximating variance of a complicated estimate. J. Amer. Statis. Assoc. 66:411-414, June 1971.

Woteki, C., C. Johnson, and R. Murphy: Nutritional status of the U.S. population, Iron, vitamin C, and zinc, in What Is America Eating? National Academy of Sciences. Washington, D.C. National Academy Press, 1986.

BIBLIOGRAPHY

U.S. Department of Agriculture

Reports on Food Composition

USDA, Human Nutrition Information Service, Consumer Nutrition Division: USDA Nutrient Data Base for Household Food Use Surveys. NTIS No. PB 82-138496. National Technical Information Service, Springfield, Va., 1982.

USDA, Human Nutrition Information Service, Consumer Nutrition Division: USDA Nutrient Data Base for Individual Food Intake Surveys. NTIS No. PB 82-138504. National Technical Information Service, Springfield, Va., 1982.

Watt, B. K., and A. L. Merrill: Composition of Foods--Raw, Processed, Prepared, rev. USDA, Consumer and Food Economics Institute, Agriculture Handbook No. 8. Washington. U.S. Government Printing Office, 1963.

USDA, Consumer and Food Economics Institute: Composition of Foods--Dairy and Egg Products. Agriculture Handbook No. 8-1. Washington. U.S. Government Printing Office, 1976.

USDA, Consumer and Food Economics Institute: Composition of Foods--Spices and Herbs. Agriculture Handbook No. 8-2. Washington. U.S. Government Printing Office, 1977.

USDA, Consumer and Food Economics Institute: Composition of Foods--Baby Foods. Agriculture Handbook No. 8-3. Washington. U.S. Government Printing Office, 1978.

USDA, Consumer and Food Economics Institute: Composition of Foods--Fats and Oils. Agriculture Handbook No. 8-4. Washington. U.S. Government Printing Office, 1979.

USDA, Consumer and Food Economics Institute: Composition of Foods--Poultry Products. Agriculture Handbook No. 8-5. Washington. U.S. Government Printing Office, 1979.

USDA, Consumer and Food Economics Institute: Composition of Foods--Soups, Sauces, and Gravies. Agriculture Handbook No. 8-6. Washington. U.S. Government Printing Office, 1980.

USDA, Consumer Nutrition Center: Composition of Foods--Sausages and Luncheon Meats. Agriculture Handbook No. 8-7. Washington. U.S. Government Printing Office, 1980.

USDA, Consumer Nutrition Center: Composition of Foods--Breakfast Cereals. Agriculture Handbook No. 8-8. Washington. U.S. Government Printing Office, 1982.

USDA, Consumer Nutrition Center: Composition of Foods--Fruits and Fruit Juices. Agriculture Handbook No. 8-9. Washington. U.S. Government Printing Office, 1982.

USDA, Consumer Nutrition Division: Composition of Foods--Pork Products. Agriculture Handbook No. 8-10. Washington. U.S. Government Printing Office, 1983.

USDA, Human Nutrition Information Service: Composition of Foods--Vegetables and Vegetable Products. Agriculture Handbook No. 8-11. Washington. U.S. Government Printing Office, 1984.

USDA, Human Nutrition Information Service: Composition of Foods--Nut and Seed Products. Agriculture Handbook No. 8-12. Washington. U.S. Government Printing Office, 1984.

Reports from 1977-78 Nationwide Food Consumption Survey

Household--Final Reports

USDA, Human Nutrition Information Service, H-1--Food Consumption: Households in the United States, Spring 1977. Washington. U.S. Government Printing Office, 1982.

USDA, Human Nutrition Information Service, H-2--Food Consumption: Households in the Northeast, Spring 1977. Washington. U.S. Government Printing Office, 1982.

USDA, Human Nutrition Information Service, H-3--Food Consumption: Households in the North Central Region, Spring 1977. Washington. U.S. Government Printing Office, 1982.

USDA, Human Nutrition Information Service, H-4--Food Consumption: Households in the South, Spring 1977. Washington. U.S. Government Printing Office, 1982.

USDA, Human Nutrition Information Service, H-5--Food Consumption: Households in the West, Spring 1977. Washington. U.S. Government Printing Office, 1982.

