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Abstract

Individual chapters in this book provide different perspectives on the nutrition problem in the United States: what are the economic costs associated with unhealthy eating patterns; how do dietary patterns compare with dietary recommendations; how do national income and prices, advertising, health claims, and trends in eating away from home affect nutrient intake; how much do people know about nutrition and how does nutrition knowledge and attitudes affect intake of fats and cholesterol; how do different government programs and regulations influence food expenditures and consumption; what are some public and private efforts to improve healthy eating; and what are potential impacts of healthier eating on domestic agriculture.

Keywords: Diet, nutrition, health, eating patterns, nutrition education, nutrition knowledge, dietary guidelines, food guide pyramid, food supply, food consumption, food assistance programs, school lunch, food away from home, advertising, health claims, nutrition labeling, agriculture, economic costs, Healthy Eating Index, Healthy People 2000.

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Preface

No country in the world has a more bountiful food supply than the United States. Not only are American farmers remarkably productive but our surpluses are an important part of the supply of food to the rest of the world. Nor is this abundance a recent development. American agricultural surpluses have been a major factor in U.S. exports, going back more than three centuries. In addition to exporting such nonfood crops as tobacco and cotton during the eighteenth and nineteenth centuries, the U.S. exported grains, meat, and fish to the Caribbean and Europe in increasing amounts. As late as the end of the nineteenth century, the U.S. not only had higher caloric consumption per capita but a larger proportion of calories originating in meat and fish than any other country in the world.

At the end of the nineteenth century, for example, the consumption of meat per capita in the U.S. was twice as high as in Germany, more than 3 times as high as in the Netherlands and Russia, 2.5 times as high as in France, 1.8 times as high as in England, and 8 times as high as in Italy. A lush supply of food, however, does not necessarily mean good nutrition.

When stature and the body mass index (BMI) are used as proxies for nutritional status, it becomes apparent that despite the vast food supply of the second half of the nineteenth century native-born males in the United States were chronically malnourished (stature at maturity was only at the twenth-fifth centile of the current standard). Males in their thirties had a BMI of about 21, which is about 4 BMI points below the current average. Regressions relating height and BMI to the odds of developing chronic disease at middle and late ages were quite significant. The studies of the nineteenth and twentieth centuries point to the existence of a synergism between technological and physiological improvements that has produced a form of human evolution that is biological but not genetic, rapid, culturally transmitted, and not necessarily stable. This process is still ongoing in both rich and developing countries and has been referred to as "techno-physio evolution."

Unlike the genetic theory of evolution, the theory of technophysio evolution rests on the proposition that during the last 300 years, particularly during the last century, human beings have gained an unprecedented degree of control over their environment—a degree of control so great that it sets them apart not only from all other species, but also from all previous generations of Homo sapiens. This new degree of control has enabled Homo sapiens to increase its average body size by over 50 percent, to increase its average longevity by more that 100 percent, and to improve greatly the robustness and capacity of vital organ systems.

The most important aspect of technophysio evolution is the continuing conquest of chronic malnutrition due mainly to a severe deficiency in dietary energy, which was virtually universal three centuries ago. In France at the beginning of the nineteenth century, for example, the amount of energy available for work per equivalent adult male was less than one-third of the current U.S. supply of energy for work. As a consequence, mature Frenchmen were only about 163 centimeters tall on average and weighed about 50 kilograms.

Recent studies have estimated that variations in nutritional status are associated with variations in chemical composition of the tissues that make up vital organs, in the quality of electrical transmissions across membranes and in the functioning of the endocrine system and other vital systems. Nutritional status thus appears to be a critical link connecting improvements in technology to improvements in human physiology.

So far I have focused on the contribution of technological change to physiological improvements. The process has been synergistic, however, with improvement in nutrition and physiology contributing significantly to the process of economic growth and technological progress along the lines that I have described elsewhere. Here I merely want to point out the main conclusion. Technophysio evolution appears to account for about half of British economic growth over the past two centuries. Much of this gain was due to the improvement in human thermodynamic efficiency. The rate of converting human energy input into work output appears to have increased by about 50 percent since 1790.

Robert W. Fogel,
Nobel Laureate

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Introduction

On the Road to Better Nutrition

Eileen Kennedy, James Blaylock, and Betsey Kuhn

As the Deputy Under Secretary for Research, Education, and Economics, I am quite pleased that the Economic Research Service took the responsibility for planning, coordinating, and producing this book. But it is as a nutritionist and researcher that I am truly grateful. An effort mobilizing experts from a wide range of fields—from nutritionists to economists—to examine America's eating habits is indeed a worthwhile undertaking. However, to succeed in such grand fashion is unusual. This book is truly a road map to understanding the complex world of food choices and diets. I am honored to have coauthored this introduction.

–Eileen Kennedy

Improved nutrition has been the cornerstone upon which all modern societies and economies were built. Adequate nutrition frees a nation and its people to pursue goals that improve the human condition. A nation whose basic nutritional needs are met is healthier, more productive, and can focus its energies on educational attainment, improved housing, enhanced medical care, and the provision of goods and services associated with a highly developed society. However, in modern America, the past problems of low caloric intakes and inadequate consumption of vitamins and minerals have been supplanted by poor diets of a different hue and with different

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implications. In America today, poor diets are typically too high in calories and fats, and too low in fruits and vegetables—problems associated with certain chronic diseases and obesity. While the dietary problems may be different today, one thing remains the same—poor eating habits still exact a heavy toll on individuals and society.

A century ago, nutritional problems centered on the inadequate intakes of certain vitamins and minerals, resulting in nutritional deficiencies such as rickets, scurvy, and beriberi. Now, nutritional problems in America are driven by the discovery of strong links between nutrition and chronic diseases such as coronary heart disease, cancer, and stroke. Solutions now center on understanding consumer behavior and the factors influencing food choices. We emphasize the words “consumer” and “choice.” Consumers make dietary decisions based on economic, physiologic, psychologic, sociologic, and even spiritual considerations. Eating in a developed country like the United States becomes a social, business, and family event, an act of pleasure, that goes far beyond the ingestion of the necessary nutrients to sustain life. People eat both for pleasure and as a biological necessity. This must be remembered if we are to understand the complex world of food choices, dietary quality, and dietary change.

Many forces, most outside the consumer’s direct control, shape food demand and food consumption. In Senate testimony over 20 years ago, Dr. Winikoff of the Rockefeller Foundation said, “Nutrition is affected by governmental decisions in the area of agricultural policy, economic and tax policy, export and import policy, and involves questions of food production, transportation, processing, marketing, consumer choice, income and education, as well as food palatability and availability. Nutrition is the end result of pushes and pulls in many directions, a response to the multiple forces creating the national nutrition environment.” This is just as true today as it was two decades ago.

Economics is just one of many complex forces shaping food choices, nutrient intake, and diet quality. Recognizing this, we thought that the Economic Research Service could facilitate and organize a distinguished team of multidisciplinary researchers to address what is known and not known about America’s eating habits. Our colleagues in the nutrition, health, and diet arena help us understand the implications of food choices on health outcomes. Psychologists and other social scientists help us to understand how societal influences and pressures as well as individual attitudes and habits shape what we eat. Last, the economist role is to help us understand why the allocation of scarce resources—such as time, information, and money—to competing ends has such a profound impact on food choices and, hence, diet quality.

Americans are slowly adopting more healthful diets—the share of calories from fat is declining, people are eating more fruit than 10 years ago, and the U.S. Department of Agriculture's Healthy Eating Index has shown some improvement in recent years. Countering these positive signs is evidence that more Americans than ever are overweight, fiber consumption is low, and snack foods are as popular as ever. Cheese consumption is at record levels thanks to our passion for cheeseburgers, pizza, and tacos. A heavier population means that people are not balancing energy intake with energy use—that is, Americans are eating more and exercising less.

Consumer knowledge about nutrition and health is improving, but slowly. Even dietitians, when asked to estimate the fat content of restaurant meals, were often off the mark. Over 200 dietary experts surmised that a hamburger and onion rings contained 863 calories and 44 grams of fat. In fact, the meal contained 1,550 calories and 101 grams of fat. A tuna salad containing 720 calories and 43 grams of fat was estimated to have 374 calories and 18 grams of fat.

Even when we understand basic nutrition and health principles, we often fail to follow through. The desire for high-fat and high-sodium foods often outweighs nutrition concerns. Many people cannot measure the nutritional quality of a meal—a problem compounded in our society by the increasing incidence of dining out, fast foods, home delivery, and pre-packaged meals. We may be aware of the nutrient content of a particular food, but lose track when foods and ingredients are combined in unknown portions. Also remember that consumers eat three meals a day, quench their thirst with carbonated beverages, and constantly nibble on snacks. Is it any wonder that by the end of the day few of us know how many calories we have ingested, let alone our fat intake?

Confounding everything is the fact that benefits of good nutrition are often not observed immediately or are elusive. There is no guarantee that a lifetime of healthy eating will result in reduced morbidity outcomes or increased longevity. Some may forestall practicing good nutrition in the hope that medical science will find a substitute for that low-fat, high-fiber diet. In the short run, people may prefer convenience foods over more healthful alternatives because of demands on their time. In the long run, taste considerations may simply prevail. Similarly, the uncertain future benefits of better nutrition may outweigh the perceived potential benefits of healthy eating. Put differently, for many people, healthy eating is just not worth the effort and sacrifice. The latter may be a particularly difficult phenomenon to overcome since Americans seem to discount the future heavily. We need only to look at the nation's extraordinarily low savings rates or high credit card balances for evidence. Convincing people of the longrun benefits of good nutrition is clearly made more difficult if immediate gratification is given higher priority.

Changes in society continue to exert a tremendous influence on our dietary patterns. Food consumed away from home—which typically contains more fat, saturated fat, and cholesterol than meals prepared at home—is at an all-time high and growing. The explanations are familiar: more women in the labor force, more discretionary income, and smaller households. Clearly, counting grams of fat is more difficult for food purchased from the local hamburger joint, a sidewalk vendor, or the supermarket deli.

With a bewildering array of food items to select from, research indicates that the average consumer takes only 12 seconds to make a brand selection. Of course, Madison Avenue spends $11 billion in advertising to help us here. Not surprisingly, most of these advertising dollars promote prepared and convenience foods, snacks, and alcoholic beverages. By contrast, the Federal Government spends a mere $350 million annually to promote healthy eating.

The chapters in this volume are intended to help initiate and encourage a dialogue on nutrition in this country. This report is published under the auspices of the Economic Research Service, but its contributors come from many institutions and disciplines. Economists, dietitians, nutritionists, psychologists, and social scientists are represented. Our hope is that this effort will not only contribute to future U.S. nutrition and agriculture policy, but also provide lessons for developing countries throughout the world. As incomes and wealth increase, these countries are already struggling with many of the same nutrition issues discussed here even as they continue to face problems of undernutrition. Much work remains.

Chapter 1

High Costs Of Poor Eating Patterns In the United States

Elizabeth Frazão

Dietary patterns in the United States are associated with increased risk of several chronic diseases such as coronary heart disease, cancer, stroke, diabetes, hypertension, overweight, and osteoporosis. This chapter looks only at the first four conditions, which account for over half of all deaths in the United States each year. After accounting for comorbidity and potential double-counting, it is estimated that healthier diets might prevent $71 billion per year in medical costs, lost productivity, and the value of premature deaths associated with these conditions.

Introduction

Scientific research increasingly confirms that what we eat may have a significant impact on our health, quality of life, and longevity. In the United States, high intakes of fat and saturated fat, and low intakes of calcium and fiber-containing foods—such as whole grains, vegetables, and fruits—are associated with several chronic health conditions that can impair the quality of life and hasten mortality. In particular, 14 percent of all deaths have been attributed to poor diets and/or sedentary lifestyles (McGinnis and Foege, 1993).

Diet is a significant factor in the risk of coronary heart disease (CHD), certain types of cancer, and stroke—the three leading causes of death in the United States, and responsible for over half of all

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Table 1—Leading causes of death in the United States, 1994

Cause of death	Deaths	Share of all deaths
	Number	*Percent*
1. Heart disease	732,409	32.1
Coronary heart disease	**481,458**	**21.1**
2. Cancer	**534,310**	**23.4**
3. Stroke	**153,306**	**6.7**
4. Chronic obstructive pulmonary diseases and allied conditions	101,628	4.5
5. Accidents and adverse effects	91,437	4.0
6. Pneumonia and influenza	81,473	3.6
7. Diabetes mellitus	**56,692**	**2.5**
8. Human immunodeficiency virus infection	42,114	1.4
9. Suicide	31,142	1.4
10. Chronic liver disease/cirrhosis	25,406	1.1
All causes	2,278,994	100.0

Bold = Health condition influenced by diet (excluding alcohol).

Source: USDA/ERS, from Singh and others, 1996.

deaths in 1994 (table 1). Diet also plays a major role in the development of diabetes (the seventh leading cause of death), hypertension, and overweight.[1] These six health conditions incur considerable medical expenses, lost work, disability, and premature deaths—much of it unnecessary, since a significant proportion of these conditions is believed to be preventable through improved diets (Frazão, 1995, 1996).

However, no estimates are currently available on the total economic costs that might be associated with food consumption patterns in the United States and the economic benefits that might derive from improved diets. This is partly because of the difficulties involved in estimating the direct effect of diet on health conditions. For example, an individual's risk for chronic disease can be increased by genetic predisposition, stress levels, smoking, and activity level, as well as diet. Further, because these chronic diseases occur in middle

[1] Diet also plays an important role in the risk for osteoporosis, neural tube birth defects, and other health conditions that are not addressed in this study.

age or later in life, and because dietary patterns tend to change over time, it is not clear which dietary patterns may be more important in establishing the risk for chronic disease: is it eating patterns during infancy? during early childhood? during adolescence? during adulthood?

Efforts to improve dietary patterns could markedly decrease morbidity and mortality associated with chronic health conditions. These benefits would result in lower medical care costs, lower institutional care costs, less lost productivity, improved quality of life, and increased life span. For example, studies have found that even fairly small reductions in intakes of fat, saturated fat, and cholesterol would likely yield substantial benefits (Browner, Westenhouse, and Tice, 1991; Zarkin and others, 1991). The economic impact analysis for the 1993 nutrition labeling regulations estimated that a 1-percent reduction in intake of fat and saturated fat and a 0.1-percent reduction in intake of cholesterol would prevent over 56,000 cases of CHD and cancer, avoid over 18,000 deaths, and save over 117,000 life-years over 20 years (USDA, 1993; DHHS, 1993a).

This study uses estimates from the medical literature on the likely effects of diet on specific chronic health conditions to estimate the medical costs and lost productivity that could be prevented through improved dietary patterns. The study also provides a more complete estimate of the total economic costs associated with diet by estimating the value of diet-related premature deaths. It should be noted, however, that the methodology for estimating the value of diet-related premature mortality is still being refined, and further work is needed to assess the appropriateness and relevance of the social values that have been incorporated in the estimates.

Health Consequences Of Poor Eating Patterns

Coronary Heart Disease[2]

Mortality data for 1994 show that coronary heart disease (CHD) was the cause of over 480,000 deaths in the United States—nearly two-

[2] Although mortality statistics list "heart disease" as the leading cause of death, this paper focuses on coronary heart disease (CHD), also known as ischemic heart disease, the type commonly associated with diets.

Table 2—Number of deaths, by age, from four major causes influenced by diet, 1994

Cause of death	Age at death				
	< 55	55-64	65-74	75 +	Total[1]
	Total number of deaths				
Coronary heart disease	28,549	45,567	104,184	303,123	481,458
Cancer	68,857	89,251	163,795	212,391	534,310
Stroke	9,382	9,577	25,386	108,954	153,306
Diabetes	6,306	7,784	15,744	26,856	56,692
All 4 causes	113,094	152,179	309,109	651,324	1,225,766

[1] Numbers may not add up to total number of deaths because no age is reported for some deaths.

Source: USDA/ERS, from Singh and others, 1996.

thirds of all deaths from heart disease, and more than one of every five deaths (table 1). Individuals 55-74 years of age accounted for 31 percent of all CHD deaths in 1994, and individuals 75 years and older accounted for 63 percent of these deaths (table 2).

The American Heart Association (1997) estimates that as many as 1.1 million Americans suffer a new or recurrent heart attack each year, that over 13.9 million people alive today have a history of CHD, and that someone dies from a heart attack about every minute. And although heart attacks affect mainly the elderly, 40 percent occur in people age 40-64 (American Heart Association, 1996a).

Although genetics plays an important role in an individual's risk of CHD, environmental factors are also significant. Major modifiable risk factors for CHD include high blood cholesterol levels, diabetes, overweight, hypertension, physical inactivity, and smoking. Diet—in particular, consumption of saturated fats—can influence blood cholesterol levels in some people. New research also suggests that increased intake of antioxidants and folic acid—a vitamin available in dry beans, and many fruits and vegetables—may reduce the risk of CHD (Boushey and others, 1995; Willett, 1994; Plotnick, Corretti, and Vogel, 1997). And diet can also influence other risk factors for CHD, such as diabetes, hypertension, and overweight (see below).

Although CHD currently represents over 20 percent of all deaths in the United States, mortality rates from heart attacks have been declining since the 1950's. However, it is not clear that the incidence of heart disease has been declining. Rothenberg and Koplan (1990), for example, found that the frequency of hospitalization for CHD was increasing in spite of downward trends in mortality, while hospitalization from stroke increased 24 percent from 1979 to 1995 (American Heart Association, 1997). Hunink and others (1997) examined the decline in mortality from CHD between 1980 and 1990 and determined that 25 percent of the decline was explained by primary prevention and an additional 29 percent was explained by secondary reduction in risk factors in patients with coronary disease. Other improvements in treatment explained 43 percent of the decline in mortality. They concluded that more than 70 percent of the overall decline in mortality occurred among patients with coronary disease. An analysis conducted at the Harvard Center for Risk Analysis also suggests that most of the decline in mortality from CHD between 1980 and 1990 was due to improvements in the management of patients who already had the disease rather than due to reduced incidence of CHD (Goldman and Hunink, 1997). It is difficult to isolate the effect of dietary changes, because of other concomitant practices—such as lower-dose oral contraceptives, and increased use of cholesterol-lowering drugs and postmenopausal estrogen replacement therapy—that also reduce blood cholesterol levels (Johnson and others, 1993).

Cancer

Cancer claimed over 530,000 lives in the United States in 1994 (table 1). Individuals 55-74 years of age accounted for nearly half (47 percent) of all cancer deaths, while individuals 75 years and older accounted for an additional 40 percent (table 2).

The American Cancer Society (1997) estimates that over 1 million new cancer cases are diagnosed each year, and that about 560,000 people will die of cancer in 1997—more than 1,500 people per day.

Even though genetics is an important factor in cancer risk, epidemiologic studies suggest that cancer is not an inevitable consequence of aging (World Cancer Research Fund and American Institute for Cancer Research, 1997; Wynder and Gori, 1977; American Cancer Society, 1997). Changes in cancer patterns over time—such as the sharp increase in incidence of breast and lung cancer and the decline in stomach cancer in the United States in the past decades—support the hypothesis that environmental and lifestyle factors may play an important role in the occurrence of cancer. This hypothesis is further strengthened by studies showing that when populations migrate, their cancer patterns change in a fairly short time to approximate the patterns prevalent in the new area of residence (Higginson and Muir, 1979; Doll and Peto, 1981; National Research Council, 1982; Page and Asire, 1985).

Studies increasingly demonstrate a strong protective effect against cancer associated with increased consumption of fruits and vegetables (Block, Patterson, and Subar, 1992; World Cancer Research Fund and American Institute for Cancer Research, 1997); the evidence on the role of high-fat diets and cancer risk is less clear. The increased risk of cancer attributed to a high-fat diet may really be due to low intake of something else—such as fruits and vegetables (Subar and others, 1994) or due to the increased risk of obesity associated with high-fat diets (World Cancer Research Fund and the American Cancer Research Institute, 1997).

Stroke

Stroke (cerebrovascular disease) affects over 500,000 people each year—averaging nearly one every minute—and killed over 150,000 people in 1994 (table 1). Individuals 55-74 years of age accounted for 23 percent of stroke deaths in 1994, while individuals 75 years and older accounted for 71 percent of stroke deaths in 1994 (table 2).

According to the American Heart Association (1997), stroke is the leading cause of serious long-term disability, and accounts for half of all patients hospitalized for acute neurological disease. Mortality rates from stroke have been steadily declining since 1950 (Singh, Kochanek, and MacDorman, 1996). Some of this decline has been attributed to improvements in the detection and treatment of hypertension (see below).

Diabetes

Diabetes is the seventh leading cause of death in the United States, directly responsible for 56,000 deaths in 1994 (table 1). Forty-two percent of these deaths occurred among individuals 55-74 years of age; an additional 47 percent occurred among individuals 75 years and older (table 2). However, because people often die of the complications of diabetes rather than from diabetes itself, mortality statistics tend to underreport the true impact of diabetes (Centers for Disease Control and Prevention, 1997a; Geiss, Herman, and Smith, 1995; Rothenberg and Koplan, 1990; Herman, Teutsch, and Geiss, 1987). The American Diabetes Association (1998) estimates that diabetes contributes to at least an additional 100,000 deaths each year (100,000 more deaths than the 56,000 currently attributed to diabetes). For example, diabetes is the single leading cause of end-stage renal disease, and a risk factor for CHD, stroke, and hypertension. People with diabetes are two to four times more likely to have heart disease and to suffer a stroke (American Diabetes Association, 1998) and twice as likely to have hypertension as people who do not have diabetes (American Diabetes Association, 1993; Herman, Teutsch, and Geiss, 1987). Diabetes is also the leading cause of blindness, and the leading cause of nontraumatic lower limb amputation (American Diabetes Association, 1998).

Diabetes affects more than 15 million people in the United States, although one-third are not aware they have the condition. Approximately 2,200 people are diagnosed with diabetes each day (American Diabetes Association, 1998). Both prevalence and incidence are higher among blacks and Hispanics than among whites—probably due to a combination of genetic factors and higher prevalence of risk factors such as obesity (American Diabetes Association, 1993).

There are two main types of diabetes. Type I, also called insulin-dependent or juvenile-onset diabetes, is characterized by an absolute deficiency of insulin and usually appears before age 40. Type II diabetes, also called noninsulin-dependent or adult-onset diabetes, appears in midlife, most often among overweight or obese adults. Many times it can be controlled by diet and exercise alone. Over 90 percent of the diagnosed cases of diabetes are Type II. Undiagnosed cases are likely to be Type II, since the severity of Type I symptoms requires medical intervention.

The only therapeutic interventions known to be effective in noninsulin-dependent diabetes are the maintenance of desirable body weight and exercise (DHHS and USDA, 1992; American Diabetes Association, 1993). About 80 percent of people with Type II diabetes have a history of being overweight (DHHS, 1992; Herman, Teutsch, and Geiss, 1987). McGinnis and Foege (1993) estimate that half of

Type II diabetes can be prevented by controlling weight (perhaps through dietary improvement and physical activity).

Hypertension

Hypertension, or high blood pressure, affects as many as 50 million people in the United States (American Heart Association, 1996).[3] Mortality statistics for 1994 list 23,943 deaths from hypertensive heart disease, 2,494 deaths from hypertensive heart and renal disease, and 11,765 deaths from hypertension with or without renal disease (Singh, Kochanek, and MacDorman, 1996). If listed together, these three categories would add to 38,202 deaths and would comprise the ninth leading cause of death. But mortality statistics report the two types of hypertensive heart disease under "diseases of the heart" and list hypertension with or without renal disease as a separate category.

Furthermore, because hypertension is a common and important risk factor for CHD, stroke, and renal disease (DHHS, 1993c), mortality statistics grossly underestimate the impact of hypertension on mortality (Weinstein and Stason, 1976). Milio (1981) estimates that hypertension contributes to 50 percent of stroke deaths and 6 percent of CHD deaths. The American Heart Association (1997) estimates that as many as 30 percent of all deaths in hypertensive black men and 20 percent of all deaths in hypertensive black women may be attributable to high blood pressure. In 1993, hypertension was listed as a contributing cause of death on more than 180,000 death certificates of stroke, heart attack, and heart failure victims (American Heart Association, 1996b).

Each year, some 2 million people start treatment for hypertension (DHHS, 1993b). Yet, 1988-91 data from the National Health and Nutrition Examination Survey show that 35 percent of those with high blood pressure were unaware of their condition. In addition, only 44 percent were on hypertensive medication, and only 21 percent were on adequate therapy and had their hypertension under control. Surveys conducted in 1991-92 estimated that 2.2 million Americans age 15 and over had disabilities resulting from high blood pressure (American Heart Association, 1996a).

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3 Hypertension, or sustained high blood pressure, is defined as systolic blood pressure (SBP) of 140 mm Hg or greater and/or diastolic blood pressure (DBP) of 90 mm Hg or greater.

Because hypertension can be controlled, but not cured, treatment is often costly. Further, since there are usually no symptoms associated with hypertension, and since the medication may cause side effects, compliance with the medication is not very good (DHHS, 1993b). Little is known about the implications of long-term drug therapy for the millions of people who take medication to try to control their hypertension (DHHS, 1988).

Age-related increases in blood pressure, as occur in the United States, are associated with overweight and physical inactivity, high intakes of sodium and alcohol, and low potassium intake (DHHS, 1993b).[4] The National Heart, Lung, and Blood Institute estimates that 20-30 percent of hypertension cases can be attributed to overweight (DHHS, 1993c), and a recent study suggests that efforts to prevent hypertension should focus on energy intake and preventing or controlling overweight (Pickering, 1997). Although not all individuals are equally susceptible to the effects of sodium, a lower sodium intake might also prevent blood pressure from increasing with age in the United States (DHHS, 1990). New research at Johns Hopkins University also suggests that increased consumption of fruits and vegetables can lower high blood pressure as effectively as some medications (Appel and others, 1997).

Improvements in the detection, treatment, and control of hypertension are believed to have contributed substantially to the decline in mortality rates from stroke and CHD in the past two decades. The National High Blood Pressure Education Program, launched in 1992, is credited with improving the number of hypertensives aware of their condition and receiving treatment for it (DHHS, 1993b).

Overweight

Being overweight is associated with increased risk for morbidity and mortality from a number of chronic health conditions, including CHD, high blood pressure, noninsulin-dependent diabetes, and some types of cancer (Centers for Disease Control and Prevention, 1997a; American Heart Association, 1998). Although not an official cause

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[4] In nonindustrialized countries, there is little increase in blood pressure with age (DHHS, 1993b). In the United States, high blood pressure affects men more than women until early middle age, and then reverses. The prevalence of high blood pressure is greater for blacks than for whites, and is greater among less educated than more educated people.

of death, being overweight is considered by some experts to be one of the leading precursors of premature deaths in the United States (Amler and Eddins, 1987; McGinnis and Foege, 1993). Prevention of obesity could reduce the incidence of hypertension by 20 percent (Pickering, 1997) and Type II diabetes by 50 percent (Herman, Teutsch, and Geiss, 1987).

Despite efforts to address overweight as a public health problem, and the enormous consumer interest in weight loss programs and in reduced-fat foods, the prevalence of overweight has increased dramatically in the United States in the past two decades. Between 1976-80 and 1988-94, there was an increase of 10 percentage point in the proportion of the population classified as overweight (Centers for Disease Control and Prevention, 1997b).[5] The magnitude of the problem becomes even more severe using the American Heart Association's recently released definition (1998)—that individuals with a BMI of 25 and above are overweight.[6] This results in over half of all U.S. adults being classified as overweight in 1988-94: 59.4 percent of the men and 50.7 percent of women (Kuczmarski and others, 1997).

Since overweight is an important risk factor for CHD, stroke, some types of cancer, hypertension, and diabetes, the adverse health implications of this increasing weight problem are significant. In particular, there is some concern that as the prevalence of overweight increases among children and teenagers, the chronic diseases that have typically been associated with people in their 50's may begin to appear at an earlier age (DeBrosse, 1997).

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5 Being overweight was defined in that study as a body mass index (BMI, calculated as weight in kilograms, divided by height, in meters, squared) value of at least 27.3 for women and at least 27.8 for men. Children and adolescents were classified as overweight when their BMI's were at or above sex- and age-specific 95th-percentile BMI cutoff points derived from the National Health Examination Surveys (Centers for Disease Control and Prevention, 1997b).

6 This definition for overweight was incorporated in the 1995 edition of the *Dietary Guidelines for Americans*, based on studies that mortality increased significantly above a BMI of 25 (USDA, 1995).

Economic Consequences Of Poor Eating Patterns

Methodology and Data

This study follows the "cost-of-illness" methodology, in which the direct and indirect costs associated with a particular illness are estimated and then summed to obtain total economic costs. The direct costs measure resources used in the prevention, diagnosis, treatment, and continuing care of the disease, such as expenditures on medical care and services. The indirect costs represent the time and output lost from employment, housekeeping, volunteer activities, and/or leisure, either due to morbidity or due to death.

Measures of lost productivity, however, ignore other less tangible dimensions associated with the illness, such as deterioration in the quality of life, pain and suffering, and reduced life span (Brown, Hodgson, and Rice, 1996). In some cases, these intangibles may be more important than the lost wages.

Methods for valuing deaths have been developed that provide a more comprehensive measure of the value consumers attach to postponing death, or "value of life," than is provided by estimates of lost productivity due to death. Therefore, this study uses the data available on medical costs and lost productivity from disability associated with chronic health conditions that are affected by diet, but estimates its own value of diet-related deaths without using the data available in the literature on lost productivity due to deaths.

Value of Life

Consumers, often without realizing, demonstrate the value they place on life and health when they pay more for safer products or earn higher wages for riskier jobs (Aldrich, 1994). Economists have translated these actual behaviors—particularly through statistical analysis of wage premiums necessary for workers to accept riskier jobs or from consumer market studies for observable tradeoffs people make between risks and benefits (such as the decision to use automobile seat belts or smoke detectors)—into estimates of consumer willingness to pay to avoid death, or "value of life." Willingness-to-pay estimates can also be derived from contingent valuation surveys in which respondents are given a hypothetical situation and asked how much they would be willing to pay to reduce their risk of premature death by a specified small amount. In a survey of 24 wage-risk studies, Viscusi (1993) concluded that most estimates of the "value of life" fell between $3 million and $7 million per life, in 1990 dollars.[7] Updated to 1995 dollars, these estimates range from $3.6 million to $8.4 million per life.

Estimates of the "value of life" do not measure the value of life of any one identified individual, but represent the total amount that a group of individuals is willing to pay for small reductions in the probability of death. For example, if 100,000 people are each willing to pay $250 for a program that is expected to reduce the overall probability of death from 90 in 100,000 to 80 in 100,000, the implied value of life for the 10 "statistical" (or unidentified) lives saved is $25 million. This translates into $2,500,000 per each "statistical life" saved, or a "value of life" of $2.5 million.

An individual's willingness to pay to avoid illness or premature death may be highly dependent on the expected risk or change in risk, as well as the individual's age, income, and/or health condition. Therefore, it is not clear that the "value-of-life" estimate obtained for one group of individuals can be applied to groups of individuals with different characteristics, or facing different risk choices or levels. In practice, however, because of the difficulties in obtaining value-of-life estimates, available estimates are applied. Of particular concern is the use of the same value of life regardless of age at time of death. The implicit assumption is that the value of life is the same for an individual who dies at the age of 5, 25, or 95. From a human capital perspective, age is clearly important, since an individual who loses 30 years of life incurs a larger productivity loss than an individual who loses 5 years of life. This remains a controversial issue.

Landefeld and Seskin (1982) developed age-specific estimates of the value of life by adjusting their estimates of lost productivity with a measure of willingness-to-pay for small changes in risk of death based on life insurance data. However, their estimates still do not include a measure of other intangible factors, such as pain and suffer-

[7] Estimates vary because of variations across studies in populations, their levels of risk aversion, mean levels of fatal and nonfatal risks, omission of nonpecuniary job attributes, etc.

ing or the quality of remaining years of life, and therefore should be viewed as a conservative measure of the "true" value of life.[8]

For this study, estimates derived from Landefeld and Seskin's (1982) age-specific value of life are applied to mortality data to obtain the value of diet-related deaths.

Medical Costs

Data on medical costs were obtained from the literature and updated to 1995 dollars using the consumer price index (CPI) for medical care. Note, however, that the data available (and presented in table 3) represent medical costs for all cases of each health condition. Because diet is only one of the many factors that influence an individual's risk for any of these health conditions, only a portion of the costs listed in table 3 may be attributable to diet. Further, the costs listed in table 3 should not be added, since they likely include considerable double-counting associated with the joint occurrence of more than one health condition in the same individual (comorbidity). For example, 55 percent of diabetics die from cardiovascular disease (Javitt and Chiang, 1995). This suggests that the costs of cardiovascular disease in diabetics are likely included under both diabetes and cardiovascular diseases (which include CHD and stroke).

Before adjusting for double-counting, it is interesting to note that table 3 provides a very different picture of the disease burden associated with each of the six health conditions than the picture provided by the mortality statistics in table 1. Medical costs associated with diabetes and obesity are considerably higher than those for heart disease and cancer, the two leading causes of death in the United States. The high cost burden associated with diabetes is consistent with the assertions by many experts that mortality statistics underestimate the true health impact of diabetes (American Diabetes Association, 1993; Herman, Teutsch, and Geiss, 1987). Rothenberg and Koplan (1990), for example, found that of all the times diabetes appeared in a death certificate, it was listed as the underlying cause of death less than 25

[8] A measure has been developed, quality-adjusted life years (QALY), that adjusts the remaining years of life for their quality. The Panel on Cost-Effectiveness in Health and Medicine, created by the Office of Disease Prevention and Health Promotion of the U.S. Public Health Service, recommends using a QALY measure in cost-effectiveness studies of health interventions (Harvard Center for Risk Analysis, 1996). However, data on QALY are not incorporated in Landefeld and Seskin's age-specific values of life.

Table 3—Medical costs for six health conditions, 1994[1,2]

Health condition	Costs, all cases[3]
	$ billion (1995)
Coronary heart disease	39.8
Cancer	47.4
Stroke	21.9
Diabetes	52.5
Hypertension[4]	18.3
Obesity	62.3

[1] Includes hospital and nursing services, physician services, drugs, rehabilitation and institutional care, and special services.

[2] Estimates updated to 1995 dollars using the Bureau of Labor Statistics CPI for general medical care; estimates for obesity were updated to 1995 dollars using the Bureau of Labor Statistics CPI for all goods.

[3] Numbers should not be added since they likely include some double counting.

[4] Includes only costs associated with hypertension with and without renal disease; does not include costs associated with hypertensive heart disease or hypertensive heart and renal disease.

Sources: For coronary heart disease, stroke, and hypertension: American Heart Association, 1996 and conversation with Dr. Hodgson, 1997; for cancer: American Cancer Society, 1997; for diabetes: adapted from American Diabetes Association, 1993; for obesity: adapted from Colditz, 1992; and Colditz and Wolf, 1996.

percent of the time. Similarly, mortality statistics ignore the true health impact of hypertension and obesity—conditions strongly moderated by diet and which increase the risk of coronary heart disease, cancer, stroke, and/or diabetes, although neither condition is considered a major cause of death.

Although correlations between mortality and medical care expenditures tend to be poor (Hodgson, 1997), the simplest way to adjust for the double-counting in table 3 is to assume that the 55 percent of diabetics who die from cardiovascular disease account for 55 percent of the costs associated with diabetes in table 3, and that these costs are already fully accounted for under CHD and stroke. Based on these assumptions, only the remaining 45 percent of the costs associated with diabetes represent incremental costs. This also assumes that the only significant comorbidity occurs between diabetes, CHD, and stroke.

The adjusted numbers, however, may not present an accurate reflection of the disease burden associated with specific health conditions.

Table 4—Adjusted and diet-related medical costs, four health conditions, 1994[1]

Health condition	All cases, adjusted costs[2]	Diet-related costs[3]
	$ billion (1995)	
Coronary heart disease, stroke, and diabetes	85.3	19.4
Cancer	47.4	14.2
All 4 causes	132.7	33.6

[1] Includes hospital and nursing services, physician services, drugs, rehabilitation and institutional care, and special services.

[2] Numbers have been adjusted for double-counting by including only 45 percent of the costs associated with diabetes (see text).

[3] Attributes to diet 20 percent of CHD and stroke costs and 30 percent of cancer and diabetes costs (see text).

Source: USDA/ERS from numbers in table 3.

For this reason, the adjusted costs, as well as the diet-related costs presented below, are estimated in the aggregate for CHD, stroke, and diabetes. Furthermore, due to lack of data, the study focuses from this point on only on the costs associated with four health conditions—CHD, cancer, stroke, and diabetes.

Adjusted medical costs of CHD, cancer, stroke, and diabetes are presented in table 4. However, these costs still apply to all cases of each disease. Studies suggest that improved diets could reduce CHD and stroke mortality by at least 20 percent, and cancer and diabetes mortality by at least 30 percent (McGinnis and Foege, 1993; Willett, Colditz, and Mueller, 1996; and Trichopoulos, Li, and Hunter, 1996). These estimates are consistent with other estimates on the potential reduction in mortality based on risk removal (Rothenberg and Koplan, 1990; Gori and Richter, 1978). For lack of better data, we assume that if diet can reduce mortality by a certain percentage, it can also reduce the incidence of the disease by the same percentage—and that the same effect applies to costs. Therefore, this study attributes to diet 20 percent of the adjusted medical costs associated with CHD and stroke, and 30 percent of the adjusted medical costs associated with cancer and diabetes. Based on these assumptions,

Table 5—Lost productivity from disability for six health conditions, 1994[1]

Health condition	All cases[2]
	$ billion (1995)
Coronary heart disease	5.8
Cancer	14.4
Stroke	4.5
Diabetes	22.0
Hypertension[3]	4.2
Obesity	4.9

[1] Estimates updated to 1995 dollars using the average usual weekly earnings of employed part- time and full-time wage and salary workers of all ages, rounded to the nearest dollar.

[2] Numbers should not be added since they likely include some double-counting.

[3] Includes only costs associated with hypertension with and without renal disease; does not include costs associated with hypertensive heart disease or hypertensive heart and renal disease.

Source: USDA/ERS, see table 3.

over $33 billion in medical costs associated with CHD, cancer, stroke, and diabetes each year may be attributed to diet (table 4).

Lost Productivity Resulting From Disability

As with medical costs, data on lost productivity resulting from disability were obtained from the medical literature. The costs in table 5 represent the costs associated with all cases of each of six health conditions, updated to 1995 dollars using the Bureau of Labor Statistics average weekly earnings of employed full-time and part-time wage and salary workers. As with medical costs, these costs should not be added because they likely include double-counting. And as with medical costs, the unadjusted costs support the assertion that mortality data underestimate the true disease burden associated with diabetes.

Adjustments for double-counting of the lost productivity estimates in table 5 are identical to the adjustments made to medical costs, and assume that only 45 percent of the costs of diabetes represent incremental costs (table 6). The proportion of productivity losses attributed to diet is the same as the proportion of medical costs attributed to diet: 20 percent of the costs associated with CHD and stroke, and

Table 6—Adjusted and diet-related productivity losses from disability, four health conditions, 1994

Health condition	All cases, adjusted costs[1]	Diet-related costs[2]
	$ billion (1995)	
Coronary heart disease, stroke, and diabetes	20.2	5.0
Cancer	14.3	4.3
All 4 causes	34.5	9.3

[1] Numbers have been adjusted for double-counting by including only 45 percent of the costs associated with diabetes (see text).

[2] Attributes to diet 20 percent of CHD and stroke costs and 30 percent of cancer and diabetes costs (see text).

Source: USDA/ERS, estimated from numbers in table 5.

30 percent of the costs associated with cancer and diabetes. Over $9 billion per year in lost productivity associated with morbidity from CHD, cancer, stroke, and diabetes is attributed to diet (table 6).

Value of Diet-Related Premature Deaths

As with costs, diet-related deaths from CHD, cancer, stroke, or diabetes are a subset of all CHD, cancer, stroke, or diabetes deaths. Although studies suggest that improved diets could reduce CHD and stroke mortality by at least 20 percent, and cancer and diabetes mortality by at least 30 percent, this study did not consider that all deaths were equally affected by diet, and therefore imposed some constraints on those deaths that could be potentially affected by diet.

For example, because everyone must eventually die, the study determined that improved diets could postpone, but could not prevent, deaths. Therefore, for purposes of this study, only premature deaths could be attributable to diet. Following the American Heart Association (1996) convention, deaths occurring after the age of 75—the average life expectancy at birth—were not considered to be premature, and therefore were not considered to be affected by diet.

However, not all premature deaths from CHD, cancer, stroke, or diabetes can be attributed to diet, either. In particular, because the adverse health effects of diet are thought to be cumulative, they are not likely to manifest themselves during the early years of life. Therefore, CHD, cancer, stroke, or diabetes deaths among young individuals are probably not a result of poor dietary habits. However, the age at which the cumulative effects of diet begin to manifest themselves is not known. According to Harper (1990), "a high proportion of those who die (from CHD) at ages below 55 suffer from genetic defects of lipid metabolism, which are not highly responsive to diets." On the other hand, McGill and others (1997) observed differences in arterial lesions that were associated with serum level of low-density lipoproteins in individuals as young as 15 years who had died of external causes. To be on the conservative side, a premature CHD, cancer, stroke, or diabetes death was potentially associated with diet only if it occurred in individuals older than 55. In summary, for this study, only deaths among individuals 55-74 years of age were considered to be potentially related to diet.

In 1994, individuals 55-74 years of age accounted for 38 percent of all deaths from CHD, cancer, stroke, and diabetes (table 2). More specifically, this age group accounted for 31 percent of all deaths from CHD, 47 percent of all cancer deaths, 23 percent of all deaths from stroke, and 42 percent of all deaths from diabetes.

However, even among individuals age 55-74, not all CHD, cancer, stroke, and diabetes deaths can be attributed to diet. Following McGinnis and Foege (1993), 20 percent of CHD and stroke deaths and 30 percent of diabetes deaths were defined as being diet-related; following Trichopoulos, Li, and Hunter (1996) and Willett, Colditz, and Mueller (1996), 30 percent of cancer deaths were defined as being diet-related. Based on these definitions, there were 119,912 diet-related premature deaths in 1994 among individuals 55-74 years, accounting for 5.3 percent of all deaths in the United States (all deaths, among all ages, from all causes). Individuals 65-74 years accounted for 67 percent of all diet-related premature deaths from CHD, cancer, stroke, or diabetes.

