

A Study of Dietary Intake and Nutritional Status: Trends and Assessment

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Throughout most of history, the quest for sufficient food was the chief occupation of the earth's people. The diet of Paleolithic hunter-gatherers, before the development of agriculture, is believed to have consisted of approximately 35% meat and 65% plant foods; no dairy products and practically no cereal grains were consumed. Meat from wild animals contains low levels of fats (4% in this early diet compared to 25 to 30% fat in today's domesticated animals), and the plant foods in this early diet consisted of a variety of vegetables and fruits (Eaton and Konner, 1985). The high-meat diet resulted in a high protein intake, but dietary fat was relatively low and contained more polyunsaturated fats than saturated fats. The intake of cholesterol, dietary fiber, calcium, and ascorbic acid is believed to have been high, but sodium intake was remarkably low. The accuracy of these estimates of the diet of hunter-gatherers cannot be established, however.

Two notable revolutions caused major changes in food supplies. The first occurred around 10,000 B.C., when people began to give up their nomadic ways in favor of living on specific plots of land, existing chiefly on plants they grew and animals they domesticated. For the first time, dairy products and cereal grains became a part of the diet. Agricultural innovations evolved slowly at first, but accelerated greatly with the onset of the second important revolution—the Industrial Revolution of the 1800's. Industrialization gave rise to two new socioeconomic classes: a new middle class of merchants and managers, who demanded a variety of socially desirable foods, and a new class of industrial workers, who could afford only the cheapest foods. Although the poverty, poor sanitary conditions, malnutrition, and disease that prevailed among workers in the industrial cities and towns was a blight on the Industrial Revolution, resources were soon mobilized to meet the food demands of the middle classes. Eventually the poor also benefited, as increased production and new techniques made cheaper foods available to them (Tannahill, 1973).

When large numbers of people left farming to work for wages in factories or to become entrepreneurs, there was a marked change in the kinds and quantities of food that were readily accessible. In the years since the Industrial Revolution, the U.S. diet has again undergone very large

changes. In 1800, 95% of all Americans consumed minimally processed foods produced chiefly on their own small farms, but by 1900, only 60% of the population remained on farms (Hampe and Wittenberg, 1964). In less than 175 years, nearly all Americans have become dependent on others to produce and distribute food to supermarkets where their ability to obtain items they desire is determined largely by their financial resources.

The construction of railroads across the country in the mid-1880s was responsible for changes in the character of the food supply. Foods were no longer strictly seasonal in nature, because they could be shipped from different climates. This trend accelerated with the advent of refrigerated railcars and trucks. Innovations in food processing were also important. In 1869, processed foods consisted chiefly of milled flour and cornmeal, refined sugar, cured meats, and processed dairy products. Today, in addition to these foods, the consumer finds canned, frozen, fermented, and dehydrated foods, as well as foods fabricated in the laboratory to resemble traditional foods. These include drinks resembling fruit juices, but containing no fruit juice, and analogs of meat or fish made from soybeans or wheat gluten. Innovations such as sugared breakfast cereals and a variety of snack items were unheard of before World War II. Hampe and Wittenberg (1964) estimate that 60% of the items on supermarket shelves in 1960 came into existence during the 15 years after the end of World War II. Home refrigerators and freezers also increased the homemaker's ability to select and store a variety of foods. Today's large supermarkets carry as many as 15,000 different items from which consumers must choose, complicating the task of nutrition educators.

The next section focuses on changes in the food supply during the twentieth century and describes national surveys to determine the U.S. population's intake of foods, nutrients, and, to a limited extent, pesticides and industrial chemicals. This is followed by a discussion of the limitations of the studies and a section on consumption trends.

The Food Supply : Historical Data

Changes in foods available to the public from 1909 to the present have been ascertained from USDA data based on the disappearance of foods into wholesale and retail markets. Annually, foods available to the civilian population are estimated by subtracting data on exports, year-end inventories, nonfood use, and military procurement from data on total production, imports, and

beginning-of-the-year inventories. These quantities are larger than those actually consumed, because they fail to take into account losses that occur during processing, marketing, and home use. Since they do not represent actual consumption, they are referred to here as *availability* or *use* of foods or nutrients.

The USDA estimates per-capita use of foods or food groups by dividing total available food by the population of the 50 states and the District of Columbia. The nutritive value of the food supply is calculated from per-capita use by using nutritive values found in food composition tables. Although these data provide no information on how foods are distributed among individuals or population groups, or on changes in patterns of waste and other losses, they nevertheless reflect changes in overall patterns of foods available over time. Furthermore, these data are similar to data produced in many other countries, and they have been useful in epidemiologic research across countries, such as studies of dietary lipids and atherosclerotic diseases (Stamler, 1979).

The Nationwide Food Consumption Surveys (NFCS)

NFCS focuses on the food use of households and the dietary intakes and patterns of individuals. These surveys have been conducted approximately every 10 years since 1935 by USDA's Human Nutrition Information Service (HNIS), but the first four surveys (in 1935, 1942, 1948, and 1955) obtained information only on household food use over a 7-day period. These data reflect food use in an economic sense only and do not take into account food waste or how food is distributed among household members. Beginning in 1965, data have been collected on intakes by individuals. Surveys were conducted in 1965-1966 and in 1977-1978; separate surveys were conducted in 1977-1978 in Puerto Rico, Alaska, and Hawaii, and among low-income and elderly populations. The most recent NFCS, 1985 and 1986, were the Continuing Surveys of Food Intakes of Individuals (CSFII), designed to be conducted annually. The household screening procedures for CSFII were designed to provide three separate samples: (1) women 19 to 50 years of age and their children 1 to 5 years of age—the core group; (2) a similar age sample of low-income women and children; and (3) men 19 to 50 years of age. Data have been published on both the 1985 and 1986 surveys (USDA, 1985, 1986a,b, 1987a,b,c, 1988).