USDA, Human Nutrition Information Service, H-6--Food Consumption: Households in the United States, Seasons and Year, 1977-78. Washington. U.S. Government Printing Office, 1983.

USDA, Human Nutrition Information Service, H-7--Food Consumption: Households in the Northeast, Seasons and Year, 1977-78. Washington. U.S. Government Printing Office, 1983.

USDA, Human Nutrition Information Service, H-8--Food Consumption: Households in the North Central Region, Seasons and Year, 1977-78. Washington. U.S. Government Printing Office, 1983.

USDA, Human Nutrition Information Service, H-9--Food Consumption: Households in the South, Seasons and Year, 1977-78. Washington. U.S. Government Printing Office, 1983.

USDA, Human Nutrition Information Service, H-10--Food Consumption: Households in the West, Seasons and Year, 1977-78. Washington. U.S. Government Printing Office, 1983.

USDA, Human Nutrition Information Service, H-11--Dietary Levels: Households in the United States, Spring 1977. Washington. U.S. Government Printing Office, 1985.

USDA, Human Nutrition Information Service, H-12--Dietary Levels: Households in the Northeast, Spring 1977. Washington. U.S. Government Printing Office, 1985.

USDA, Human Nutrition Information Service, H-13--Dietary Levels: Households in the North Central Region, Spring 1977. Washington. U.S. Government Printing Office, 1985.

USDA, Human Nutrition Information Service, H-14--Dietary Levels: Households in the South, Spring 1977. Washington. U.S. Government Printing Office, 1985.

USDA, Human Nutrition Information Service, H-15--Dietary Levels: Households in the West, Spring 1977. Washington. U.S. Government Printing Office, 1985.

Individual--Final Reports

USDA, Human Nutrition Information Service, I-1--Food Intakes: Individuals in 48 States, Year 1977-78. Washington. U.S. Government Printing Office, 1983.

USDA, Human Nutrition Information Service, I-2--Nutrient Intakes: Individuals in 48 States, Year 1977-78. Washington. U.S. Government Printing Office, 1984.

USDA, Human Nutrition Information Service, I-3--Food and Nutrient Intakes: Individuals in Four Regions, 1977-78. Washington. U.S. Government Printing Office, 1985.

Special Reports

Consumer Nutrition Center: Food and nutrient intakes of individuals in 1 day in the United States, Spring 1977. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 2. USDA, 1980.

Consumer Nutrition Center: Food consumption and dietary levels of households in Hawaii, Winter 1978. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 4. USDA, 1981.

Consumer Nutrition Center: Food and nutrient intakes of individuals in 1 day in Hawaii, Winter 1978. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 5. USDA, 1981.

Consumer Nutrition Center: Food and nutrient intakes of individuals in 1 day in Alaska, Winter 1978. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 6. USDA, 1981.

Consumer Nutrition Center: Food consumption and dietary levels of households in Alaska, Winter 1978. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 7. USDA, 1981.

Consumer Nutrition Center: Food consumption and dietary levels of low-income households, November 1977-March 1978. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 8. USDA, 1981.

Consumer Nutrition Center: Food consumption and dietary levels of households in Puerto Rico, Summer and fall 1977. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 9. USDA, 1981.

Consumer Nutrition Center: Food consumption and dietary levels of low-income households, November 1979-March 1980. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 10. USDA, 1982.

Consumer Nutrition Center: Food and nutrient intakes of individuals in 1 day, low-income households, November 1977-March 1978. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 11. USDA, 1982.

Consumer Nutrition Center: Food and nutrient intakes of individuals in 1 day in Puerto Rico, Summer and fall 1977. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 12. USDA, 1982.

Consumer Nutrition Center: Food and nutrient intakes of individuals in 1 day, low-income households, November 1979-March 1980. Nationwide Food Consumption Survey 1977-78, Nationwide Food Consumption Survey Preliminary Report, No. 13. USDA, 1982.

U.S. Department of Health and Human Services

The National Center for Health Statistics disseminates information on a wide variety of health topics. Selected sources of data on nutrition and related health measurements are listed in this bibliography.