The value of these diet-related premature deaths from CHD, cancer, stroke, or diabetes was estimated based on interpolations of the Landefeld and Seskin's age-specific estimates (Buzby and others, 1996), averaged across genders and updated to 1995 values with usual weekly earnings of part-time and full-time employed wage and salary workers. We used the value of life at the midpoint of the relevant age ranges: $412,751 for a death at age 60, and $143,760 for a

Table 7—Number and value of diet-related premature deaths, 1994

Cause of diet-related death	Age at death 55-64	65-74
	Number of diet-related deaths[1]	
Coronary heart disease	9,113	20,836
Stroke	1,915	5,077
Diabetes	2,335	4,723
Cancer	26,775	49,138
All 4 causes	40,138	79,774
	$ billion (1995)	
Value[2]	16.6	11.4

[1] Defined as 20 percent of CHD or stroke deaths, and 30 percent of cancer or diabetes deaths, among those who died between ages 55 and 74.

[2] Deaths among those age 55-64 are valued at $412,751 in 1995 dollars, and deaths among those age 65-74 are valued at $143,760.

Source: USDA/ERS, adapted from Singh and others, 1996.

death at age 70.[9] Multiplying these values by the appropriate number of diet-related premature deaths from CHD, cancer, stroke, or diabetes yields an economic value of $28 billion per year (table 7).

Conclusion

Total economic costs attributed to diet in the United States were obtained by adding diet-related medical costs, diet-related productivity losses from disability, and the economic value of diet-related premature deaths. The total economic cost attributable to diet associated with CHD, cancer, stroke, and diabetes add to $70.9 billion (table 8). Medical costs account for nearly half of the total (47 percent), premature deaths account for 39 percent, and lost productivity associated with morbidity accounts for the remaining 13 percent.

The conservative assumptions used in this study suggest that the $70.9-billion estimate understates the true costs associated with current dietary patterns in the United States. For example, diet-related

[9] These values are considerably lower than the $3.6-million lower bound of the "value of life" obtained by willingness-to-pay studies.

Table 8—Diet-related costs for four health conditions exceed $70 billion, 1994

Diet-related health condition	Medical costs	Lost productivity	Premature deaths	Total economic costs
		$ billion (1995)		
Coronary heart disease, stroke and diabetes	19.4	5.0	9.9	34.3
Cancer	14.2	4.3	18.1	36.7
All 4 causes	33.6	9.3	28.0	70.9

Source: USDA/ERS, estimated from tables 4, 6, and 7.

premature deaths from CHD, cancer, stroke, or diabetes, as defined in this study, accounted for only 5.3 percent of all deaths in the United States, considerably less than the 14 percent of all deaths attributed to diet and/or inactivity by McGinnis and Foege (1993). Furthermore, the estimates do not include diet-related costs associated with osteoporosis, hypertension, overweight, and neural tube birth defects, which would clearly increase the costs associated with diets. For example, including the costs of diet-related osteoporosis hip fractures would add $5.1-$10.6 billion each year to the costs associated with poor diets (Barefield, 1996).

In addition, although the dollar values of medical costs and lost productivity were updated to reflect changes in the price level of wages, earnings, and productivity, they do not reflect the increased number of cases associated with these health conditions. Although age-adjusted death rates are declining for most of the diet-related health conditions, the number of cases is increasing because of the aging of the population. For example, the American Cancer Society (1997) estimates there are 1 million new cases of cancer diagnosed each year (1 million more in 1990 than in 1989; 1 million more in 1991 than in 1990, etc.).

Nor do the estimates reflect technological advances that improve treatment—but may also increase the cost of treatment as well as affect the quality of life of the remaining years. These may be particularly important issues for CHD and stroke, in particular, where declines in mortality appear to be due more to improvements in medical management and technology than to primary prevention and reduced incidence (Goldman and Hunink, 1997, Hunink and others, 1997). Survivors might have to cope with increased disability during their remaining years. The increased frequency of hospitalization associated with CHD and stroke that has accompanied the drop in mortality rates suggests that a large proportion of increased life expectancy may be associated with a gain in "disabled" years (Rothenberg and Koplan, 1990). However, the "value-of-life" estimates used in this study do not account for quality-of-life issues, and are considerably lower than the $3.6-$8.4 million per life (in 1995 dollars) obtained from willingness-to-pay studies (Viscusi, 1993). Valuing each of the 119,912 diet-related premature deaths at $3.6 million results in total economic costs of more than $474 billion each year attributable to diet (this includes the $43 billion in medical costs and lost productivity).

With the U.S. population growing older, the number of those affected by chronic health conditions is expected to increase, with important consequences for health expenditures and quality of life during the older years. The National Osteoporosis Foundation has estimated that, because osteoporosis affects primarily the elderly, the direct medical costs of osteoporosis will increase six-fold by the year 2000 and 20-fold by the year 2040 (McBean, Forgac, and Finn, 1994).

In addition, the increasing weight problem in the United States—and, in particular, the increased prevalence of overweight among children and teenagers—is anticipated to bring about an increase in the prevalence of chronic health problems for which overweight is a predisposing or risk factor, such as CHD, cancer, stroke, diabetes, and hypertension. It is also possible that these chronic problems will begin to manifest themselves at an earlier age (DeBrosse, 1997). Both of these outcomes would lead to increased diet-related costs.

All of these factors suggest that the $70.9 billion in costs attributed to diet represent a low estimate, and that considerably larger economic benefits might result from more healthful dietary patterns. With health care spending topping $1 trillion in 1996 and accounting for over 13 percent of gross domestic product (Levit and others, 1998), the potential for large savings in health care costs from more healthful diets merits closer attention.

However, in spite of efforts by public and private agencies to educate consumers about more healthful diets and how to achieve them, Americans are far from the mark. For many, dietary improvements are offset by pitfalls (see chapters 3, 4, 5, 6, 7). Continued and improved efforts are needed to further inform, educate, and motivate consumers to make appropriate dietary changes.

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Chapter 2

Dietary Recommendations and How They Have Changed Over Time

Carole Davis and Etta Saltos

The U.S. Department of Agriculture has been issuing dietary recommendations for over 100 years. As the research base underlying these recommendations has expanded considerably over the century, dietary recommendations have evolved to keep pace with both the new findings and the changing patterns in food consumption and activity of the population. In spite of these changes, many of today's dietary recommendations remain impressively similar to those of yesterday.

Introduction

Nutritionists in both the public and private sectors have been giving dietary advice to Americans for more than a century. However, the research base underlying dietary recommendations has expanded considerably in that time.

When the U.S. Department of Agriculture (USDA) published its first dietary recommendations in 1894, specific vitamins and minerals had not even been discovered. Since then, researchers have identified a number of vitamins and minerals that are essential to health, and have determined the minimum levels required to prevent nutritional deficiencies such as scurvy and beriberi. Food policies—such as iodine fortification of salt and the enrichment of flour products with

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B-vitamins—together with consumer education, have eliminated many nutritional deficiencies in the United States.

With the elimination of many nutritional deficiencies and improved control over infectious diseases, chronic diseases such as heart disease, cancer, and stroke have become more prevalent causes of death. Nutrition research began to focus on the connection between excessive consumption of certain dietary components—fat, saturated fat, cholesterol, and sodium—and the risk for chronic health conditions. More recently, research has expanded to other dietary components such as dietary fiber and antioxidants, and the role that low consumption levels of these may play in the development of certain chronic diseases.

As the knowledge base about nutrition has expanded over the century, dietary recommendations have evolved to keep pace with both the new findings as well as with changing patterns in food consumption and physical activity. Yet, in spite of all these changes, many of today's dietary recommendations remain impressively similar to those of yesterday.

Early Food Guidance—1900 to 1940's

The first published dietary guidance by the USDA was a Farmers' Bulletin written in 1894 by W.O. Atwater, the first director of the Office of Experiment Stations in USDA. He suggested diets for American males based on content of protein, carbohydrate, fat, and "mineral matter" (ash) (Atwater, 1894). Specific minerals and vitamins had not been identified at that time.

Atwater initiated the scientific basis for connecting food composition, dietary intake, and health, and emphasized the importance of variety, proportionality, and moderation in healthful eating:

> *Unless care is exercised in selecting food, a diet may result which is one-sided or badly balanced—that is, one in which either protein or fuel ingredients (carbohydrate and fat) are provided in excess.... The evils of overeating may not be felt at once, but sooner or later they are sure to appear—perhaps in an excessive amount of fatty tissue, perhaps in general debility, perhaps in actual disease.*
>
> (Atwater, 1902)

Atwater's research on food composition and nutritional needs set the stage for development of a food guide. A food guide translates nutrient intake recommendations into food intake recommendations. It provides a conceptual framework for selecting the kinds and amounts of foods, which together provide a nutritionally satisfactory diet.

The first USDA food guide, *Food for Young Children*, by Caroline Hunt, a nutritionist, appeared in 1916 (Hunt, 1916) (table 1). Foods were categorized into five groups—milk and meat, cereals, vegetables and fruits, fats and fatty foods, and sugars and sugary foods. This food guide was followed in 1917 by dietary recommendations also based on these five food groups, targeted to the general public in *How to Select Foods* (Hunt and Atwater, 1917). A guide was released in 1921 using the same five food groups and suggesting amounts of foods to purchase each week for the average family (Hunt, 1921). This publication was slightly modified in 1923 (Hunt, 1923) to include households that differed from the average five-member size. These guides remained popular throughout the 1920's.

In the early 1930's, the economic constraints of the Depression influenced dietary guidance. In 1933, Hazel Stiebeling, a USDA food economist, developed food plans at four cost levels to help people shop for food (table 1). The plans were outlined in terms of 12 major food groups to buy and use in a week to meet nutritional needs (Stiebeling and Ward, 1933). Research to provide guidance on selecting a healthful diet at different cost levels continues at USDA (Cleveland and others, 1983).

Dietary Guidance—1940's to 1970's

In 1941, President Franklin Roosevelt called the National Nutrition Conference for Defense (National Nutrition Conference for Defense, 1941) memorable for the release of the first set of Recommended Dietary Allowances (RDA's) by the Food and Nutrition Board of the National Academy of Sciences. These RDA's listed specific recommended intakes for calories and nine essential nutrients—protein, iron, calcium, vitamins A and D, thiamin, riboflavin, niacin, and ascorbic acid (vitamin C). The conference also addressed the need for public nutrition education and promoted 10 characteristics of a truly effective program—characteristics still recommended today (table 2).

As part of this effort, USDA released the Basic Seven food guide in 1943 as the leaflet National Wartime Nutrition Guide, and revised it in 1946 as the National Food Guide (table 1). This guide specified a foundation diet that would provide a major share of the RDA's for nutrients, but only a portion of caloric needs. It was assumed that people would include more foods than the guide recommended to satisfy their full calorie and nutrient needs. Little guidance was provided about the use of fats and sugars. The wartime version of the Basic Seven was intended to help people cope with limited supplies of certain foods during the war (USDA, 1943). The 1946 version suggested numbers of food group servings and was widely used for over a decade (USDA, 1946). However, its complexity and lack of specifics regarding serving sizes led to the need for modification.

A new food guide that also specified a foundation diet was released by USDA in 1956 (table 1). Popularly known as the "Basic Four," the guide recommended a minimum number of foods from each of four food groups—milk, meat, fruits and vegetables, and grain products (Page and Phipard, 1956). This food guide, with its focus on getting enough nutrients, was widely used for the next two decades.

New Directions for Dietary Guidance—1970's to the 1990's

By the 1970's, a growing body of research had related overconsumption of certain food components—fat, saturated fat, cholesterol, and sodium—and the risk of chronic diseases, such as heart disease and stroke. In 1977, *Dietary Goals for the United States* by the Senate Select Committee on Nutrition and Human Needs (U.S. Senate, 1977) heralded a new direction for dietary guidance. The focus shifted from obtaining adequate nutrients to avoiding excessive intakes of food components linked to chronic diseases. The report specified quantitative goals for intakes of protein, carbohydrate, fatty acids, cholesterol, sugars, and sodium. Because diets developed using these goals were so different from usual food patterns, USDA did not adopt the goals as the basis for its food plans and guides. However, the goals drew attention to the need for new guidance on diet and health.

USDA began addressing the role of fats, sugars, and sodium in risks for chronic diseases in its 1979 publication, *Food* (USDA, 1979). This colorful bulletin presented a new food guide, the *Hassle-Free Guide to* *a Better Diet* (table 1). This guide modified the "Basic Four" to highlight a fifth food group—fats, sweets, and alcoholic beverages—targeted for moderation. Also in 1979, the Department of Health, Education, and Welfare [now the Department of Health and Human Services (DHHS)] released a study by the American Society for Clinical Nutrition (ASCN) on the relationship between dietary practices and health outcomes. The findings, presented in *Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention*, suggested that people reduce their consumption of excess calories, fat and cholesterol, salt, and sugar to lower disease rates.

Responding to the public's need for authoritative, consistent guidance on diet and health, USDA and DHHS together issued seven principles for a healthful diet. The guidelines, intended for healthy Americans age 2 and older, were based in part on the 1979 Surgeon General's Report and were published in 1980 as the first edition of *Nutrition and Your Health: Dietary Guidelines for Americans* (USDA and DHHS, 1980). The guidelines called for a variety of foods to provide essential nutrients while maintaining recommended body weight and moderating dietary constituents—fat, saturated fat, cholesterol, and sodium—that might be risk factors in certain chronic diseases. Although the guidelines were directional, not quantitative, their release prompted some concern among consumer, commodity, and food industry groups—as well as nutrition scientists—who questioned the causal relationship between certain guidelines and health.

With the release of the first edition of the *Dietary Guidelines*, USDA began work on development of a new food guide that would help consumers implement the guidelines in their daily food choices. Development and documentation of the research base for the food guide took the Department about 3 years (USDA, 1993). Focusing on the total diet rather than the foundation diet described by earlier guides, the new food guide emphasized how to make food selections to meet both nutrient objectives and to moderate intake of those components related to risk of chronic diseases. It outlined suggested numbers of servings from each of five major food groups—the bread, cereal, rice, and pasta group; the vegetable group; the fruit group; the milk, yogurt, and cheese group; and the meat, poultry, fish, dry beans, eggs, and nuts group—and recommended sparing use of a sixth food group—fats, oils, and sweets.

Table 1—Principal USDA Food Guides, 1916-92

(All food guide recommendations are for daily servings (svg), except where otherwise indicated.)

Food guide	Number of food groups	Protein-rich foods Milk/Meat	Breads
1916 Caroline Hunt buying guides	5	Meats/other protein-rich food 10% cal milk; 10% cal other *1 cup milk plus 2-3 svg other* (based on 3-oz. serving)	Cereals and other starchy foods 20% cal *9 svg* (based on 1 oz. or 3/4 cup dry cereal svg)
1930's H.K. Stiebeling buying guide	12	Milk–*2 cups* Lean meat/poultry/fish—*9-10/week* Dry mature beans, peas, nuts–*1/week* Eggs—*1*	Flours, cereals— *As desired*
1940's Basic Seven foundation diet	7	Milk and milk products— *2 cups or more* Meat, poultry, fish, eggs, dried beans, peas, nuts—*1-2*	Bread, flour, and cereals—*Every day*
1956-70's Basic Four foundation diet	4	Milk group—*2 cups or more* Meat group—*2 or more* (2-3 oz. svg)	Bread, cereal— *4 or more* (1 oz. dry, 1 slice, 1/2-3/4 cup cooked)
1979 Hassle-Free foundation diet	5	Milk-cheese group—*2* (1 cup, 1 1/2 oz. cheese) Meat, poultry, fish, and beans group—*2* (2-3 oz. svg)	Bread-cereal group—*4* (1 oz. dry, 1 slice, 1/2 to 3/4 cup cooked)
1984 Food Guide Pyramid total diet	6	Milk, yogurt, cheese–*2-3* (1 cup, 1 1/2 oz. cheese) Meat, poultry, fish, eggs, dry beans, nuts—*2-3* (5-7 oz. total/day)	Breads, cereals, rice, pasta— *6-11 svg* • Whole grain • Enriched (1 slice, 1/2 cup cooked)

--Continued

Table 1—Principal USDA Food Guides, 1916-92—continued
(All food guide recommendations are for daily servings (svg), except where otherwise indicated.)

Food Guide	Vegetables/Fruit	Other (incl. fats)
1916	Vegetables and fruit 30% cal *5 svg* (based on average 8 oz. svg.)	Fatty foods (20% cal)—*9*; Sugars (10% cal)–*10* (based on 1 tbsp. svg)
1930's	Leafy green/yellow—*11-12/week* Potatoes, sweet potatoes—*1* Other veg/fruit—*3* Tomatoes and citrus—*1*	Butter—*na* Other fats—*na* Sugars—*na*
1940's	Leafy green/yellow—*1 or more* Potatoes, other fruit/veg—*2 or more* Citrus, tomato, cabbage, salad greens—*1 or more*	Butter, fortified margarine— *Some daily*
1956-70's	Vegetable-fruit group— *4 or more* (incl. dark green/yellow veg frequently and citrus daily; 1/2 cup or average-size piece)	
1979	Vegetable-fruit group—*4* (incl. vit. C source daily and dark green/yellow veg. frequently 1/2 cup or typical portion)	Fats, sweets, alcohol— *Use dependent on calorie needs*
1984	Vegetable—*3-5* • Dark green/deep yellow • Starchy/legumes • Other (1 cup raw, 1/2 cup cooked) Fruit—*2-4* • Citrus • Other (1/2 cup or average)	Fats, oils, sweets— *Total fat not to exceed 30% cal* *Sweets vary according to calorie needs*

Source: USDA, Human Nutrition Information Service, 1993.

Table 2—Characteristics of an effective nutrition education program

A truly effective nutrition education program will—

- Reach the whole population—all groups, all races, both sexes, all creeds, all ages.
- Recognize motives for action and include suggestions on what to do and how to do it.
- Develop qualified leadership.
- Drive home the same ideas many times and in many ways.
- Employ every suitable education tool available.
- Adapt those tools to the many and varied groups to be reached and use them with intelligence and skill.
- Consider all phases of individual, family, and group situations that have a bearing upon ability to produce, buy, prepare, conserve, and consume food.
- Afford opportunity for participation in making, putting into effect, and evaluating local nutrition programs.
- Enlist the fullest participation of all citizens and work through every possible channel to reach the people.
- Be adequately financed.

Source: National Nutrition Conference for Defense, 1941

The food guide, *A Pattern for Daily Food Choices*, was first presented to consumers in a food wheel graphic as part of a 1984 nutrition course developed by USDA in cooperation with the American National Red Cross (American Red Cross, 1984). The food guide was also used in tabular form in several USDA publications published in the 1980's (USDA, 1986, 1989).

Since 1980, the *Dietary Guidelines for Americans* have been revised and issued jointly by USDA and DHHS every 5 years, after thorough review of its scientific basis by nongovernmental experts invited to participate in a Federal Dietary Guidelines Advisory Committee. The second edition of the *Dietary Guidelines*, released in 1985, was very similar to the first. Some changes were made to provide guidance about nutrition topics that became more prominent after 1980, such as following unsafe weight-loss diets, using large-dose supplements, and drinking of alcoholic beverages by pregnant women (USDA and DHHS, 1985). This edition received wide acceptance and was used as the framework for consumer nutrition education messages. It was also used as a guide for healthy diets by scientific, consumer, and industry groups.

Throughout the 1980's and into the 1990's, USDA developed and disseminated a number of publications and other materials designed to help the public use the *Dietary Guidelines*. These included *Ideas for Better Eating* (USDA, 1981), which presented sample menus; *Dietary Guidelines and Your Diet* (USDA, 1986, 1988), providing more detailed information and ways to apply the guidelines; *Dietary Guidelines and Your Diet: Home Economics Teacher's Guide* (USDA, 1988) and *Dietary Guidelines and Your Health: Health Educator's Guide to Nutrition and Health* (USDA, 1993a), two specialized curricula for use by junior and senior high school home economics and health education teachers; *Making Healthy Food Choices* (USDA, 1993c), targeted toward low-literacy adults; and *Food Facts for Older Adults* (USDA, 1993b), targeted toward healthy older adults.

In 1989, USDA and DHHS established a second advisory committee to review the 1985 *Dietary Guidelines* and make recommendations for revision. *The Surgeon General's Report on Nutrition and Health* (DHHS, 1988) and the National Research Council's 1989 report *Diet and Health: Implications for Reducing Chronic Disease Risk* were key resources used by the committee.

The Surgeon General's Report on Nutrition and Health provided a comprehensive review of scientific evidence in support of Federal nutrition policy as stated in the 1985 *Dietary Guidelines for Americans*. Recommendations in the report promoted a dietary pattern that emphasized consumption of vegetables, fruits, and whole-grain products—foods rich in complex carbohydrates and fiber—and of fish, poultry without skin, lean meats, and low-fat dairy products selected to reduce consumption of total fat, saturated fat, and cholesterol.

The National Research Council's *Diet and Health* report concluded that reducing total fat and saturated fat consumption was the most important dietary change needed to reduce risk of chronic diseases such as cardiovascular disease and certain cancers. The Council's Food and Nutrition Board recommended a total fat intake of 30 percent or less of calories, saturated fat intake of less than 10 percent of calories, less than 300 mg of cholesterol daily, five or more daily servings of vegetables and fruits, and six or more daily servings of breads, cereals, and legumes.

The 1990 Dietary Guidelines Advisory Committee's review also considered the utility of the 1985 *Guidelines* to the public, drawing on

USDA-sponsored research conducted at the University of Wisconsin and Pennsylvania State University on use of the bulletin by professionals and consumers.

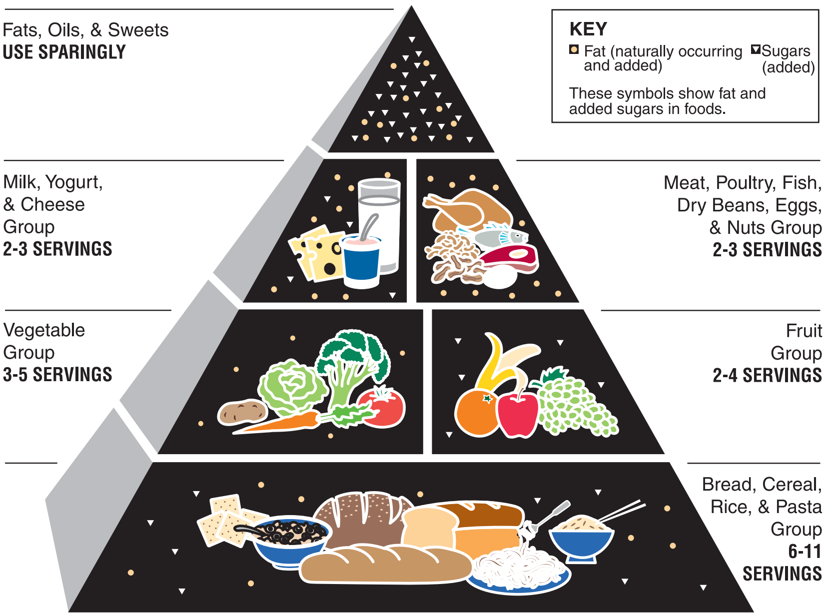
The Wisconsin study found the Guidelines to be well accepted and valued as a consensus document by Federal, State, and local professionals involved in the communication of food and nutrition information (Steele, 1990). These professionals recommended that the *Dietary Guidelines* be kept constantly before the public, in a variety of presentations. The Pennsylvania State University study indicated that consumers wanted more specific food-related guidance, definition of technical terms, and practical tips for behavior change strategies (Achterberg and others, 1989; Achterberg and others, 1991).

The basic tenets were reaffirmed in the third edition of the *Dietary Guidelines* (USDA and DHHS, 1990), which promoted enjoyable and healthful eating through variety and moderation, instead of dietary restriction. For the first time, the guidelines suggested numerical goals for total fat—30 percent or less of calories—and for saturated fat—less than 10 percent of calories. The goals were for diets over several days, not for one meal or one food. These goals were consistent with recommendations in the Diet and Health report and those suggested for the National Cholesterol Education Program of the National Heart, Lung, and Blood Institute in DHHS (National Cholesterol Education Program, 1993). The *Dietary Guidelines* brochure provided more practical advice on how to implement the *Guidelines* in daily food choices by including the food guide—*A Pattern for Daily Food Choices*—developed by USDA in the early 1980's.

Release of the Food Guide Pyramid and the Nutrition Facts Label—1990's

Although USDA's food guide, *A Pattern for Daily Food Choices*, had been used in Department publications since the mid-1980's, it was not well known. Therefore, work began in 1988 to develop a graphic presentation of the food guide that conveyed the key concepts of the guide—variety, proportionality, and moderation. Consumer studies were conducted with adults having a high school education who were not overly constrained by food cost concerns and who had eating patterns typical of the general U.S. population. After this testing, the food guide graphic was presented as a pyramid design (fig. 1).

Figure 1
Food Guide Pyramid



Source: U.S. Department of Agriculture/U.S. Department of Health and Human Services

Additional testing was done with those at nutritional risk—children, low-literate adults, and low-income adults—who are beneficiaries of USDA's nutrition assistance programs.

A consumer booklet devoted entirely to a description of the food guide and how to use it was developed by USDA and supported by DHHS. The *Food Guide Pyramid* was released in 1992 with the objective of helping consumers put the *Dietary Guidelines* into action (USDA, 1992). In it, variety among food groups is shown by the names of the food groups and by the separate sections of the pyramid. Variety within food groups is illustrated by pictures of typical food items. Proportionality is conveyed by the size of the food group sections and the text stating numbers of servings. Moderation of foods high in fat and added sugars is represented by the small tip of the pyramid and text specifying that they be used sparingly. Moderation related to food choices within food groups is shown by the density of the fat and sugars symbols in the food groups. The text of the food guide booklet provides additional information on how to choose foods that are low in fat, saturated fat, cholesterol, added sugars, or sodium within each food group.

Since its release, the *Food Guide Pyramid* has been widely used by nutrition and health professionals, educators, the media, and the food industry. Its use in a variety of materials—including posters, textbooks, school curricula, computer software, and on food labels—has helped to disseminate the *Dietary Guidelines* message.

The Nutrition Labeling and Education Act of 1990 (NLEA) mandated the use of nutrition information on virtually all packaged and processed foods. The law, implemented in mid-1994, provided an additional tool—the Nutrition Facts Label—consumers could use to select a healthy diet within the framework of the *Food Guide Pyramid*.

Fourth Edition of the *Dietary Guidelines for Americans*—1995

A Dietary Guidelines Advisory Committee was appointed in 1994 by USDA and DHHS to review the 1990 edition of the *Dietary Guidelines* to determine if, based on current scientific knowledge, revisions were warranted. Whereas the 1980, 1985, and 1990 editions of the *Guidelines* had been issued voluntarily by the two Departments, the 1995 edition was the first report mandated by statute—the 1990 National Nutrition Monitoring and Related Research Act (7 U.S.C. 5341). This legislation requires the Secretaries of Agriculture and Health and Human Services jointly to publish a report titled *Dietary Guidelines for Americans* at least every 5 years.

Although the titles of the dietary guidelines have changed over the past 15 years, there have been few changes in the overall concepts. There are seven guidelines for each of the four editions (table 3). The target audience has remained the same—healthy Americans 2 years of age and older.

Table 3—Dietary guidelines for Americans, 1980-95

1980	1985	1990	1995
Eat a variety of foods.	Eat a variety of foods.	Eat a variety of foods.	Eat a variety of of foods.
Maintain ideal weight.	Maintain desirable weight.	Maintain healthy weight.	Balance the food you eat with physical activity—maintain or improve your weight.
Avoid too much fat, saturated fat, and cholesterol.	Avoid too much fat, saturated fat, and cholesterol.	Choose a diet low in fat, saturated fat, and cholesterol.	Choose a diet with plenty of grain products, vegetables, and fruits.*
Eat foods with adequate starch and fiber.	Eat foods with adequate starch and fiber.	Choose a diet w/plenty of vegetables, fruits, and grain products.	Choose a diet low in fat, saturated fat, and cholesterol.*
Avoid too much sugar.	Avoid too much sugar.	Use sugars only in moderation.	Choose a diet moderate in sugars.
Avoid too much sodium.	Avoid too much sodium.	Use salt and sodium only in moderation.	Choose a diet moderate in salt and sodium.
If you drink alcohol, do so in moderation.	If you drink alcoholic beverages, do so in moderation.	If you drink alcoholic beverages, do so in moderation.	If you drink alcoholic beverages, do so in moderation.

* In the 1995 edition, the order of the third and fourth guidelines was reversed.
Source: USDA/DHHS, 1980, 1985, 1990, 1995..

New information in the 1995 *Dietary Guidelines* included:

- use of the Nutrition Facts Label and Food Guide Pyramid graphic
- boxes highlighting good food sources of key nutrients such as iron and calcium
- a statement recognizing that vegetarian diets can meet RDA's and conform with the dietary guidelines
- changes in the weight guideline to emphasize the benefits of physical activity, to encourage weight maintenance as a first step to achieving a healthy weight, and to discourage weight gain with age for adults

- replacement of the weight table with a chart that illustrates weight ranges for healthy weight, moderate overweight, and severe overweight
- movement of the grain products, vegetables, and fruits guideline from fourth to third position to give it more prominence, and a slight change in the title to be consistent with the placement of food groups in the *Food Guide Pyramid*
- addition of specific guidance regarding dietary fat intake among children (gradual decrease to no more than 30 percent of calories from fat between the ages of 2 and 5 years) and more information about types and sources of fatty acids
- increased emphasis on sugars as a calorie source and less on the relationship of sugars to health
- information about the relationship of nutrients other than sodium to blood pressure
- referral of readers to food label standards for dietary cholesterol and sodium intake without making specific recommendations
- a statement about the potential benefit of moderate alcohol intake in reducing the risk for heart disease in some individuals.

For the first time, the *Dietary Guidelines* brochure was also made available electronically through the World Wide Web. The *Dietary Guidelines* continue to form the basis of Federal nutrition policy and have provided a consensus as to what makes a healthy diet.

The Future for Dietary Guidance

Dietary guidelines will continue to be revised as the science base evolves. In the *Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 1995* (USDA, 1995), the Committee recognized the difficulty of having a single bulletin address the needs of consumers, policymakers, and health professionals. The Committee recommended changes in the process used to develop the guidelines, following a two-step approach—first, to determine the most important nutrition-related public health issues and dietary strategies on which to focus; and second, to determine effective communication messages to educate the public and change their behavior.

The Dietary Guidelines Advisory Committee's recommendation is consistent with a shift in emphasis, both in USDA and the nutrition education profession, from simply providing knowledge to allow consumers to make informed decisions about healthy eating practices to actually motivating them to bring about behavior change. Encouraging audiences to adopt different eating practices is a large undertaking. Behavioral change is motivated not by knowledge alone, but also by a supportive social environment and the availability of facilitative services. Thus, future research efforts will be devoted to learning more about the target audience—their environment and what motivates their food decisions. Research is also needed to develop methods to evaluate the effectiveness of nutrition education programs to determine if behavior is changing.

Recent research shows that consumers feel frustrated when they hear different nutrition messages from different sources. In a USDA survey of main meal planners/preparers, over 40 percent strongly agreed with the statement, "There are so many recommendations about healthy ways to eat, it's hard to know what to believe" (USDA, 1996). Almost half of respondents to an American Dietetic Association (ADA) telephone survey of adults responded that they found news reports on nutrition to be confusing. Eighty-one percent of respondents reported that they would prefer to hear about new research only after there is acceptance among nutrition and health professionals (versus hearing about all studies individually) (ADA, 1995). Therefore, it is important for nutrition educators to speak with one voice. At the same time, many government agencies and private sector organizations are faced with budget constraints. Nutrition educators are being asked to do more with less. Because of these trends, there will continue to be an increase in partnerships and cooperation between the public and private sector.

An example of one such cooperative effort is the Dietary Guidelines Alliance, which has participation from USDA, DHHS, industry groups, and the American Dietetic Association. The Alliance was formed to develop effective, consumer-focused nutrition education messages based on the *Dietary Guidelines for Americans*. Nutrition education messages jointly produced in this way will increasingly focus on motivating behavior change.

Nutrition educators will also be faced with increasing questions from consumers concerning the nutritive value and safety of the many new food products appearing in the marketplace. Some of these products are due to new technology (e.g., fat replacers and sugar substitutes).

Other new food products result from the introduction of ethnic foods into the market in response to demand for such products from a more culturally diverse population. New dietary guidance materials will need to address the use of these foods and how they fit into the diet. For example, the 1995 *Dietary Guidelines* bulletin (USDA and DHHS, 1995) includes ethnic foods in the list of good food sources of nutrients and includes a special discussion of the role of sugar substitutes in the diet.

Since the initial release of the *Dietary Guidelines for Americans* in 1980, each edition has gained in acceptance and use by both professionals and consumers. As nutrition guidance advances into the 21st century, the underlying themes of variety, proportionality, and moderation—initiated about 100 years ago and reinforced by the dietary guidelines—will likely still apply to choosing healthful diets for many years to come.

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Chapter 2

Dietary Recommendations and How They Have Changed Over Time

Carole Davis and Etta Saltos

The U.S. Department of Agriculture has been issuing dietary recommendations for over 100 years. As the research base underlying these recommendations has expanded considerably over the century, dietary recommendations have evolved to keep pace with both the new findings and the changing patterns in food consumption and activity of the population. In spite of these changes, many of today's dietary recommendations remain impressively similar to those of yesterday.

Introduction

Nutritionists in both the public and private sectors have been giving dietary advice to Americans for more than a century. However, the research base underlying dietary recommendations has expanded considerably in that time.

When the U.S. Department of Agriculture (USDA) published its first dietary recommendations in 1894, specific vitamins and minerals had not even been discovered. Since then, researchers have identified a number of vitamins and minerals that are essential to health, and have determined the minimum levels required to prevent nutritional deficiencies such as scurvy and beriberi. Food policies—such as iodine fortification of salt and the enrichment of flour products with

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B-vitamins—together with consumer education, have eliminated many nutritional deficiencies in the United States.

With the elimination of many nutritional deficiencies and improved control over infectious diseases, chronic diseases such as heart disease, cancer, and stroke have become more prevalent causes of death. Nutrition research began to focus on the connection between excessive consumption of certain dietary components—fat, saturated fat, cholesterol, and sodium—and the risk for chronic health conditions. More recently, research has expanded to other dietary components such as dietary fiber and antioxidants, and the role that low consumption levels of these may play in the development of certain chronic diseases.

As the knowledge base about nutrition has expanded over the century, dietary recommendations have evolved to keep pace with both the new findings as well as with changing patterns in food consumption and physical activity. Yet, in spite of all these changes, many of today's dietary recommendations remain impressively similar to those of yesterday.

Early Food Guidance—1900 to 1940's

The first published dietary guidance by the USDA was a Farmers' Bulletin written in 1894 by W.O. Atwater, the first director of the Office of Experiment Stations in USDA. He suggested diets for American males based on content of protein, carbohydrate, fat, and "mineral matter" (ash) (Atwater, 1894). Specific minerals and vitamins had not been identified at that time.

Atwater initiated the scientific basis for connecting food composition, dietary intake, and health, and emphasized the importance of variety, proportionality, and moderation in healthful eating:

> *Unless care is exercised in selecting food, a diet may result which is one-sided or badly balanced—that is, one in which either protein or fuel ingredients (carbohydrate and fat) are provided in excess.... The evils of overeating may not be felt at once, but sooner or later they are sure to appear—perhaps in an excessive amount of fatty tissue, perhaps in general debility, perhaps in actual disease.*

(Atwater, 1902)

Atwater's research on food composition and nutritional needs set the stage for development of a food guide. A food guide translates nutrient intake recommendations into food intake recommendations. It provides a conceptual framework for selecting the kinds and amounts of foods, which together provide a nutritionally satisfactory diet.

The first USDA food guide, *Food for Young Children*, by Caroline Hunt, a nutritionist, appeared in 1916 (Hunt, 1916) (table 1). Foods were categorized into five groups—milk and meat, cereals, vegetables and fruits, fats and fatty foods, and sugars and sugary foods. This food guide was followed in 1917 by dietary recommendations also based on these five food groups, targeted to the general public in *How to Select Foods* (Hunt and Atwater, 1917). A guide was released in 1921 using the same five food groups and suggesting amounts of foods to purchase each week for the average family (Hunt, 1921). This publication was slightly modified in 1923 (Hunt, 1923) to include households that differed from the average five-member size. These guides remained popular throughout the 1920's.

In the early 1930's, the economic constraints of the Depression influenced dietary guidance. In 1933, Hazel Stiebeling, a USDA food economist, developed food plans at four cost levels to help people shop for food (table 1). The plans were outlined in terms of 12 major food groups to buy and use in a week to meet nutritional needs (Stiebeling and Ward, 1933). Research to provide guidance on selecting a healthful diet at different cost levels continues at USDA (Cleveland and others, 1983).

Dietary Guidance—1940's to 1970's

In 1941, President Franklin Roosevelt called the National Nutrition Conference for Defense (National Nutrition Conference for Defense, 1941) memorable for the release of the first set of Recommended Dietary Allowances (RDA's) by the Food and Nutrition Board of the National Academy of Sciences. These RDA's listed specific recommended intakes for calories and nine essential nutrients—protein, iron, calcium, vitamins A and D, thiamin, riboflavin, niacin, and ascorbic acid (vitamin C). The conference also addressed the need for public nutrition education and promoted 10 characteristics of a truly effective program—characteristics still recommended today (table 2).

As part of this effort, USDA released the Basic Seven food guide in 1943 as the leaflet National Wartime Nutrition Guide, and revised it in 1946 as the National Food Guide (table 1). This guide specified a foundation diet that would provide a major share of the RDA's for nutrients, but only a portion of caloric needs. It was assumed that people would include more foods than the guide recommended to satisfy their full calorie and nutrient needs. Little guidance was provided about the use of fats and sugars. The wartime version of the Basic Seven was intended to help people cope with limited supplies of certain foods during the war (USDA, 1943). The 1946 version suggested numbers of food group servings and was widely used for over a decade (USDA, 1946). However, its complexity and lack of specifics regarding serving sizes led to the need for modification.

A new food guide that also specified a foundation diet was released by USDA in 1956 (table 1). Popularly known as the "Basic Four," the guide recommended a minimum number of foods from each of four food groups—milk, meat, fruits and vegetables, and grain products (Page and Phipard, 1956). This food guide, with its focus on getting enough nutrients, was widely used for the next two decades.

New Directions for Dietary Guidance—1970's to the 1990's

By the 1970's, a growing body of research had related overconsumption of certain food components—fat, saturated fat, cholesterol, and sodium—and the risk of chronic diseases, such as heart disease and stroke. In 1977, *Dietary Goals for the United States* by the Senate Select Committee on Nutrition and Human Needs (U.S. Senate, 1977) heralded a new direction for dietary guidance. The focus shifted from obtaining adequate nutrients to avoiding excessive intakes of food components linked to chronic diseases. The report specified quantitative goals for intakes of protein, carbohydrate, fatty acids, cholesterol, sugars, and sodium. Because diets developed using these goals were so different from usual food patterns, USDA did not adopt the goals as the basis for its food plans and guides. However, the goals drew attention to the need for new guidance on diet and health.

USDA began addressing the role of fats, sugars, and sodium in risks for chronic diseases in its 1979 publication, *Food* (USDA, 1979). This colorful bulletin presented a new food guide, the *Hassle-Free Guide to* *a Better Diet* (table 1). This guide modified the "Basic Four" to highlight a fifth food group—fats, sweets, and alcoholic beverages—targeted for moderation. Also in 1979, the Department of Health, Education, and Welfare [now the Department of Health and Human Services (DHHS)] released a study by the American Society for Clinical Nutrition (ASCN) on the relationship between dietary practices and health outcomes. The findings, presented in *Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention*, suggested that people reduce their consumption of excess calories, fat and cholesterol, salt, and sugar to lower disease rates.

Responding to the public's need for authoritative, consistent guidance on diet and health, USDA and DHHS together issued seven principles for a healthful diet. The guidelines, intended for healthy Americans age 2 and older, were based in part on the 1979 Surgeon General's Report and were published in 1980 as the first edition of *Nutrition and Your Health: Dietary Guidelines for Americans* (USDA and DHHS, 1980). The guidelines called for a variety of foods to provide essential nutrients while maintaining recommended body weight and moderating dietary constituents—fat, saturated fat, cholesterol, and sodium—that might be risk factors in certain chronic diseases. Although the guidelines were directional, not quantitative, their release prompted some concern among consumer, commodity, and food industry groups—as well as nutrition scientists—who questioned the causal relationship between certain guidelines and health.

With the release of the first edition of the *Dietary Guidelines*, USDA began work on development of a new food guide that would help consumers implement the guidelines in their daily food choices. Development and documentation of the research base for the food guide took the Department about 3 years (USDA, 1993). Focusing on the total diet rather than the foundation diet described by earlier guides, the new food guide emphasized how to make food selections to meet both nutrient objectives and to moderate intake of those components related to risk of chronic diseases. It outlined suggested numbers of servings from each of five major food groups—the bread, cereal, rice, and pasta group; the vegetable group; the fruit group; the milk, yogurt, and cheese group; and the meat, poultry, fish, dry beans, eggs, and nuts group—and recommended sparing use of a sixth food group—fats, oils, and sweets.

Table 1—Principal USDA Food Guides, 1916-92

(All food guide recommendations are for daily servings (svg), except where otherwise indicated.)