In the Ten-State Nutrition Survey conducted during 1968-1970, DHHS studied low-income populations in 10 states (DHEW, 1972). In the biennial Food Label and Package Survey (Woteki, 1986), DHHS studies a statistically representative sample of packaged food products to obtain information on ingredients and on the extent of nutrient labeling. Two other DHHS studies—the Total Diet Study, conducted by the Food and Drug Administration (FDA), and the National Health and Nutrition Examination Survey (NHANES), conducted by the National Center for Health Statistics (NCHS)—are of greatest interest in the present report.

Total Diet Study

The only national system for studying average intakes of pesticides, toxic substances, radionuclides, and industrial chemicals is FDA's Total Diet Study. That study also provides estimates of dietary intakes of certain essential elements: iodine, iron, sodium, potassium, copper, magnesium, and zinc. The extent to which selected age-sex groups (males and females age 6 to 11 months, 2 years, 14 to 16 years, 25 to 30 years, and 60 to 65 years) are exposed to harmful substances and to essential minerals through diet can be determined from the results of this annual study.

Four times a year, foods representative of U.S. diets are purchased in grocery stores across the nation and are individually analyzed in FDA laboratories for the constituents mentioned above. The food items used in the Total Diet Study through April 1982 were based on data from the 1965 NFCS. Since 1982, the food items have been based on data from the 1977-1978 NFCS and the Second National Health and Nutrition Examination Survey (NHANES II), conducted during 1976-1980 and described below. Revisions to the list of food items have been described by Pennington (1983).

An example of findings from the Total Diet Study was the observation that iodine was present in the food supply in larger-than-recommended amounts, chiefly because of a higher-than-usual iodine content of milk and cereal grain products (Park et al., 1981). These findings are discussed in greater detail in the Minerals subsection of Trends in the Food Supply and Dietary Intakes, below.

Another important finding of that study in the early 1970s was that polychlorinated biphenyls (PCBs) were migrating into foods through paperboard packaging. Such packaging materials were

immediately banned. Since that time, PCBs have been detected in this study only in minute amounts and then only sporadically (E. Gunderson, FDA, personal communication, 1987).

A 1987 survey conducted by the Food Marketing Institute indicated that 76% of the food shoppers questioned believed that pesticides in foods constitute a "serious hazard" (Food Marketing Institute, 1987). No pesticide examined in the Total Diet Study as far back as 1961 has been found in the diet above tolerance levels. However, the FDA's laboratory methods did not permit analyses of all pesticides that might contaminate foods, and so few samples were taken that rare but high contamination levels could be missed entirely. According to a National Research Council (NRC) report, 71 to 80% of pesticides on U.S. markets have been insufficiently tested for carcinogenesis, 90% have never been tested for damage to the nervous system, and 50 to 61% have not been tested for teratogenicity (NRC, 1984).

A 1987 report from the NRC Board on Agriculture pointed out that government regulation of herbicides, fungicides, and insecticides needs to be greatly improved to protect consumers from cancer risks due to the presence of these contaminants in food. Consistent standards are not applied to old and new pesticides, with the result that continued use of some pesticides is permitted, despite the fact that newer alternative compounds posing smaller cancer risks are available (NRC, 1987).

National Health and Nutrition Examination Survey (NHANES)

NHANES is conducted by NCHS, in part to monitor the overall nutritional status of the U.S. population through health and medical histories, dietary interviews, physical examinations, and laboratory measurements. Information is obtained about many medical conditions, including nutrition-related disorders. Among these are obesity, growth retardation, anemia, diabetes, atherosclerotic cardiovascular diseases, hypertension, and deficiencies of vitamins or minerals. NHANES I was conducted between 1971 and 1974, NHANES II between 1976 and 1980, and the Hispanic HANES (HHANES) between 1982 and 1984. NHANES III, which began in 1988, includes a potential for following people throughout their lives, surveying them at regular intervals, and using a national death certificate system to establish cause and date of death. It may also be possible in NHANES III to reexamine respondents to earlier studies. During 1982-1984, reexamination of

respondents who were 25 to 74 years old during NHANES I provided a unique research opportunity for epidemiologists (Madans et al., 1986).

India has the highest occurrence of childhood malnutrition in the world. According to IAP, for children to be well nourished they need energy from variety of nutrients to lead a healthy and happy life. While adequate food is important throughout childhood, it is crucial during the first five years of child's life.

Children are one of the most vulnerable populations who face unusually high threats as they grow. This is seen more clearly in children less than 5 years old. Most brain development occurs before a child reaches 3 years old. In the first three years period of life children develop their abilities to think and speak, learn and reason and lay the foundation for their values and social behavior as adults. At birth a child has got 100 billion brain cells. Most of them cannot connect to each other. These connections are wonders of the human body, depending partly on genes and on the events of early life. Many kinds of experiences affect how young brain develops, but nothing is more important than early care and nutrition ^[3]. Early childhood malnutrition can have lasting effects on growth and functional status. The inadequate energy and protein intake leads to malnutrition in the form of wasting, stunting and underweight.

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