Vital and Health Statistics Reports

National Center for Health Statistics: Plan and initial program of the Health Examination Survey. Vital and Health Statistics. Series 1, No. 4. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, July 1965.

National Center for Health Statistics: Plan, operation, and response results of a program of children's examinations. Vital and Health Statistics. Series 1, No. 5. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, Oct. 1967.

National Center for Health Statistics: Plan and operation of a health examination survey of U.S. youths 12-17 years of age. Vital and Health Statistics. Series 1, No. 8. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, Sept. 1969.

National Center for Health Statistics H. W. Miller: Plan and operation of the Health and Nutrition Examination Survey, United States, 1971-73. Vital and Health Statistics. Series 1, No. 10a. DHEW Pub. No. (HSM) 73-1310. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, Feb. 1973.

National Center for Health Statistics: Plan and operation of the Health and Nutrition Examination Survey, United States, 1971-73. Vital and Health Statistics. Series 1, No. 10b. DHEW Pub. No. (HSM) 73-1310. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, Feb. 1973.

National Center for Health Statistics, A. Engel, R. S. Murphy, K. Maurer and E. Collins: Plan and operation of the HANES I Augmentation Survey of Adults 25-74 Years, United States, 1974-75. Vital and Health Statistics. Series 1, No. 14. DHEW Pub. No. (PHS) 78-1314. Public Health Service. Washington. U.S. Government Printing Office, June 1978.

National Center for Health Statistics: The one-hour oral glucose tolerance test. Vital and Health Statistics. Series 2, No. 3. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, July 1963.

National Center for Health Statistics, E. E. Bryant, M. G. Kovar, and H. Miller: A study of the effect of response in the Health and Nutrition Examination Survey, United States. Vital and Health Statistics. Series 2, No. 67. DHEW Pub. No. (HRA) 76-1341. Health Resources Administration. Washington. U.S. Government Printing Office, Oct. 1975.

National Center for Health Statistics, J. R. Landis, J. M. Lepkowski, S. A. Eklund, and S. A. Stehouwer: A statistical methodology for analyzing data from a complex survey, the First National Health and Nutrition Examination Survey. Vital and Health Statistics. Series 2, No. 92. DHHS Pub. No. (PHS) 82-1366. Public Health Service. Washington. U.S. Government Printing Office, Sept. 1982.

National Center for Health Statistics, T. Gordon: Blood pressure of adults by age and sex, United States, 1960-62. Vital and Health Statistics. Series 11, No. 4. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, June 1964.

National Center for Health Statistics, T. Gordon: Blood pressure of adults by race and area, United States, 1960-62. Vital and Health Statistics. Series 11, No. 5. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, July 1964.

National Center for Health Statistics, T. Gordon: Heart disease in adults, United States, 1960-62. Vital and Health Statistics. Series 11, No. 6. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, Sept. 1964.

National Center for Health Statistics, H. W. Stoudt, A. Damon, and R. McFarland: Weight, height, and selected body dimensions of adults, United States, 1960-62. Vital and Health Statistics. Series 11, No. 8. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, June 1965.

National Center for Health Statistics, T. Gordon and C. C. Garst: Coronary heart disease in adults, United States, 1960-62. Vital and Health Statistics. Series 11, No. 10. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, Sept. 1965.

National Center for Health Statistics, T. Gordon and B. Devine: Hypertension and hypertensive heart disease in adults, United States, 1960-62. Vital and Health Statistics. Series 11, No. 13. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, May 1966.

National Center for Health Statistics, J. Roberts: Weight by height and age of adults, United States, 1960-62. Vital and Health Statistics. Series 11, No. 14. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, May 1966.

National Center for Health Statistics, F. E. Moore and T. Gordon: Serum cholesterol levels of adults, United States, 1960-62. Vital and Health Statistics. Series 11, No. 22. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, Mar. 1967.

National Center for Health Statistics, B. Devine: Mean blood hematocrit of adults, United States, 1960-62. Vital and Health Statistics. Series 11, No. 24. PHS Pub. No. 1000. Public Health Service. Washington. U.S. Government Printing Office, Apr. 1967.