Food guide	Number of food groups	Protein-rich foods Milk/Meat	Breads
1916 Caroline Hunt buying guides	5	Meats/other protein-rich food 10% cal milk; 10% cal other *1 cup milk plus 2-3 svg other* (based on 3-oz. serving)	Cereals and other starchy foods 20% cal *9 svg* (based on 1 oz. or 3/4 cup dry cereal svg)
1930's H.K. Stiebeling buying guide	12	Milk–*2 cups* Lean meat/poultry/fish—*9-10/week* Dry mature beans, peas, nuts–*1/week* Eggs—*1*	Flours, cereals—*As desired*
1940's Basic Seven foundation diet	7	Milk and milk products—*2 cups or more* Meat, poultry, fish, eggs, dried beans, peas, nuts—*1-2*	Bread, flour, and cereals—*Every day*
1956-70's Basic Four foundation diet	4	Milk group—*2 cups or more* Meat group—*2 or more* (2-3 oz. svg)	Bread, cereal—*4 or more* (1 oz. dry, 1 slice, 1/2-3/4 cup cooked)
1979 Hassle-Free foundation diet	5	Milk-cheese group—*2* (1 cup, 1 1/2 oz. cheese) Meat, poultry, fish, and beans group—*2* (2-3 oz. svg)	Bread-cereal group—*4* (1 oz. dry, 1 slice, 1/2 to 3/4 cup cooked)
1984 Food Guide Pyramid total diet	6	Milk, yogurt, cheese–*2-3* (1 cup, 1 1/2 oz. cheese) Meat, poultry, fish, eggs, dry beans, nuts—*2-3* (5-7 oz. total/day)	Breads, cereals, rice, pasta—*6-11 svg* • Whole grain • Enriched (1 slice, 1/2 cup cooked)

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Table 1—Principal USDA Food Guides, 1916-92—continued
(All food guide recommendations are for daily servings (svg), except where otherwise indicated.)

Food Guide	Vegetables/Fruit	Other (incl. fats)
1916	Vegetables and fruit 30% cal *5 svg* (based on average 8 oz. svg.)	Fatty foods (20% cal)—*9*; Sugars (10% cal)–*10* (based on 1 tbsp. svg)
1930's	Leafy green/yellow—*11-12/week* Potatoes, sweet potatoes—*1* Other veg/fruit—*3* Tomatoes and citrus—*1*	Butter—*na* Other fats—*na* Sugars—*na*
1940's	Leafy green/yellow—*1 or more* Potatoes, other fruit/veg—*2 or more* Citrus, tomato, cabbage, salad greens—*1 or more*	Butter, fortified margarine— *Some daily*
1956-70's	Vegetable-fruit group— *4 or more* (incl. dark green/yellow veg frequently and citrus daily; 1/2 cup or average-size piece)	
1979	Vegetable-fruit group—*4* (incl. vit. C source daily and dark green/yellow veg. frequently 1/2 cup or typical portion)	Fats, sweets, alcohol— *Use dependent on calorie needs*
1984	Vegetable—*3-5* • Dark green/deep yellow • Starchy/legumes • Other (1 cup raw, 1/2 cup cooked) Fruit—*2-4* • Citrus • Other (1/2 cup or average)	Fats, oils, sweets— *Total fat not to exceed 30% cal* *Sweets vary according to calorie needs*

Source: USDA, Human Nutrition Information Service, 1993.

Table 2—Characteristics of an effective nutrition education program

A truly effective nutrition education program will—

- Reach the whole population—all groups, all races, both sexes, all creeds, all ages.
- Recognize motives for action and include suggestions on what to do and how to do it.
- Develop qualified leadership.
- Drive home the same ideas many times and in many ways.
- Employ every suitable education tool available.
- Adapt those tools to the many and varied groups to be reached and use them with intelligence and skill.
- Consider all phases of individual, family, and group situations that have a bearing upon ability to produce, buy, prepare, conserve, and consume food.
- Afford opportunity for participation in making, putting into effect, and evaluating local nutrition programs.
- Enlist the fullest participation of all citizens and work through every possible channel to reach the people.
- Be adequately financed.

Source: National Nutrition Conference for Defense, 1941

The food guide, *A Pattern for Daily Food Choices*, was first presented to consumers in a food wheel graphic as part of a 1984 nutrition course developed by USDA in cooperation with the American National Red Cross (American Red Cross, 1984). The food guide was also used in tabular form in several USDA publications published in the 1980's (USDA, 1986, 1989).

Since 1980, the *Dietary Guidelines for Americans* have been revised and issued jointly by USDA and DHHS every 5 years, after thorough review of its scientific basis by nongovernmental experts invited to participate in a Federal Dietary Guidelines Advisory Committee. The second edition of the *Dietary Guidelines*, released in 1985, was very similar to the first. Some changes were made to provide guidance about nutrition topics that became more prominent after 1980, such as following unsafe weight-loss diets, using large-dose supplements, and drinking of alcoholic beverages by pregnant women (USDA and DHHS, 1985). This edition received wide acceptance and was used as the framework for consumer nutrition education messages. It was also used as a guide for healthy diets by scientific, consumer, and industry groups.

Throughout the 1980's and into the 1990's, USDA developed and disseminated a number of publications and other materials designed to help the public use the *Dietary Guidelines*. These included *Ideas for Better Eating* (USDA, 1981), which presented sample menus; *Dietary Guidelines and Your Diet* (USDA, 1986, 1988), providing more detailed information and ways to apply the guidelines; *Dietary Guidelines and Your Diet: Home Economics Teacher's Guide* (USDA, 1988) and *Dietary Guidelines and Your Health: Health Educator's Guide to Nutrition and Health* (USDA, 1993a), two specialized curricula for use by junior and senior high school home economics and health education teachers; *Making Healthy Food Choices* (USDA, 1993c), targeted toward low-literacy adults; and *Food Facts for Older Adults* (USDA, 1993b), targeted toward healthy older adults.

In 1989, USDA and DHHS established a second advisory committee to review the 1985 *Dietary Guidelines* and make recommendations for revision. *The Surgeon General's Report on Nutrition and Health* (DHHS, 1988) and the National Research Council's 1989 report *Diet and Health: Implications for Reducing Chronic Disease Risk* were key resources used by the committee.

The Surgeon General's Report on Nutrition and Health provided a comprehensive review of scientific evidence in support of Federal nutrition policy as stated in the 1985 *Dietary Guidelines for Americans*. Recommendations in the report promoted a dietary pattern that emphasized consumption of vegetables, fruits, and whole-grain products—foods rich in complex carbohydrates and fiber—and of fish, poultry without skin, lean meats, and low-fat dairy products selected to reduce consumption of total fat, saturated fat, and cholesterol.

The National Research Council's *Diet and Health* report concluded that reducing total fat and saturated fat consumption was the most important dietary change needed to reduce risk of chronic diseases such as cardiovascular disease and certain cancers. The Council's Food and Nutrition Board recommended a total fat intake of 30 percent or less of calories, saturated fat intake of less than 10 percent of calories, less than 300 mg of cholesterol daily, five or more daily servings of vegetables and fruits, and six or more daily servings of breads, cereals, and legumes.

The 1990 Dietary Guidelines Advisory Committee's review also considered the utility of the 1985 *Guidelines* to the public, drawing on

USDA-sponsored research conducted at the University of Wisconsin and Pennsylvania State University on use of the bulletin by professionals and consumers.

The Wisconsin study found the Guidelines to be well accepted and valued as a consensus document by Federal, State, and local professionals involved in the communication of food and nutrition information (Steele, 1990). These professionals recommended that the *Dietary Guidelines* be kept constantly before the public, in a variety of presentations. The Pennsylvania State University study indicated that consumers wanted more specific food-related guidance, definition of technical terms, and practical tips for behavior change strategies (Achterberg and others, 1989; Achterberg and others, 1991).

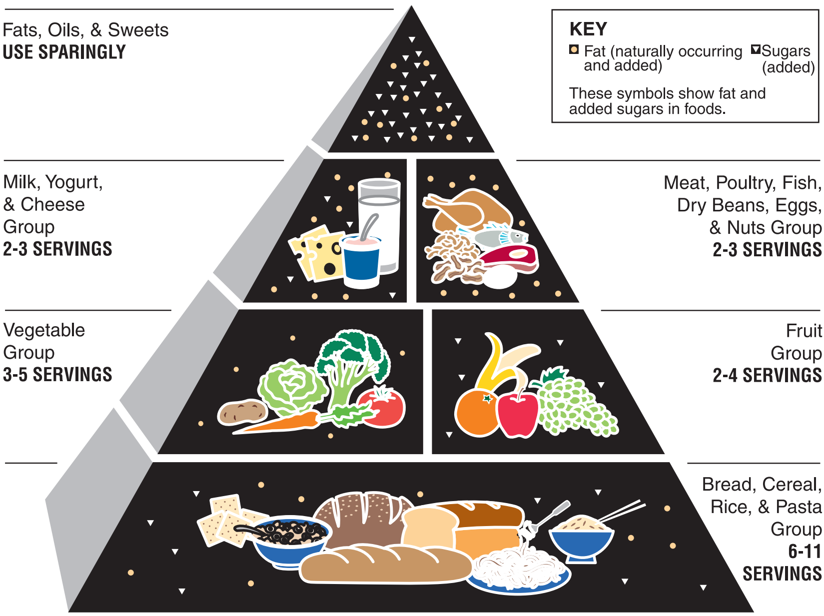
The basic tenets were reaffirmed in the third edition of the *Dietary Guidelines* (USDA and DHHS, 1990), which promoted enjoyable and healthful eating through variety and moderation, instead of dietary restriction. For the first time, the guidelines suggested numerical goals for total fat—30 percent or less of calories—and for saturated fat—less than 10 percent of calories. The goals were for diets over several days, not for one meal or one food. These goals were consistent with recommendations in the Diet and Health report and those suggested for the National Cholesterol Education Program of the National Heart, Lung, and Blood Institute in DHHS (National Cholesterol Education Program, 1993). The *Dietary Guidelines* brochure provided more practical advice on how to implement the *Guidelines* in daily food choices by including the food guide—*A Pattern for Daily Food Choices*—developed by USDA in the early 1980's.

Release of the Food Guide Pyramid and the Nutrition Facts Label—1990's

Although USDA's food guide, *A Pattern for Daily Food Choices*, had been used in Department publications since the mid-1980's, it was not well known. Therefore, work began in 1988 to develop a graphic presentation of the food guide that conveyed the key concepts of the guide—variety, proportionality, and moderation. Consumer studies were conducted with adults having a high school education who were not overly constrained by food cost concerns and who had eating patterns typical of the general U.S. population. After this testing, the food guide graphic was presented as a pyramid design (fig. 1).

Figure 1

Food Guide Pyramid



Source: U.S. Department of Agriculture/U.S. Department of Health and Human Services

Additional testing was done with those at nutritional risk—children, low-literate adults, and low-income adults—who are beneficiaries of USDA's nutrition assistance programs.

A consumer booklet devoted entirely to a description of the food guide and how to use it was developed by USDA and supported by DHHS. The *Food Guide Pyramid* was released in 1992 with the objective of helping consumers put the *Dietary Guidelines* into action (USDA, 1992). In it, variety among food groups is shown by the names of the food groups and by the separate sections of the pyramid. Variety within food groups is illustrated by pictures of typical food items. Proportionality is conveyed by the size of the food group sections and the text stating numbers of servings. Moderation of foods high in fat and added sugars is represented by the small tip of the pyramid and text specifying that they be used sparingly. Moderation related to food choices within food groups is shown by the density of the fat and sugars symbols in the food groups. The text of the food guide booklet provides additional information on how to choose foods that are low in fat, saturated fat, cholesterol, added sugars, or sodium within each food group.

Since its release, the *Food Guide Pyramid* has been widely used by nutrition and health professionals, educators, the media, and the food industry. Its use in a variety of materials—including posters, textbooks, school curricula, computer software, and on food labels—has helped to disseminate the *Dietary Guidelines* message.

The Nutrition Labeling and Education Act of 1990 (NLEA) mandated the use of nutrition information on virtually all packaged and processed foods. The law, implemented in mid-1994, provided an additional tool—the Nutrition Facts Label—consumers could use to select a healthy diet within the framework of the *Food Guide Pyramid*.

Fourth Edition of the *Dietary Guidelines for Americans*—1995

A Dietary Guidelines Advisory Committee was appointed in 1994 by USDA and DHHS to review the 1990 edition of the *Dietary Guidelines* to determine if, based on current scientific knowledge, revisions were warranted. Whereas the 1980, 1985, and 1990 editions of the *Guidelines* had been issued voluntarily by the two Departments, the 1995 edition was the first report mandated by statute—the 1990 National Nutrition Monitoring and Related Research Act (7 U.S.C. 5341). This legislation requires the Secretaries of Agriculture and Health and Human Services jointly to publish a report titled *Dietary Guidelines for Americans* at least every 5 years.

Although the titles of the dietary guidelines have changed over the past 15 years, there have been few changes in the overall concepts. There are seven guidelines for each of the four editions (table 3). The target audience has remained the same—healthy Americans 2 years of age and older.

Table 3—Dietary guidelines for Americans, 1980-95

1980	1985	1990	1995
Eat a variety of foods.	Eat a variety of foods.	Eat a variety of foods.	Eat a variety of of foods.
Maintain ideal weight.	Maintain desirable weight.	Maintain healthy weight.	Balance the food you eat with physical activity—maintain or improve your weight.
Avoid too much fat, saturated fat, and cholesterol.	Avoid too much fat, saturated fat, and cholesterol.	Choose a diet low in fat, saturated fat, and cholesterol.	Choose a diet with plenty of grain products, vegetables, and fruits.*
Eat foods with adequate starch and fiber.	Eat foods with adequate starch and fiber.	Choose a diet w/plenty of vegetables, fruits, and grain products.	Choose a diet low in fat, saturated fat, and cholesterol.*
Avoid too much sugar.	Avoid too much sugar.	Use sugars only in moderation.	Choose a diet moderate in sugars.
Avoid too much sodium.	Avoid too much sodium.	Use salt and sodium only in moderation.	Choose a diet moderate in salt and sodium.
If you drink alcohol, do so in moderation.	If you drink alcoholic beverages, do so in moderation.	If you drink alcoholic beverages, do so in moderation.	If you drink alcoholic beverages, do so in moderation.

* In the 1995 edition, the order of the third and fourth guidelines was reversed.
Source: USDA/DHHS, 1980, 1985, 1990, 1995..

New information in the 1995 *Dietary Guidelines* included:

- use of the Nutrition Facts Label and Food Guide Pyramid graphic
- boxes highlighting good food sources of key nutrients such as iron and calcium
- a statement recognizing that vegetarian diets can meet RDA's and conform with the dietary guidelines
- changes in the weight guideline to emphasize the benefits of physical activity, to encourage weight maintenance as a first step to achieving a healthy weight, and to discourage weight gain with age for adults

• replacement of the weight table with a chart that illustrates weight ranges for healthy weight, moderate overweight, and severe overweight

• movement of the grain products, vegetables, and fruits guideline from fourth to third position to give it more prominence, and a slight change in the title to be consistent with the placement of food groups in the *Food Guide Pyramid*

• addition of specific guidance regarding dietary fat intake among children (gradual decrease to no more than 30 percent of calories from fat between the ages of 2 and 5 years) and more information about types and sources of fatty acids

• increased emphasis on sugars as a calorie source and less on the relationship of sugars to health

• information about the relationship of nutrients other than sodium to blood pressure

• referral of readers to food label standards for dietary cholesterol and sodium intake without making specific recommendations

• a statement about the potential benefit of moderate alcohol intake in reducing the risk for heart disease in some individuals.

For the first time, the *Dietary Guidelines* brochure was also made available electronically through the World Wide Web. The *Dietary Guidelines* continue to form the basis of Federal nutrition policy and have provided a consensus as to what makes a healthy diet.

The Future for Dietary Guidance

Dietary guidelines will continue to be revised as the science base evolves. In the *Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 1995* (USDA, 1995), the Committee recognized the difficulty of having a single bulletin address the needs of consumers, policymakers, and health professionals. The Committee recommended changes in the process used to develop the guidelines, following a two-step approach—first, to determine the most important nutrition-related public health issues and dietary strategies on which to focus; and second, to determine effective communication messages to educate the public and change their behavior.

The Dietary Guidelines Advisory Committee's recommendation is consistent with a shift in emphasis, both in USDA and the nutrition education profession, from simply providing knowledge to allow consumers to make informed decisions about healthy eating practices to actually motivating them to bring about behavior change. Encouraging audiences to adopt different eating practices is a large undertaking. Behavioral change is motivated not by knowledge alone, but also by a supportive social environment and the availability of facilitative services. Thus, future research efforts will be devoted to learning more about the target audience—their environment and what motivates their food decisions. Research is also needed to develop methods to evaluate the effectiveness of nutrition education programs to determine if behavior is changing.

Recent research shows that consumers feel frustrated when they hear different nutrition messages from different sources. In a USDA survey of main meal planners/preparers, over 40 percent strongly agreed with the statement, "There are so many recommendations about healthy ways to eat, it's hard to know what to believe" (USDA, 1996). Almost half of respondents to an American Dietetic Association (ADA) telephone survey of adults responded that they found news reports on nutrition to be confusing. Eighty-one percent of respondents reported that they would prefer to hear about new research only after there is acceptance among nutrition and health professionals (versus hearing about all studies individually) (ADA, 1995). Therefore, it is important for nutrition educators to speak with one voice. At the same time, many government agencies and private sector organizations are faced with budget constraints. Nutrition educators are being asked to do more with less. Because of these trends, there will continue to be an increase in partnerships and cooperation between the public and private sector.

An example of one such cooperative effort is the Dietary Guidelines Alliance, which has participation from USDA, DHHS, industry groups, and the American Dietetic Association. The Alliance was formed to develop effective, consumer-focused nutrition education messages based on the *Dietary Guidelines for Americans*. Nutrition education messages jointly produced in this way will increasingly focus on motivating behavior change.

Nutrition educators will also be faced with increasing questions from consumers concerning the nutritive value and safety of the many new food products appearing in the marketplace. Some of these products are due to new technology (e.g., fat replacers and sugar substitutes).

Other new food products result from the introduction of ethnic foods into the market in response to demand for such products from a more culturally diverse population. New dietary guidance materials will need to address the use of these foods and how they fit into the diet. For example, the 1995 *Dietary Guidelines* bulletin (USDA and DHHS, 1995) includes ethnic foods in the list of good food sources of nutrients and includes a special discussion of the role of sugar substitutes in the diet.

Since the initial release of the *Dietary Guidelines for Americans* in 1980, each edition has gained in acceptance and use by both professionals and consumers. As nutrition guidance advances into the 21st century, the underlying themes of variety, proportionality, and moderation—initiated about 100 years ago and reinforced by the dietary guidelines—will likely still apply to choosing healthful diets for many years to come.

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Chapter 3

How Current Diets Stack Up

Comparison With Dietary Guidelines

Katherine S. Tippett and Linda E. Cleveland

How well do our diets meet the Dietary Guidelines for Americans? This study compares 1994-96 food intake data from the U.S. Department of Agriculture's Continuing Survey of Food Intakes by Individuals with the recommendations in the Dietary Guidelines for Americans.

Introduction

How well do our diets meet the *Dietary Guidelines for Americans*? Have changes over time in what we eat moved us closer to dietary recommendations made by professional science and health groups?

The trend toward lower-fat diets between 1977-78 and 1994-96 is a step in the right direction (fig. 1). However, the proportion of our food energy that comes from fat is still higher than recommended, and survey data indicate that large proportions of the population fail to meet recommendations for fruits and vegetables (USDA, 1998a). Some of the changes people have made are moving them in the right direction, but others are not. For example, large increases in the share of milk that is low-fat or skim suggest that people are interest-

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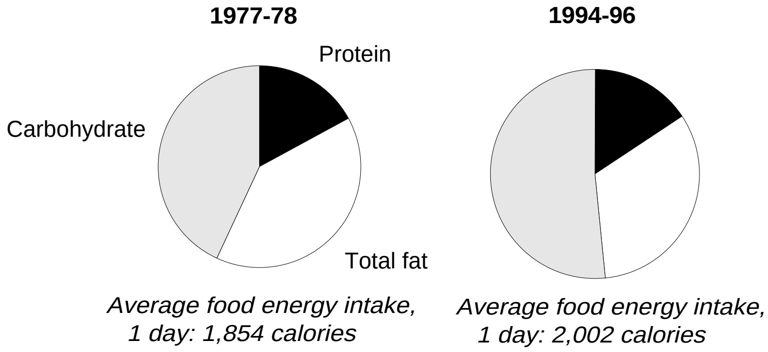
Figure 1

The share of calories from fat has fallen, but is still above the recommendation



Source: USDA Nationwide Food Consumption Survey, 1977-78, and Continuing Survey of Food Intakes by Individuals, 1994-96.

ed in limiting calories, fat, and/or sugar. However, the shift toward eating more mixtures like pizza, which can be high in fat, and drinking more soft drinks suggests the opposite.

The Continuing Survey of Food Intakes by Individuals (CSFII) and the Diet and Health Knowledge Survey (DHKS), both conducted by the Agricultural Research Service of the U.S. Department of Agriculture (USDA), provide information on the kinds and amounts of foods eaten by Americans and on Americans' attitudes and knowledge about diet and health. Data from the surveys are compared here with principles for healthy eating described in the 1995 *Dietary Guidelines for Americans* (USDA and DHHS, 1995).

The 1994-96 intake estimates presented here are averages for 15,968 individuals of all ages (excluding breastfed children) who provided at least 1 day of dietary intake. The estimates are compared with similar data collected in the 1977-78 Nationwide Food Consumption Survey to see how eating patterns and intake levels have changed over time. A second day of dietary data was collected in 1994-96 from 15,170 individuals and the 2-day average is used here to provide estimates of the percentages of individuals meeting dietary recommendations for fat and cholesterol. Information on dietary attitudes and knowledge is based on the 5,765 individuals 20 years and over who provided at least 1 day of dietary intake in the 1994-96

CSFII and who participated in the 1994-96 DHKS. Estimates of intakes of servings and the percentages of individuals meeting recommendations in the Food Guide Pyramid are based on information from 14,256 people 2 years of age and over who provided food intakes on 2 days in 1994-96.

Eat a Variety of Foods

The first dietary guideline—to eat a variety of foods—aims at ensuring that we obtain the nutrients and other substances we need from foods. Because different foods supply different nutrients, a daily diet should contain an assortment of foods from within each of the five major food groups emphasized by the Food Guide Pyramid (USDA, 1992): bread, cereal, rice, and pasta; vegetables; fruits; milk, yogurt, and cheese; and meat, poultry, fish, dry beans, eggs, and nuts.

One way to assess variety is to look at nutrient intakes. The many foods we eat provide us with most of the nutrients we need, but, as a population, we still consume diets that are short in some nutrients.

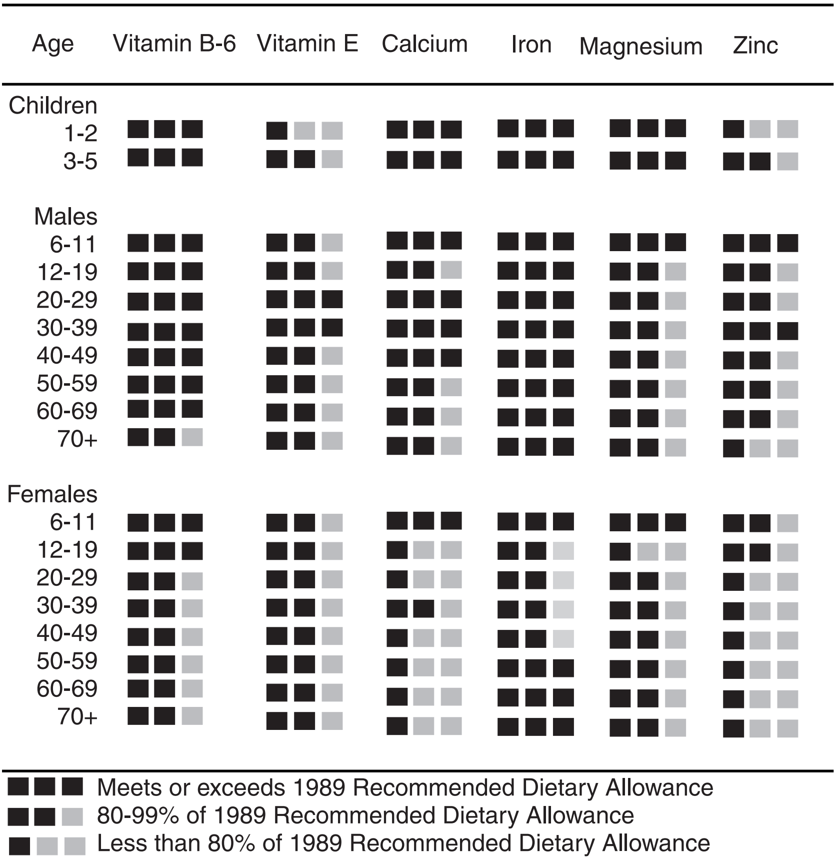
The wide array of foods consumed in 1994-96 provided the Recommended Dietary Allowances (RDA) (National Research Council, 1989a) for many nutrients, but not for others. Average nutrient intakes for most population groups exceeded the RDA for protein, vitamin A, vitamin C, thiamin, riboflavin, niacin, folate, vitamin B-12, and phosphorus. For other nutrients—notably vitamins B-6 and E, calcium, iron, magnesium, and zinc—intakes were below the RDA for many groups (fig. 2). In general, the nutrients that were below the RDA in 1994-96 are the same nutrients that were below the RDA in the 1970's. (Vitamin E and zinc were not examined in 1977-78.)

An average intake below the RDA does not necessarily mean that people in a group have inadequate intakes. Individuals' nutrient requirements differ, and the RDA's include a safety factor so that the RDA's exceed actual requirements of most individuals. However, the risk that some individuals within a population group have inadequate intakes increases as the average intake for the group falls further below the RDA (National Research Council, 1989a).

Calcium and iron are of particular interest because some groups of people in the United States, especially adolescent and adult females,

Figure 2

Intakes of several nutrients below the RDA, 1994-96



Source: CSFII 1994-96 and National Research Council. Recommended Dietary Allowances. 10th-ed. Wash., DC: National Academy Press, 1989

have notably low intakes, and there is evidence that health problems are related to these low intakes. In 1994-96, DHKS respondents were asked to estimate how their diets compare “to what is healthy” for selected nutrients. Sixty-one percent of men and 51 percent of women said their diets were about right in calcium and 67 percent of men and 59 percent of women said their diets were about right in iron. In 1994-96, of those who said their diets were about right in calcium, only 39 percent met the RDA for calcium. However, of those who said their diets were about right in iron, 62 percent met the RDA for iron (see chapter 15 for more information on how individuals perceive their diets).

Table 1—Recommended servings based on USDA's Food Guide Pyramid and average consumption in 1994-96

Food group	Recommended Pyramid servings	Average servings consumed (2-day average)	Individuals consuming recommended number of servings based on reported caloric intake[1]
	Number		*Percent*
Grain	6 to 11	6.7	38
Vegetable	3 to 5	3.3	41
Fruit	2 to 4	1.5	23
Dairy	2 to 3	1.5	23
Meat (ounces)	5 to 7	4.7	32

[1] Based on reported calorie intake: For the grain, vegetable, fruit, and meat groups, individuals consuming 2,200 calories met the recommendation if they ate at least the lowest number of servings in the range a day; individuals consuming 2,200-2,800 calories met the recommendation if they ate the number of servings in the middle of the range; and individuals consuming 2,800 calories or more met the recommendation if they ate at least the number of servings at the top of the range. For the dairy group, women who were pregnant or lactating and individuals 11 to 24 years of age were counted as meeting the recommendation if they consumed at least 3 dairy servings a day; all other individuals were counted as meeting the recommendation if they consumed at least 2 dairy servings a day.

Sources: USDA's Continuing Survey of Food Intakes by Individuals, 1994-96; USDA *Food Guide Pyramid*, 1992.

Another way to assess variety is to look at how well Americans eat compared with recommendations in USDA's *Food Guide Pyramid* (USDA, 1992). USDA has developed a new method for converting food intake data from the CSFII into servings (USDA, 1998a; Cleveland and others, 1997). The method adheres to Pyramid principles, uses the serving sizes specified by the Pyramid, and strictly categorizes foods according to Pyramid criteria. Since many foods people eat—foods like pizza, soups, and pies—count toward more than one food group, the method separates foods into their ingredients before servings are counted.

The Pyramid provides guidance for individuals 2 years of age and over. According to the Pyramid, everyone should eat at least the lowest number of servings within recommended ranges (table 1). Except for the dairy group, the number of servings that is right for a person depends on his or her calorie needs. For the dairy group, the recommended number of servings depends on age and, for women, on whether or not they are pregnant or breastfeeding. Generally speaking, the bottom of the recommended range of servings is about right for many sedentary women and older adults; the middle is about right for most children, teenage girls, active women, and many sedentary men; and the top of the range is about right for teenage boys, many active men, and some very active women.

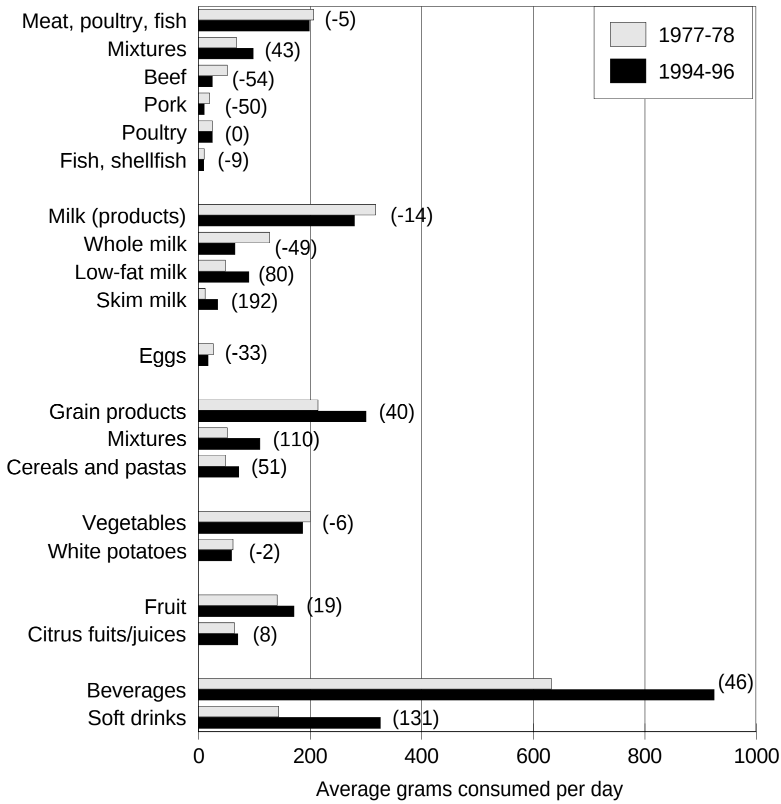
In 1994-96, the average diet of Americans 2 years of age and over contained about 2,000 calories. Average numbers of servings from the fruit, dairy, and meat groups were below minimum numbers recommended; those from the grain and vegetable groups were near the bottom of recommended ranges (table 1). When the recommended number of servings is based on an individual's calorie intake (or for the dairy group, on an individual's age and physiological status), only 4 of 10 individuals met the recommendations for the grain and vegetable groups, only 3 of 10 met the recommendation for the meat group, and only about 2 of 10 met the recommendations for the fruit and dairy groups.

Pyramid servings were first available with the 1994 CSFII. However, comparisons with previous surveys may be made using the more traditional way of reporting data—the amount of food consumed as measured in grams. For the Pyramid servings, mixtures have been broken down into their component parts and classified into Pyramid food groups; for traditional intake data, foods were classified into food groups according to the their main ingredient (see box, "How Food is Reported").

Based on traditional intake data, diets in 1994-96 differed considerably from those in 1977-78 (fig. 3). In 1994-96, we ate more mixtures that were mainly meat, poultry, or fish (such as hamburgers, stews, and chicken or fish sandwiches). At the same time, we ate fewer separate cuts of beef and pork (such as steaks and roasts), slightly more poultry, and slightly less fish and shellfish. We drank less whole milk and more low-fat and skim milk. We ate fewer eggs. We ate more grain products, especially as part of mixtures such as pizza and as cereals and pastas. We drank more carbonated soft drinks, especially low-calorie soft drinks. Fruit consumption was up, but a large proportion of the population still does not eat fruit on any given day.

Some of these consumption changes may indicate interest in diet and health issues. The changes may also reflect shifts in incomes and in relative food prices (for more details on the effects of income and

Figure 3
Diets have changed in the past decade



( ) = percentage change in amount consumed, 1 day, 1977-78 and 1994-96.

Source: USDA Nationwide Food Consumption Survey, 1977-78, and Continuing Survey of Food Intakes by Individuals, 1994-96.

price changes on nutrient intake, see chapter 8). And these trends may be influenced by industry efforts to meet the public's desire for health and convenience through increased numbers and varieties of restaurants, microwave-ready products, commercially prepared convenience foods, carryout meals and home-delivered food, and supermarkets with bakeries, delicatessens, and salad bars.

Some of the estimated changes—such as the apparent decline in consumption of beef and pork and the limited change in the consumption of poultry, fish and shellfish, fruit, and vegetables—are contrary to

Table 2—Vegetables are the second largest ingredient in grain mixtures and in meat mixtures

Ingredient	Grain mixtures	Meat mixtures
	Percent	
Grain products	32	14
Vegetables	24	28
Milk and milk products	8	6
Meat, poultry, fish	8	34
Water	19	10
Other	9	8

Source: USDA Continuing Survey of Food Intakes by Individuals, 1994, 1-day, adults 20 years and older.

trends suggested by food disappearance data (see chapter 7). Some of these differences may be due to the difference in methodologies (see box, "Survey Consumption Estimates May Differ From Food Disappearance Trends"), and to frequent use of meat, cheese, grains, fruit, and vegetables as ingredients in mixed dishes. As a result, intake estimates in figure 3 for some food groups—particularly meats, vegetables, and grains—may be different than if food in the mixtures were divided and counted separately. By definition, grains are, by weight, the chief ingredient of grain mixtures such as lasagna; and meat, poultry, and fish are the chief ingredients of meat mixtures such as chili. However, among foods consumed in 1994 by adults 20 years and older, vegetables were the second largest ingredient of both grain mixtures and meat mixtures (table 2).

Balance the Food You Eat With Physical Activity—Maintain or Improve Your Weight

Many Americans gain weight in adulthood, increasing their risk for major health problems such as high blood pressure, heart disease, stroke, adult-onset diabetes, certain types of cancer, arthritis, breathing problems, and other illnesses (USDA and DHHS, 1995). Therefore, most adults should not gain weight. To stay at the same body weight, people must balance calories in the foods and drinks they consume with calories (food energy) the body uses. Physical activity is an important way to use calories; the *Dietary Guidelines for Americans* recommend that people get at least 30 minutes of moderate physical activity daily (USDA and DHHS, 1995).

To determine the extent of overweight, survey respondents were classified based on their Body Mass Index (BMI). BMI's are calculated by dividing weight in kilograms by the square of height in meters (Rowland, 1989). For the data reported here, BMI's are based on self-reported heights and weights. Following the 1995 Dietary Guidelines, overweight was designated as a BMI of 25 or more for both men and women—studies demonstrate that mortality increases significantly above a BMI of 25 (USDA, 1995; American Heart Association, 1998). In 1994-96, 60 percent of males and 46 percent of females 20 years and over were overweight. These percentages are considerably higher than those calculated in previous years using different levels of BMI. For example, in *Healthy People 2000*, overweight was designated as a BMI of 27.8 or more for men and 27.3 or more for women (DHHS, 1991). Using these BMI levels, the 1994-96 CSFII data indicated that 32 percent of males 20 years and over were overweight, up from 18 percent in 1977-78, and 32 percent of females were overweight, up from 22 percent in 1977-78 (table 3). (For more details on the progress of *Healthy People 2000* objectives, see chapter 6.)

Although the proportion of the population classified as overweight increased considerably between 1977-78 and 1994-96, estimated caloric intakes increased only slightly for most groups in the same period, and some of that increase may be due to improvements in the way dietary data are collected. The average 1-day caloric intake in 1994-96 was 2,002 kcal, compared with 1,854 kcal in 1977-78. In 1994-96, men 20 years and over ate more than women the same age—2,455 kcal compared with 1,646 kcal, but men also have higher calorie requirements than women. For nearly all sex-age groups, intake estimates were below the recommended energy allowances (REA) (National Reseach Council, 1989a).[1] However, some evidence suggests that people participating in nutrition surveys underreport the food they eat (Mertz and others, 1991; Schoeller, 1990), either by completely omitting food items or by inaccurately estimating the amount eaten. Also, the average energy allowances are designed for a light-to-moderate level of physical activity. It is possi-

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[1] Unlike the RDA's, which are set high enough to exceed actual nutrient requirements for most individuals, the REA reflects the average caloric requirement for moderately active people within each population group, since excessive consumption of energy may lead to obesity.

Table 3—More people are overweight than two decades ago[1]

Gender and age	1977-78	1994-96
	Percent overweight	
Males		
20-29	12	22
30-39	20	32
40-49	24	37
50-59	23	40
60-69	20	41
70+	13	22
20 and over	18	32
Females		
20-29	12	22
30-39	18	27
40-49	26	36
50-59	30	38
60-69	31	38
70+	24	33
20 and over	22	32

[1] Based on a Body Mass Index of 27.8 or more for men and 27.3 or more for women (DHHS, 1991).

Source: USDA Nationwide Food Consumption Survey 1977-78, and Continuing Survey of Food Intakes by Individuals 1994-96.

ble that Americans' actual level of physical activity is lower than light-to-moderate. In 1994-96, 28 percent of men and 44 percent of women said they rarely or never exercised vigorously.

In 1994-96, 68 percent of adult men and 77 percent of adult women said it was very important to them to maintain a healthy weight, but only 36 percent of men and 42 percent of women thought they ate too many calories. More than 9 of 10 respondents had heard of health problems related to being overweight. Nevertheless, about 4 of 10 respondents agreed with the statement, "Some people are born to be fat and some thin; there is not much you can do to change this."

Choose a Diet With Plenty of Grain Products, Vegetables, and Fruits

Grain products, vegetables, and fruits are key parts of a varied diet. They are emphasized in the Guidelines because they provide vitamins, minerals, complex carbohydrates, and other substances that are important for good health. They are also generally low in fat, depending on how they are prepared and what is added to them at the table.

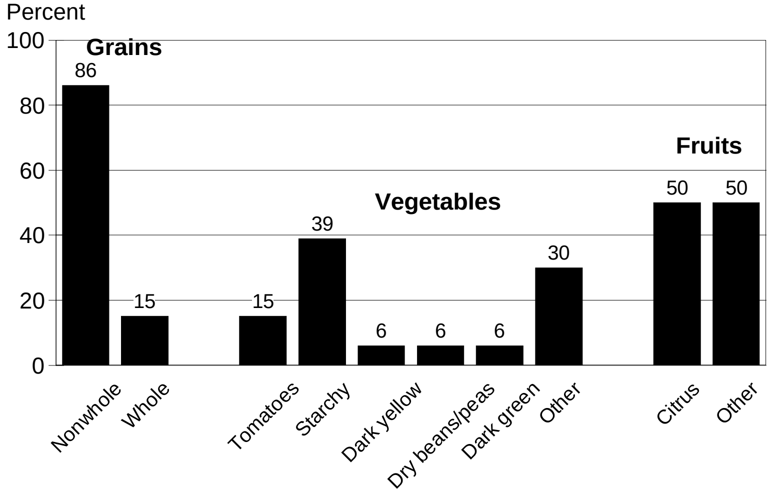
The 1995 Guidelines recommend eating 6 to 11 servings of grain products daily, including several servings of whole grains (USDA and DHHS, 1995). In 1994-96, only about a third of respondents to the DHKS thought it was very important to choose a diet with plenty of breads, cereals, rice, and pasta. In 1994-96, on average, Americans ate the minimum number of grain servings recommended (table 1), but less than one in seven grain servings (15 percent) were whole grains (fig. 4). Whole grains contribute to fiber intake. The average intake of dietary fiber in 1994-96 was 15 grams; intake by men was 19 grams and intake by women was 14 grams. Although the *Dietary Guidelines* do not recommend a specific amount of fiber, intakes by women are well below the 20-30 grams recommended by the National Cancer Institute (1987).

Consumption of grain products (in grams) has increased by 40 percent since the late 1970's (fig. 3). Among grain products, consumption of grain mixtures has increased 110 percent and consumption of cereals and pastas has increased by 51 percent. Data on pizza from the first year (1994) of the survey illustrate how consumption of grain mixtures increased over the years. The percentage of individuals eating pizza on any given day increased from 4 to 10 percent between 1977-78 and 1994. In 1994-96, males 6 to 11 years were the biggest consumers of pizza—19 percent ate pizza on any given day.

The 1995 *Guidelines* also recommend eating three to five servings of vegetables and two to four servings of fruits daily (USDA and DHHS, 1995). About two-thirds of adults thought it was very important to choose a diet with plenty of vegetables and fruits. On average, individuals 2 years and over ate the minimum number of vegetables, but less than the minimum number of fruits (table 1).

Although the Pyramid suggests eating dark-green vegetables and cooked dry beans and peas several times a week, intakes of these vegetables are low. The largest proportion of vegetables are starchy types—mostly white potatoes (fig. 4). In 1994-96, about 44 percent of individuals ate white potatoes at least once on any given day. Overall, more than a third of the intake of white potatoes was french

Figure 4
Pyramid servings: percent of intake by selected subgroups



Source: USDA's Continuing Survey of Food Intakes by Individuals, 1994-96, 2-day average.

fries. The proportion of white potatoes eaten as french fries was highest among individuals under 30 years of age.

The Pyramid suggests dividing fruit servings equally between two subgroups: citrus fruits, melons, and berries; and other fruits. On average, Americans follow this advice (fig. 4). Fruit consumption (in grams) increased by 19 percent between 1977-78 and 1994-96. However, the percentage of individuals who reported eating fruit on any given day remained about 54 percent.

Vegetables and fruits are major sources of vitamins A and C. Although average intakes by all sex-age groups for both vitamins were above the RDA, the averages conceal variations. In 1994-96, for women age 20 years and over who ate no fruit on day 1 of the survey, average intake of vitamin C was 82 percent of RDA compared with 205 percent for women who ate fruit. Diets of women who did not eat fruit included a higher percentage of calories from fat (34 percent) than did diets of women who ate fruit (31 percent).

By 1994-96, the proportion of carbohydrates in our diets had increased to 52 percent of calories, up from 43 percent in 1977-78. This change is in line with the *Guidelines*. Some of the increase in carbohydrates is probably due to increased consumption of grain products. However, some is probably due to the increased use of sweetened beverages, which provide calories from sugar (a carbohydrate) but no other nutrients.

Choose a Diet Low in Fat, Saturated Fat, and Cholesterol

The 1995 *Guidelines* emphasize that, as a population, we should consume less total fat, saturated fat, and cholesterol. Americans are advised to choose a diet that has no more than 30 percent of calories from fat, less than 10 percent of calories from saturated fat, and 300 mg or less of cholesterol.

In 1994-96, total fat provided 33 percent of calories and saturated fat, 11 percent. Although the percentage of calories from total fat in our diets is above the recommendation, it is down considerably from the 40 percent of calories estimated in 1977-78. (Saturated fat was not measured in 1977-78, so no comparisons are possible.)

Cholesterol intakes averaged 256 milligrams, but were considerably higher for men (331 mg) than for women (213 mg). Among men, average cholesterol intakes ranged from 270 milligrams for men age 70 and over to 352 milligrams for men 30 to 39 years. Among women, average cholesterol intakes fell below the recommended 300 mg for all age groups. Cholesterol intake was not measured in 1977-78.

Much higher percentages of adult men and women had average 2-day intakes meeting the recommendation for cholesterol than for total fat and saturated fat. More than half of the men (55 percent) and nearly four-fifths of the women (79 percent) had diets that met the recommendation for cholesterol. In contrast, only 29 percent of men and 37 percent of women had diets that met the recommendation for fat; slightly higher proportions had diets that met the recommendations for saturated fat (34 and 43 percent, respectively). However, of the adults responding to the DHKS, less than half thought their diets were too high in fat, and only about a third thought their diets were too high in saturated fat. (For additional discussion on the accuracy of individuals' perception about the healthfulness of their diets, see chapter 15.)

Table 4—Milk drunk by older age groups is more likely to be low-fat or skim

	Percentage of fluid milk that was		
Sex-age group	Whole milk	Low-fat milk[1]	Skim milk
		Percent	
Males:			
20-29	34	46	19
30-39	35	48	15
40-49	29	46	22
50-59	22	50	27
60-69	25	46	28
70+	25	52	22
Females:			
20-29	40	30	28
30-39	23	50	24
40-49	27	43	29
50-59	17	38	42
60-69	19	45	34
70+	20	49	30

Percents may not add to 100 because milk that was unspecified as to type is not included here.

[1] Includes 1% and 2% milk.

Source: USDA Continuing Survey of Food Intakes by Individuals, 1994-96.

Changes in food choices have contributed to the reduced percentage of energy from fat. For example, our intake of whole fluid milk fell by nearly half (down 49 percent) between 1977-78 and 1994-96 while our intakes of low-fat and skim milk increased by 80 percent and 192 percent. In 1994-96, older age groups drank larger proportions of their milk as low-fat or skim milk than did younger age groups (table 4)—possibly because older people are more aware of dietary guidance to reduce fat and calories (Cypel and others, 1996).

Choose a Diet Moderate in Sugars

About 82 percent of adult men and 89 percent of adult women thought it was somewhat or very important to use sugars only in moderation. However, much of the sugar we eat is as an ingredient in other foods, such as cookies, cakes, ice cream, sweetened beverages, and other processed foods. This may make it difficult for individuals to know how much sugar they are consuming, or to realize that their consumption of sugar is increasing.

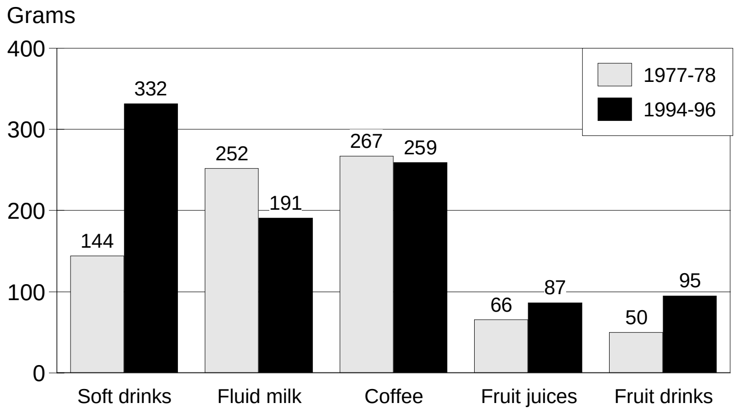
The Pyramid suggests that Americans try to limit their added sugars to 6 teaspoons a day if they eat about 1,600 calories, 12 teaspoons at 2,200 calories, or 18 teaspoons at 2,800 calories. In 1994-96, Americans consumed an average of 20 teaspoons of added sugars a day in a diet that provided about 2,000 calories. Added sugars accounted for 16 percent of calories.

A look at consumption trends for foods likely to contain large amounts of added sugar suggests that sugar consumption is increasing. In 1977-78, consumption of soft drinks was about half as great as consumption of either milk or coffee; by 1994-96, the consumption of soft drinks was higher than those of milk and coffee (fig. 5). While average milk consumption declined and coffee consumption remained about the same, soft drink consumption increased 130 percent from 144 to 332 grams. (An 8-ounce cup of fluid milk, coffee, fruit juice, or soda weighs about 245 grams.) Although the intake of low-calorie soft drinks nearly quadrupled, from 20 grams in 1977-78 to 78 grams in 1994-96, about three-fourths of the total consumption of soft drinks is the sugar-sweetened type. Consumption of other high sugar-added foods also increased during the last decade and a half; consumption of milk desserts (which includes ice cream) increased by 29 percent and consumption of cakes, cookies, pastries, and pies increased by 15 percent.

Choose a Diet Moderate In Salt and Sodium

Sodium has an important role in the body, helping to regulate fluids and blood pressure. However, most Americans consume more sodium than is needed. The Committee on Diet and Health of the National Research Council (1989b) has recommended that daily intakes of salt (sodium chloride) be limited to 6 grams, and this recommendation is the basis for the Daily Values on the Nutrition Facts label (USDA and DHHS, 1995). This translates into a daily sodium intake of 2,400 milligrams. In household measures, one level teaspoon of salt provides about 2,300 milligrams of sodium. Many studies in diverse populations have shown that a high sodium intake is associated with higher blood pressure (USDA and DHHS, 1995).

Figure 5
Consumption of soft drinks surpasses consumption of fluid milk in 1994-96



Source: USDA Continuing Survey of Food Intakes by Individuals, 1994-96.

The average intake of sodium from food in 1994-96 was 3,271 milligrams, 4,074 milligrams for men 20 years and over and 2,752 milligrams for women 20 years and over. These intakes are underestimated because they do not include sodium from salt added at the table. Intakes of sodium were not examined in 1977-78, but average intakes in 1994-96 were higher than the average of 2,974 mg in a similar survey conducted in 1987-88 (USDA, 1993). In 1994-96, only 25 percent of men and 24 percent of women thought that their diets were too high in salt or sodium; 61 percent of men and 66 percent of women believed that their diets were about right. Almost 9 of 10 individuals indicated that they were aware of health problems related to salt or sodium consumption. Hypertension was cited most frequently.

If You Drink Alcoholic Beverages, Do So in Moderation

Alcoholic beverages supply calories but few or no nutrients. The alcohol in these beverages has harmful effects when consumed in excess. Current evidence suggests that moderate drinking (that is, no more than one drink per day for women and no more than two drinks

How Food Is Reported

The Continuing Survey of Food Intakes by Individuals (CSFII) included the collection of information about foods eaten on 2 nonconsecutive days using a 1-day recall for each day. Survey procedures call for the collection and coding of information on food as individuals eat it. Over 5,700 different foods were reported in the 1994-96 survey. For purposes of analysis, these foods were handled in two ways:

(1) To aggregate and summarize intakes the traditional way—in grams consumed—foods reported in the survey were combined into about 70 food groups and subgroups (Wilson and others, 1997). These groups are compared with consumption of the same food groups and subgroups in previous surveys. Mixtures (such as stew, macaroni and cheese, and pizza) were assigned to the food group of the main ingredient. For example, spaghetti, pizza, and fruit pies were assigned to the grain products' group, even though they may also contain foods from the meat, dairy, vegetable, or fruit groups. Similarly, fast-food cheeseburgers were assigned to the meat group, even though they may also contain foods from the grain, dairy, or vegetable groups. Other examples include egg salad sandwiches, which are classified with eggs, and potato salad, which is classified with potatoes. Data on components of mixtures that were mainly grain or mainly meat, poultry, or fish have previously been published with results of both the 1987-88 Nationwide Food Consumption Survey (USDA, 1993) and the 1989-91 Continuing Survey of Food Intakes by Individuals (Tippett and others, 1995).

(2) For the Pyramid servings, food mixtures were separated into their ingredients before categorizing them by the five major Pyramid food groups and the Pyramid tip (fats, oils, and sweets). Eighty-nine percent of the foods reported in CSFII 1994-96 had to be separated into ingredients in order to report servings for at least one of the Pyramid food groups (USDA, 1998b).

Researchers or other individuals who wish to compare food intake with dietary recommendations should use the Pyramid servings data. Traditional dietary intake data may be used to compare data over time. The traditional dietary data also provide information on foods as they are eaten—pizza, hamburgers, salads, etc.

per day for men) is associated with a lower risk for coronary heart disease in some individuals (USDA and DHHS, 1995). However, higher levels of alcohol intake raise the risk for high blood pressure, stroke, heart disease, certain cancers, damage to body organs, accidents, violence, suicides, birth defects, and overall mortality (USDA and DHHS, 1995). Heavy drinkers are at risk of malnutrition because alcohol contains calories that may substitute for those in more nutritious foods.

About 23 percent of men 20 years or older and about 12 percent of women 20 years and older drank liquor, wine, beer, or ale on the day of the survey—these percentages are up slightly from 1977-78. In 1994-96, consumption of alcoholic beverages by men was highest at 20-29 years and gradually declined with age.

About 84 percent of alcoholic beverage consumption was from beer and ale. Beer and ale consumption more than doubled between 1977-78 and 1994-96, from 42 grams to 87 grams daily. Alcoholic beverage consumption has been assumed to be underreported in nationwide food surveys. The increase shown here may, in part, reflect a decrease in underreporting of alcoholic beverages.

More information about the survey is available on the Internet at: [http://www.barc.usda.gov/bhnrc/foodsurvey/home.htm].

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Survey Consumption Estimates May Differ From Food Disappearance Trends

Consumption estimates from the Continuing Survey of Food Intakes by Individuals (CSFII) may not match food disappearance trends because of differences in collection methods (see also chapters 4 and 7).

Food disappearance data reflect the amount of the major food commodities entering the marketing channels, regardless of their final use. The food disappearance data estimate the total amount available for consumption as the residual after exports, industrial uses, seed and feed use, and year-end inventories are subtracted from the sum of production, beginning inventories, and imports. The use of conversion factors allows for subsequent processing, trimming, shrinkage, or loss in the distribution system. However, the estimates also include residual uses for which data are not available (such as miscellaneous nonfat uses, and changes in retail and consumer stocks). Because the food disappearance data come from market channels, the data are available only on a per capita basis and cannot be used to estimate consumption by sex, age, or demographic group.

The CSFII collects information on the kinds and amounts of foods eaten at home and away from home. The data provide estimates of food actually ingested by individuals classified by sex, age, income, race, and region.

Consumption estimates derived from food disappearance data tend to overstate actual consumption because they include spoilage and waste accumulated through the marketing system and in the home. On the other hand, survey estimates may understate actual consumption because respondents in dietary intake surveys tend to underreport what they ate. The food disappearance data are used more appropriately as indicators of trends in consumption over time, while the survey data are used appropriately as estimates of food actually eaten.

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Chapter 4

A Comparison of the U.S. Food Supply With the Food Guide Pyramid Recommendations

Linda Scott Kantor

Information on the extent to which eating patterns differ from dietary recommendations is a key tool for policymakers and nutrition educators in the effective targeting of educational messages. This chapter uses aggregate food supply data, adjusts for losses, and converts the remaining supply into daily per capita Food Guide Pyramid servings. These are then compared with Pyramid servings recommendations for the U.S. population. Annual 1992-96 growth rates in per capita servings are compared with those needed to meet Food Guide Pyramid servings recommendations by 2005.

Introduction

Federal dietary guidance outlined in the *Dietary Guidelines for Americans* and presented in the *Food Guide Pyramid* are intended to help consumers choose diets that improve health, reduce their risk for diet-related chronic disease, and meet their nutritional needs (USDA/DHHS, 1995; USDA, CNPP, 1995). Information on the extent to which eating patterns differ from these recommendations is useful for consumers in making dietary adjustments, and is a key tool for policymakers and nutrition educators in the effective targeting of educational messages.

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Federal efforts to monitor the dietary and nutritional status of the population under the congressionally mandated *Ten-Year Comprehensive Plan for National Nutrition Monitoring and Related Research Program* have been recently enhanced by the development of new methods for assessing dietary health in terms of (Food Guide) Pyramid serving recommendations. To date, these efforts have used food intake data from USDA's Continuing Survey of Food Intakes by Individuals (CSFII), a key component of the Nutrition Monitoring Program (Krebs-Smith and others, 1995, 1996, 1997; Cleveland and others, 1995, 1997; Munoz and others, 1997; Bowman and others, 1998; USDA, CNPP, 1995).

Numerous studies, however, have suggested that food intake surveys such as the CSFII, which collect food consumption data through recall or food records over a short period of time, are subject to underreporting of consumption when measured in terms of energy intake (Bingham, 1994; Black and others, 1993; Mertz and others, 1991, Schoeller, 1990, Riddick, 1996). Dietary assessments based on these data probably reflect a lower limit on actual food intake. Consequently, these assessments may also tend to understate the number of servings actually consumed by individuals, at least for some food groups. In addition, the CSFII measures food consumption using methodologies that differ by survey period, making it difficult to separate methodological effects from true consumption changes.

Food supply and utilization data, compiled and published annually by USDA's Economic Research Service (ERS), measure the flow of raw and semiprocessed agricultural commodities through the U.S. marketing system and are another key component of the Nutrition Monitoring Program. The series complements the CSFII with continuous consumption data back to 1909 and is typically used to measure changes in food consumption over time and determine the approximate nutrient content of the food supply. This aggregate approach has the benefit of capturing all food components, no matter how small, including small quantities used as ingredients in other food products. Also, because the food supply series is commodity-based, servings estimates developed from this data set can be readily converted back to the farm level, easing the translation of dietary recommendations into production and supply goals for the agricultural sector (see chapter 20). However, because the series measures food supplies on an aggregate level as they move through marketing channels for domestic consumption, it typically overstates the amount of food actually ingested by humans by capturing substantial quantities of nonedible food parts and food lost to human use through spoilage and other losses in the home and marketing system.

ERS has developed new methods to adjust the food supply data for these losses and express the data in terms of daily per capita Pyramid-based servings (Kantor, 1998). This will allow researchers to gain a more complete understanding of U.S. dietary patterns by comparing food supply servings measured at the national level, with the estimates generated at the individual level by food intake surveys (USDA, ARS, 1998). Also, because the servings estimates are continuous since 1970, policymakers can assess changes in food consumption relative to major nutrition or policy initiatives.

This chapter summarizes these methods and reports per capita Pyramid servings for the U.S. population for 1970-96. Food supply servings estimates are then compared with servings data from the 1996 CSFII (USDA, ARS, 1998). Finally, the likelihood that the food supply will provide the recommended diet by 2005 is assessed by comparing recent growth in food supply servings (1992-96) with growth rates needed to meet Pyramid recommendations by that time.

Federal Dietary Guidance

Growing scientific evidence about the relationship between diet and health has increased the need for information about the quality and composition of the American diet. Chronic diseases for which diet is a risk factor—including coronary heart disease, cancer, stroke, and diabetes—account for nearly two-thirds of all deaths in the United States each year (Frazão, 1995; see also chapter 1). Healthy diets—which are abundant in grains, vegetables, and fruits, and low in fat, saturated fat, and cholesterol—combined with moderate and regular physical activity can reduce the risk for these diseases.

ERS estimates that improved diets could prevent $43 billion (in 1995 dollars) in medical costs and lost productivity resulting from disability, and $28 billion in the value of premature deaths each year (see chapter 1).

The *Dietary Guidelines for Americans* summarizes the most current scientific evidence on diet and health into recommendations for healthy Americans 2 and older, and serves as the basis for Federal nutrition and education programs (USDA/DHHS, 1995; see also chapter 2). The *Food Guide Pyramid* helps consumers put the *Dietary Guidelines* into practice by recommending the type and quantity of foods to eat from five major food groups—bread, cereals, rice, and pasta; vegetables; fruits; milk, yogurt, and cheese; and meat, poultry, fish, dry beans, eggs, and nuts (USDA, ARS, 1996). It also recommends that consumers use fats, oils, and sweets sparingly. For each food group, specific serving sizes are defined—for example, a slice of bread, a medium piece of fruit—which may differ considerably from the serving size listed on nutrition labels. The number of Pyramid servings that are right for any one person varies depending on age, sex, and physiology (table 1).

Translating the Food Supply Data Into Food Servings

The ERS food supply and utilization series measures the national supply of more than 250 foods using records of commodity flows from production to end uses (Putnam and Allshouse, 1997). The amount of food available for domestic consumption is estimated through the development of supply and utilization data sets for raw and semiprocessed agricultural commodities—wheat, corn, red meat, and fluid milk, for example—from which final food products are made. Human food use is not directly measured or statistically estimated. Rather, the amount of food available for human consumption is calculated as the difference between available commodity supplies (the sum of production, beginning inventories, and imports) and nonfood use (exports, ending stocks, seed, feed, and industrial consumption). These components are either directly measurable or estimated by government agencies using sampling and statistical techniques.

Aggregate food supply estimates were converted into Pyramid servings using a multistage process. Each commodity was assigned to one of the Pyramid's five major food groups or to one of two additional groups for added fats and oils and added sweeteners. The data were then converted from pounds and ounces into grams to ease comparison with serving weights identified for different foods in USDA's *Nutrient Data Base for Standard Reference (NDB), Release 11* (USDA, ARS, 1997a).

Table 1—Food Guide Pyramid serving recommendations vary with calorie intake

Daily caloric intake[1]	Bread, cereals, rice/pasta	Vege-tables	Fruit	Dairy[2]	Meat[3]	Total fats[4]	Added sugars[5]
	Servings				*Oz.*	*Grams*	*Tsp.*
1,600 calories:							
Many sedentary women, and some older adults	6	3	2	2-3	5	53	6
2,200 calories:							
Most children, teenage girls, active women, and many sedentary men	9	4	3	2-3	6	73	12
2,800 calories:							
Teenage boys, many active men, and some very active women	11	5	4	2-3	7	93	18

[1] Sample diets for a day at three calorie levels.

[2] Includes milk, yogurt, and cheese. Three servings are appropriate for teenagers and young adults to age 24 and for pregnant and breastfeeding women. Two servings are recommended for all others.

[3] Includes fish, dry beans, eggs, and nuts.

[4] The *Dietary Guidelines* recommend that consumers choose a diet that provides no more than 30 percent of total calories from fat. The upper limit on the grams of fat in a consumer's diet will depend on calorie intake. For example, for a person consuming 2,200 calories per day, the upper limit on total daily fat intake is 660 calories. Seventy-three grams of fat contribute about 660 calories (73 grams x 9 calories per gram of fat = 660 calories).

[5] To avoid getting too many calories from sugar, *The Food Guide Pyramid* suggests that consumers try to limit added sugars to the daily quantities listed.

Source: USDA, CNPP. *The Food Guide Pyramid*, Home and Garden Bulletin Number 252, Oct. 1996.

Next, the data were adjusted for spoilage and other losses by subtracting estimated losses from the consumption weight reported in the food supply data set. Loss was estimated at several different stages in the marketing system (retail, household, institutions) and averaged 27 percent of total available food supplies (Kantor, 1998; Kantor and others, 1997). Cooking losses for selected commodities and the nonedible portions of all foods—seeds, pits, and inedible peels—were also removed from the data set (USDA, ARS, 1975). However, the limited ability of researchers to measure such losses accurately suggests that actual loss rates, and hence the servings estimates on which they depend, may differ from the amounts reported here.

Estimation of Serving Weights

For each food supply commodity, a Pyramid serving weight was defined, based on serving sizes identified in the *Food Guide Pyramid* and weights identified in USDA's NDB. For example, the *Food Guide Pyramid* defines one medium apple as a serving of fruit and the Nutrient Data Base indicates that a medium apple with skin weighs 138 grams.

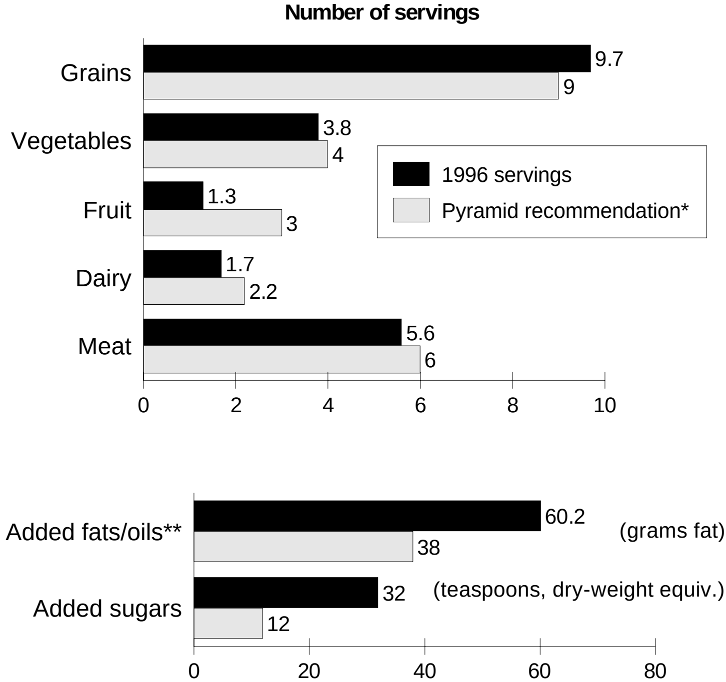
Once Pyramid serving weights were defined for each commodity, daily per capita consumption—adjusted for loss and nonedible parts—was divided by the assigned Pyramid serving weight to calculate the number of per capita Pyramid servings for the commodity (Kantor, 1998). Per capita servings for individual commodities were then aggregated to determine total daily servings for each Pyramid food group and compared with recommended servings. This study used the recommended servings for a sample diet of 2,200 calories (table 1), since this approximates the daily Recommended Energy Allowance (REA) of 2,247 calories for the United States, derived from a 1995 population-weighted average of REA's for different cohorts of the U.S. population.

Gaps Between Per Capita Servings And Recommendations

The food supply data suggest that the average American diet is heavily weighted toward the added fats and sweeteners at the tip of the Pyramid while falling short of recommendations for fruits, vegetables, dairy products, and lean meats and meat alternates (fig. 1). At the same time, the mix of foods provided by the meat, poultry, fish, dry beans, eggs, and nuts group and the bread, cereals, rice, and pasta group may need to change for most consumers to meet recommendations for dietary variety and selected food components such as fiber, total fat, saturated fat, and cholesterol.

Figure 1

1996 food supply servings compared with Food Guide Pyramid serving recommendations



*Pyramid recommendation based on a sample diet of 2,200 calories.

**The Food Guide Pyramid does not make a recommendation for added fats and oils. This recommendation is implied by the 52-percent share of total fats accounted for by added fats and oils in the food supply in 1994 and an upper limit on total fat consumption of 73 grams for a 2,200-calorie diet.

Source: USDA, Economic Research Service.

A comparison of food supply servings between 1970 and 1996 with Pyramid recommendations also suggests that many people have had mixed success in moving toward healthier diets (table 2).

While the average number of servings for several food groups—grains, vegetables, and fruits—has moved closer to recommendations since 1970, the grains, meats, and vegetable groups are the only food groups where total servings are within 10 percent of the recommended intake for a 2,200-calorie diet. While fruit consumption has increased nearly 20 percent between 1970 and 1996, this translates to an increase of about one-fifth of a serving.

Table 2—Average food supply servings for 1970-96 compared with Food Guide Pyramid serving recommendations

Food group	Food supply servings 1970-75	1980-85	1990-95	1996	Recommendation[1]
Grains	6.8	7.5	9.2	9.7	9
Vegetables	3.1	3.2	3.6	3.8	4
Fruits	1.1	1.2	1.3	1.3	3
Milk, yogurt, cheese	1.6	1.5	1.6	1.7	2.2[2]
Meat, poultry, fish, dry beans, eggs, and nuts (oz.)	5.4	5.5	5.6	5.6	6
Added fats and oils (grams)	49	55	62	60	38[3]
Added sugars (tsps.)	27	26	31	32	12

[1] Recommendation based on a 2,200-calorie diet, which is close to the 2,247 calories recommended as an average caloric intake for the population in 1995. Recommended servings for other years may differ.

[2] Based on a weighted average of 3 servings of milk, yogurt, and cheese for teenagers and young adults to age 24 and 2 servings for all others.

[3] According to food supply data for 1994, added fats and oils accounted for 52 percent of the total fat provided by the food supply in that year. The recommendation shown here assumes that added fats and oils account for 52 percent of total fat intake for a daily upper limit of 38 grams of added fats and oils (73 *.52) = 38.

Source: USDA, Economic Research Service.

Whole Grain Servings Fall Short Of Recommendations

In 1996, the food supply provided 9.7 servings of flour and other commodities that make up the bread, cereals, rice, and pasta group, suggesting that many consumers met the 9-serving Pyramid recommendation for a 2,200-calorie diet (table 3). Total daily servings were more than 40 percent higher than in the early 1970's. Almost half of the increase was accounted for by higher consumption of white and whole-wheat flour. A two-fold increase in durum flour (used for pasta) and corn products (used for snack chips and Mexican-style foods such as tortillas) and a three-fold increase in rice consumption accounted for the remainder of the additional grain group servings.

Table 3—1996 food supply servings for the bread, cereals, rice, and pasta group

Item	Servings
Total	9.7
White and wheat flour	7.2
Durum flour (for pasta)	0.4
Rice	0.5
Corn products	1.3
Oat products	0.3
Rye flour and barley products	*
Recommendation	9.0

* = less than 0.1
Source: USDA, Economic Research Service.

While the food supply data suggest that average total grain consumption meets Pyramid recommendations, many consumers may need to change the types of foods consumed from this group to meet dietary recommendations for fiber, fat, cholesterol, and added sugars. In 1992, for example, the latest year for which data are available, whole-wheat flour accounted for less than 2 percent of total wheat flour provided by the food supply (Putnam and Allshouse, 1997; U.S. Department of Commerce, 1995). This shortfall in whole-grain servings is confirmed by food intake data, which indicate that average consumption of foods made from whole grains was well below suggested levels (several servings daily) at about 1 serving per person per day (USDA, ARS, 1998).

Little Variety in Daily Vegetable Servings

The food supply provided a daily average of 3.8 servings of fresh, frozen, and canned vegetables, and dry beans, peas, and lentils in 1996, close to the 4 daily servings recommended for a 2,200-calorie diet (table 4). Per capita servings grew about 20 percent, or just over half a vegetable serving, between 1970 and 1996. Half a daily vegetable serving is about a quarter cup of cooked vegetables, one-quarter of a baked potato, or 5 french fries.

While food supply servings were close to recommendations, consumption was concentrated in a small number of foods, suggesting

Table 4—1996 food supply servings for the vegetable group

Item	Servings
Total vegetables	3.8
Dark green leafy vegetables	0.1
Deep yellow vegetables	0.2
Dry beans, peas, and lentils	0.2
Other starchy vegetables	1.4
Other vegetables	1.9
Recommendation	4.0

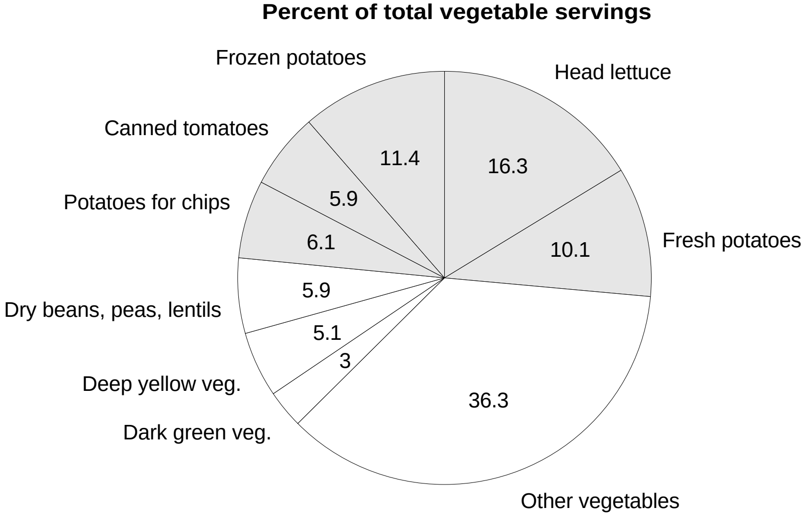
Source: USDA, Economic Research Service.

that many consumers may be incorporating too little variety in their daily vegetable choices.

Dietary guidance suggests that consumers divide their total vegetable servings into three vegetable subgroups—dark green leafy and deep yellow vegetables; starchy vegetables, including potatoes, dry beans, peas, and lentils; and other vegetables (Cronin and others, 1987). However, the food supply servings estimates suggest that most consumers fail to meet these subgroup recommendations. Per capita servings of dark green leafy vegetables, deep yellow vegetables, and dry beans, peas, and lentils were well below recommended levels, while a larger share of servings came from other starchy vegetables, particularly potatoes for freezing. Potatoes for freezing, most of which are used for french fries, accounted for one-third of other starchy vegetable consumption and 11 percent of total vegetable servings (fig. 2).

Variety was also limited within the subgroups. For example, although the food supply data report consumption of more than 80 different vegetables, 5 single commodities (head lettuce (mostly iceberg), potatoes for freezing, fresh potatoes, potatoes for chips and shoestrings, and tomatoes for canning) accounted for half of total 1996 vegetable servings (fig. 2). Dry beans, peas, and lentils combined made up 6 percent of total consumption. Another 15 percent of total vegetable servings came from potatoes for dehydration (used mainly for instant potato products), fresh tomatoes, fresh garlic, and fresh carrots. No other single commodity accounted for more than 3 percent of total vegetable consumption or 0.1 serving.

Figure 2
Share of vegetable servings, 1996



Source: USDA/Economic Research Sservice.

Fruit Consumption Is Less Than Recommended

The food supply provided 1.3 servings per person per day of fresh and processed fruit and fruit juices in 1996, less than half the 3 daily fruit servings recommended by the Food Guide Pyramid for a 2,200-calorie diet (table 5). When measured in Pyramid servings, average fruit consumption has remained relatively unchanged over the past two decades, with average servings increasing by about one-fifth of a

Table 5—1996 food supply servings for the fruit group

Item	Servings
Total fruit	1.3
Citrus, melons, and berries	0.6
Fresh citrus	0.1
Melons, berries, kiwi	0.2
Citrus juice	0.3
Other fruit	0.7
Recommendation	3.0

Source: USDA, Economic Research Service.

serving—the equivalent of a quarter of a medium banana or apple per person daily or one and a half ounces of fruit juice—between 1970 and 1996.

Consistent with recommendations, total fruit servings were almost evenly divided between two fruit subgroups—citrus, melons, and berries, including kiwifruit; and other fruit. However, with close to half of total fruit servings coming from five foods—orange juice (18 percent), bananas (9.8 percent), fresh apples (7.9 percent), watermelon (6.5 percent), and apple juice (5.8 percent)—out of the more than 60 fruit products included in the food supply data, the data suggest that many consumers are not incorporating adequate variety into their daily fruit choices.

Cheese Accounts for More Than a Third Of Total Dairy Servings

Dairy products—including milk, yogurt, and cheese—accounted for almost three-quarters of the calcium available in the U.S. food supply in 1994 (see chapter 7 for more on the nutrient content of the food supply). Calcium is essential for the formation of bones and teeth, and requirements thus increase significantly during adolescence, early adulthood, pregnancy, and lactation. As a result, the milk, yogurt, and cheese group is the only food group for which recommended servings are based on age and physiology rather than energy requirements. Three daily servings—the equivalent of three 8-ounce glasses of milk per day—are suggested for teenagers, young adults up to 24 years of age, and pregnant and lactating women. Two daily servings are recommended for all others.

In this study, food supply servings were measured against a daily recommended intake of 2.2 servings. This target was based on a weighted average of recommended servings for different age groups of the U.S. population (excluding the higher needs of pregnant and lactating women). The food supply provided about 1.7 daily servings of dairy products in 1996, about three-quarters of the 2.2 servings target, and essentially unchanged since 1970 (table 6).

A modest increase in consumption, equal to about a half cup of milk per person daily, would bring per capita servings up to Pyramid recommendations. However, because many dairy foods are naturally high in fat and saturated fat, consumers may need to balance any

Table 6—1996 food supply servings for the milk, yogurt, and cheese group

Item	Servings
Total milk, yogurt, and cheese	1.7
Fluid milk	0.8
Cheese	0.6
Yogurt	*
Frozen dairy	0.1
Other	0.1
Recommendation	2.2

* less than 0.1 serving.
Source: USDA, Economic Research Service.

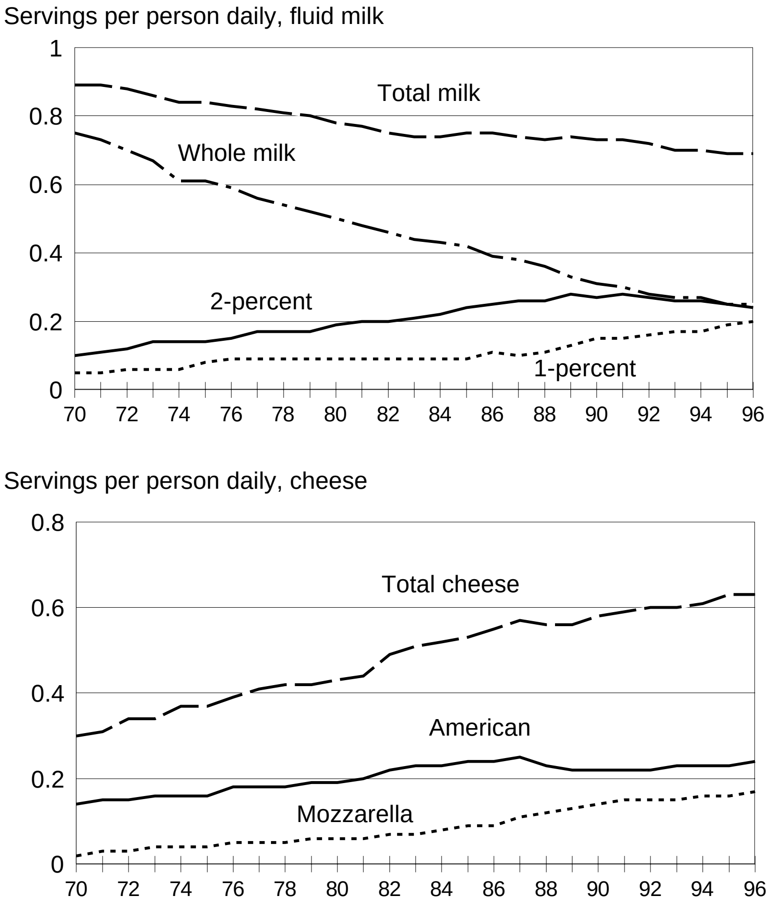
increased dairy consumption with overall fat intake. In 1996, for example, more than half the dairy servings provided by the food supply came from two dairy products that are naturally high in fat—cheese (natural and processed) and whole milk (including dry and condensed).

Sharp changes over time in consumption patterns for fluid milk and cheese also suggest that many consumers may simply be substituting one high-fat dairy food for another, with little net reduction in total dairy fat intake (fig. 3). Between 1970 and 1996, for example, Americans reduced their per capita daily servings of whole milk by one-third to just over one-fourth cup. Servings of lowfat and nonfat milk (1-percent and skim) nearly doubled during this same period, but consumption is still relatively low, at one-fifth cup per person per day. Servings of reduced-fat (2-percent) milk increased by about 25 percent to just over one-fourth cup. However, during the same period, declining whole milk consumption was accompanied by a sharp increase in per capita servings of cheese, most of which is nearly as high (or higher than) whole milk in total and saturated fat per serving. This is consistent with food supply nutrient data that show that total fat and saturated fat provided by dairy products remained constant between 1970 and 1994 (USDA, CNPP, 1997; see also chapter 7).

Red Meat Dominates Meat Group Consumption

For a 2,200-calorie diet, the *Food Guide Pyramid* recommends the equivalent of 6 ounces of cooked lean meat per person per day. Meat, poultry, and fish are counted in total ounces. Other foods in

Figure 3
Average daily food supply servings of selected dairy products, 1970-96



Source: USDA, Economic Research Service.

this group—1 egg, 2 tablespoons of peanut butter, or 1/3 cup of nuts—are counted as the equivalent of 1 ounce of cooked lean meat.

After adjusting for waste and cooking losses, the food supply provided the equivalent of 5.6 ounces of cooked meat (lean and fat portion) per person per day in 1996—a modest 4-percent increase from the early 1970's, and close to the recommended 6 ounces of cooked lean meat (table 7). Because the food supply estimates for meat and poul-

Table 7—1996 food supply servings for the meat, poultry, fish, eggs, dry beans, and nuts group[1]

Item	Ounces
Total meat group	5.6
Meat, poultry, and fish	4.9
Red meat	2.9
Poultry	1.6
Fish and seafood	0.4
Eggs	0.5
Peanuts and peanut butter	0.1
Tree nuts	0.1
Recommendation	6.0

[1] Dry beans, peas, and lentils counted in the vegetable group.
Source: USDA, Economic Research Service.

try include both the lean and fat portion of these products, they likely overstate lean meat consumption, and are not directly comparable with the *Food Guide Pyramid* recommendation. However, the data do suggest that, on average, Americans consume larger quantities of foods that, relative to others in the meat group, are naturally high in fat, saturated fat, and cholesterol. Thus, many consumers may need to adjust the types of foods consumed from this group.

Despite a nearly 60-percent increase in poultry meat (chicken and turkey) consumption since 1980, red meat (beef, veal, pork, and lamb) accounted for 52 percent of total meat equivalents in 1996, nearly double the 27-percent poultry share. Fish and shellfish accounted for 8 percent of consumption, while about 10 percent of meat group consumption came from eggs. Another 2 percent of meat group consumption came from peanut butter.

Added Fats and Oils Account for Over Four-Fifths of Recommended Upper Limit for Total Fat Consumption

Fats and oils are added in cooking and at the table and in many processed food products, including baked goods, french fries, snack foods, and peanut butter. Much of the added fat in processed foods is “invisible” to the consumer, who is typically not aware of their fat

Table 8—1996 food supply fat grams from added fats and oils

Item	Servings (grams)
Total fat grams from added fats and oils	60.2
Salad and cooking oils	25.6
Shortening	17.8
Margarine	7.1
Lard	1.4
Edible tallow	1.4
Other edible fats	1.6
Dairy fats	5.3
Butter	3.3
Heavy cream	0.5
Light cream	0.1
Sour cream	0.5
Half and half	0.3
Cream and neufchatel cheese	0.6
Recommendation	38.0

Source: USDA, Economic Research Service.

content. These added fats are consumed in addition to those that occur naturally in meats, fish, nuts, eggs, and dairy products.

After adjusting for losses and the nonfat portion of composite products like margarine, the food supply provided 60 grams of fat from added fats and oil products in 1996, a 22-percent increase from the 49 grams provided by the food supply in the early 1970's (table 2).

Over 70 percent of the added fat in 1996 came from salad and cooking oils and shortening (table 8). Animal fats—including lard, edible tallow, butter, and other dairy fats—accounted for 13.5 percent of total servings. Lard and edible tallow, together with vegetable shortening, are used largely for deep-fat frying by fast-food restaurants and other food establishments.

Although some dietary fat is essential for good health, excessive fat intake is associated with increased blood cholesterol, heart disease, and some cancers. The Dietary Guidelines recommend that people limit their total fat consumption to no more than 30 percent of daily energy intake—about 73 grams of added and naturally occurring fat for a 2,200-calorie diet (USDA/DHHS, 1995). In 1996, added fats and oils alone accounted for 82 percent of this suggested upper limit.

According to food supply nutrient data for 1990-94, added fats accounted for 52 percent of the total fat provided by the food supply (Putnam and Allshouse, 1997). Although some of this fat was not actually consumed due to loss and spoilage, the data suggest that consumption of both added and naturally occurring fats needs to be reduced in order to meet dietary recommendations. Assuming that added fats continue to account for 52 percent of daily fat consumption, consumption of added fats and oils would have to decline by more than one-third to 38 grams to bring average total fat consumption per person to the 30 percent of calories recommended as an upper limit by the *Dietary Guidelines*.

Added Sugar Consumption Exceeds Dietary Targets

Although the human body cannot distinguish between naturally occurring and added sugars, dietary guidance focuses on added sugars because foods high in added sugars often supply calories but few nutrients. To the extent that consumers substitute the calories from less nutrient-dense sugary snacks like sweetened soft drinks and candy for nutrient-rich foods like fruits, vegetables, and whole grains, dietary intake of the fiber, vitamins, minerals, and other nutrients found in these foods may be reduced. To maintain nutritious diets and healthy weights, the *Food Guide Pyramid* suggests that consumers limit their added sugars to 12 teaspoons for a 2,200-calorie diet (USDA, CNPP, 1996).

After adjusting for losses, the food supply provided 32 teaspoons, or one-quarter pound per person per day of added sugars and other caloric sweeteners (refined cane and beet sugar, corn sweeteners, and edible syrups) in 1996—or the amount of sweetener in about three and a half regular 12-ounce colas (table 9). Average daily consumption was nearly triple the 12 teaspoons suggested as an upper limit for a 2,200-calorie diet by the *Food Guide Pyramid* (USDA, CNPP, 1996). Consumption grew by 23 percent between 1970 and 1996, led by a sharp rise in the use of high-fructose corn syrup and other corn sweeteners (see chapter 7).

The ability of consumers to moderate their consumption of added sugars and sweeteners is complicated by the fact that many added

Table 9—1996 food supply servings for caloric sweeteners

Item	Servings (tsp.)
Total caloric sweeteners	32
Cane and beet sugar	14
High-fructose corn syrup	13
Glucose	4
Dextrose	0.8
Edible syrups	0.1
Honey	0.2
Recommendation	12.0

Source: USDA, Economic Research Service.

sweeteners are likely to be "hidden" in prepared foods. Although the new food label mandated by the Nutrition Labeling and Education Act (FDA, 1997) requires manufacturers to disclose the total sugar content of food, the label does not distinguish total from added sugars, which may sometimes make it difficult for consumers to determine how much added sugar they are actually consuming.