National Center for Health Statistics, C. du V. Florey and R. M. Acheson: Blood pressure as it relates to physique, blood glucose, and serum cholesterol, United States, 1960-62. Vital and Health Statistics. Series 11, No. 34. PHS Pub. No. 1000. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, Oct. 1969.

National Center for Health Statistics, H. W. Stoudt, A. Damon, R. A. McFarland, J. Roberts: Skinfolds, body girths, biacromial diameter, and selected anthropometric indices of adults, United States, 1960-62. Vital and Health Statistics. Series 11, No. 35. PHS Pub. No. 1000. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, Feb. 1970.

National Center for Health Statistics, P. V. V. Hamill, F. E. Johnston, and W. Grams: Height and weight of children, United States. Vital and Health Statistics. Series 11, No. 104. PHS Pub. No. 1000. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, Sept. 1970.

National Center for Health Statistics, J. E. Kelly and J. V. Scanlon: Decayed, missing, and filled teeth among children, United States. Vital and Health Statistics. Series 11, No. 106. DHEW Pub. No. (HSM) 72-1003. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, Aug. 1971.

National Center for Health Statistics, P. V. V. Hamill, F. E. Johnston, and S. Lemeshow: Height and weight of children, socioeconomic status, United States. Vital and Health Statistics. Series 11, No. 119. DHEW Pub. No. (HSM) 73-1601. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, Oct. 1972.

National Center for Health Statistics, F. E. Johnston, P. V. V. Hamill, and S. Lemeshow: Skinfold thickness of children 6-11 years, United States. Vital and Health Statistics. Series 11, No. 120. DHEW Pub. No. (HSM) 73-1602. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, Oct. 1972.

National Center for Health Statistics, R. M. Malina, P. V. V. Hamill, and S. Lemeshow: Selected body measurements of children 6-11 years, United States. Vital and Health Statistics. Series 11, No. 123. DHEW Pub. No. (HSM) 73-1605. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, Jan. 1973.

National Center for Health Statistics, P. V. V. Hamill, F. E. Johnston, and S. Lemeshow: Height and weight of youths 12-17 years, United States. Vital and Health Statistics. Series 11, No. 124. DHEW Pub. No. (HSM) 73-1606. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, Jan. 1973.

National Center for Health Statistics, P. V. V. Hamill, F. E. Johnston, and S. Lemeshow: Body weight, stature, and sitting height, white and negro youths 12-17 years, United States. Vital and Health Statistics. Series 11, No. 126. DHEW Pub. No. (HRA) 74-1608. Health Resources Administration. Washington. U.S. Government Printing Office, Aug. 1973.

National Center for Health Statistics, F. E. Johnston, P. V. V. Hamill, and S. Lemeshow: Skinfold thickness of youths 12-17 years, United States. Vital and Health Statistics. Series 11, No. 132. DHEW Pub. No. (HRA) 74-1614. Health Resources Administration. Washington. U.S. Government Printing Office, Jan. 1974.

National Center for Health Statistics, J. Roberts: Blood pressure of persons 18-74 years, United States, 1971-72. Vital and Health Statistics. Series 11, No. 150. DHEW Pub. No. (HRA) 75-1632. Health Resources Administration. Washington. U.S. Government Printing Office, Apr. 1975.

National Center for Health Statistics, P. V. V. Hamill, T. A. Drizd, C. L. Johnson, et al.: NCHS growth curves for children, birth-18 years, United States. Vital and Health Statistics. Series 11, No. 165. DHEW Pub. No. (PHS) 78-1650. Public Health Service. Washington. U.S. Government Printing Office, Nov. 1977.

National Center for Health Statistics, S. Abraham, M. D. Carroll, C. M. Dresser, and C. L. Johnson: Dietary intake findings, United States, 1971-74. Vital and Health Statistics. Series 11, No. 202. DHEW Pub. No. (HRA) 77-1647. Health Resources Administration. Washington. U.S. Government Printing Office, July 1977.

National Center for Health Statistics, J. Roberts and K. Maurer: Blood pressure levels of persons 6-74 years, United States, 1971-74. Vital and Health Statistics. Series 11, No. 203. DHEW Pub. No. (HRA) 78-1648. Health Resources Administration. Washington. U.S. Government Printing Office, Sept. 1977.