Food Supply Data Compared With the CSFII

ERS food supply data are only one component of the Federal Government's nutrition monitoring program. Comparing food supply servings estimates with the CSFII servings data can help researchers refine estimates of food loss and other factors used to generate these data and to address data gaps for subgroups like dark green leafy and deep yellow vegetables. Such a comparison may also help to pinpoint the extent to which underreporting of energy intake by CSFII respondents differs across food groups. This knowledge may lead to further improvements in data collection methods for both data sets and improved accuracy in estimating the population's dietary status.

A comparison of the food supply servings estimates with those generated from the 1996 CSFII shows notable differences in two major food groups—bread, cereals, rice, and pasta; and meat, poultry, fish, dry beans, eggs, and nuts—and smaller differences in the vegetable, fruit, and dairy groups (table 10). A large gap also exists between the food supply and CSFII servings estimates for added sugars.

Table 10—Comparing food supply servings with CSFII servings estimates[1]

Food group	1996 food supply servings	1996 CSFII servings
Bread, cereals, rice, and pasta	9.7	6.8
Vegetables	3.8	3.4
Fruit	1.3	1.5
Milk, yogurt, and cheese	1.7	1.5
Meat, poultry, fish, dry beans, eggs, and nuts (oz.)	5.6	4.5
Added fats and oils (grams)[2]	60.2	--
Added sugars (tsp.)	32	20.1

[1] Differences in methodology may affect comparability of the servings estimates.

[2] Added fats and oils were not measured separately in the CSFII servings estimates.

Sources: USDA, Economic Research Service; USDA, ARS, 1998.

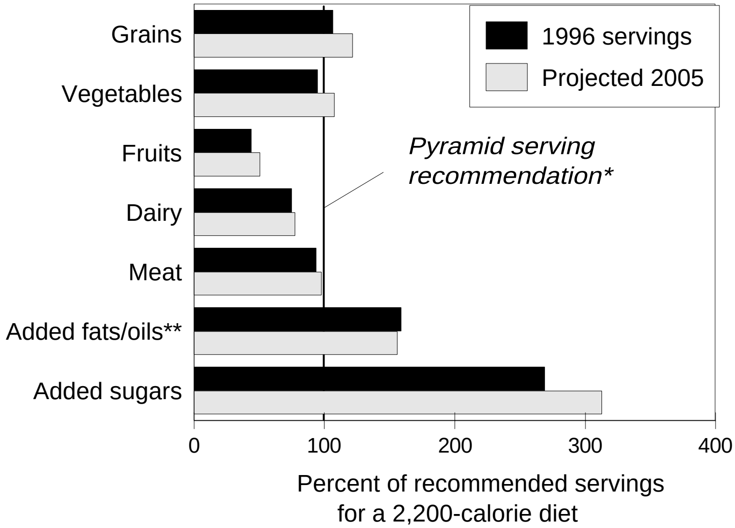
A portion of the gap between the food supply and CSFII servings estimates can be attributed to methodological differences (Kantor, 1998). For meat, poultry, and fish, for example, the food supply estimates include both the lean and fat portions while the CSFII estimates include lean meat only. However, these methodological differences are not sufficient to explain all of the variation in the servings estimates from the two data sets, and additional research is needed to gain a more complete understanding of actual intakes of these foods.

Is the Food Supply Likely to Meet Pyramid Recommendations in 2005?

Using annual per capita 1992-96 growth rates in food supply servings to project food supply servings through 2005 and assuming that recommendations remain at the same level (for a 2,200-calorie diet), our projections indicate that by 2005, most diets will continue to fall short of recommended servings of fruits, dairy products, and some vegetable subgroups, while consumption of added sugars and added fats and oils will continue to exceed suggested limits (fig. 4).

For those food groups where consumption is currently below dietary targets—fruits, vegetables, dairy products, and meats—the largest gap between projected servings in 2005 and recommendations will be in the fruit group. At 1992-96 growth rates, per capita servings will

Figure 4
Projected per capita food supply servings in 2005 compared with 1996



*Pyramid recommendations based on a sample diet of 2,200 calories.
**The Food Guide Pyramid does not make a recommendation for added fats and oils. This recommendation is implied by the 52-percent share of total fats accounted for by added fats and oils in the food supply in 1994 and an upper limit on total fat consumption of 73 grams for a 2,200-calorie diet.
Source: USDA/ERS.

increase only slightly to 1.5 servings in 2005. A 9-percent average annual increase in per capita fruit servings—more than five times the 1992-96 growth rate—would be needed for average fruit consumption to reach the target of three daily servings.

Per capita daily vegetable servings will slightly exceed the recommendation in 2005, climbing to 4.3 servings by the end of the projection period. However, if the current composition of vegetable consumption were to continue, vegetable servings would remain well below recommended levels for some vegetable subgroups. For example, at 1992-96 growth rates, average servings of dark green leafy vegetables, deep yellow vegetables, and dry beans, peas, and lentils would be 30 percent, 41 percent, and 42 percent of recommended levels in 2005. To reach Pyramid targets by the end of the projection period, daily servings of these three subgroups would have to grow at 6, 3, and 18 times the annual per capita rate observed during 1992-96.

While the *Food Guide Pyramid* makes separate servings recommendations for fruits and vegetables, the 5-A-Day for Better Health program and the U.S. Department of Health and Human Services' Healthy People 2000 set a combined minimum consumption goal of five daily servings of fruits and vegetables (see chapter 6). This consumption target was met in 1996 with 5.1 combined per capita servings of fruits and vegetables. At 1992-96 growth rates of 1.4 percent annually, total fruit and vegetable consumption would grow to 5.8 servings by 2005, 17 percent above the 5-servings target. However, our analysis suggests that consumption would need to grow at more than twice that rate to reach the 7-servings daily target associated with a 2,200-calorie diet used in this study. Were current growth rates to continue, the seven-serving target would not be reached until 2018.

At 1992-96 annual growth rates, average dairy consumption will also fall short of dietary targets in 2005, remaining virtually unchanged at 1.7 servings per capita. Per capita dairy servings would need to grow 8 times the 1992-96 pace for the 2.2-serving target to be met by 2005.

Aggregate consumption from the meat, poultry, fish, dry beans, eggs, and nuts group was close to dietary targets in 1996, and at 1992-96 growth rates will nearly meet the minimum target for a 2,200-calorie diet by 2005 at 5.9 ounces of cooked-meat equivalents.

Consumption of grain products will continue to exceed minimum Pyramid serving recommendations for the bread, cereals, rice, and pasta group through 2005. At 1992-96 growth rates, grain product consumption will reach nearly 11 servings per person daily by 2005, about a 1.5-serving increase over the 1996 estimate.

Consumption of both added fats and oils and added sugars will continue to exceed recommended upper limits in 2005. Although fat grams from added fats and oils will continue to trend downward following the 1992-96 decline, average consumption will remain well above suggested upper limits (38 grams) in 2005, at 59 grams per person per day. At 1992-96 growth rates, the gap between average consumption of added sugars and upper consumption limits suggested by dietary guidance would widen in 2005 with average consumption reaching 38 teaspoons per person daily, 3 times recommended levels. However, the magnitude of this increase, which would result in an additional 96 calories per person daily from added sugars alone, suggests that this trend may flatten over time.

Conclusions

This study details new methods for expressing time series food supply data in terms of Food Guide Pyramid servings. Aggregate annual food supply data for the United States were adjusted for food spoilage, nonedible food parts, and other losses and converted into daily per capita servings, which could be assessed against Pyramid serving recommendations.

Information on the extent to which diets meet Federal dietary recommendations is key to Federal efforts to monitor the dietary and nutritional status of the population. The results of this analysis provide Federal policy officials and nutrition educators with new insights about the progress our Nation is making in achieving healthier diets. Also, because the food supply series is commodity-based, servings estimates presented here can be readily converted back to the farm level, allowing researchers, for the first time, to directly link dietary recommendations to the U.S. food production and marketing system (see chapter 20).

The analysis suggests that despite positive dietary changes that have occurred over the past two decades—including increased consumption of fruits, vegetables, and grain products—many Americans are falling short of suggested consumption targets for most of the Pyramid's five major food groups, while consuming excess calories of fats, oils, and sweeteners depicted at the tip of the Pyramid.

A continuation of recent (1992-96) growth rates in per capita servings through 2005 suggests that, on average, diets will fall short of Pyramid serving recommendations for fruits, some vegetable subgroups (dark green leafy vegetables, deep yellow vegetables, and dry beans, peas, and lentils), and dairy products, while servings of added sugars and added fats and oils will far exceed recommended upper consumption limits.

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Chapter 5

Diet Quality Of Americans

Healthy Eating Index

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The Healthy Eating Index (HEI), developed by the Center for Nutrition Policy and Promotion of the U.S. Department of Agriculture, provides a single summary measure of the overall nutritional quality of the American diet. While the average HEI increased from 61.5 in 1989-90 to 63.8 in 1994-96, most individuals (70 percent) had diets defined as "needing improvement" (HEI scores between 51 and 80); only about 12 percent of individuals had diets that could be classified as "good" (HEI score above 80). The 10 components that make up the HEI provide insights into the types of dietary changes needed to improve American eating patterns and call attention to the fact that Americans need to do more than reduce their fat intake to attain healthier diets.

Introduction

As the focus of nutritional concerns in the United States has changed over the past decades, with nutritional deficiencies giving way to health problems associated with nutritional excesses, measures of

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diet quality have also changed. Early measures of diet quality focused on evaluating intake levels of specific dietary components, such as the percentage of Recommended Dietary Allowances achieved (Guthrie and Scheer, 1981). The emergence of dietary guidelines in the late 1970's—focusing on reducing consumer intakes of fat, saturated fat, cholesterol, sodium, and sugar, and increasing consumption of foods high in fiber and complex carbohydrates—became the basis for the development of new indexes of diet quality. Even these, however, have been selective in their components, typically limiting themselves to measuring intake of total fat and/or saturated fat, cholesterol, and sodium (Patterson, Haines, and Popkin, 1994). Few instruments have been developed to assess overall dietary quality—even though most American diets fall short of the recommendations in more than one aspect (see chapters 3, 4, and 6).

In an effort to measure how well American diets conform to recommended healthy eating patterns, and to provide a single summary measure of overall diet quality, the Center for Nutrition Policy and Promotion of the U.S. Department of Agriculture (USDA) developed the Healthy Eating Index (HEI) (USDA, CNPP, 1995; Kennedy and others, 1995). The HEI provides a picture of the types of foods people are eating, the variety in their diet, and the degree to which they comply with specific recommendations in the *Dietary Guidelines for Americans* (USDA and DHHS, 1995) and the *Food Guide Pyramid* (USDA, 1992). As such, the HEI can serve as a report card on the overall nutritional quality of the American diet. The American Dietetic Association (1995) has described the HEI as "the most accurate measurement to date on how Americans eat."

Components of the Index

The Healthy Eating Index (HEI) was designed to reflect the sum of 10 components of a healthful diet, where each component is assigned equal weight (for additional details on the HEI see Bowman and others, 1998; USDA, CNPP, 1995; Kennedy and others, 1995).

Components 1-5 measure the degree to which a person's diet conforms to the *Food Guide Pyramid*'s serving recommendations for the five major food groups: grains group (bread, cereal, rice, and pasta; vegetables group; fruits group; milk group (milk, yogurt, and cheese); and the meat group (meat, poultry, fish, dry beans, eggs, and nuts). The number of recommended servings for each food group

Table 1—Recommended number of USDA Food Guide Pyramid servings per day by age/gender categories

Age/gender	Energy[1]	Grains	Vegetables	Fruits	Milk	Meat[2]
	Kilocalories	*Recommended number of daily servings*				
Children 2-3[3]	1,300	6	3	2	2	2
R	*1,600*	*6*	*3*	*2*	*2*	*2*
Children 4-6	1,800	7	3.3	2.3	2	2.1
Females 51+	1,900	7.4	3.5	2.5	2	2.2
Children 7-10	2,000	7.8	3.7	2.7	2	2.3
Females 11-24	2,200	9	4	3	3	2.4
R	*2,200*	*9*	*4*	*3*	*2*	*2.4*
Females 25-50	2,200	9	4	3	2	2.4
Males 51+	2,300	9.1	4.2	3.2	2	2.5
Males 11-14	2,500	9.9	4.5	3.5	3	2.6
R	*2,800*	*11*	*5*	*4*	*2*	*2.8*
Males 19-24	2,900	11	5	4	3	2.8
Males 25-50	2,900	11	5	4	2	2.8
Males 15-18	3,000	11	5	4	3	2.8

[1] Recommended Energy Allowances from National Research Council, Food and Nutrition Board. *Recommended Dietary Allowances*, 10th ed., Washington, DC: National Academy Press 1989b.

[2] One serving of meat equals 2.5 ounces of lean meat.

[3] Portion sizes were reduced to two-thirds of the adult serving size except for milk.

R = Recommended number of servings per day at food energy levels specified in the Food Guide Pyramid (USDA, 1992).

Source: Bowman and others, 1998.

varies with the individual's age, gender, physiological status (such as being pregnant or breastfeeding), and energy requirement (table 1). The decision to use food groups rather than nutrients for the first five components was based on the notion that people eat foods, not nutrients, and this would provide an easier standard against which people could judge their diets. Furthermore, it is thought that there may be as yet unknown nutrients in foods.

Four of the other five components are based on nutrients specifically mentioned in the *Dietary Guidelines*. Component 6 measures total fat as a percentage of total energy intake, component 7 measures saturated fat intake as a percentage of total energy intake, component 8 measures cholesterol intake, and component 9 measures sodium intake. The final component addresses the variety in a person's diet—one of the key recommendations in the *Dietary Guidelines*.

Table 2—Components of the Healthy Eating Index

Component	Range of score	Criteria for perfect score of 10[1]	Criteria for score of 0
Food group			
1. Grains	0 to 10	6-11 servings	0 servings
2. Vegetables	0 to 10	3-5 servings	0 servings
3. Fruits	0 to 10	2-4 servings	0 servings
4. Milk	0 to 10	2-3 servings	0 servings
5. Meat	0 to 10	2-3 servings	0 servings
Dietary guidelines			
6. Total fat	0 to 10	30% or less calories	45% more calories
7. Saturated fat	0 to 10	< 10% calories	15% or more calories
8. Cholesterol	0 to 10	300 mg or less	450 mg or more
9. Sodium	0 to 10	2,400 mg or less	4,800 mg or more
10. Variety	0 to 10	8 or more different items in a day	3 or fewer food items in a day

[1] Persons with component scores between the maximum and minimum cutoff points were assigned scores proportionately. Recommended servings depend on recommended energy intake and age (see table 1).

Source: Bowman and others, 1998.

Each of the 10 components can be scored from 0 to 10, resulting in a total HEI range of 0 to 100. For components 1-5, individuals who consume at least the daily recommended number of servings in each food group receive a maximum score of 10; individuals who consume no item in a particular food group receive a score of 0 (table 2). Intermediate scores are calculated proportionately. For example, if the serving recommendation for a food group was four, and the person consumed two servings, the person would receive a component score of 5 for that food group; if three servings were consumed, the score would be 7.5. If five servings were consumed, the person would receive the maximum score of 10, since additional servings receive no additional credits nor deductions.

Components 6-10 are scored differently. Index scores for total fat and saturated fat (components 6 and 7) are examined in proportion to total food energy intake; cholesterol and sodium (components 8 and 9) are based on milligrams consumed. Variety (component 10) is assessed by totaling the number of "different" foods eaten by an individual in amounts sufficient to contribute at least one-half serving of the relevant food group. Identical food items eaten on separate occasions were aggregated before imposing the one-half-serving constraint. Foods that were similar—such as two different forms of white bread—or that differed only in preparation methods—such as baked, fried, and boiled potatoes—were grouped together and counted as one type of food. Different types of a food—for example, different types of fish, such as tuna, mackerel, and trout—were grouped separately. Food mixtures were broken down into their component parts and assigned to the relevant food groups. For example, lasagna might contribute to both the grains and the meat groups.

The 1994-96 HEI

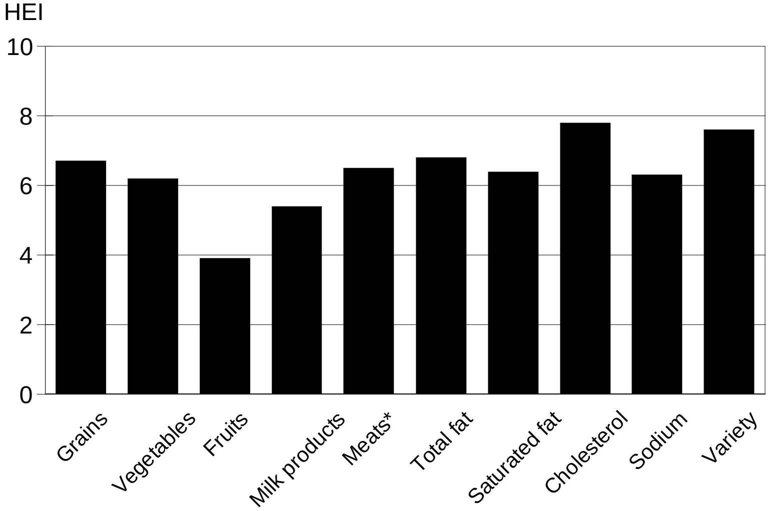
The Continuing Survey of Food Intakes by Individuals (CSFII) by the U.S. Department of Agriculture provides information on the consumption of foods and nutrients by individuals. It also provides extensive data about personal and socioeconomic characteristics. Although the HEI was first computed using the 1989-90 CSFII (USDA, CNPP, 1995; Kennedy and others, 1995), it has recently been updated using the most recent CSFII data available, the 1994-96 CSFII, which collected dietary intake data for 2 nonconsecutive days (Bowman and others, 1998). For the HEI analysis, however, only the first day's intake data were used. Further, the sample was made up of individuals 2 years and older except pregnant and lactating women. Sample sizes were approximately 5,200 individuals in 1994, 4,900 individuals in 1995, and 4,800 individuals in 1996.

The HEI scores averaged 63.6 in 1994, 63.5 in 1995, and 63.8 in 1996. Most individuals (70 percent) fell in the middle range, with a score between 51 and 80, defined as a diet that "needs improvement." Only about 12 percent had scores above 80 ("good diets"), while 18 percent had diets classified as "poor" (scores below 51).

Scores for the individual components of the index varied considerably, ranging from 3.9 for consumption of fruits to 7.8 for cholesterol (fig. 1). The variety component accounted for the second highest score—7.6. High component scores indicate intakes close to recommended levels, while low component scores indicate less compliance with recommended levels.

Fewer than half the individuals obtained the maximum score of 10 in any of the component categories, with the exception of the cholesterol and variety components (fig. 2). Less than 20 percent of the sample had the recommended number of servings of fruits, less than a third consumed the recommended number of servings from the

Figure 1
Healthy Eating Index component mean scores, 1994-96



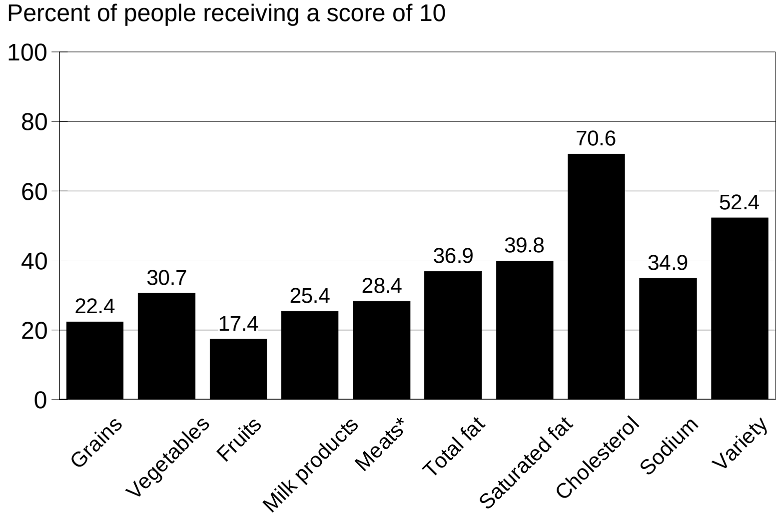
* Meats include eggs, nuts, and some legumes.
Source: Bowman and others, 1998.

grains, vegetables, milk, or meat groups, and less than 40 percent met the dietary recommendations for total fat, saturated fat, or sodium. Only for the cholesterol and variety components did a majority of individuals (71 percent and 52 percent) achieve a perfect score.

The HEI varied with some economic and demographic factors (table 3). Females had slightly higher scores than males; and persons in the younger and older age groups scored higher than other individuals. Children age 2-3 had the highest average HEI score (74), while older children had lower HEI scores than younger children. Some of the score differences may be related to the lower caloric intake of females relative to males, and of younger children and older adults relative to teenagers and young adults, since individuals who eat fewer calories likely consume less cholesterol and sodium, and therefore would have higher scores for those components. However, children age 2-3 scored particularly higher on the fruit and milk components of the HEI than older children, suggesting that changes in dietary habits may play an important role. For example, children age 2-3 had an average fruit score of 7 compared with 3.5 for males age

Figure 2

Percentage of people meeting the dietary recommendations for the Healthy Eating Index component mean scores, 1994-96



* Meats include eggs, nuts, and some legumes.
Source: Bowman and others, 1998.

11-14, and an average milk group score of 7.3 compared with 5.2 for females age 11-14 (Bowman and others, 1998).

HEI scores generally improved with increasing household income. Individuals in higher income households did better on the saturated fat and sodium components of the HEI than did people in lower income households.

Education level was positively associated with a better diet. In 1994-96, the average HEI score was 61 for those with a high school diploma or less, 66 for those with 4 years of college, and 68 for those with more than 4 years of college. Education may be a predictor of people's ability to translate nutrition guidance information into better dietary practices.

Among adults 19 and older, those with better diets had lower body mass indexes (BMI, a measure, based on weight and height, of

Table 3—Healthy Eating Index scores by sociodemographic characteristics, 1994-96

Characteristic	1994	1995	1996	1994-96
			HEI	
Gender:				
Male	63.0	63.0	62.6	62.9
Female	64.2	64.0	65.0	64.4
Age/gender:				
Children 2-3	74.4	74.0	73.2	73.9
Children 4-6	66.4	68.8	68.0	67.7
Children 7-10	66.9	67.1	65.9	66.6
Females 11-14	63.1	63.5	64.0	63.5
Females 15-18	61.4	58.4	62.5	60.8
Females 19-50	61.8	61.2	62.7	61.9
Females 51+	67.1	67.6	67.5	67.4
Males 11-14	62.4	63.2	61.2	62.3
Males 15-18	60.4	61.4	60.2	60.7
Males 19-50	61.2	60.6	60.6	60.8
Males 51+	64.0	64.0	65.2	64.4
Education level:				
4 years of high school or less	60.8	60.6	61.0	60.8
Some college	63.5	63.0	63.2	63.2
4 years of college	66.6	65.4	67.1	66.4
More than 4 years of college	67.6	68.1	68.4	68.0
Income as percentage of poverty level:				
0-50	58.8	61.2	60.7	60.2
51-100	60.5	61.4	60.5	60.8
101-130	61.5	61.6	61.6	61.6
131-200	62.8	61.4	63.7	62.6
201-299	63.8	63.6	63.6	63.7
300+	65.0	64.9	65.0	65.0
Region:				
Northeast	65.3	65.0	65.8	65.4
Midwest	64.1	64.0	65.2	64.4
South	61.7	61.7	61.3	61.6
West	64.5	64.6	64.7	64.6

Source: Bowman and others, 1998.

Table 4—Mean body mass index for adults, by HEI, 1994-96

Adults	Good diet	Diet needs improvement	Poor diet
Female	25.1	25.6	26.2
Male	25.6	26.4	26.6

Source: Bowman and others, 1988.

appropriate body weight), suggesting a connection between diet quality and their BMI (table 4).

How Does the HEI Correlate With Other Measures of Diet Quality?

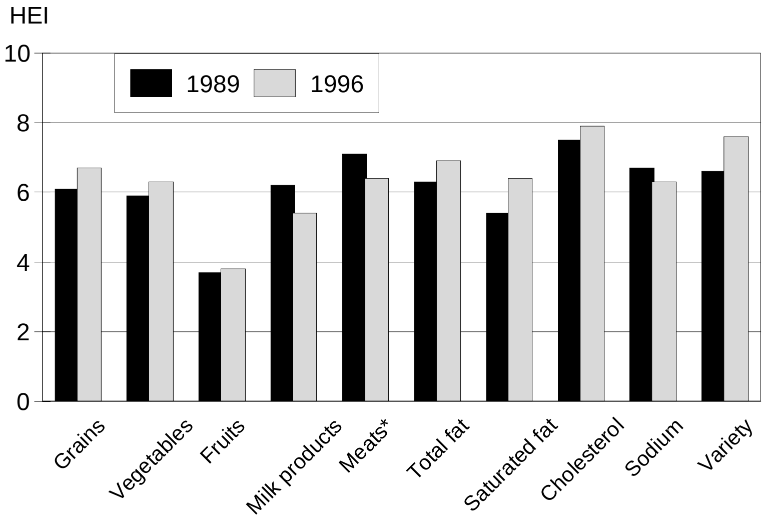
The usefulness of the HEI depends partly on the degree to which it correlates with other conventional measures of diet quality. The 1989-90 HEI, computed using data from the 1989-90 CSFII (USDA, CNPP, 1995; Kennedy and others, 1995), was shown to correlate well with the Recommended Dietary Allowances (RDA's) for a number of nutrients, with the likelihood of falling below 75 percent of the RDA decreasing as the mean score on the HEI increased.

In addition, for those individuals 18 and older for whom the information was available, the HEI score was compared with individuals' self-rating of their diets. Persons who rated their diets as excellent had a significantly higher HEI (67.6) than individuals who rated their diets as good (63.2), fair (59.9), or poor (55.8). Only 16.3 percent of the study subjects self-rated their diets as excellent (see chapter 15 for a comparison of subjects' perception of the cholesterol content of their diets and their actual cholesterol intake). Unfortunately, this comparison could not be performed with the 1994-96 CSFII, which did not collect information on how individuals rated their diets.

Trends in the HEI: 1989 vs. 1996

A comparison of the 1996 HEI with the HEI using the first day's intake from the 1989 CSFII suggests that, on average, diets have improved since 1989, although most people's diets still need improvement.

Figure 3
Healthy Eating Index component mean scores, 1989 and 1996



* Meats include eggs, nuts, and some legumes.
Source: Bowman and others, 1998.

The increase in average HEI score between 1989 and 1996, from 61.5 to 63.8, is the result of higher scores in 7 of the 10 HEI components (fig. 3). Gains in HEI component scores are particularly noticeable for the saturated fat and variety components. The three components for which scores did not increase were milk, meat, and sodium. In the past several years, consumption of milk has declined as consumption of carbonated soft drinks has increased (Putnam and Gerrior, 1997). The decrease in the sodium component may be related to the increase in the grains score, since grain products contribute large amounts of dietary sodium (Saltos and Bowman, 1997).

The increase in the average HEI since 1989 may be due to several factors, including the implementation of the Nutrition Labeling and Education Act, and various nutrition campaigns emphasizing the health benefits of better diets.

Implications for Nutrition Promotion and Public Policy

The data from the Healthy Eating Index show that although diet quality has improved over the past few years, the diets of most Americans need improvement in several aspects. In 1996, only 12 percent of those 2 and older had a diet that could be considered "good."

Although component scores have typically increased, the vast majority of Americans are still not consuming the recommended number of servings from the five major food groups in the Food Guide Pyramid. In addition, less than 40 percent of the individuals had diets that conformed to the quantitative recommendations for total fat or saturated fat in the *Dietary Guidelines*.

Although the HEI for most people needs improvement, some individuals are more at risk of consuming a poor diet than others. Persons from low-income households, individuals with less education, and persons age 15-50 were most likely to have lower average scores.

The Healthy Eating Index reflects the complexity of dietary patterns. Doing well on one component of the index—say, total fat—does not ensure a high score on the overall HEI. Overall diet quality is reflected in the total index score and is not determined by any individual component score.

The results of the HEI are useful in designing and targeting nutrition education and health promotion activities. The HEI provides insights into the types of dietary changes needed to improve American eating patterns. In particular, the HEI calls attention to the fact that there are a number of problems with current dietary patterns, and that Americans need to do more than reduce their fat intake to attain healthier diets.

A two-tiered approach appears warranted. First, nutrition promotion activities that address the nutritional needs of all Americans are needed. For example, consumption of fruit was low across all population groups.

Second, additional strategies for nutrition promotion targeted at certain groups are needed. Results from these analyses suggest that individuals from low-income households and less-educated people are more likely to have lower HEI scores. Nutrition promotion interventions need to take into consideration these special constraints.

Efforts are already underway within USDA to integrate nutrition education into all of the food assistance programs. In addition, the USDA Center for Nutrition Policy and Promotion plans to develop a consumer-oriented, self-assessment guide to allow consumers to evaluate the quality of their own diet.

The HEI also provides a useful instrument for monitoring trends in U.S. consumption patterns and in the overall healthfulness of the American diet. USDA's Center for Nutrition Policy and Promotion plans to continue to update and publish the Index as nationally representative dietary survey data become available.

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Chapter 6

American Diets and Year 2000 Goals

Nancy T. Crane, Van S. Hubbard, and Christine J. Lewis

Healthy People 2000 is a national initiative to improve the health of all Americans. This chapter describes the progress made toward the nutrition objectives that are related to the goals of the Dietary Guidelines for Americans.

Introduction

The *Healthy People 2000* initiative presents a national prevention strategy for improving the health of the American people (DHHS, 1991, 1995). Its goals are to increase the span of healthy life for Americans, reduce health disparities among the population, and ensure access to preventive services for everyone.

Healthy People 2000 continues and expands on efforts initiated in the late 1970's, which resulted in national health promotion and disease prevention objectives targeted for achievement by 1990 (DHHS, 1979, 1980; Nestle, 1988). The current initiative, begun in 1990, is driven by 319 specific objectives that are targeted for achievement by the year 2000. All levels of government—national, State, and local—and over 300 organizations work through a *Healthy People 2000* consortium to develop and implement these national objectives.

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Because of its role in promoting good health and in reducing premature death and disability from chronic disease, nutrition is one of the 22 priority areas in which these objectives are organized.

For this priority area, the Assistant Secretary for Health designated the Food and Drug Administration and the National Institutes of Health as lead agencies responsible for the monitoring, tracking, and reporting of the Nation's progress. The 27 nutrition objectives in *Healthy People 2000* address a broad range of public health goals for the general population, and for special populations identified to be at high risk because of factors such as age, gender, race/ethnicity, or income. The goals range from reducing death rates from chronic diseases to more targeted goals, such as reducing the prevalence of growth retardation among low-income children or increasing the proportion of mothers who breastfeed (DHHS, 1995).

This chapter addresses 17 nutrition objectives that are related to the goals or recommendations of the *Dietary Guidelines for Americans* (USDA and DHHS, 1995)—such as reducing fat intake, achieving useful and informative nutrition labeling to facilitate improvements in dietary behaviors, and reducing the prevalence of overweight. These objectives provide a gauge of Americans' progress in implementing the *Dietary Guidelines*. In addition to describing the progress to date on these nutrition objectives, the chapter also discusses issues in data interpretation and future directions.

Progress on Year 2000 Nutrition Objectives

The *Year 2000* nutrition objectives are organized into three areas: health status, risk reduction, and services and protection. Whereas the health status objectives aim to reduce rates of death, disease, and disability and to enhance physical and mental functioning and well-being, the risk reduction objectives aim to reduce the prevalence or incidence of risks to health or to increase behaviors known to reduce such risks. The services and protection objectives aim to increase comprehensiveness, accessibility, and/or quality of preventive services and protective interventions.

Table 1—Progress on health status objectives that address diet-related chronic diseases[1]

Objective	Baseline year(s)	Baseline value	Last update year	Last update value	Year 2000 target
2.1. Coronary heart disease deaths (age-adjusted per 100,000)	1987	135	1995	108	100
2.2. Cancer deaths (age-adjusted per 100,000)	1987	134	1995	130	130
2.22. Stroke deaths (age-adjusted per 100,000)	1987	30.4	1995	26.7	20
2.3. Overweight prevalence (percent):					
Adults 20+[2]	1976-80	26	1988-94	35	20
Males	1976-80	24	1988-94	34	20
Females	1976-80	27	1988-94	37	20
Adolescents 12-19	1976-80	15	1988-94	24	15
2.24. Diabetes incidence/prevalence (per 1,000):					
Incidence	1986-88	2.9	1992-94	3.1	2.5
Prevalence	1986-88	28	1992-94	30	25

[1] Excludes subobjectives for various racial, ethnic, and other subpopulations.
[2] 1976-80 estimates are for individuals 20-74 years of age.
Source: DHHS, 1997.

Health Status Objectives

Several of the *Healthy People 2000* health status objectives reflect the goals of the *Dietary Guidelines* (USDA, 1995). These objectives measure the Nation's progress in reducing death rates from chronic diseases associated with diet—particularly cardiovascular disease and cancer—and in reducing the prevalence of conditions that contribute to morbidity and premature mortality, and in which diet plays a role, such as overweight and diabetes.

Progress on these five objectives has been mixed (table 1). In the last decade, death rates for the total population from coronary heart disease, cancer, and stroke have declined. In 1995, death rates from coronary heart disease were close to the year 2000 target, while death rates from cancer met the year 2000 target (DHHS, 1997).

Table 2—Percentage of adults age 20 and older who were overweight, by race/ethnicity, 1988-94[1]

Population group	Sample	Women	Men
	Number	*——Percent——*	
White, non-Hispanic	7,040	34	34
Black, non-Hispanic	4,602	52	33
Mexican American	4,378	50	36
Total[2]	16,681	36	33

[1] Excludes pregnant women. Overweight is defined as body mass index (kg/m^2) equal to or greater than 27.8 for men and 27.3 for women.

[2] Total estimates include racial/ethnic groups not shown.

Source: Third National Health and Nutrition Examination Survey (NHANES III), 1988-94, CDC, 1997a.

However, the incidence and prevalence of diabetes have increased (DHHS, 1997), as has the prevalence of overweight (Kuczmarski and others, 1994; Troiano and others, 1995; Ogden and others, 1997; CDC, 1997a).

For the *Healthy People 2000* initiative, overweight for adults is defined as a body mass index (BMI, a measure derived from weight and height) equal to or greater than 27.8 for men and 27.3 for women, which corresponds to the sex-specific 85th-percentile of the 1976-80 National Health and Nutrition Examination Survey (NHANES II) reference population 20-29 years of age. For adolescents, overweight is defined as sex- and age-specific 85th-percentile values from NHANES II. With the above definitions, data on measured weights and heights from NHANES II and NHANES III (1988-94) show that the percentage of adolescents 12-19 years who were overweight increased from 15 percent in 1976-80 to 24 percent in 1988-94; for adults 20 years and older, overweight prevalence increased from 26 percent to 35 percent. The prevalence of overweight is especially high among Black and Mexican-American women (table 2). Self-reported weights and heights from the National Health Interview Survey also suggest a high prevalence of overweight among American Indian and Alaska Native adults (DHHS, 1997).

In recent years, there has emerged a consensus to use a BMI of 25.0 or greater as the cutpoint to identify adults who are overweight (USDA, 1995; American Heart Association, 1998; DHHS, 1998b). With the use of this lower cutpoint, approximately 55 percent of the U.S. adult population is considered overweight (Kuczmarski and others, 1997).

The increased prevalence of overweight may be due to increased food energy intake, decreased energy expenditure, or both. Median energy intake for adults 20-74 years increased 275 calories from 1976-80 to 1988-94 (CDC, 1997b). However, changes in data collection methodology between the two surveys might be partially responsible for this increase (McDowell and others, 1994). For example, interviewers in the 1988-94 NHANES III systematically probed for detailed information about all foods consumed, and reviewed a list of frequently omitted food items with all respondents. In addition, NHANES III collected a higher percentage of dietary recalls on weekend days—which may be associated with higher caloric intake than weekdays—than did the 1976-80 NHANES II.

Energy expenditure may also have decreased. Results from the first phase of NHANES III indicated that many adults were either inactive (22 percent) or irregularly active (34 percent) during their leisure time (Crespo and others, 1996). Rates of inactivity were greater for women (27 percent) than for men (17 percent). The highest rates of no leisure-time physical activity were among Black women (40 percent) and Mexican-American women (46 percent).

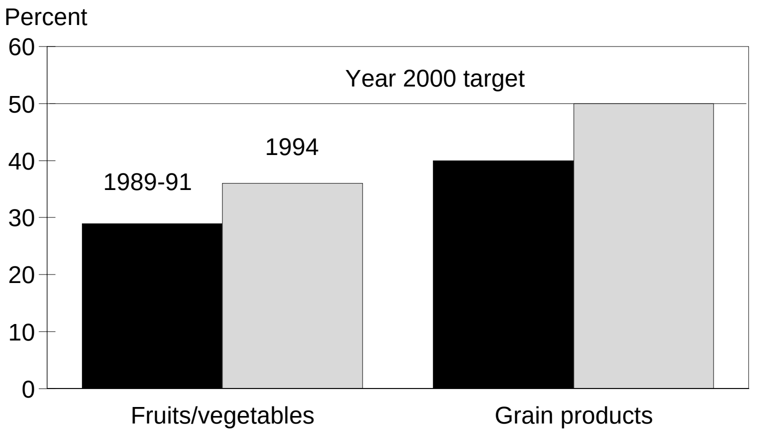
Risk Reduction Objectives

Several of the nutrition objectives measure the Nation's progress in implementing the food and nutrient intake recommendations of the *Dietary Guidelines* and the *Food Guide Pyramid* (USDA, 1992), and in promoting other individual behaviors that support these guidelines. Objectives measure the population's progress in (1) increasing consumption of grain products, fruits, and vegetables; (2) increasing consumption of calcium-rich foods; (3) reducing intake of total fat and saturated fat; and (4) reducing intake of salt and sodium. Two additional objectives address the prevalence of food label use, and the extent to which overweight adolescents and adults adopt sound dietary practices combined with regular physical activity. As with the health status objectives, progress on these objectives has been mixed.

Data on the first two objectives reflect an improved methodology that disaggregates food mixtures into their ingredients prior to assignment into a major food group (Krebs-Smith and others, 1995; Cleveland and others, 1997). For example, the new methodology assigns the cheese in pizza to the dairy group, the flour to the grain products group, and the tomato paste to the vegetable group. The amounts

Figure 1

Share of people age 2 and older who met the average daily goal for fruits/vegetables (five or more servings) and grain products (six or more servings)



Source: 1989-91 CSFII (3-day data); 1994 CSFII (2-day data). Estimates are based on unrounded servings (i.e., >= 5.0 for fruits/vegetables; >= 6.0 for grain products).

consumed of the pizza ingredients are then converted into a fraction or multiple of a serving, in accordance with serving size definitions derived from the *Food Guide Pyramid*.

Progress is evident in terms of increased consumption of grain products. In 1989-91, 40 percent of the population age 2 and older met the goal of consuming six or more servings of grain products per day; by 1994, this percentage had increased to 50 percent, thus meeting the target established for the year 2000 (fig. 1).[1] There has also been a corresponding increase in the mean intake of grain products by those 2 years and older, from an average of 5.8 servings in 1989-91 to an average of 6.7 servings in 1994, thereby meeting the year 2000 target of six or more daily servings (DHHS, 1997).

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[1] These numbers differ from those cited in chapter 3 because these numbers refer to the proportion of population consuming six or more servings, whereas chapter 3 refers to the proportion consuming the recommended number of servings based on reported caloric intake. Therefore, an adult male who reported consuming 3,000 calories and who should therefore be consuming 11 servings of grains per day is included here as consuming 6 or more servings, but is not included in the proportion cited in chapter 3.

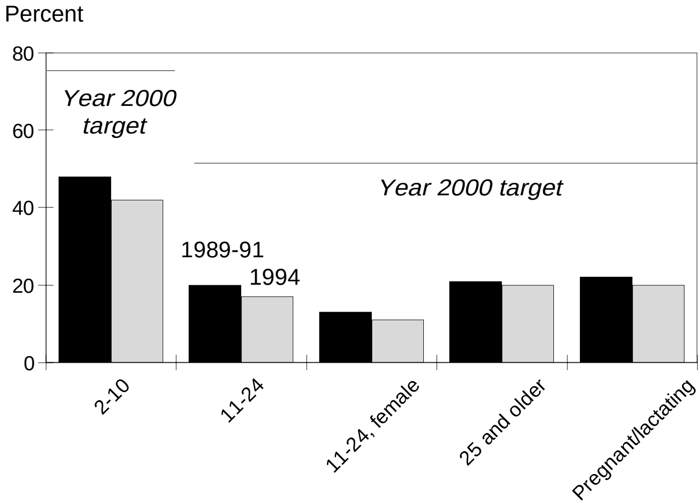
Some progress is also evident in terms of increased consumption of fruits and vegetables. In 1989-91, less than one-third (29 percent) of the population age 2 and older achieved the average daily goal of five or more servings of fruits and vegetables; by 1994, this percentage had increased to 36 percent (fig. 1). The mean intake of fruits and vegetables by those age 2 and older increased from an average of 4.1 servings in 1989-91 to an average of 4.6 servings in 1994 (DHHS, 1997). The 1989-91 baseline and 1994 update estimates for fruit and vegetable intake exclude potato chips, condiments, and candies, which in 1989-91 accounted for about 5-7 percent of total intake (Krebs-Smith and others, 1995; Krebs-Smith and others, 1996).

Despite this apparent progress, additional factors need to be considered from a public health perspective. For example, the year 2000 target that half the population age 2 and older meet these food intake recommendations was established in relation to the baseline estimates, and does not reflect the optimal goal that all healthy Americans age 2 and older follow these dietary recommendations. Thus, additional progress after achievement of a year 2000 target may still result in substantial public health gains. In interpreting these estimates, we may also need to consider the types of products consumed, their nutrient contribution, and the extent to which other ingredients—such as fat—are added. For example, 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) data for children and adolescents age 2-19 showed that less than 10 percent of all vegetable servings were dark green and/or deep yellow vegetables (DHHS, 1998a). In addition, many of the vegetables consumed were prepared with fat, with fried potatoes alone accounting for nearly one-third of vegetable consumption.

Similarly, the objective to increase consumption of grain products measures all grain products—from breads, rice, and pasta to cookies, cakes, and doughnuts—which vary in their amounts of dietary fiber, fat, sugars, and other nutrients. Supplementary analyses are needed to clarify the types of grain products consumed, and their nutrient contribution. For example, 1994-96 CSFII data indicated that less than one-fifth (14 percent) of the total servings consumed by children and adolescents were whole-grain (DHHS, 1998a), whereas the *Dietary Guidelines* recommend consumption of several daily servings of whole-grain products.

Figure 2

Share of people age 2 and older who met the average daily goal for servings of milk and milk products



Source: 1989-91 CSFII (3-day data); 1994 CSFII (2-day data).
Estimates are based on unrounded servings (i.e., >= 2.0 and >= 3.0).

No progress is evident in terms of increasing consumption of calcium-rich foods, as measured by intake of milk and milk products such as cheese and yogurt (fig. 2). From 1989-91 to 1994, the proportion of the population age 2 and older who consumed the recommended number of daily servings of milk products declined slightly. In 1994, only about one-fifth of adolescents, adults, and pregnant and lactating women consumed the recommended number of daily servings. The proportion of these subpopulations who meet the recommendations must more than double to approach the year 2000 target of 50 percent. The challenge is even greater for female adolescents and young adult women, since only about 1 in 10 consumed the recommended number of daily servings of milk products in 1994. Although mean intake by young girls age 2-10 and pregnant and lactating women approached recommendations, mean intake was only about half of the recommendations for all females 11 and older (table 3).

Supplementary data to more fully assess the public health implications of the results above would include estimation of total calcium intake and contributing sources. Foods from other food groups, such

Table 3—Mean daily servings of milk products by individuals age 2 and older, 1994

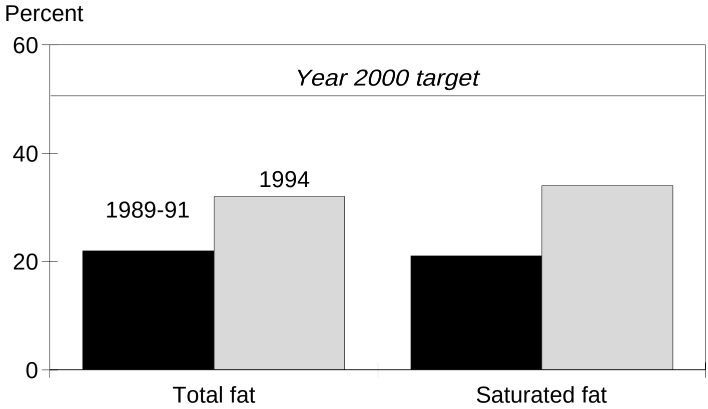
Population	Sample	Mean servings
Subgroup for whom recommendation is three daily servings:		
	Number	
Females--		
11-24 years old	464	1.6
Pregnant or lactating	49	2.7[1]
Males 11-24 years old	445	2.2
Subgroup for whom recommendation is two daily servings:		
Females--		
2-10 years old	644	1.9
25 years and older[2]	1,460	1.1
Males--		
2-10 years	644	2.1
25 and older	1,531	1.5

[1] Estimate may be unreliable because of small sample size.
[2] Excludes pregnant or lactating women.
Source: 1994 Continuing Survey of Food Intakes by Individuals (1-day data).

as grain products, can be important sources of calcium (Calvo and Park, 1996). Calcium intake from fortified foods, such as orange juice, and dietary supplements, also must be considered in estimating total calcium intake (Park, Yetley, and Calvo, 1996).

Some progress is evident in reducing intake of fat and saturated fat, when fat intake is expressed as a percentage of total calories but not when intake is measured in grams (Center for Nutrition Policy and Promotion, 1998). NHANES data show that average fat intake by the U.S. population age 2 and older declined from 36 percent of total calories from fat and 13 percent of total calories from saturated fat in 1976-80 to 34 percent and 12 percent in 1988-94 (DHHS, 1997). In addition, CSFII data indicate a small decline during the first half of this decade—from 34 percent of total calories from fat and 12 percent of total calories from saturated fat in 1989-91 to 33 percent and 11 percent in 1994 (DHHS, 1997). However, average intake by the U.S. population needs to decline further to meet the year 2000 targets: no more than 30 percent of calories from fat and less than 10 percent of calories from saturated fat.

Figure 3
Share of people age 2 and older who met the average daily goal for total fat (no more than 30 percent of calories) and saturated fat (no more than 10 percent of calories)



Source: 1989-91 CSFII (3-day data); 1994 CSFII (2-day data).

Similarly, although the estimated proportion of the population age 2 and older meeting the average daily goals for total fat and saturated fat consumption increased from 1989-91 to 1994, only about one-third of the population met each of these fat recommendations in 1994 (fig. 3). Additional progress is still needed to achieve the year 2000 target of 50 percent.

The objective to reduce salt and sodium intake tracks progress in individual behaviors, such as the purchase of foods with reduced sodium, avoidance of salt use at the table, and preparation of foods without salt. No progress has been observed on the first two measures, for which followup data are available. The percentage of adults age 18 and older who reported regularly purchasing foods reduced in sodium decreased slightly from 20 percent in 1988 to 19 percent in 1995 (DHHS, 1997). A doubling of this proportion is needed to approach the year 2000 target of 40 percent. Similarly, the percentage of individuals who reported never or rarely using salt at the table decreased slightly from 60 percent in 1989-91 to 58 percent in 1995, considerably below the year 2000 target of 80 percent (DHHS, 1997). No data are available to evaluate the progress on the third measure, which aimed to increase to at least 65 percent by the year 2000 the proportion of home meal preparers who prepare foods without adding salt. The baseline estimate for this measure indicates that 43 percent of main meal preparers did not use salt in food preparation in 1989-90 (DHHS, 1997).

The use of food labels has also remained fairly stable from the baseline year of 1988 through the most recent update in 1995, with about three-fourths of adults age 18 and older reporting that they read the food label when buying a product (DHHS, 1997). However, this measure does not capture several areas of progress since new food labeling regulations became effective in August 1994. For example, Levy and Derby (1996) show that the proportion of respondents who reported using quantitative nutrient information on the food label "often" increased from 43 percent in March 1994 to 56 percent in November 1995.

During this same period, consumer confidence in health claims and nutrient content claims improved, although not to desirable levels. For example, the proportion of respondents who reported that about all or most health claims are accurate increased from 25 percent to 31 percent, and the proportion that reported that about all or most claims for "high," "low," or "free" are accurate increased from 29 percent to 34 percent (Levy and Derby, 1996). Furthermore, the new nutrition labels appear to have a considerable influence on purchasing decisions, with 48 percent of survey respondents reporting they had changed their minds about buying or using a food product after reading the nutrition label in 1995, compared with 30 percent in 1990.

Regular physical activity is also recognized as a key intervention along with sound dietary practices in a risk reduction objective that targets overweight adolescents and adults. No baseline or update data are available for adolescents. For adults, the available measures show movement in the wrong direction. From 1985 to 1993, the share of self-reported overweight adults who reported taking steps to control their weight by consuming fewer calories and exercising more declined from 30 percent to 19 percent for women and from 25 percent to 17 percent for men, moving away from the year 2000 target of 50 percent (DHHS, 1997).

Services and Protection Objectives

Several of the national nutrition objectives address institutional, marketing, and other types of support for implementing the Dietary Guidelines. These objectives measure the Nation's progress in promoting and implementing the *Dietary Guidelines* in a variety of settings, including retail foodstores, restaurants, schools, and worksites.

For the objectives that have tracking data, movement has generally been in the right direction (table 4). For example, the number of food products that claimed to be reduced in fat increased from 2,500 in 1986 to over 5,600 in 1991, already exceeding the year 2000 target of 5,000. The year 2000 target for achieving informative nutrition labeling for virtually all processed foods has nearly been met as a result of the implementation of the Nutrition Labeling and Education Act of 1990, with an estimated 96 percent of processed foods in the FDA Food Label and Package Survey providing nutrition labeling in 1995. In addition, the available data indicate substantial progress in nutrition labeling for fresh produce and seafood. At the start of this decade, almost none of the retail food stores sampled provided nutrition labeling for these foods, whereas over 70 percent did in 1996. Furthermore, 67 percent of the retail food stores sampled in 1995 provided nutrition labeling for fresh meat and poultry.

Progress is less clear for the objective to increase the proportion of restaurants and institutional foodservice operations that offer identifiable low-fat, low-calorie choices, consistent with the *Dietary Guidelines*. In 1995, food away from home accounted for 27 percent of all eating occasions (meals and snacks), contributing 34 percent of daily calories and 38 percent of total fat intake (for more details on the nutrient content of food away from home, see chapter 12). Two surveys conducted by the National Restaurant Association suggested a small increase from 1989 to 1990 (from 70 percent to 75 percent) in the proportion of restaurants offering at least one low-fat, low-calorie menu item (DHHS, 1997). No recent updates are available using comparable methodology. Furthermore, the definitions of low-fat and low-calorie may be subjective, and this single measure does not capture the extent to which variety in low-fat choices is offered.

No update data are available for the objective to increase the proportion of school lunch/breakfast services and childcare food services with menus that are consistent with the *Dietary Guidelines*. Baseline

Table 4—Progress on services and protection objectives

Objective	Baseline year(s)	Baseline value	Last update year	Last update value	Year 2000 target
		Percent		*--Percent--*	
Foodstores:					
2.14. Informative nutrition labeling--					
Processed foods	1988	60	1995	96	100
Fresh produce	1991	< 1	1996	73	90
Fresh seafood	1991	0	1996	71	90
Fresh meat/poultry	1995	67	—	—	90
Ready-to-eat carry-away foods	—	—	—	—	40
		Number		*--Number--*	
2.15. Availability of reduced-fat processed foods	1986	2,500	1991	5,618	5,000
Restaurants:		*Percent*		*--Percent--*	
2.16. Proportion of large chain restaurants offering at least one low-fat, low-calorie menu item	1989	70	1990	75	90
Schools/child care:					
2.17. Menus consistent with the Dietary Guidelines	—	—	—	—	90
Schools offering lunches with an average of—					
30 percent or less of calories from total fat	1992	1	—	—	—
Less than 10 percent of calories from saturated fat	1992	< 1	—	—	—
Schools offering breakfasts with an average of—					
30 percent or less of calories from total fat	1992	44	—	—	—
Less than 10 percent of calories from saturated fat	1992	4	—	—	—
2.19. States that require nutrition education	1990	60	1994	69	75
Nutrition education in at least one class—					
Middle/junior high school	—	—	1994	83	—
Senior high school	—	—	1994	85	—
Worksite:					
2.20. Worksite nutrition/weight management program					
Nutrition education	1985	17	1992	31	50
Weight control	1985	15	1992	24	50

— = not available.
Source: DHHS, 1997.

estimates for this objective from a 1992 study indicated that only 1 percent of schools offered lunches that provided an average of 30 percent or less of calories from total fat, and less than 1 percent offered lunches that provided an average of less than 10 percent of calories from saturated fat. Of the schools participating in the school breakfast program, 44 percent offered breakfasts that provided an average of 30 percent or less of calories from fat, and 4 percent offered breakfasts that provided an average of less than 10 percent of calories from saturated fat (USDA, 1993).

However, in 1995, USDA issued final regulations that require that school lunches and breakfasts comply with the recommendations of the *Dietary Guidelines* by the 1996-97 school year (*Federal Register*, 1995). Thus, the next USDA study to be conducted in schools will likely show much progress on this objective. Baseline estimates that address child care food services will become available shortly.

Some progress is suggested for the objective to increase the proportion of the Nation's schools that provide nutrition education from preschool through 12th grade. In 1990, a national survey indicated that 60 percent of States either had mandates for nutrition education (9 States), or required nutrition education in mandated subjects (21 States) for grades K-12 (Shannon and others, 1992). In 1994, over two-thirds (69 percent) of States required that schools offer instruction on dietary behaviors and nutrition in these grades. The 1994 survey also indicated that over 80 percent of middle and senior high schools offered nutrition education in at least one class (Collins and others, 1995).

Some progress is also indicated for an objective that targets the workplace. From 1985 to 1992, the proportion of worksites with 50 or more employees that offered nutrition education increased from 17 percent to 31 percent, and the proportion that offered weight control programs increased from 15 percent to 24 percent (DHHS, 1997).

Issues in Data Interpretation

Point Estimates

Key to interpreting estimates for the nutrition objectives is the operational definition(s) used to measure the objective. For example, the objective targeted to overweight adults used self-reports of "eating fewer calories" from the National Health Interview Survey to define "sound dietary practices," and self-reports of "increasing physical activity" or "exercising more" were used to define regular physical activity. In addition, self-reported weights and heights for the respondents in this survey were used to define people who were overweight, rather than more accurate measured weights and heights that are available in NHANES.

Although all measures for the nutrition objectives may not be optimal, they are largely driven by the nature of the data available. In addition, in some cases, it may be difficult to design optimal measure(s) that can meaningfully measure certain concepts (for example, "sound dietary practices").

In other cases, the choice of cutoff levels will influence the prevalence of health indices, such as overweight. For example, whereas *Healthy People 2000* uses a BMI equal to or greater than 27.8 for men and 27.3 for women to classify adults as overweight, others have recommended that adults with a BMI of 25 or more be identified as overweight (USDA, 1995; American Heart Association, 1998; DHHS, 1998b). The use of the lower BMI cutpoint would significantly increase the reported prevalence of overweight in the adult population (Kuczmarski, 1997).

Another consideration is the reliability and accuracy of single estimates, relative to the question(s) and target populations being addressed. Population estimates of dietary intake have many potential sources of error and bias (National Research Council, 1986; Life Sciences Research Office, 1988), which may be reduced but not eliminated in the conduct of surveys. Examples include underreporting of food intakes by respondents (Briefel and others, 1997; Beaton, Burema and Ritenbaugh, 1997; Riddick, 1996; Black and others, 1993; Mertz and others, 1991; Schoeller, 1990), use of recipes in dietary surveys that may misrepresent the food mixtures actually consumed, and use of a limited number of days of dietary intake to estimate usual intakes (National Research Council, 1986; Beaton, Burema, and Ritenbaugh, 1997; Sempos and others, 1991).

Available resources also greatly affect the choice of nutrition measures and the accuracy and reliability of estimates. Resource constraints have especially limited data collection at the State and local levels and also affect the quality of nutrition measures available nationally.

In addition, because the nutrition objectives may address only one aspect of a public health issue, additional data may be needed to help interpret the public health significance of a particular estimate. With regard to estimates of fruit/vegetable and grain product consumption, additional monitoring would show consumer choices within these food groups, and the nutrient consequences of these choices. Furthermore, additional data are needed to show total calcium intake from foods and dietary supplements beyond milk and milk products.

Assessing Progress

Additional considerations are involved when using two or more estimates from different time periods. How have survey methods changed from one period to the next, and how have these changes affected the results? For example, the national food consumption surveys used for the *Healthy People 2000* nutrition objectives have varied over time with respect to the number of days of dietary data collected, the methods of collection, and whether data were collected on consecutive days (Interagency Board for Nutrition Monitoring and Related Research, 1992). Other considerations are the extent to which changes over time may be due to improvements in obtaining more complete information (for example, the use of multiple passes to aid in recall of foods eaten, or additional probes for amounts or types of food ingredients), improvements and other changes in assessing food composition (such as the addition of more brand-specific foods and ethnic foods), and improvements in data analysis (for example, the separation of food ingredients from food mixtures and their reaggregation by food group). In some cases, data from earlier surveys may be reanalyzed with the improved analytical approaches for trend analysis. However, in other cases, when the data collection methodology has changed, an assessment of the impact of the changes may be needed to interpret the observed trends.

The time periods and the number of data points are other considerations in assessing progress. For example, the periods for the baseline estimates range from 1976-80 to 1995. Similarly, the periods for the last data points for assessing progress toward year 2000 targets will vary considerably. Consequently, the different time periods need to be considered when directly comparing progress among and within objectives.

The assignment of cause is another consideration with *Healthy People 2000* health status objectives. Multiple factors affect the development of chronic diseases and health-related conditions, and additional factors, such as medical treatment, may influence death rates.

National Versus State-Level Data

Since the design of national surveys, such as the CSFII and NHANES, does not permit State-level estimates, the assessment of a State's progress on many of the nutrition objectives depends on a State's initiative, alone or in conjunction with Federal support.

However, State-level measures may differ from national survey measures in the type of data collection methods used (for instance, self-reported weights and heights to assess overweight, and a short food frequency questionnaire to assess fruit and vegetable consumption (Byers and others, 1997; Serdula and others, 1995)), and in the representativeness of their estimates. Therefore, it may not be possible to compare certain State-level estimates with national estimates.

Development of Year 2010 Objectives

While recent efforts have focused on evaluating progress for the *Healthy People 2000* objectives, efforts have begun aimed at developing objectives for the next decade. As with the year 2000 objectives, the development and implementation of these objectives will involve broad participation from the public and private sectors.

A council chaired by the Secretary of the U.S. Department of Health and Human Services will guide the overall development of *Healthy People 2010* objectives and their release in the year 2000. The development process will include two public comment periods and regional hearings, and will address proposals for a 2010 framework, objectives, and leading health indicators. Information about *Healthy People 2010* activities is posted on the Internet at [http://web.health.gov/healthypeople/].

The development of nutrition objectives for the next decade will rely on two types of resources: (1) Federal policy guidance on nutrition-related public health recommendations as provided by the *Dietary*

Guidelines, and (2) availability of appropriate data to help assess strategies for and measure the Nation's progress toward implementing these recommendations.

Objectives for the next decade would benefit from data systems that provide increased linkages among measures of health status, biochemical and hematological measures, dietary intake, physical activity and other lifestyle behaviors, and dietary knowledge and attitudes. For example, data from the NHANES allow the analysis of the relationship of weight to biochemical indices such as blood lipid levels and to different aspects of dietary intake.

Data that are of high quality, frequent if not continuous, and timely are also desired. Interest in estimating distributions of usual food and nutrient intake will continue, as will the challenges to improve on these estimates through improved survey methodology and statistical adjustment procedures (National Research Council, 1986; Beaton, Burema, and Ritenbaugh, 1997). The use of comparable methods, where possible, is especially important for trend analyses.

Implementation of the year 2010 nutrition objectives will also require broad public and private sector participation, as exemplified by public-private sector partnerships, such as the Dietary Guidelines Alliance and 5-A-Day for Better Health program. The increased collaboration this decade between the public and private sectors and among national, State, and local levels will be key to further gains by Americans in the next decade in adopting the *Dietary Guidelines* and achieving lifelong health benefits.

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Chapter 7

Trends in the U.S. Food Supply, 1970-97

Judy Putnam and Shirley Gerrior

This chapter summarizes the major trends since 1970 in U.S. per capita food and nutrient supplies. It notes that some trends are consistent with dietary and health recommendations, while other trends are contrary to recommendations. Per capita levels of most vitamins and all minerals increased from 1970 to 1994. Although historically, the nutrient levels in the food supply were deemed sufficient to meet the needs of most Americans, increases in recommended intakes for some nutrients—notably calcium and folate—translate into levels greater than those provided in the 1994 per capita food supply. As new recommendations are established for other nutrients, other nutrient shortfalls in the food supply may become apparent.

Introduction

Consistent with dietary and health recommendations, Americans now consume a half more grain products and a fourth more fruits and vegetables per capita than they did in 1970, eat leaner meat, and drink lower fat milk. Moreover, a steady increase in the proportion of refined flour that is enriched (from 65 percent in 1970 to more than 90 percent today), changes in flour-enrichment standards in 1974 and 1983, along with big increases in grain product consumption since 1984, have boosted per capita supplies of four of the nutrients lost in the milling process and approximately replaced by manufacturers—iron, niacin, thiamin, and riboflavin.

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But contrary to recommendations, Americans are consuming record-high amounts of caloric sweeteners and some high-fat dairy products, and near-record amounts of added fats, including salad and cooking oils and baking and frying fats. Moreover, the hefty increase in grain consumption reflects higher consumption of mostly refined, rather than high-fiber, whole-grain products—less than 2 percent of the 150 pounds of wheat flour consumed per capita in 1997 was whole wheat flour. (Most nutrients lost during processing, including fiber, vitamins, minerals, and phytochemicals, are not restored to refined flour.)

A variety of factors are responsible for the changes in U.S. consumption patterns in the last 25 years, including changes in relative prices, increases in real (adjusted for inflation) disposable income, and more food assistance for the poor. New products, particularly more convenient ones, also contribute to shifts in consumption, along with more imports, growth in the away-from-home food market, expanded advertising programs, and changes in food-enrichment standards and fortification policy. Sociodemographic trends also driving changes in food choices include smaller households, more two-earner households, more single-parent households, an aging population, and increased ethnic diversity. An expanded scientific base relating diet and health, new Dietary Guidelines for Americans (USDA and DHHS, 1980, 1985, 1990, 1995) designed to help people make food choices that promote health and prevent disease, improved nutrition labeling, and a burgeoning consumer interest in nutrition also influence marketing and consumption trends.

USDA's Economic Research Service (ERS) and Center for Nutrition Policy and Promotion (CNPP) estimate per capita food and nutrient supplies, based on food disappearance data (Putnam and Allshouse, 1997; Gerrior and Bente, 1997). These data are used as a proxy to estimate human consumption, even though the data may overstate what is actually eaten because they represent food supplies available in the market and do not account for waste (see "Food Supply Data Used to Measure Consumption" in Appendix). This chapter summarizes the major trends since 1970 in U.S. per capita food and nutrient supplies.[1] Appendix table 1 provides annual per capita consumption data for major food commodities. Appendix table 2 presents annual

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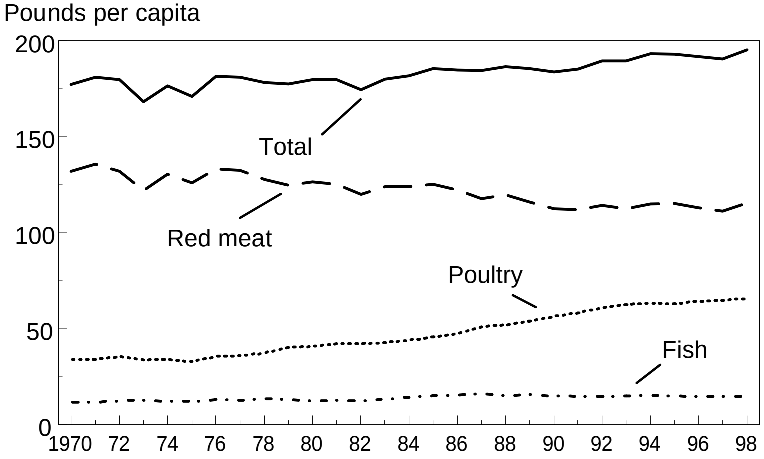
[1] For most commodities, the latest year for which supply data are available is 1997; in the case of meats and eggs, 1998 forecasts are available. 1994 is the latest year for which data on the nutrient content of the food supply are available.

Figure 1

In 1998, total per capita meat consumption (196 pounds) was 19 pounds above the 1970 level--a new record high



Pounds per capita is boneless, trimmed equivalent.
Source: USDA/Economic Research Service.

estimates of the amounts per capita per day of food energy, and 24 nutrients and food components in the food supply. Appendix table 3 shows nutrient contributions from the major food groups for the years 1970 and 1994. (Appendix tables begin on page 424.)

Per Capita Meat Supply Larger and Leaner

Now more than ever, we are a Nation of meat eaters—but we are eating leaner meat. In 1997, total meat consumption (red meat, poultry, and fish) amounted to 190 pounds (boneless, trimmed-weight equivalent) per person, 13 pounds above the 1970 level (fig. 1). Each American consumed an average of 21 pounds less red meat (mostly less beef) than in 1970, 31 pounds more poultry, and 3 pounds more fish and shellfish.

Nutritional concern about fat and cholesterol has encouraged the production of leaner animals, the closer trimming of outside fat on retail cuts of meat, the marketing of lower-fat ground meat and processed meat products, and consumer substitution of poultry for red meat—significantly lowering the meat, poultry, and fish group's contribution to total fat and saturated fat in the food supply. Despite near-record per capita consumption of total meat in 1994, the proportion of fat in the U.S. food supply contributed by meat, poultry, and fish declined from 35 percent in 1970 to 25 percent in 1994. Similarly, the proportion of saturated fat contributed fell from 37 percent to 26 percent.

Red meat (beef, pork, lamb, and veal) accounted for 58 percent of the total meat supply in 1997, compared with 74 percent in 1970. By 1997, chicken and turkey accounted for 34 percent of the total meat consumed, up from 19 percent in 1970. Fish and shellfish accounted for 8 percent of total meat consumption in 1997 and 7 percent in 1970.

The poultry industry has enjoyed great success, partly by catering to consumers. The industry has provided scores of new brand-name, value-added products processed for consumers' convenience, as well as a host of products for foodservice operators. Poultry has also benefited from health-related concerns about beef.

Year-to-year fluctuations in pork consumption are often quite large, but consumption has been fairly stable in the long run. In fact, annual per capita pork consumption averaged 47.6 pounds per person in 1970-74, and 47.8 pounds per person in 1994-98. The 1990's quantity, however, contained much more lean meat and much less fat. Through improved breeding and husbandry practices and greater trimming of outside fat on retail cuts, the pork industry has lowered the fat content of retail pork by more than 30 percent since the 1970's. The industry has capitalized on this accomplishment by portraying pork as a light and nutritious alternative to chicken with its "Pork: The Other White Meat" advertising campaign, which debuted in 1987. Research indicates that consumers now are less likely to perceive pork negatively in terms of fat, calories, and cholesterol than before the advertising began. The campaign focused on the industry's leaner cuts and lower-fat products.

Consumer concerns about cholesterol and saturated fat, inconsistent quality, and lack of convenience in preparation are behind the negative trend in beef demand. The mass entry of women into the paid labor force has drastically reduced consumption of beef roasts and other beef cuts requiring lengthy cooking times.

Beginning around 1960, in response to concerns about fat and cholesterol, beef producers began shifting production from the very fat English breeds like Hereford and Angus to the bigger, rangier, leaner, faster growing exotic breeds. This shift led to increasing inconsistency in the quality of beef—a less tender, less juicy, less succulent product. By 1995, one of four steaks was too tough to chew, according to the 1995 National Beef Quality Audit (Cattlemen's Beef Promotion Board, 1996). In summer 1998, the beef industry initiated a 42-month, checkoff-funded study that will establish concrete evidence and standardize genetic characteristics for tenderness, marbling, and other qualities. Understanding and being able to selectively breed for any of these traits will help ensure a quality eating experience for consumers, and will likely spark marketing of branded beef like Certified Angus Beef, branded beef that is consistently tender.

In response to concerns about fat and cholesterol, supermarkets continue to make their retail beef cuts leaner, with less external fat. In 1985, most retail trim specifications called for three-quarters-inch of outside fat on retail cuts of beef. By 1994, less than 1 percent of retailers had fat-trim specifications exceeding a quarter-inch and 21 percent specified an eighth-inch or less.

Retailers also keep cutting fat from ground beef, which is required by Federal regulations to have at least 70 percent lean meat (no more than 30 percent fat by weight). The amount of fat in ground and processed beef dropped from 28 percent to 22 percent between 1975 and 1987, with most of the decline during 1986-87. This trend has continued. In a 1997 survey, top U.S. retailers indicated that 66 percent of the ground beef they sold in 1996 was 80 percent lean or greater, 28 percent was 86 percent lean or greater, and 10 percent was 91 percent lean or greater. Further, they expected that 75 percent of the ground beef they sell in 1999 will be 80 percent lean or greater, 39 percent will be 86 percent lean or greater, and 15 percent will be 91 percent lean or greater (Cryovac, 1998).

The average fat content of foodservice ground beef remains higher than that for retail ground beef, but has nonetheless declined as well. In 1997, the North American Meat Processors Association revised and updated its 1988 *Meat Buyers Guide* to foodservice meat buyers and cut the upper limit for fat content of ground beef, unless otherwise specified, by three percentage points to 22 percent. (The purchaser may, however, specify a different fat content provided it does not exceed 30 percent.)

Beef has lagged behind poultry and pork in marketing value-added, convenience items. Beginning January 1999, the beef industry will launch a new advertising campaign that uses the familiar "Beef, It's What's for Dinner" tagline and aims to inform consumers and beef industry channels about a new trend—beef dishes that are fully cooked and ready to microwave and serve in 10 minutes. Such dishes include traditional beef favorites like pot roasts, meat loaf, and beef ribs.

The next decade will undoubtedly bring more changes. Technological advances will mean a host of new products in the meat case. With little increase in overall consumption of meat products expected in the next decade, the beef, pork, poultry, and fish industries will try to capture a larger share of a stagnant market by offering more prepared products.

Long-Term Decline in Egg Consumption Levels Off in the 1990's

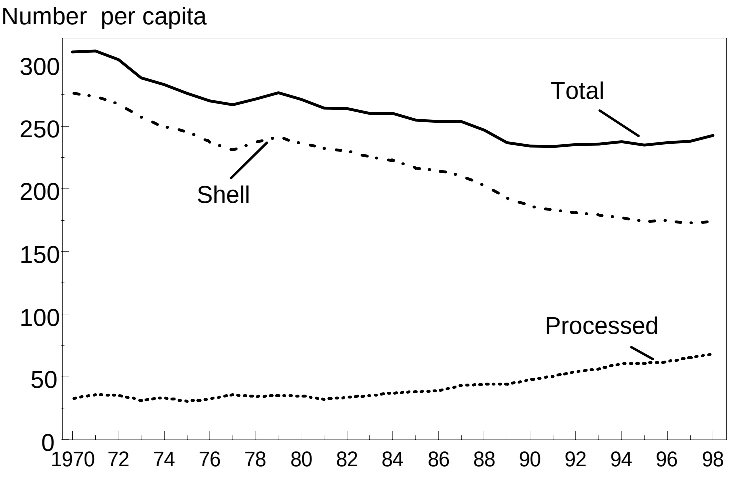
Egg consumption has two components: shell eggs and egg products. Shell eggs are those eggs purchased in cartons in the grocery store. Egg products are eggs that have been processed and sold primarily to food manufacturers and foodservice operators in liquid or dried form. These pasteurized eggs reach consumers as ingredients in foodservice menu items and processed foods—such as pasta, candy, baked goods, and cake mixes—or directly as liquid eggs in grocery stores. These liquid egg products usually are made from egg whites and are used by consumers as a nonfat, no-cholesterol, and safer alternative to shell eggs.

Between 1970 and 1989, total annual consumption of shell eggs and egg products steadily declined about 4 eggs per person per year, from 309 eggs to 237 (fig. 2). During the 1990's, total egg consumption has leveled off, fluctuating between 234 and 238 eggs per person per year. The record high for U.S. per capita egg consumption was 403 eggs in 1945.

The decline in per capita egg consumption over the last few decades reflects two very different and somewhat counterbalancing trends: a dominating, nearly constant decline in consumption of shell eggs,

Figure 2

Long-term decline in total per capita egg consumption levels off in the 1990's



Source: USDA/Economic Research Service.

and a partially offsetting growth in consumption of egg products during the 1980's and 1990's.

Shell-egg consumption dropped from 276 eggs per capita in 1970 to 173 in 1997. The average annual rate of decline in per capita shell-egg consumption was 4 eggs per year in the 1970's and 5 eggs per year in the 1980's. In the 1990's, the rate of decline in per capita consumption of shell eggs has slowed to 2-1/2 eggs per year and is expected to slow even more.

Much of the decline in shell-egg consumption since 1970 was due to changing lifestyles (for example, less time for breakfast preparation in the morning as large numbers of women joined the paid labor force) and the perceived ill effects of the cholesterol intake associated with egg consumption. Total cholesterol in the U.S. per capita food supply declined 13 percent between 1970 and 1994, from 470 milligrams per person per day to 410 milligrams. Eggs contributed 39 percent of the total cholesterol in the food supply in 1970 and 34 percent in 1994.

Declining wholesale and retail egg prices may have spurred egg use in recent years. The average retail price for a dozen large, Grade A eggs declined from $1.01 in 1990 to 86 cents in 1994. In 1997, it was $1.06. The Consumer Price Index (CPI) for eggs increased 13 percent between 1990 and 1997. That compares with a 19-percent increase in the CPI for all food during the same period, and a 27-percent increase in the CPI for cereals and bakery products. Changing consumer attitudes toward eggs may also be responsible. New test results show eggs to contain less cholesterol than previously documented, leading the American Heart Association to increase its maximum recommended consumption from three eggs per week to four.

Consumption of egg products has nearly doubled since 1983, reaching the equivalent of 68 eggs per person by 1998. The growth period followed more than two decades of relatively constant consumption. Egg product consumption will continue to increase as consumers opt for more prepared foods.

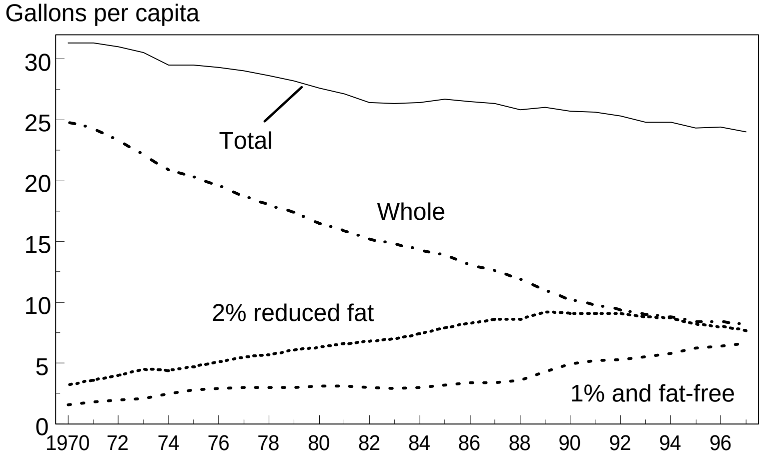
Higher Use of Cheese Foils Efforts To Cut Average Milkfat Consumption

In 1997, Americans drank an average of 23 percent less milk and ate nearly 2-1/2 times as much cheese (excluding cottage types) as in 1970 (fig. 3). Annual per capita consumption of milkfat from fluid milk products (beverage milks and yogurt) has declined by half since 1970 due to lower milk consumption and a trend toward lower fat milks. Americans cut their average consumption of fluid whole milk by two-thirds between 1970 and 1997, and nearly tripled their use of lower fat milks. But because of the growing yen for cheese and fluid cream products, the Nation failed to cut the overall use of milkfat. (Annual average consumption of milkfat from some other dairy products—butter, frozen dairy products, condensed milk, evaporated milk, dry milk, and cottage-type cheeses—also declined during 1970-97 due to lower consumption of these products and increasing preference for lower fat versions.)

Annual per capita consumption of beverage milk declined from 31 gallons in 1970 to 24 gallons in 1997. A sixfold increase in per capita consumption of yogurt since 1970—to 9.5 half-pint servings per person in 1997—partially offset the decline in beverage milks. Consumption of soft drinks, fruit drinks and ades, and flavored teas

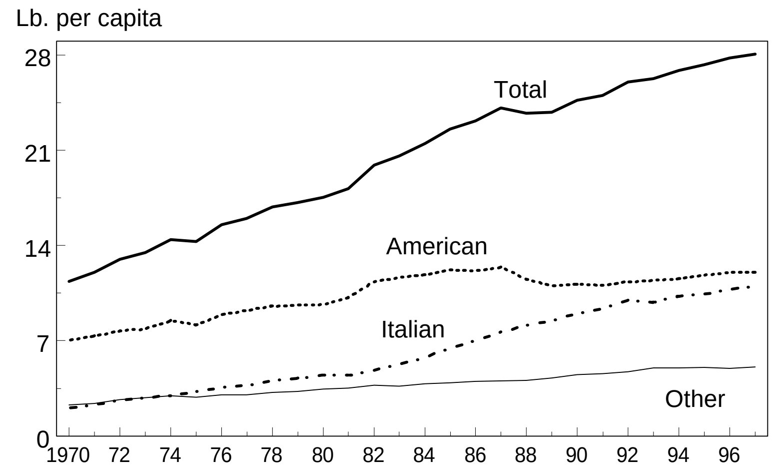
Figure 3

Americans are switching to lower-fat milks ...



Total includes flavored milk and buttermilk.

... but cheese consumption continues to rise

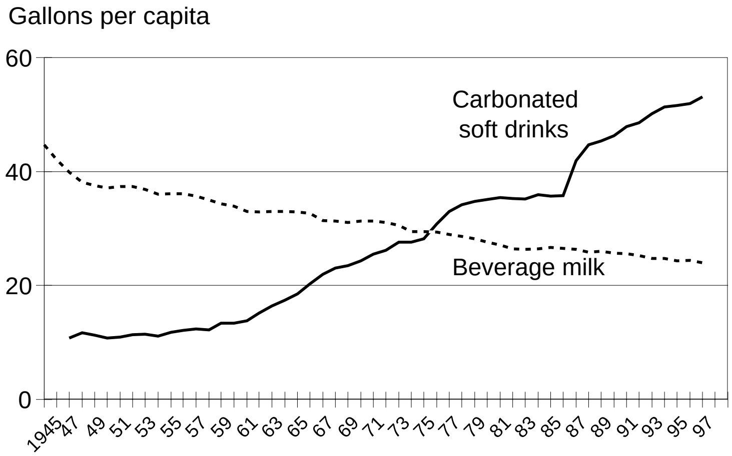


Natural equivalent of cheese and cheese products.
Excludes full-skim American and cottage-type cheeses.

Source: USDA/Economic Research Service.

Figure 4

In 1945, Americans drank more than four times as much milk as carbonated soft drinks; in 1997, they downed nearly two and a half times more soda than milk.



1947 is the earliest year for which data on soft drink consumption are available.

Per capita consumption of milk reached an all-time high in 1945 (data series dates from 1909).

Source: USDA/Economic Research Service.

may be displacing beverage milk in the diet (fig. 4). Big increases in eating away from home, especially at fast-food places, and in consumption of salty snack foods favored soft drink consumption.

The beverage milk trend is toward lower fat milk. While whole milk represented 81 percent of all beverage milk (plain, flavored, and buttermilk) in 1970, its share dropped to 35 percent in 1997. As a result, total beverage milk contributed 51 percent less fat to the average American's diet in 1997 than in 1970. In contrast, rising consumption of fluid cream products meant that they contributed two times as much milkfat to the average diet in 1997 as in 1970. (Per capita consumption of fluid cream products—half-and-half, light cream, heavy cream, eggnog, sour cream, and dips—jumped from 9.8 half-pints in 1970 to 17.0 half-pints in 1997.)

On balance, however, annual per capita consumption of milkfat from all fluid milk and cream products declined by 37 percent in 1970-97, from 9.1 pounds per person to 5.8 pounds. Of that 5.8 pounds, whole milk contributed 2.4 pounds; lower fat milks, 1.7 pounds; and fluid cream products, 1.6 pounds. Skim milk added 0.05 pound of fat to the average diet in 1997, and yogurt (most of which is reduced-fat or fat-free) added 0.09 pound of fat.

These changes are consistent with increased public concern about cholesterol and animal fats. However, the decline in per capita consumption of fluid milk between 1970 and 1997 also may be attributed to declining numbers of U.S. teenage males and children age 5-12 years, an increasing prevalence of lactose intolerance among Americans due to the growing ethnic diversity and aging of the population, and increasing preference for soft drinks.

Price may also be behind the shift to lower-fat milks. Skim milk traditionally has been cheaper than whole milk, but this has not always been the case for 1-percent and 2-percent milks. However, since 1980, the retail prices for a half-gallon of 1-percent and 2-percent milks have averaged a few cents below that for whole milk.

Over time, this price break has enabled consumers to accept and prefer the lower fat milk. Evidence of such acceptance is McDonald's switch from whole milk to 2-percent in 1986 and from 2-percent milk to 1-percent in 1991. Starbucks and other coffee chains and foodservice operators now provide whole milk and fat-free milk in addition to half-and-half, cream, and coffee whiteners.

Advertising has influenced the shift to lower fat milks. A major print advertising program that features celebrities, models, and sports stars wearing "milk mustaches" has improved the overall image of milk, especially light and skim milks. Preliminary research, conducted by Roper Starch, an independent research firm, indicated that major contributing factors to a decline in total milk consumption were concern about fat and a belief that lower fat milks contain fewer nutrients than whole milk. Followup research, also conducted by Roper Starch, showed that more people now know that lower fat milks are as high as or higher than whole milk in calcium, vitamins, and other nutrients, except fat (see chapter 10 for more on the effect of dairy advertising on overall consumption of milk).

Average consumption of cheese (excluding full-skim American and cottage, pot, and baker's cheeses) increased 146 percent between 1970 and 1997, from 11 pounds per person to 28 pounds. Lifestyles that emphasize convenience foods were probably major forces behind the higher consumption. In fact, two-thirds of our cheese now comes in commercially manufactured and prepared foods (including foodservice) such as pizza, tacos, nachos, salad bars, fast-food sandwiches, bagel spreads, sauces for baked potatoes and other vegetables, and packaged snack foods. Advertising and new products—such as reduced-fat cheeses and resealable bags of shredded cheeses, including cheese blends tailored for use in Italian and Mexican recipes—also boosted consumption.

From 1970 to 1997, consumption of Cheddar cheese, America's favorite cheese, increased 65 percent to 9.6 pounds per capita. Per capita consumption of mozzarella—the main pizza cheese—in 1997 was 8.4 pounds, more than 7 times higher than in 1970, making it America's second favorite cheese. Cream cheese (including Neufchatel) overtook Swiss in the 1980's to become America's third favorite cheese, at 2.3 pounds per person in 1997. Despite the flurry of lower fat cheese introductions in the 1990's, these products still accounted for a fifth (reduced fat, 16 percent; nonfat, 4 percent) of supermarket sales for the 52 weeks ending July 11, 1998 (at 20 percent, that is down 2 percentage points from 2 years earlier), according to the International Dairy Foods Association. In the year ending July 11, 1998, sales of nonfat cheese fell 20 percent, while sales of reduced-fat and regular increased 3.3 percent and 4.0 percenty. Lower-fat cheeses make up a much smaller proportion of the total cheese used by food manufacturers and foodservice operators.