National Center for Health Statistics, S. Abraham, C. L. Johnson, and M. D. Carroll: Total serum cholesterol levels of adults 18-74 years, United States, 1971-74. Vital and Health Statistics. Series 11, No. 205. DHEW Pub. No. (PHS) 78-1652. Public Health Service. Washington. U.S. Government Printing Office, Apr. 1978.

National Center for Health Statistics, S. Abraham, C. L. Johnson, and M. D. Carroll: Total serum cholesterol levels of children 4-17 years, United States, 1971-74. Vital and Health Statistics. Series 11, No. 207. DHEW Pub. No. (PHS) 78-1655. Public Health Service. Washington. U.S. Government Printing Office, 1978.

National Center for Health Statistics, S. Abraham, C. L. Johnson, and M. F. Najjar: Weight by height and age for adults 18-74 years, United States, 1971-74. Vital and Health Statistics. Series 11, No. 208. DHEW Pub. No. (PHS) 79-1656. Public Health Service. Washington. U.S. Government Printing Office, Sept. 1979.

National Center for Health Statistics, S. Abraham, M. D. Carroll, C. L. Johnson, and C. M. Dresser: Caloric and selected nutrient values for persons 1-74 years of age, First Health and Nutrition Examination Survey, United States, 1971-74. Vital and Health Statistics. Series 11, No. 209. DHEW Pub. No. (PHS) 79-1657. Public Health Service. Washington. U.S. Government Printing Office, June 1979.

National Center for Health Statistics, C. M. Dresser, M. D. Carroll, and S. Abraham: Food consumption profiles of white and black persons aged 1-74 years, United States, 1971-74. Vital and Health Statistics. Series 11, No. 210. DHEW Pub. No. (PHS) 79-1658. Public Health Service. Washington. U.S. Government Printing Office, May 1979.

National Center for Health Statistics, S. Abraham, C. L. Johnson, and M. F. Najjar: Weight and height of adults 18-74 years of age, United States, 1971-74. Vital and Health Statistics. Series 11, No. 211. DHEW Pub. No. (PHS) 79-1659. Public Health Service. Washington. U.S. Government Printing Office, May 1979.

National Center for Health Statistics, J. E. Kelly and C. R. Harvey: Basic data on dental examination findings of persons 1-74 years, United States, 1971-74. Vital and Health Statistics. Series 11, No. 214. DHEW Pub. No. (PHS) 79-1662. Public Health Service. Washington. U.S. Government Printing Office, May 1979.

National Center for Health Statistics, R. Fulwood, S. Abraham, and C. L. Johnson: Serum cholesterol levels of persons 4-74 years of age, by socioeconomic characteristics, United States, 1971-74. Vital and Health Statistics. Series 11, No. 217. DHEW Pub. No. (PHS) 80-1667. Public Health Service. Washington. U.S. Government Printing Office, Mar. 1980.

National Center for Health Statistics, J. Roberts and M. Rowland: Hypertension in adults 25-74 years of age, United States, 1971-75. Vital and Health Statistics. Series 11, No. 221. DHHS Pub. No. (PHS) 81-1671. Public Health Service. Washington. U.S. Government Printing Office, Apr. 1981.

National Center for Health Statistics, C. R. Harvey and J. E. Kelly: Decayed, missing, and filled teeth among persons 1-74 years, United States. Vital and Health Statistics. Series 11, No. 223. DHHS Pub. No. (PHS) 81-1673. Public Health Service. Washington. U.S. Government Printing Office, Aug. 1981.

National Center for Health Statistics, R. Fulwood, S. Abraham, and C. Johnson: Height and weight of adults ages 18-74 years, by socioeconomic and geographic variables, United States. Vital and Health Statistics. Series 11, No. 224. DHHS Pub. No. (PHS) 81-1674. Public Health Service. Washington. U.S. Government Printing Office, Aug. 1981.

National Center for Health Statistics, W. R. Harlan, A. L. Hull, R. P. Schmouder,: Dietary intake and cardiovascular risk factors, Part I, blood pressure correlates, United States, 1971-75. Vital and Health Statistics. Series 11, No. 226. DHHS Pub. No. (PHS) 83-1676. Public Health Service. Washington. U.S. Government Printing Office, Feb. 1983.