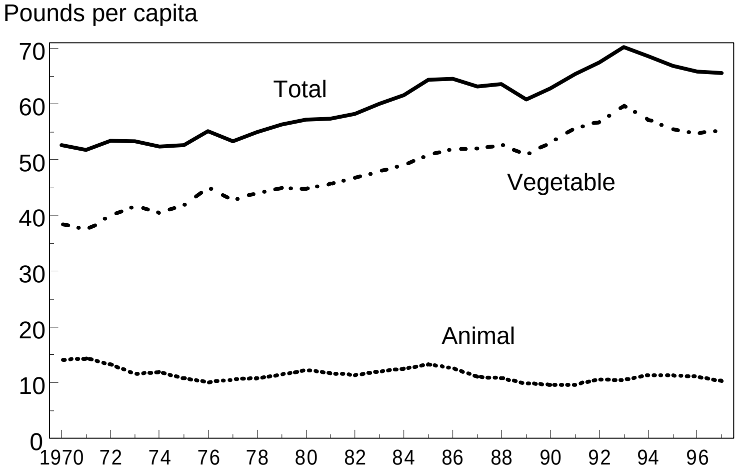
Use of Added Fats Begins To Decline, But Remains Near Record-High Level

Americans' overriding nutrition concern in the mid-1990's with cutting dietary fat is apparent in the recent per capita food supply data, which shows a modest decline since 1993 in the use of added fats and oils (fig. 5). Annual per capita consumption of added fats and oils declined at least 7 percent between 1993 and 1997, from a record-high 70.2 pounds (fat-content basis) per person to 65.6 pounds.[2] However, average use of added fats and oils in 1997 remained a fourth above the 1970 level. Added fats and oils include

[2] ERS is in the process of adjusting the data to reflect the trend toward lower-fat margarine-type spreads.

Figure 5

Vegetable-based products represent an increasing share of total added fats and oils consumption



Source: USDA/Economic Research Service.

fats and oils used directly by consumers, such as butter on bread, as well as shortenings and oils used in commercially prepared cookies, pastries, and fried foods. Excluded is all fat naturally present in foods, such as in milk and meat.

Studies in the 1950's and 1960's showed that replacing saturated fatty acids (SFA's) and animal fat with polyunsaturated fatty acids (PUFA's) lowered serum cholesterol levels (Keys, Anderson, and Grande, 1957). Consequently, diets high in PUFA's were widely recommended for the prevention of heart disease. Within the added fats and oils group, animal fats declined roughly a fourth from 1970 to 1997, on a per capita basis, and vegetable fats increased roughly two-fifths. Per capita consumption of salad and cooking oils (high in PUFA's) nearly doubled between 1970 and 1997, from 15 pounds to 29 pounds.

However, concern developed about the safety of PUFA's, and interest in the health benefits of monounsaturated fatty acids (MUFA's) also increased. Some research suggests that replacing SFA's with PUFA's reduces LDL cholesterol but also reduces beneficial HDL cholesterol, while replacing SFA's with MUFA's lowers LDL cholesterol but leaves HDL levels stable. In addition, PUFA's are more easily oxidized than MUFA's, making them more likely to contribute to atherosclerosis. Monounsaturated fatty acids are the most common fat in foods, but they are particularly plentiful in olive oil, canola oil, almonds, and avocados. In the 1997 food supply, olive oil and canola oil together accounted for 16 percent of total salad and cooking oils, up from 2 percent in 1985. Canola oil also is used in some soft, liquid-oil margarines.

In 1993, health concern about trans-fatty acids (or trans-fats) hit newspaper headlines. Trans-fats are created when liquid oils are hydrogenated to make them more solid and stable at room temperature; they raise LDL cholesterol and lower beneficial HDL cholesterol levels, and are associated with increased risk of coronary heart disease. Hydrogenated fats are used in everything from margarines, shortenings, crackers, cookies, baked goods, and peanut butter to foods fried in fast-food eateries, fried snack foods, and even some soups, beans, and cereals. From 1993 to 1997, consumption of margarine declined 23 percent per capita and consumption of shortening declined 17 percent per capita. About 40 percent of the margarine on supermarket shelves today is the old-fashioned stick variety, with the other 60 percent made up of tub or liquid margarines. In 1970, most margarine was the stick variety. In general, the softer the margarine, the lower its percentage of partially hydrogenated oils, and thus the lower the amount of trans-fats.

In 1970, the fats and oils group (composed of all added fats and oils) contributed the most fat to the food supply (43 percent), followed by the meat, poultry, and fish group (35 percent). By 1994, the fats and oils group's contribution to total fat had jumped 9 percentage points to 52 percent, probably due to the greatly expanded consumption of fried foods in foodservice outlets, the huge increase in consumption of high-fat snack foods, and the increased use of salad dressings. USDA food intake survey data show that, in 1989-91, the average woman age 19 to 50 got more fat from salad dressing than from any other food (Krebs-Smith and others, 1992).

In contrast, by 1994, the meat, poultry, and fish group's contribution to total fat had dropped 10 percentage points to 25 percent, reflecting changes in fat-trimming practices at processor and retail levels, improvements in animal husbandry, and increasing substitution of poultry and fish for red meats. Dairy products' contribution to total fat declined from 12.6 to 12.3 percent between 1970 and 1994, even as total fat from dairy products increased from 19 to 20 grams per person per day.

Average Consumption of Fruits And Vegetables Rises

As Americans increasingly embrace national health authorities' recommendation of consuming at least five fruits and vegetables a day, their array of choices continues to widen. Fresh-cut fruits and vegetables, prepackaged salads, locally grown items, and exotic produce—as well as hundreds of new varieties and processed products—have been introduced or expanded since the early 1980's. Supermarket produce departments carry over 400 produce items today, up from 250 in the late 1980's and 150 in the mid-1970's. Also, the number of ethnic, gourmet, and natural foodstores—which highlight fresh produce—continues to rise.

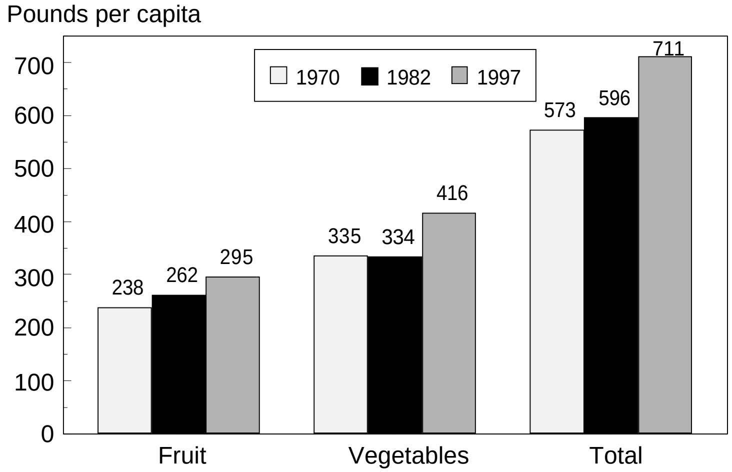
Consumers increasingly have more access to fresh, local produce as well. The number of farmers' markets reported to State agriculture departments has grown substantially throughout the United States over the last several decades, numbering around 1,755 at the end of 1993 and eclipsing 2,746 in 1998. Some analysts say that the total number of farmers' markets, including those not reported, is more than double that figure.

While the overall market for fruits and vegetables has expanded in the last 15 years, the mix has changed. Shifts have taken place among traditional produce items and between fresh and processed forms. Traditional varieties have lost market share to specialty varieties, and exotic produce has gained favor. For example, per capita consumption of iceberg lettuce fell by 4.4 pounds (or 15 percent) between 1989 and 1997, while per capita consumption of romaine and leaf lettuces increased 2.5 pounds (or 69 percent) during the same period. In addition, many specialty lettuces not yet tracked in USDA's food supply database—such as radicchio, frisee, arugula, and red oak—gained in popularity in the last several years because of inclusion in fresh-cut salad mixes and in upscale restaurant menus.

Total per capita use of the 129 commercially produced fruits and vegetables for which ERS has U.S. production data rose 24 percent,

Figure 6

Total per capita consumption of fruits and vegetables increased 24 percent between 1970 and 1997



Fresh-weight equivalent.

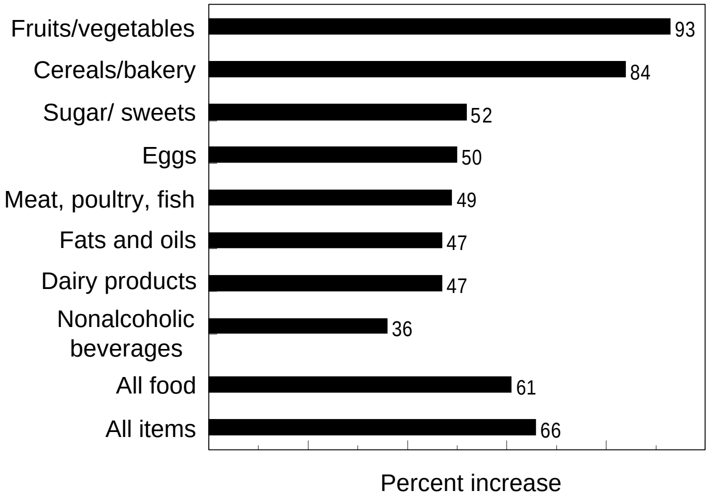
1982 saw the publication of "Diet, Nutrition, and Cancer," which empasized the importance of fruits and vegetables in the daily diet.

Source: Calculated by USDA/ERS from the Consumer Price Index.

from 573 pounds in 1970 to 711 pounds in 1997 (fig. 6). Four-fifths of this increase occurred since 1982, the year in which an expert scientific panel convened by the U.S. National Academy of Sciences published its landmark report *Diet, Nutrition, and Cancer*. The report emphasized the importance of including fruits (especially citrus fruits), vegetables (especially carotene-rich and cruciferous, or cabbage-family, vegetables), and whole-grain cereal products in the daily diet, noting that these dietary guidelines were consistent with good nutritional practices and likely to reduce the risk of cancer.

The 19-percent gain in fruit and vegetable consumption between 1982 and 1997 was probably tempered by the fact that fruits and vegetables led in retail price increases from 1982 to 1997 (fig. 7). Price increases for fresh fruits and vegetables were more than double those for processed. Despite the bigger price increases for fresh than processed, per capita consumption from 1982 to 1997 increased 24 percent for fresh fruit and 5 percent for processed fruit. Better quality, increased variety, and year-round availability have boosted con-

Figure 7
Fruits and vegetables have led in retail price increases, 1982-97



Source: Calculated by USDA/ERS from the Consumer Price Index.

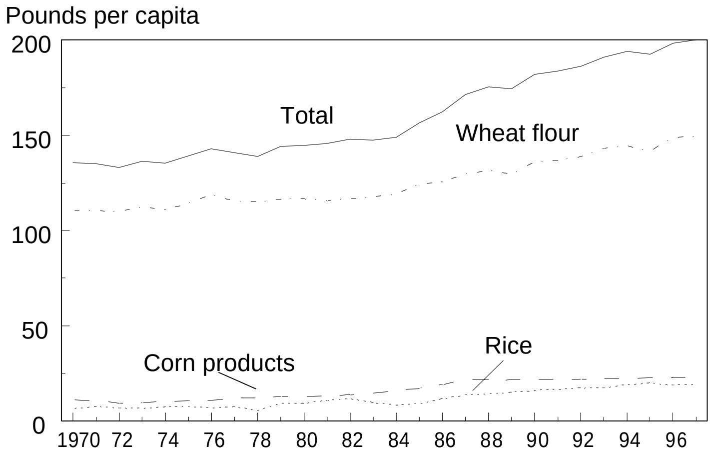
sumption of fresh fruits and vegetables. The increase between 1982 and 1997 in per capita consumption of processed vegetables nearly equaled that of fresh vegetables—24 percent versus 25 percent. Price, convenience, and increasing preference for fast-food eateries and ethnic foods have hiked consumption of frozen vegetables (especially french fries) and canned tomato products.

Grain Consumption Up From 1970's, But Far Below Early 1900's Highs

Per capita use of flour and cereal products reached 200 pounds in 1997 from an annual average of 145 pounds in 1980 and 136 pounds in 1970 (fig. 8). The expansion in supplies reflects ample grain stocks, strong consumer demand for variety breads and other instore bakery items, as well as grain-based snack foods, and increasing fast-food sales of products made with buns, doughs, and tortillas. Yet this consumption level is far below the 300 pounds consumed per person in 1909 (the earliest year for which data are available). In 1909, the

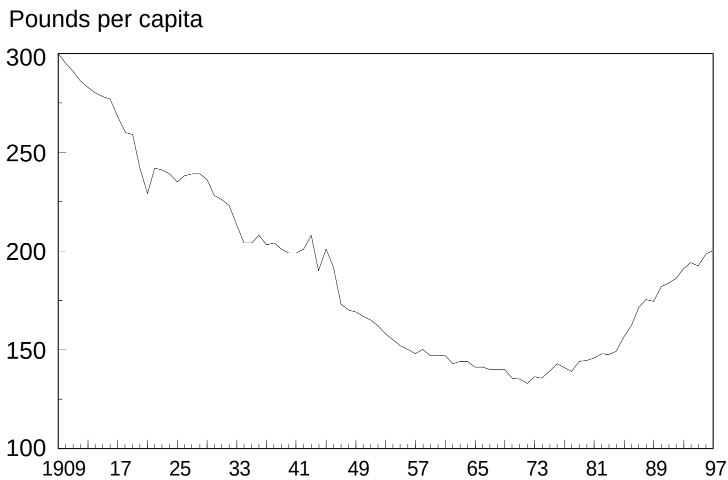
Figure 8

Consumption of flour and cereal products increased 34 percent between 1984 and 1997...



Total includes oat, rye, and barley products.

... but in 1997, it remained 100 pounds below the 1909 level



Source: USDA/Economic Research Service.

major source of protein in the American diet was grain products. By 1994, it was meat, poultry, and fish.

USDA's nationwide food consumption surveys confirm the food supply data, also indicating Americans are eating more grain products (see chapter 3). Consumption of grain mixtures—such as lasagna and pizza—increased 115 percent between 1977-78 and 1994. Snack foods—such as crackers, popcorn, pretzels, and corn chips—soared 200 percent, and ready-to-eat cereals were up 60 percent. One of the biggest changes within the grain mixture group was the explosion of ethnic foods, especially Mexican foods. Mexican foods were consumed four times more often in 1994 than in the late 1970's.

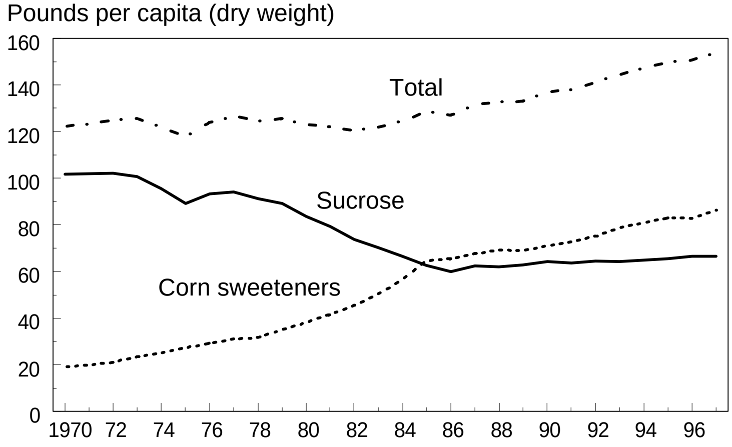
Yet Americans are still eating a serving or less a day of whole-grain foods, far below the minimum three per day the American Dietetic Association recommends. If a bread does not have whole wheat, oats, or some other whole grain as the first ingredient, much of its vitamin- and mineral-rich germ and bran have been milled away, along with most of its fiber. Enriched flour, from which most breads are made, is not a whole grain. The processor has simply added back three of the B-vitamins (niacin, thiamin, and riboflavin) and the iron that were lost when the flour was refined. Some companies that make "light" breads also add highly processed fiber to boost the fiber content and cut the calories. But nothing replaces the lost vitamin E, B-6, magnesium, manganese, zinc, potassium, copper, pantothenic acid, and phytochemicals.

Since January 1, 1998, all enriched grain foods—including ready-to-eat breakfast cereals, pasta, bread, rolls, flour, cakes, and cookies—have been fortified with folic acid (the synthetic form of folate, a B-vitamin). That should reduce the risk of neural tube birth defects like spina bifida. It may also protect adults from heart disease and reduce the chances of cervical cancer in women. Folic acid is found naturally in legumes; liver; many vegetables, especially green leafy ones like spinach; citrus fruits and juices; whole-grain products; and eggs.

Average Consumption of Caloric Sweeteners Hits Record High

Americans have become conspicuous consumers of added sugars and sweet-tasting foods and beverages. Per capita consumption of caloric

Figure 9
In 1997, Americans consumed more than two-fifths of a pound of caloric sweeteners per day



Total includes honey, molasses, and other refiner's syrups.
Source: USDA/Economic Research Service.

sweeteners (dry-weight basis)—mainly sucrose (table sugar made from cane and beets) and corn sweeteners (notably high-fructose corn syrup, or HFCS)—increased 34 pounds, or 28 percent, between 1982 and 1997 (fig. 9). In 1997, each American consumed a record average 154 pounds of caloric sweeteners. That amounted to more than two-fifths of a pound—or 53 teaspoonfuls—of added sugars per person per day in 1997. USDA's Food Guide Pyramid suggests that people consuming 1,600 calories limit their intake of added sugars to 6 teaspoons per day. The daily suggested limit increases to 12 teaspoons for those consuming 2,200 calories, and to 18 teaspoons for those consuming 2,800 calories (USDA, 1992).

A striking change in the availability of specific types of sugar occurred in the past two decades. Sucrose's share of total caloric sweetener use dropped from 83 percent in 1970 to 43 percent in 1997, while corn sweeteners increased from 16 percent to 56 percent. All other caloric sweeteners—including honey, maple syrup, and molasses—combined to maintain a 1-percent share.

In 1997, Americans consumed three-fourths more caloric sweeteners per capita than in 1909. In 1909, two-thirds of the sugar produced went directly into the home, which meant control was in the hands of the person who bought it. The balance was used mostly by industry. In contrast, more than three-quarters of the refined and processed sugars produced today goes to food and beverage industries, and less than a quarter is brought home.

The steep rise in caloric sweetener consumption since the mid-1980's coincides with a 47-percent increase in annual per capita consumption of regular (nondiet) carbonated soft drinks, from 28 gallons per person in 1986 to 41 gallons in 1997 (that is 14.5 ounces per person per day, an amount that contains 11 teaspoonfuls of sugar). Carbonated soft drinks provided more than a fifth (22 percent) of the refined and processed sugars in the 1994 American diet.

One quarter of the calories available from the 1994 per capita food supply (excluding alcoholic beverages) came from sugars. Lactose from milk and the sugars occurring naturally in fruit and vegetables accounted for one-fourth of this amount. The remaining three-fourths—more than 18 percent of total calories—was from sugars added to foods.

Sugar—including sucrose, corn sweeteners, honey, and molasses—is, in a sense, the number-one food additive. It turns up in some unlikely places, such as pizza, bread, hot dogs, boxed rice mixes, soup, crackers, spaghetti sauce, lunch meat, canned vegetables, fruit drinks, flavored yogurt, ketchup, salad dressing, mayonnaise, and some peanut butter.

The new food label, introduced in 1994, which lists the amount of sugars in grams (4 grams is equivalent to 1 teaspoon) in a serving of the food, can help people who are trying to moderate their sugar intake. This number includes both added sugars and those naturally present. Foods with natural sugars, such as milk and fruit, are also good sources of other nutrients, such as vitamins and minerals.

New sweeteners will likely enter the market in the next decade. With more alternative sweeteners, food processors can custom-blend caloric and high-intensity sweeteners to reduce calories and to achieve an optimum combination of taste, cost, and functional properties for specific applications.

Availability of Calories and Most Nutrients Also Increased

The level of food energy available in the food supply increased 15 percent between 1970 and 1994, from 3,300 to 3,800 calories per person per day. The proportion of calories from carbohydrates increased from 47 to 51 percent, while the share from fat decreased from 42 to 38 percent. Protein has consistently accounted for about 11 percent of calories.

Although the share of calories from fat declined, the amount of fat provided by the food supply increased between 1970 and 1994, from 154 grams to 159 grams per capita per day (table 1). Saturated fatty acids decreased due to the increased availability of leaner red meat and the substitution of poultry and fish for red meat. Cholesterol also declined, due largely to a 23-percent decline in egg consumption and, to a lesser extent, a drop in consumption of organ meats, such as liver, and a switch to lower fat dairy products.

Per capita levels of most vitamins and all minerals increased from 1970 to 1994. B-12 is the only vitamin with a per capita drop between 1970 and 1994. The 15-percent decrease was due to lower consumption of organ meats and egg yolks. While the 1994 value for vitamin B-12 was lower than earlier levels, it still exceeded the recommended dietary allowance (RDA) for a healthful diet by a generous margin.

Historically, the nutrient levels in the food supply were deemed sufficient to meet the needs of most Americans. However, a significant expansion of the research base and an increased understanding of nutrient requirements and food constituents in the 1990's have prompted increases in recommended intakes for some nutrients—notably calcium and folate—to levels greater than those provided in the 1994 per capita food supply. The RDA's, first developed by the National Academy of Sciences in 1941 and periodically updated, are being replaced by new recommendations, called Dietary Reference Intakes (DRI's), developed by the Institute of Medicine (IOM). Unlike RDA's, which were initially established to protect against diseases like rickets caused by nutrient deficiencies, DRI's aim to optimize health by also minimizing the risk of major chronic diseases, such as osteoporosis. The first two reports on DRI's review and provide recommendations for five bone-related nutrients (calcium, phos-

Table 1—Per capita food supply provides insufficient levels of calcium and folate[1]

Nutrient	Unit	1970	1994	% change
Food energy	Calories	3,300	3,800	15
Carbohydrates	Grams	386	491	27
Protein	“	95	110	16
Total fat	“	154	159	3
Saturated fatty acids	“	54	52	-4
Monounsaturated fatty acids	“	63	65	2
Polyunsaturated fatty acids	“	26	31	19
Cholesterol	Milligrams	470	410	-13
Vitamin A	Micrograms, retinol equiv.	1,500	1,520	1
Carotenes	Micrograms, retinol equiv.	510	660	29
Vitamin E	Milligrams, alpha-tocopherol equiv.	13.7	16.9	23
Vitamin C	Milligrams	107	124	16
Thiamin	“	2.0	2.7	35
Riboflavin	“	2.3	2.6	13
Niacin	“	22	29	32
Vitamin B-6	“	2.0	2.3	15
Folate	Micrograms	279	331	19
Vitamin B-12	“	9.5	8.1	-15
Calcium	Milligrams	890	960	8
Phosphorus	“	1,460	1,680	15
Magnesium	“	320	380	16
Iron	“	15.4	21.2	38
Zinc	“	12.2	13.2	1
Copper	“	1.6	1.9	19
Potassium	“	3,510	3,780	8

[1] The level of calcium in the 1994 food supply was insufficient to meet the 1997 Dietary Reference Intake (DRI) values for calcium, which would require a population-weighted-average of 1,040 milligrams (not counting losses or waste) per person in 1994. The level of folate in the 1994 food supply was insufficient to support the Public Health Service's 1992 recommendation that all women of childbearing age consume 400 micrograms of folate, or folic acid, a day. However, implementation on January 1, 1998 of new FDA folate-fortification policy for all enriched grain foods should provide ample folate in the 1998 food supply.

Source: USDA/ERS.

phorus, magnesium, vitamin D, and fluoride) and the B vitamins (thiamin, riboflavin, niacin, vitamin B-6, folate, vitamin B-12, pantothenic acid, biotin, and choline) (Institute of Medicine, 1997, 1998).

Adequate intake of folate—one method to having healthier babies and possibly a healthier heart—is a public health concern. The 1994 food supply provided 331 micrograms of folate per person per day, an amount that exceeds the 1989 RDA's for all individuals except pregnant women. Since 1989, however, strong scientific research has shown that folate, or synthetic folic acid, reduces the risk of neural tube birth defects such as spina bifida when consumed in adequate amounts by women before and during early pregnancy. Mounting scientific evidence also suggests that folate may reduce the risk of heart disease by lowering levels of homocysteine in the blood. The U.S. Public Health Service recommended in 1992 that all women of childbearing age consume 400 micrograms of folic acid daily. The new IOM recommendation for both men and women is 400 micrograms of dietary folate equivalent daily (Institute of Medicine, 1998). For women capable of becoming pregnant, the IOM recommendation is to take 400 micrograms of synthetic folic acid daily, from fortified foods and/or supplements, in addition to consuming food folate from a varied diet. Folate levels in the per capita food supply prior to 1998 fell short of these recommendations. However, with implementation by January 1, 1998, of a new FDA folate-fortification policy for all enriched grain foods, the 1998 food supply should provide enough folate to meet the new recommendations.

The new IOM vitamin D recommendations are twice as high for adults 51-70 years and three times higher for adults above 70 than for younger people or previous recommendations (Institute of Medicine, 1997). The amount of vitamin D in the food supply is not estimated because data on the vitamin D content of foods are provisional and limited to selected foods. Since the main dietary source of vitamin D is fortified milk products for which consumption is low, food supply levels of vitamin D are likely insufficient to meet the new recommendations for the U.S. population.

Calcium intakes recommended by the IOM are increased to at least 1,000 milligrams a day (that is, the amount in three and a third servings of milk or other dairy foods) for all Americans over 8 years of age. Higher calcium intakes are recommended for adults over 50 (1,200 milligrams per day; 4 1/3 servings) and for teens 9-18 (1,300 milligrams per day; 4 servings) (Institute of Medicine, 1997). The 1994 per capita food supply provided an average 960 milligrams of calcium per person per day. Of that 960 milligrams, ERS estimates that 280 were lost to milk spill, plate waste, and discard of moldy cheese, old yellowed broccoli, edible bones in canned salmon, and the like. That estimate would put actual dietary consumption of calcium in 1994 at about 680 milligrams per person per day. The new IOM recommendations would have required a population-weighted-average 1,040 milligrams (not counting waste or losses) per person per day in 1994.

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Appendix: Food Supply Data Used To Measure Food Consumption

The USDA's Economic Research Service (ERS) food supply series measures the flow of several hundred commodities into the U.S. marketing system. Food consumption is normally not directly measured or statistically estimated. The availability of total food for human use is, therefore, a residual component after subtracting other uses (such as exports, seed, feed, industrial use, and ending inventories) from the available food supply (the sum of production, beginning inventories, and imports) and then dividing by population estimates.

The food supply series is the only continuous source of food and nutrient availability in the United States, providing researchers with a unique data set with which to measure changes in food consumption trends over time. However, the data are only one of several different sources of dietary information in the United States. Food intake surveys, such as USDA's Continuing Survey of Food Intakes by Individuals (CSFII), provide data on food consumption reported by individuals. These surveys differ from the food supply series in that they record intake over a specific period of time ranging from 1 day to 1 week and they combine demographic information with food intake data.

Both the food supply and food intake data have strengths and limitations that affect their usefulness as a dietary assessment tool. For example, food intake surveys are subject to underreporting, although little is known about the extent to which underreporting may differ among food groups. The average caloric intakes reported by survey respondents are often well below those needed to maintain body weight, and research indicates that, when people are given a diet containing the calories reported in the intake surveys, they lose weight. In the 1989-91 CSFII, for example, the diets reported by women age 20-39 yielded an average caloric intake of 1,657 calories, compared with a Recommended Energy Allowance (REA) of 2,200 calories for the age group. Similarly, the average daily energy intake of 2,347 calories calculated from the foods reported by male respondents age 20-50 was about 20 percent below their REA of 2,900 calories. Because of these limitations, food intake surveys are considered an underrepresentation of actual food intakes.

On the other hand, the food supply data typically overstate actual human consumption because they capture food lost to waste, spoilage, and cooking, and include most food ingredients used in processed products that are exported. As a result, average caloric intake based on these data are often well above recommended levels. For example, the food supply provided an average of 3,800 calories per capita in 1994, the last year for which nutrient data are available for the food supply.

Despite these limitations, the aggregate approach used in the food supply series complements the individual intake data by capturing small quantities of foods used as ingredients in other products. For example, the food supply series measure per capita consumption of canning tomatoes rather than the actual intake of foods in which they are used, such as Italian and Mexican-style entrees, soups, stews, pizza, and sandwiches. This eliminates the problem—commonly associated with food intake survey data—of decomposing compound foods back to commodity ingredients. Also, because the food supply data are developed using similar methodologies across years, they provide researchers with a tool with which to measure long-term trends in food consumption relative to dietary guidance.

Food Supply Nutrient Availability Estimates. USDA's Center for Nutrition Policy and Promotion uses ERS data on the amount of food available for consumption and information on the nutrient composition of foods from USDA's Agricultural Research Service (ARS) to calculate the nutrients available in the food supply. The estimates reflect amounts available prior to moving through marketing channels—not the amounts actually consumed.

Basically, the nutrient estimates are calculated by multiplying the per capita amount of each food by the nutrient compostion of that food. The results are then totaled for each nutrient and presented per day. The estimates exclude nutrients from the inedible parts of foods, such as bones, rinds, and seeds, but include nutrients from parts of food that are edible but not always eaten, such as the separable fat on retail cuts of meat.

As with the food supply estimates, the resulting nutrient estimates do not account for losses during processing, marketing, or home use. For example, vegetables generally lose nutrients, particularly water-soluble nutrients like vitamin C and thiamin, when cooked in water.

Nutrients not included in these values are those from vitamin and mineral supplements, alcoholic beverages (or the grains and sugar used to make alcoholic beverages), baking powder, yeast, and certain vitamins and minerals used for functional or flavoring agents in foods. Nutrients added through enrichment of flour and cereal products and through fortification of other foods are included in the nutrient values.

Chapter 8

Role of National Income and Prices

Kuo Huang

While health concerns are important in affecting food choice decisions, food prices and consumer income are also important determinants of food choices, with potential consequences for nutrient availability. This study describes how a price or income change affects the availability of a nutrient of particular interest, as well as the simultaneous effects on the availability of other nutrients also.

Introduction

Concerned about their nutritional and health status, Americans appear to be trending toward more healthful diets, as measured by increased consumption of low-fat and nonfat foods and leaner cuts of meat. But a considerable gap still exists between public health recommendations and nutrient intakes (see chapters 3-6). According to the *Third Report on Nutrition Monitoring in the United States* (FASEB, 1995), consumption of a number of nutrients and food components remains a public health issue because of either excessive intake levels—such as for total fat, saturated fatty acids, and cholesterol—or intake level shortfalls, as is the case for calcium and iron.

For the past several decades, Federal nutrition education efforts in the United States have focused on providing consumers with information to help them make healthful food choices. While health concerns are important, economic factors such as food prices and consumer income are also important determinants of food choices, with potential consequences for nutrient availability. For example, if the price of beef goes up while the price of chicken remains the same, con-

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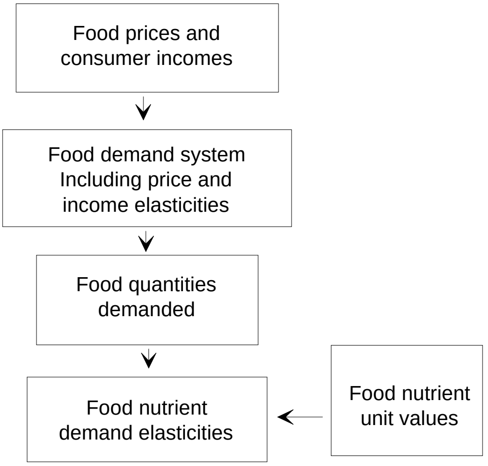
Figure 1
Measuring food nutrient demand elasticities



Source: USDA/ERS.

sumers will likely buy less beef and more chicken. Consumption of other foods could also be affected. If consumers buy less beef, such as hamburger meat, they might also buy less cheese and fewer hamburger rolls because of their complementary use in cheeseburgers. But they might buy more coleslaw, to go with the chicken. Because different foods provide different nutritional profiles, changes in the price of any one food or in consumer income are likely to translate into changes in the overall food basket that is purchased, thereby affecting the quantities of nutrients available and the nutritional quality of consumer diets.

Given the demand structure for foods and the bundle of nutrient attributes in each food product, one can derive the implied relationship between the overall availability of nutrients and changes in food prices and income. A change in the price of any one particular food group or in per capita income will affect the quantities demanded of all foods, and thus change the total level of nutrients available for consumption (fig. 1). Therefore, nutrient responses can be measured by directly incorporating all own- and cross-price and income effects of a complete food demand system into the measurement.

This chapter describes how changes in the price of food or in personal income affect nutrient quantities. The results are drawn from a larger research project that estimates the net change in 28 selected nutrients from among 35 food categories in response to changes in food prices and per capita income (Huang, 1997). That study provides a methodology for determining how a price or income change affects the availability of a particular nutrient, as well as the simultaneous effects on the availability of all other nutrients. These estimated price and income effects help food policy decisionmakers understand what changes occur in the amount of nutrients available and how these changes—including unanticipated changes—affect the overall nutritional quality of the diet.

Food Consumption and Nutrient Values

Average per capita food consumption data for 1989-93 are obtained from the Economic Research Service's food disappearance series (Putnam and Allshouse, 1994). The disappearance data represent the quantities of food supplies moving through the U.S. marketing channels. The foods are reported mostly in their raw commodity form, such as wheat flour or meats in retail-weight equivalent, rather than as finished food products, such as baked goods, ground round, or roasted chicken. The data measure average food consumption at the aggregate level, rather than at the individual or household level. For this study, annual estimates are divided by 365 days to obtain average daily per capita consumption levels and daily per capita nutrient changes in response to a change in a particular food price or in per capita income. Information on nutrient values is from the updated version of *USDA's Agricultural Handbook No. 8*, containing data on the nutrient content of 5,635 food items (USDA, 1996).

This study analyzes 12 nutrients. Food energy is measured in kilocalories (commonly referred to simply as calories); protein, fat and saturated fat, and dietary fiber are measured in grams; vitamin A is measured in retinol equivalents, vitamin E in alpha-tocopherol equivalents, folate in micrograms, and all other nutrients in milligrams. All foods are classified into one of seven food groups: (1) the grain group, which includes wheat flour and rice; (2) the vegetable group, which includes potatoes and fresh and processed vegetables; (3) the fruit group, which includes fresh and processed fruits and fruit juice; (4) the dairy group, which includes milk, evaporated and dry milk,

Table 1—Nutrient shares, by food group, 1989-93

Nutrient	Grain	Vegetables	Fruit	Dairy	Meat	Fats	Sweet-eners
				Percent of total			
Energy	25.22	2.74	2.53	13.67	21.52	22.88	11.44
Protein	22.87	3.18	0.89	25.45	47.48	0.12	0.01
Total fat	1.28	0.23	0.18	14.36	33.33	50.63	0.00
Saturated fat	0.65	0.11	0.11	27.28	35.22	36.64	0.00
Cholesterol	0.00	0.00	0.00	20.35	74.90	4.75	0.00
Dietary fiber	51.42	30.73	15.76	0.00	2.09	0.00	0.00
Calcium	3.60	5.01	1.57	84.08	5.15	0.38	0.21
Iron	62.42	9.15	1.66	3.12	23.05	0.06	0.54
Vitamin A	0.00	36.89	1.31	31.32	13.53	16.94	0.00
Vitamin C	0.00	45.82	46.51	5.76	1.89	0.02	0.00
Folate	26.95	21.56	16.97	14.70	19.69	0.13	0.01
Vitamin E	0.95	3.63	1.86	2.74	7.71	83.11	0.00

Note: Food groups are grain (wheat flour and rice), vegetable (fresh and processed vegetables, including potatoes), fruit (fresh and processed fruits), dairy (milk, cheese, and frozen dairy products), meat (meat, poultry, fish, eggs, dry beans, and nuts), fats (added fats and oils), and sweeteners (added sugars and corn sweeteners).

Source: USDA/ERS.

cheese, and frozen dairy products; (5) the meats group, which includes red meats, poultry, fish, eggs, dry beans, and nuts; (6) the added fats group, which includes butter, margarine, lard, and salad and cooking oils; and (7) the added sweeteners group, which includes all added sugars and corn sweeteners.

Nutrient values are applied to the quantities of food to compute the share each food group contributes to each nutrient's total. (Estimates in table 1 may differ from numbers in Putnam and Allshouse (1994) because of differences in the food groupings. For example, their meat group includes only meat, poultry, and fish, and not eggs, dry beans, and nuts, as in this study.) No single food group can provide all the nutrients and other food components that people need. Energy is provided mainly by the grain, meats, and added fats groups, with each group contributing slightly less than a quarter of the total energy available. Major sources of protein are the meats group (48 percent), and the dairy and the grain groups (about 25 percent each). Total fat comes mostly from the added fats group (51 percent) and the meats group (33 percent), with the meats group providing 35 percent of total saturated fat and most of the cholesterol (75 percent).

Over half of the dietary fiber comes from the grain group, with an additional 46 percent provided by the vegetable and the fruit groups. Major sources of vitamin A are the vegetable group (37 percent), and the dairy group (31 percent), while the fruit and vegetable groups contribute 92 percent of total vitamin C. The largest share of folate (a B-vitamin) comes from the grain group, although the vegetable, fruit, dairy, and meats groups also contribute considerable amounts. Vitamin E comes mainly from the added fats group (83 percent), while the dairy group is the major source of calcium, contributing 84 percent of the total. The grain and the meats groups contribute about 62 percent and 23 percent of iron, respectively.

These estimates are based on the food groups in their raw commodity form rather than as final food products. For example, the grain group is naturally low in fat, and, in its raw commodity form, provides less than 2 percent of the total fat available for consumption at this aggregate level. Nutrient shares would be considerably different at the consumer level, since preparation methods that incorporate added fats may result in a high fat content for many grain products, such as baked goods. However, because the demand analysis is based on food disappearance data, which measure average per capita consumption of foods in their commodity form, nutrient values must also be based on food groups in their commodity form.

Food Prices and Income Affect Nutrients Consumed

Given the nutrient shares of individual food categories and a complete set of own- and cross-price and income elasticities obtained from Huang (1993), the nutrient responses to price and income changes can be measured by following the procedure developed in Huang (1996). Under that procedure, the nutrient responses to a price change for any particular food group can be estimated as the weighted average of all own- and cross-price elasticities, with each weight expressed as the nutrient share for each food group. Similarly, the nutrient responses to income can be estimated as the weighted average of all income elasticities, with each weight again expressed as the nutrient share for each food group. These estimated nutrient responses for individual food categories are then summed to obtain the total group price effect on nutrients.

Table 2—Changes in nutrient availability in response to a 10-percent decrease in food price or a 1-percent increase in income

Nutrient	Grain	Veget-ables	Fruit	Dairy	Meat	Fats	Sweet-eners	Income
				Percent change				
Energy	0.22	0.18	0.50	0.16	0.52	0.34	0.25	0.26
Protein	0.25	0.01	0.35	0.69	1.82	-0.04	0.21	0.27
Total fat	0.24	0.30	0.53	0.03	0.34	0.70	0.28	0.37
Sat. fat	0.27	0.20	0.50	0.55	0.88	0.71	0.23	0.38
Cholest.	0.40	-0.13	0.24	0.20	1.46	0.17	-0.08	0.31
Diet. fiber	0.13	0.59	1.10	-0.38	1.31	0.13	0.20	0.21
Calcium	0.08	-0.03	0.86	2.60	0.95	-0.02	0.47	0.32
Iron	0.33	0.27	0.33	-0.24	1.89	-0.02	0.24	0.21
Vitamin A	1.10	-0.65	0.66	-2.32	-0.26	0.30	0.63	0.35
Vitamin C	-0.59	1.49	4.57	-0.13	2.31	-0.39	-0.04	0.35
Folate	0.07	0.44	1.44	-0.11	1.42	-0.24	0.14	0.26
Vitamin E	0.22	0.71	0.94	-0.56	-1.47	1.12	0.47	0.38

See table 1 for definition of food groups.
Source: USDA/ERS.

Table 2 shows the percentage change in the availability of 12 nutrients in response to a 10-percent decrease in the price of any one food group (holding the prices of other food groups constant) or to a 1-percent increase in consumer income. All the prices of food commodities within a food group are assumed to change at the same rate as the group price. A 10-percent decrease in the price of the meat group would increase daily per capita availability of protein by 1.82 percent, saturated fat by 0.88 percent, cholesterol by 1.46 percent, and iron by 1.89 percent. Although the meat group contributes little to the total availability of fiber, calcium, or vitamin C, a 10-percent price reduction for this group would increase availability of fiber by 1.31 percent, of calcium by 0.95 percent, and of vitamin C by 2.31 percent. At the same time, it would reduce availability of vitamin E. This is because a reduction in the price of the meat group is associated with increased consumption of foods from the grains, vegetables, and fruit groups, which would explain the higher availability of fiber, calcium, and vitamin C. These results highlight the interdependence among the different food groups through cross-price effects.

Table 3 translates the percentage changes in table 2 into quantity changes per capita per day. A 10-percent decrease in the price of the meat group would increase availability of energy by 15.6 calories, total fat by 0.52 gram, saturated fat by 0.44 gram, cholesterol by 5.75 mil-

Table 3—Changes in daily per capita nutrient availability in response to a 10-percent decrease in food price or a 1-percent increase in income

Nutrient	Daily Value[1]	Grain	Vege-tables	Fruit	Dairy	Meat	Fats	Sweet-eners	Income
					Quantity change				
Energy (cal.)	2,000	6.65	5.37	14.95	4.87	15.61	10.19	7.59	7.82
Protein (grams)	50	0.23	0.01	0.32	0.63	1.66	-0.03	0.19	0.24
Total fat (grams)	65	0.37	0.46	0.80	0.05	0.52	1.08	0.42	0.57
Sat. fat (grams)	20	0.13	0.10	0.25	0.28	0.44	0.36	0.12	0.19
Cholesterol (mg)	300	1.57	-0.52	0.94	0.80	5.75	0.68	-0.32	1.24
Diet. fiber (g)	25	0.01	0.06	0.11	-0.04	0.14	0.01	0.02	0.02
Calcium (mg)	1,000	0.75	-0.26	8.09	24.39	8.89	-0.21	4.39	2.97
Iron (mg)	18	0.05	0.04	0.05	-0.03	0.27	-0.00	0.03	0.03
Vit. A (RE)[2]	1,500	9.52	-5.62	5.67	-20.07	- 2.24	2.60	5.43	3.06
Vit. C (mg)	60	-0.40	1.01	3.11	-0.09	1.58	-0.26	-0.03	0.24
Folate (mcg)[2]	400	0.13	0.83	2.69	-0.20	2.65	-0.44	0.26	0.49
Vit. E (ATE)[2]	20	0.03	0.11	0.15	-0.09	-0.23	0.18	0.08	0.06

[1] Established by the Food and Drug Administration for nutrition labeling purposes, based on 2,000 calories a day, for adults and children over 4 (Kurtzweil, 1993).