National Center for Health Statistics, W. R. Harlan, A. L. Hull, R. P. Schmouder, et al.: Dietary intake and cardiovascular risk factors, Part II, serum urate, serum cholesterol, and correlates. Vital and Health Statistics. Series 11, No. 227. DHHS Pub. No. (PHS) 83-1677. Public Health Service. Washington. U.S. Government Printing Office, Mar. 1983.

National Center for Health Statistics, J. D. Singer, P. Granahan, N. N. Goodrich, et al.: Diet and iron status, a study of relationships, United States, 1971-74. Vital and Health Statistics. Series 11, No. 229. DHHS Pub. No. (PHS) 83-1679. Public Health Service. Washington. U.S. Government Printing Office, Dec. 1982.

National Center for Health Statistics, S. Abraham, M. D. Carroll, M. F. Najjar, R. Fulwood: Obese and overweight adults in the United States. Vital and Health Statistics. Series 11, No. 230. DHHS Pub. No. (PHS) 83-1680. Public Health Service. Washington. U.S. Government Printing Office, Feb. 1983.

National Center for Health Statistics, M. D. Carroll, S. Abraham, and C. M. Dresser: Dietary intake source data, United States, 1976-80. Vital and Health Statistics. Series 11, No. 231. DHHS Pub. No. (PHS) 83-1681. Public Health Service. Washington. U.S. Government Printing Office, Mar. 1983.

Public Use Data Tapes

Data tapes are available from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161, (703) 487-4807

National Health Examination Survey, Cycle I, 1960-62

This tape contains data on 7,800 persons ages 18-79 years. Information was obtained from household interviews, medical history, medical and dental examinations, electrocardiogram readings, laboratory blood tests, X-rays, vision and hearing tests, and anthropometric measurements.

NHES I--Demographic Data Tape	PB-293 134/HAI
NHES I--Physical Measurements	PB-293 122/HAI
NHES I--Cardiovascular	PB-293 138/HAI

National Health and Nutrition Examination Survey, Cycle I, 1971-75

The first National Health and Nutrition Examination Survey (NHANES I) was conducted from 1971-75 on a sample of the U.S. population aged 1-74 years. Four different kinds of data were collected to make this nutritional assessment: (1) Dietary intake information, (2) hematological and biochemical tests, (3) body measurements, and (4) clinical assessments. Some limited information on general health status, health care needs, and treatment was also obtained. The information included examination findings and medical history on eye conditions, skin conditions, and dental health. Further data on health status and medical care needs were obtained through more detailed examinations and history for a subsample of adults aged 25-74 years. Particular concentration was given to cardiovascular, respiratory, arthritic, and auditory conditions.

NHANES I Medical History, Ages 12-74	PB-296 073/HAI
NHANES I Detailed Medical History, Health Care Needs and Supplements on Cardiovasculary and Respiratory	PB-296 029/HAI
NHANES I Anthropometry, Bone Density, Cortical Thickness, and Skeletal Age	PB-295 908/HAI
NHANES I Medical Examination, Ages 1-74	PB-296 035/HAI
NHANES I Biochemistry, Serology, Hematology, Peripheral Blood Slide and Urinary	PB-297 344/HAI

National Health and Nutrition Examination Survey, Cycle II, 1976-80

The second National Health and Nutrition Examination Survey (NHANES II) was designed to measure and monitor the nutritional status and health of the U.S. population ages 6 months through 74 years. Data were collected by means of a household questionnaire, medical histories, dietary questionnaires, a physical examination, spirometry trials, electrocardiograms, body measurements, pure tone audiometry, speech, allergy tests, X-rays, a medication/vitamin usage questionnaire, a behavior questionnaire and laboratory analyses of blood and urine samples.

NHANES II Anthropometric Data	PB82-191917/HAI
NHANES II Biochemistry and Hematology	PB82-253162/HAI
NHANES II Medical History, 12-74 Years	PB83-154815/HAI
NHANES II Medical History Supplement, Ages 12-74 Years	PB83-256537/HAI

☆U.S. GOVERNMENT PRINTING OFFICE: 1986-158-304/50420