[2] RE = retinol equivalents; mcg = micrograms; ATE = alpha-tocopherol equivalents. See table 1 for definition of food groups.

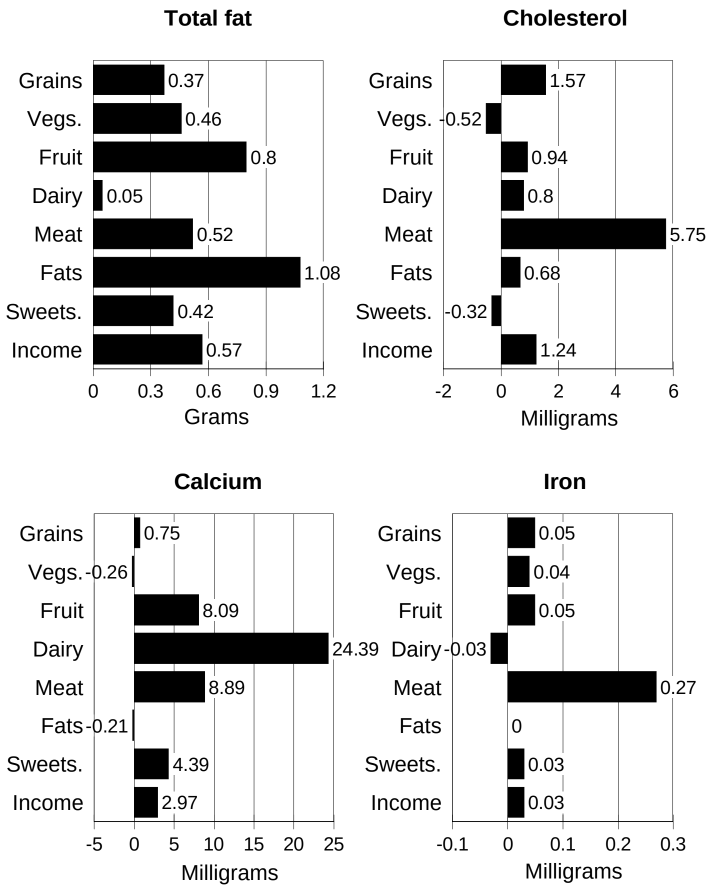
Source: USDA/ERS.

ligrams, calcium by 8.89 milligrams, vitamin C by 1.58 milligrams, and folate by 2.65 micrograms. This same price decrease would also reduce daily per capita availability of vitamin A by 2.24 retinol equivalents, and of vitamin E by 0.23 alpha-tocopherol equivalent.

A comparison of the nutrient quantity changes with FDA's Daily Values (DV) used on nutrition labels shows that the nutrient quantity changes are small, and therefore not likely to be of nutritional significance. However, the results again highlight the interdependence among the different food groups through cross-price effects. For example, although the meats group contributes very little to total dietary fiber (about 2 percent), a 10-percent decrease in the price of the meats group has a much larger effect on the overall availability of dietary fiber than does a 10-percent decrease in the price of the grain group (which contributes over half of the total dietary fiber available).

Figure 2

Selected nutrient responses, by food group, per capita per day (effects of a 10-percent price decrease and 1-percent income increase)



Source: USDA/ERS.

Figure 2 demonstrates the complexity of the effect of an income or price change on overall diet quality for four selected nutrients (total fat, cholesterol, calcium, and iron). For example, whereas a 10-percent price cut for the meat group would increase the levels of calcium and iron—a nutritional improvement, given that these components are consumed in insufficient amounts— it would also increase the levels of total fat and cholesterol, two components currently consumed in excess. Lower prices for the dairy and the fruits group would increase consumers' calcium intakes, but also increase availability of total fats. Increased consumer income would increase consumption of nutrients currently consumed in low amounts, such as calcium and iron, but it would also increase the consumption of other nutrients—such as fat, saturated fats, and cholesterol—which are already consumed in excessive amounts.

Proponents of price manipulation as a means of influencing consumption levels of particular foods or nutrients (such as subsidizing fruits and vegetables to increase their consumption, or taxing fats to reduce their consumption) should be aware of the interdependent nature of food choices and the ramifications for different nutrients. For example, a price decrease for fruits or vegetables, while encouraging their consumption, would also increase availability of total fat. A price decrease for vegetables would also trigger an unanticipated reduction in overall availability of vitamin A. Although the magnitudes of these changes are relatively small, it is possible that they could exacerbate existing nutritional problems if carried out over prolonged periods of time.

Conclusion

Consumers respond to changes in food prices and income by adjusting their food choices to maximize their satisfaction. The adjusted food choices are then translated into changes in nutrient levels. This study applies a new research model developed by Huang (1996) to measure how economic factors influence aggregate nutrient availability. This model incorporates existing interdependent demand relationships among foods, including own- and cross-price effects, into the measurement of aggregate nutrient responses. The empirical results show that changes in the availability of all nutrients vary depending on how food price and income changes manifest themselves through the food demand relationships.

Thus, these nutrient response estimates provide useful information for studying possible food program effects on the overall availability of nutrients. One way to accomplish this task would be to simulate alternative food policy scenarios and explore the effects of the resulting changes in food prices or income on the amounts of foods and nutrients that are available for consumption. For example, the estimates of nutrient income responses can be a starting point in evaluating possible effects of income changes on dietary quality when the benefits of food stamp recipients are cut or increased.

The estimates in this study represent an average person's nutrient response, and adjustments will be needed to reflect differences in behavior across different population groups. Adjustments would also be needed when studying food stamp benefits since food spending from food stamps may be different than food spending from money income.

These nutrient responses were estimated at the aggregate level, based on foods in their commodity forms, and may not reflect the nutrient responses that would occur at the consumer level. The food disappearance data commonly used by demand analysts are unable to take into account food preparation methods, which can heavily influence the final nutrient content of foods. For example, whether the chicken is fried or roasted, and whether the skin is eaten, considerably affects the final nutritional characteristics of the chicken consumed. Similarly, although grain products are naturally low in fat, preparation methods that incorporate added fats result in a high fat content for many grain products, such as baked goods. Finally, the food disappearance data are slow in measuring and reflecting changes in the nutrient composition of the commodities themselves—such as meats that are leaner and cheeses that are lower in fat—and therefore may not accurately reflect the current nutrient contribution of each food group to each nutrient's total.

To develop a consumer-based comprehensive food demand and nutrition study, further collaborative research between economists and nutritionists is needed to improve the availability of data on prices, quantities, and nutritional profiles for final food products.

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Chapter 9

Food Advertising in the United States

Anthony E. Gallo

Food manufacturers spent $7 billion in advertising in 1997. Most of this advertising focused on highly processed and highly packaged foods—which also tend to be the foods consumed in large quantities in the United States relative to Federal dietary recommendations such as the Dietary Guidelines for Americans. Advertising expenditures on meat, fruits, and vegetables are negligible. In contrast, the U.S. Department of Agriculture spent $333.3 million on nutrition education, evaluation, and demonstrations. This is approximately what the food industry spent on advertising just for coffee, tea, and cocoa, or for snacks and nuts; slightly more than half (60 percent) the amount spent on advertising for carbonated soft drinks, and less than half the amount spent promoting beer, or candy and gum, or breakfast cereals.

Introduction

Advertising and promotion are pivotal to the marketing of the American food supply. The U.S. food marketing system is the second largest advertiser in the American economy, and a leading supporter of network, spot, and cable television, newspapers, magazines, billboards, and commercial radio. Groceries account for about 70 percent of all manufacturers' coupons. Food manufacturers also spend massive amounts promoting the product to the retailer—through discounts and allowances, incentives, and actual slotting allowances—in order to secure scarce space on the Nation's grocery shelves.

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Table 1—Advertising by food industry, 1995-97

Item	1995	1996	1997
		$ million	
Total media[1]	9,947	10,486	11,082
Eating and drinking places[2]	2,645	2,961	3,148
Food retailers	795	804	860
Food manufacturers	6,507	6,721	7,074

[1] Magazines, Sunday magazines, newspapers, national newspapers, outdoor, network and spot television, network and spot radio, syndicated television, and cable television networks.

[2] Includes hotel restaurants not otherwise counted among eating and drinking places.

Source: Compiled from BAR/LNA Multi-Media Service data USDA/ERS.

Why so much advertising? There are several reasons for it. First, the food market is huge, capturing about 12.5 percent of consumer income, and there is vigorous competition among food firms to compete for this market. Second, food is a repeat-purchase item, lending itself to swift changes in consumer opinions. Third, food is one of the most highly branded items in the American economy, thus lending itself to major advertising.

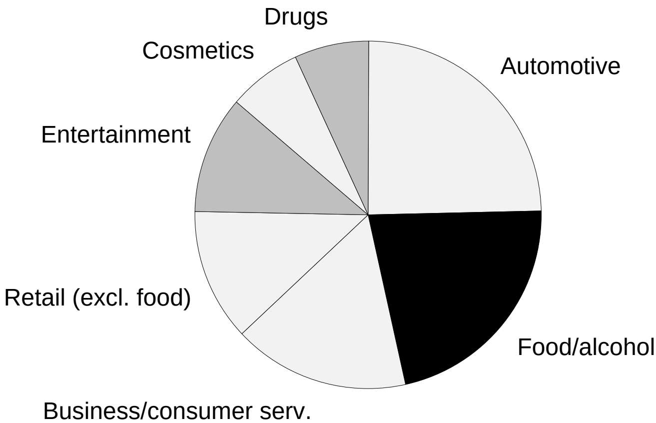
For purposes of this chapter, advertising refers to printed and electronic media, and excludes coupons, trading stamps, and games, which comprise a significant portion of total product promotion.

Advertising in the U.S. Food Marketing System

Advertising by the American food and alcohol industry—which includes food manufacturers, retailers, and foodservice—comprises nearly 16 percent of the $73-billion mass media advertising market, second only to the automotive industry, which accounts for 18 percent (fig. 1). Toiletries and drugs, a significant portion of which are sold through the U.S. grocery system, account for an additional 5 percent each.

Food manufacturers account for most of the mass media advertising on food. In 1997, the Nation's food manufacturers accounted for nearly two-thirds—$7 billion of the $11 billion—spent by the U.S. food system on advertising (table 1). Advertising by foodservice—

Figure 1
Largest advertisers in the United States, 1997



Food and alcohol includes food manufacturing, retailing, and foodservice.
Source: USDA/Economic Research Service.

mostly by fast-food places—accounted for an additional 28 percent, up from about 5 percent in 1980, reflecting the strong growth in fast-food restaurants. Foodstores accounted for the remaining 8 percent of the food industry's mass media advertising.

Television is the favorite medium used by food manufacturers. Over 75 percent of the $7 billion spent by food manufacturers for advertising in 1997 was allocated to television (table 2). Fast-food restaurants allocated over 95 percent of their budgets to television. Television is the most widely used medium because it can reach large audiences and instill brand name recognition. Much television advertising is also aimed toward people who do not read newspapers, such as children. Food retailers, on the other hand, depend more on local newspapers to communicate prices for a large number of items.

Advertising Intensity

The intensity of advertising can be measured by comparing food's share of advertising to its share of disposable income. For example, whereas food and alcohol accounted for 12.4 percent of the Nation's

Table 2—Media use by food manufacturers, 1997

Media	Food advertising by food manufacturers
	$ million
Magazines	1,099
Sunday magazines	71
Newspapers	46
National newspapers	10
Outdoor	70
Network television	3,230
Spot television	1,389
Syndicated television	466
Cable TV network	430
Network radio	104
Network sport radio	160
Total	7,074

Source: 1997 LNA data, compiled by USDA/ERS.

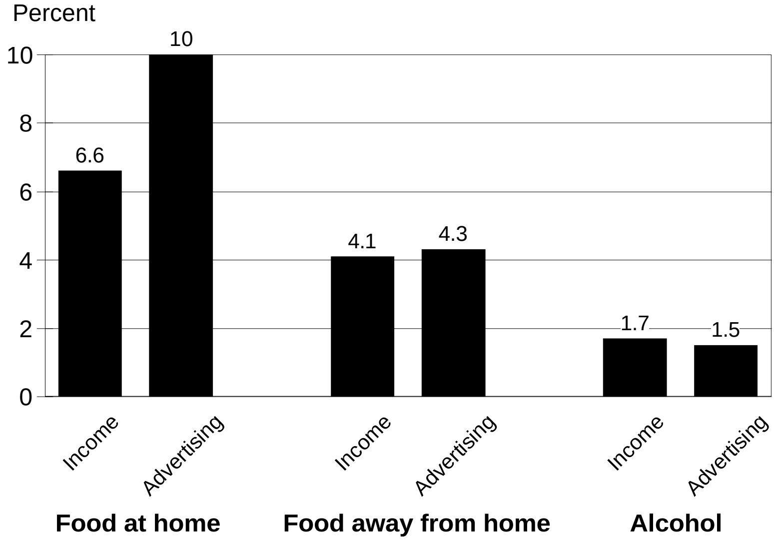
disposable income in 1997, they accounted for nearly 16 percent of advertising expenditures (food alone accounted for 10.7 percent of disposable income and 14.3 percent of advertising expenditures).

Advertising by food manufacturers—rather than by restaurants, foodstores, or even alcohol manufacturers—is the greatest contributor to the high intensity of food advertising. Purchases of food at home accounted for less than 7 percent of income in 1997, but advertising by food manufacturers accounted for 10 percent of all advertising that year (fig. 2). The foodservice share of advertising, at 4.3 percent, was slightly larger than the 4.1 percent of income consumers spent on food away from home. This low advertising intensity occurs because only about half of local restaurants do any advertising, and relatively little of it. Most advertising by the foodservice industry is by fast-food restaurants. Alcoholic beverages accounted for about 1.7 percent of the Nation's income in 1997, slightly larger than alcohol's share of mass media advertising. However, advertising intensity for alcohol may increase now that voluntary constraints to advertising on television have been removed.

Within the food manufacturing sector, advertising expenditures tend to be highest for the most highly processed and highly packaged foods—which tend to be highly branded and which can be easily dif-

Figure 2

Food's share of advertising compared with income, 1997



Source: USDA/Economic Research Service.

ferentiated. Of the $7 billion spent on advertising by food manufacturers in 1997, more than one-fifth (22 percent) was devoted to prepared, convenience foods (table 3). Alcoholic beverages accounted for an additional 15 percent, as did candy, confectionery, and salty snacks. Soft drinks/bottled water and cooking products/seasonings are also large advertisers. Advertising expenditures on meat, fruits, and vegetables are negligible.

Advertising intensity by product category is shown in table 4. Meat, poultry, and fish, which accounted for 27 percent of the consumer at-home food budget in 1995, accounted for 4 percent of all advertising by food manufacturers that year, and therefore have a low advertising intensity ratio of 0.1. Dairy products, which accounted for about 12 percent of consumer expenditures on food at home, have an advertising intensity ratio of 0.6. Soft drinks, which accounted for less than 5 percent of expenditures on food at home, have a ratio of 1.8. Prepared, convenience foods, have an advertising intensity ratio of 1.9; confectionery and sweets have the highest ratio—2.4. The share

Table 3—Advertising expenditures by food manufacturers, 1997

Product category	Advertising expenditures	
	$ million	*Share*
Prepared, convenience foods[1]	1,563	22.1
Confectionery and snacks[2]	1,095	15.5
Alcoholic beverages	1,082	15.3
Soft drinks and bottled water	702	9.9
Cooking products and seasoning[3]	675	9.5
Beverages[4]	625	8.8
Dairy products and substitutes	505	7.1
Bakery goods	408	5.8
Meat, poultry, and fish	210	3.0
Fruits, vegetables, grains, and beans	159	2.2
General promotions	50	0.7
Total	7,074	100.0

[1] Soups, cereals, jams, jellies, peanut butter, health and dietary foods, infant foods, pasta products and dinners, all other prepared dinners and entrees, and miscellaneous prepared foods.

[2] Candy, gum, mints, cookies, crackers, nuts, chips, and other salty snacks.

[3] Sugars, syrups, artificial sweeteners, shortening, cooking oils, margarine, baking mixes, crusts, flour and other baking ingredients, seasoning, spices, extracts, gelatins, puddings, condiments, pickles, relishes, sauces, gravies, dips, salad dressings, mayonnaise, and other miscellaneous ingredients.

[4] Coffee, tea, cocoa, fruit juices and fruit drinks, and vegetable juices.

Source: USDA, Economic Research Service.

of food advertising for some food categories—in particular, confectionery and sweets, prepared and convenience foods, soft drinks, cooking products and seasonings, and food beverages—is substantially higher than the share of consumer spending in those categories. For other categories—such as meat, poultry, and fish, and fruits, vegetables, grains, and beans—the share of advertising is substantially less than the share of consumer spending on them.

Foods with the highest advertising intensity tend to be the ones overconsumed relative to Federal dietary recommendations such as the *Dietary Guidelines for Americans* (see chapters 3, 5, and 6). Per capita consumption of added sugars and sweeteners, for example, continues to increase, much of it due to increased consumption of carbonated soft drinks. This increased consumption seems to be

Table 4—Advertising intensity for product categories, 1995

Product	Advertising by manufacturers	Food-at-home budget share	Advertising intensity
	Share	*Share*	*Ratio*
Confectionery and snacks[1]	13.2	5.4	2.4
Prepared, convenience foods[2]	23.5	12.5	1.9
Soft drinks	8.6	4.8	1.8
Cooking products and seasoning[3]	10.3	7.6	1.4
Food beverages[4]	8.8	6.7	1.3
Dairy products[5]	7.5	12.1	0.6
Bakery goods	5.5	9.5	0.6
Meat, poultry, and fish	4.0	26.7	0.1
Fruits, vegetables, grains, beans	1.9	14.7	0.1

[1] Candy, gum, mints, cookies, crackers, nuts, chips, and other salty snacks.

[2] Soups, cereals, jams, jellies, peanut butter, health and dietary foods, infant foods, pasta products and dinners, all other prepared dinners and entrees, and miscellaneous prepared foods.

[3] Sugars, syrups, artificial sweeteners, shortening, cooking oils, margarine, baking mixes, crusts, flour and other baking ingredients, seasoning, spices, extracts, gelatins, puddings, condiments, pickles, relishes, sauces, gravies, dips, salad dressings, mayonnaise, and other miscellaneous ingredients.

[4] Coffee, tea, cocoa, fruit juices and fruit drinks, and vegetable juices.

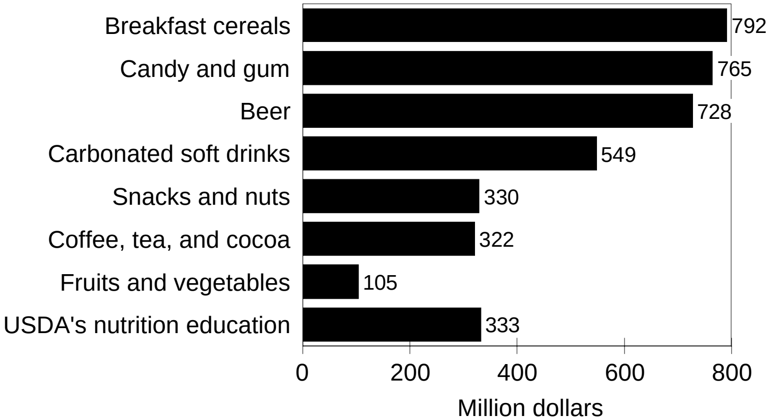
[5] Includes dairy substitutes and eggs.

Source: Compiled by USDA/ERS from 1995 LNA data and Bureau of Labor Statistics' Consumer Expenditures Survey data.

occurring at the expense of milk (see chapters 3 and 7), and may result in adverse health effects by increasing the risk of osteoporosis (see chapter 2). Consumption of fruits and vegetables, on the other hand, which Americans consume in lower amounts than recommended, has increased only slightly in the past few decades—as one might expect in view of the little advertising associated with these foods.

Government efforts to provide consumers with information on how to improve their diets— such as messages to consume at least five fruits and vegetables each day—compete with the food industry's massive advertising. Combined, the U.S. Department of Agriculture spent $333.3 million in fiscal year 1997 on nutrition education, evaluation, and demonstrations. This is approximately what the food industry spent on advertising just for coffee, tea, and cocoa, or for snacks and nuts; slightly more than half (60 percent) the amount spent on advertis-

Figure 3
Advertising expenditures, 1997



Source: USDA/Economic Research Service.

ing for carbonated soft drinks, and less than half the amount spent promoting beer, or candy and gum, or breakfast cereals (fig. 3).

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Chapter 10

Advertising and What We Eat

The Case of Dairy Products

Noel Blisard

Two national programs for dairy advertising, authorized by Congress, have concentrated on advertising for fluid milk and cheese. This chapter analyzes the effectiveness of these programs, and shows that generic advertising has had a positive impact on both cheese and fluid milk sales. After calculating the added revenue to producers due to higher prices and the added costs of generic advertising, it is estimated that dairy producers received $5.33 in return for each additional dollar spent on generic promotion.

Introduction

Advertising is directed toward existing and potential consumers of a product with the objective of increasing sales. Food advertising therefore attempts to persuade the consumer to purchase a particular type or brand of food. Advertising can directly influence the types and the amounts of foods purchased, and thereby affect the nutrient intake of consumers.

Two basic types of advertising exist. *Branded advertising* promotes the characteristics of a given brand of the commodity. The firm pays for the cost of advertising and directly receives any benefits that may accrue from the promotional campaign. *Generic advertising* promotes consumption of the general commodity by a cooperative effort

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of producers. This cooperation may be voluntary or mandatory if required by either a cooperative or by Federal/State legislation of a commodity checkoff or marketing order promotional program. In such cases, producers pay the costs and have control over the program design. The food industry uses both types of advertising.

Branded and generic advertising attempt to influence consumer purchases in slightly different ways. Branded advertising attempts to persuade and reinforce the choices the consumer makes. Since the object of branded advertising is to increase market share and thus total sales, the consumer must be persuaded to purchase and to make repeat purchases of a particular brand. On the other hand, generic advertising attempts to encourage consumers to become buyers of a product and to make repeat purchases of the product. The difference can be seen in cheese advertising. The State of Wisconsin has attempted to brand its cheese as superior to cheese produced in other States. Hence, Wisconsin advertising attempts to encourage consumers to purchase Wisconsin cheese, whereas generic advertising attempts to encourage consumers to purchase cheese regardless of its source.

There is some evidence that generic advertising increases aggregate demand for the commodity, or at least mitigates a decline in consumption. Empirical evidence that branded advertising increases aggregate demand is less persuasive. In general, generic advertising tends to provide more information about the product group (which may include nutritional information) and to be less deceptive than branded messages.

National Generic Advertising Programs

Either the Federal or State government can authorize collections for generic promotion programs. Programs can then be funded and managed entirely by producers (freestanding operations), or tied to USDA regulatory programs (marketing orders or checkoff programs). A few programs offer producers the option of having their assessment refunded, and most programs allow producers to vote on whether to start or continue the promotion.

Eleven national checkoff programs exist that deal directly with food commodities. These promotional boards collected $168.33 million in 1993. Beef, pork, and dairy accounted for $146.8 million, egg and potatoes $8 million each, honey $3 million, mushrooms and pecans around $1 million each, and watermelons $0.85 million. The lime promotional board collected nothing for 1993, and the wheat promotional board was inactive in 1993 (Neff and Plato, 1995).

There is much speculation over whether generic advertising actually influences consumer choices. However, little evidence is available since only the two dairy promotion programs require an independent evaluation of the program's effectiveness, which must be delivered to Congress each year.

Dairy Promotion Programs and Their Effects on Dairy Consumption

Two national programs for dairy advertising have been authorized by Congress. Both dairy programs are financed by an assessment and are designed to increase consumer demand for milk and other dairy products.[1] USDA has oversight responsibility for both dairy promotion programs.

Producer Dairy Promotion Program

The Dairy Production Stabilization Act of 1983 (Dairy Act) authorized a national producer program for dairy product promotion, research, and nutrition education as part of a comprehensive strategy to increase human consumption of milk and dairy products and reduce milk surpluses. This self-help program is funded by a mandatory 15-cent-per-hundredweight assessment (dairy producers received approximately $13.00 per hundredweight of milk in 1997) on all milk produced in the contiguous 48 States and marketed commercially by dairy farmers, and is administered by the National Dairy Promotion and Research Board (Dairy Board). The Dairy Act provides that dairy farmers can direct up to 10 cents per hundredweight of the assessment for contributions to qualified regional, State, or local dairy product promotion, research, or nutrition education programs (Qualified Programs).

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[1] The discussion below is based on *USDA Report to Congress on the National Dairy Promotion and Research Program and the National Fluid Milk Processor Promotion Program*, July 1, 1997.

Dairy Board revenue from the 15-cent-per-hundredweight producer assessment was $77.8 million in 1996. Of the total monies collected, 66.1 percent was used for advertising and promotion, and 14.3 percent was used for nutrition education and public and industry communication. The remainder of the funds was used for market, nutrition, and product research, as well as for export enhancement, general and administrative expenses, etc.

The producer program has concentrated on advertising for fluid milk and cheese. From 1994 through 1996, advertising programs for fluid milk and cheese accounted for approximately 90 percent of qualified programs' advertising expenditures. These included efforts to increase school participation in the school breakfast program (of which milk is an important component), as well as television and radio campaigns to stimulate consumer purchases of milk (such as the *Got Milk?* campaign, targeted at an audience age 13-34) and cheese (such as the *Cheese to the Rescue* campaign, targeted at women age 25-54—who are the main household purchasers of cheese—and which promoted cheese as a vital component of food preparation in today's time-constrained environment).

Fluid Milk Processor Promotion Program

The Fluid Milk Promotion Act of 1990 (Fluid Milk Act) authorized the establishment of a national processor program for fluid milk promotion and education. This program is financed through a 20-cent-per-hundredweight assessment on fluid milk processed and marketed in consumer-type packages in the 48 contiguous States and the District of Columbia by processors who market more than 500,000 pounds of fluid milk per month. The program was created to strengthen the position of the dairy industry in the marketplace and to maintain and expand markets and uses for fluid milk products in the United States. Processors administer this program through the National Fluid Milk Processor Promotion Board (Fluid Milk Board), with annual revenue of approximately $110 million. The initial Fluid Milk Board was appointed in June 1994.

In January 1995, the Fluid Milk Board initiated a national media campaign (*Milk, What a Surprise!*) designed to educate women age 25-44 about the nutritional qualities of milk and its importance in a healthy diet. The target audience was later expanded to include women age 25-49, teen girls 13-18, men and women 18-24, and men

25-34. These groups represent approximately 56 percent of all milk consumed in the United States. A series of print ads featuring celebrities wearing milk mustaches appeared in over 90 magazines, the largest print buy ever for a beverage advertiser. Because of the campaign's size, various magazines added features about the benefits of milk and other aspects of the print campaign. Other portions of the campaign include a medical advisory board to serve as spokesmen, outdoor billboard and transit posters, consumer tie-in promotions, a consumer hotline about the benefits of milk, a series of informational brochures on milk-related topics, the MilkPEP Internet site, a college campus tour, and a consumer milk mustache contest.

Effects of Advertising on Fluid Milk Sales

The Economic Research Service has analyzed the effect of generic advertising on fluid milk sales. The first advertising expenditures under the Dairy Act occurred in September 1984. The analysis used data from 12 regions, before (December 1978 to August 1984) and after (September 1984 to September 1996) the Dairy Act became law, and controlled for other influential factors such as the retail price of fluid milk, per capita income, demographic characteristics, and seasonality.[2,3] Advertising expenditures for 1995 and 1996 included expenditures by both the National Dairy Board and the Fluid Milk Processor Board. Sales effects resulting from the Dairy and Fluid Milk Acts were estimated by assuming that regional advertising expenditures would have continued at the same inflation-adjusted levels as in the year before the Dairy Act's implementation. Net sales gains due to the Dairy and Fluid Milk Acts were calculated by subtracting estimated sales assuming pre-Dairy Act advertising expenditure levels from estimated sales using actual advertising expenditures.

The analyses show that generic advertising had a positive effect on stemming the decline in per capita milk consumption. Per capita milk consumption has been trending downward since the late 1970's, after briefly increasing in the 1980's. The Dairy and Fluid Milk Acts

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[2] The 12 milk marketing orders account for approximately 43 percent of the U.S. population and fluid milk consumption.

[3] Per capita consumption of fluid milk exhibits significant seasonal cycles, with peaks in early fall and troughs in June and July.

accounted for $183.5 million in additional fluid milk advertising expenditures in the 12 regions from September 1984 to September 1996. These additional expenditures led to an estimated 16.9-billion pound increase over the 12 regions' expected milk sales in the absence of the programs.

From October 1995 to September 1996, fluid milk sales in the 12 regions totaled 23.5 billion pounds. Increased advertising expenditures due to the Dairy and Fluid Milk Acts were $29.8 million. It is estimated that the additional advertising expenditures increased sales by 1.4 billion pounds, or 5.9 percent of total sales, which is equivalent to 47 pounds of milk sold for each additional advertising dollar.

Sales increases due to the Dairy and Fluid Milk Acts stem from increases in both advertising dollars and in their effectiveness. Factors other than advertising (such as increased public concern about calcium intake) may have caused some shifts in the consumer demand for milk in the post-Dairy Act period. Thus, the analysis might overstate the actual effect of the Dairy and Fluid Milk Acts on sales response for a given level of advertising expenditures.

Effects of Advertising on Cheese Sales

Data limitations restricted the analysis to the effects of advertising on nationwide sales of cheese for home use, about a third of the total market for cheese. Cheese consumed away from home (in restaurants and school meals, for example) or used as ingredients in combination foods (such as macaroni-and-cheese mixtures and frozen pizza) is not included. The effects on processed and natural cheese were analyzed separately since their purchasing patterns, prices, and product characteristics differ.

As with fluid milk, sales effects resulting from the Dairy Act were estimated by assuming that regional advertising expenditures would have continued at the same inflation-adjusted levels as in the year before the Dairy Act's implementation. Net sales gains due to the Dairy Act were calculated by subtracting estimated sales assuming pre-Dairy Act advertising expenditure levels from estimated sales using actual advertising expenditures.

The model controlled for the price of cheese, prices of substitutes (such as meat, poultry, and fish as well as imitation cheese), income, seasonality, time trends, and government donations (which influence the demand for cheese).

The increase in advertising increased at-home cheese consumption by approximately 561.9 million pounds during September 1984-September 1996, or 2.3 percent of the 24.0 billion pounds sold. The impact of generic advertising on sales of cheese for at-home use differed for natural and processed cheese. The campaign is estimated to have increased natural cheese sales by 63.2 million pounds (0.5 percent of total natural cheese sales) and processed cheese sales by 498.7 million pounds (5.0 percent of total processed cheese sales).

From October 1995 to September 1996, generic advertising increased sales of natural cheese by 5.3 million pounds (0.4 percent of total sales) and processed cheese by 57.4 million pounds (6.2 percent of total sales) for a combined increase in total cheese sales for at-home use of 62.7 million pounds (2.8 percent of total sales). The greater effectiveness of generic advertising in increasing processed cheese sales may be partly because the effects are sustained over longer periods of time than is the case for natural cheese due to lag of the model.

Conclusion

Statistical analyses show that generic advertising has had a positive impact on both cheese and fluid milk sales. Advertising conducted under the Dairy and Fluid Milk Acts increased fluid milk sales by 6 percent over the 12-year period ending in September 1996, whereas advertising under the Dairy Act increased national retail sales of natural and processed cheese for at-home consumption by 2.3 percent over expected sales without the program.

After taking into account the economic links among consumers, processors, and milk producers, and other market factors that influence decisions at each market level, ERS estimated that generic advertising boosted demand for fluid milk and cheese, but not demand for butter and frozen dairy products. The advertising programs caused higher farm-level milk prices. Over the simulation period (1975 to 1996), farm prices averaged 3.8 percent higher after 1984. The rate of return to producers was estimated by calculating the added revenue to producers due to higher prices and the added costs of generic advertising associated with the Acts. This translates into dairy producers receiving $5.33 in return for each additional dollar spent on generic promotion above pre-Act levels. Other studies have reported rates of return between $2.50 and $7.00.

Other checkoff programs have also tried to increase demand for their commodities by presenting the commodity as a more wholesome product—the pork "other white meat" campaign, for example. This promotion has tried to capitalize on the perceived health benefits of chicken and to convince consumers that pork is as healthful to eat as chicken.

Research on the effectiveness of the beef checkoff program, which initiated its first national programs in 1987, has shown it to be effective in increasing demand for beef and reducing the downward trend observed in the 1970's and 1980's (Ward, 1994). That research concluded that, on average, the promotional and information programs resulted in an additional $3.3 billion in industry revenues, and that, on average, producers (at the live-weight market level) received $5.40 for each dollar spent on promotions and information programs.

In spite of the effectiveness of these promotion programs, not all the generic advertising programs can increase a food's share of the consumer's food basket. A consumer who chooses to eat more chicken will likely consume less beef and pork. If more dairy products are consumed, less meat may be eaten. Indeed, it has been hypothesized that generic advertising campaigns may offset each other. However, the final composition of the diet is still influenced by generic advertising.

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Chapter 11

Health Claims in Food Advertising and Labeling

Disseminating Nutrition Information to Consumers

Alan D. Mathios and Pauline Ippolito

The question of how best to get evolving scientific evidence linking diet and disease to consumers has been much debated in policy circles. At the core of this debate are widely varying presumptions about how effective food manufacturers are in reaching consumers compared with, or in addition to, government and other information sources, and about the best approaches for controlling misleading or deceptive claims. This chapter evaluates whether policy changes that took place in the mid-1980's, and allowed food manufacturers to explicitly link diet to disease risks in advertising and labeling, appear to have improved consumers' food choices (the information hypothesis), or as many critics fear, to have confused consumers sufficiently to slow improvements in diet that would otherwise occur (the consumer confusion hypothesis).

Introduction

In the last 30 years, scientific understanding of the role of diet in chronic disease risks has improved significantly. In the United States, diet is now believed to be linked substantially to 4 of the top 10 causes of death, and diet-disease research is continuing at a rapid

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pace. Individuals have much to gain from information that would allow them to incorporate this evolving science into basic dietary decisions.

The question of how best to get this information to consumers has been much debated in policy circles. At the core of this debate are widely varying presumptions about how effective food manufacturers are in reaching consumers compared with, or in addition to, government and other information sources, and about the best approaches for controlling misleading or deceptive claims.

The benefits of permitting diet-disease claims in food advertising and labeling depend, in part, on whether other sources of information are sufficient to inform consumers about the reasons for dietary change and to produce the competitive environment for food manufacturers to improve the nutritional characteristics of their food products. Public education efforts concerning diet-disease issues have been prominent for 20 years (see Appendix 1), and supplemented by private health organizations such as the American Heart Association and the American Cancer Institute. Yet, despite these efforts to communicate the link between diet and health, the typical American diet still deviates substantially from dietary recommendations (see chapters 3-6). While we cannot conclude that these consumption levels reflect a lack of information about diet and health (since many consumers may knowingly trade long-term health costs for taste and other things they value), dietary shortcomings raise the likelihood that public education campaigns have been relatively ineffectual.

From an economic perspective, a policy allowing a broad range of truthful diet-disease claims by producers should be beneficial to consumers since it would increase the opportunity, and thus the competitive pressure on manufacturers, to market the nutritional features of foods. Also, if producer claims are an important source of information for many consumers, a greater freedom to make valid claims could spread the information more effectively to a larger portion of the population. Whether the competitive process and the usual policies governing all marketing claims are sufficient to fill in missing information and to control deception is, of course, open to question and empirical test.

This chapter reports on one key aspect of this policy debate: the potential costs of regulatory policies that limit truthful health claims in food labeling and advertising. In particular, this chapter evaluates whether policy changes that took place in the mid-1980's, and allowed food manufacturers to explicitly link diet to disease risks in advertising and labeling, appear to have improved consumers' food choices (the information hypothesis) or, as many critics fear, to have confused consumers sufficiently to slow improvements in diet that would otherwise occur (the consumer confusion hypothesis). (See Appendix 1 for details on regulatory constraints on health claims in food advertising and labeling and expected producer and consumer behavior under alternative regulatory rules.)

As in any in-field experiment, testing the effects of policy change is difficult. Other things may have also changed during the period when policy shifts occurred, making a conclusive assessment of causal relationship between advertising and labeling policies and market outcomes difficult. Nonetheless, while more controlled experimental techniques offer some advantages in research design, evidence from real markets also has important advantages. Most notably, market data reflect the reaction of the entire market system, which most controlled experiments are forced to ignore, including producers' actions and the competitive responses to them under the changed rules. Moreover, if the effects of the policy change are large—whether beneficial or harmful—they should manifest themselves in measured market changes despite other noise in the system.

We focus on two time periods: 1977-85, when there was significant regulatory risk in advertising and labeling of explicit health claims; and 1985-90, when truthful health claims were permitted and, thus, potentially added to the continuing efforts of government and other general information sources. Use of advertising to promote the advantages of dietary fiber in helping to prevent certain kinds of cancer was first made in late 1984, and the advantages of a low-fat diet in promoting a healthy heart began in 1985-87.

Impact of Health Claims in the Ready-to-Eat Cereal Market[1]

Despite growing evidence of the link between reduced cancer rates and high-fiber diets during 1978-84, there was no shift toward high-fiber cereals (fig. 1).[2] After producer health claims in advertising and labeling began in late 1984, however, there was a significant increase in the market-share-weighted fiber content of cereals.

During 1985-87, the market-share-weighted fiber content of cereals increased 7 percent from 1.64 grams to 1.75 grams of fiber/ounce of cereal. Ippolito and Mathios (1990a) estimated that health claims in advertising and labeling in these 3 years caused 2 million more households to consume high-fiber cereals.

Cereal manufacturers, in response to the growing demand for high-fiber cereals and knowing they could now advertise the health benefits of fiber, responded by developing new high-fiber cereals. Excluding children's cereals, cereals introduced between 1985 and 1987 averaged 3.59 grams of fiber per ounce, compared with an average of 1.99 grams for cereals introduced between 1978 and 1984.

Even before 1984, firms were permitted to disclose fiber content on cereal labels. Consequently, the dramatic effects on producer and consumer behavior are clearly linked to the use of the health claim rather than the ability to disclose fiber content. In other words, it is important to permit firms to explain the reasons why consumers should care about fiber.[3]

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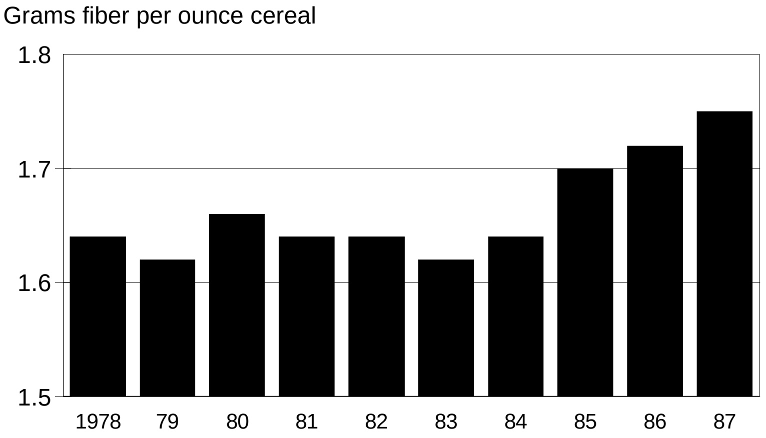
[1] This section is based on Ippolito and Mathios (1989, 1990, 1991).

[2] Annual market share and sales data for 1978-87 for major brands of cereals are taken from reports by John Maxwell in *Advertising Age*. Data on the fiber content of these cereals were obtained from the U.S. Department of Agriculture's 1985 *Continuing Survey of Food Intakes by Individuals (CSFII) for Women, Ages 19-50*, supplemented by label data from 1988 for new products. For more details, see Ippolito and Mathios (1989, 1991).

[3] Levy and Stokes (1987) also found substantial effects on cereal sales following the start of the advertising. They examined weekly sales data from a Washington DC grocery chain for a 48-week period that began 14 weeks before the Kellogg campaign. The size, distribution, and timing of the sales increases supported the conclusion that the introduction of the health claim advertising in the cereal market had a clear and substantial effect in shifting consumer purchases toward high-fiber cereals.

Figure 1
Average fiber from cereal (data weighted by market share)



Source: Ippolito and Mathios (1991).

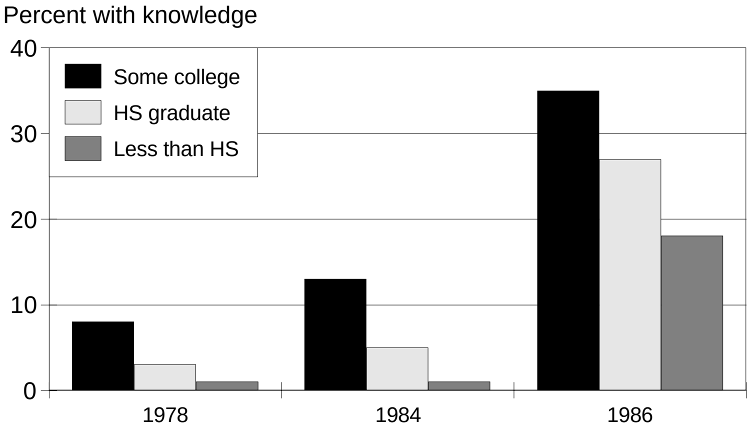
Impact of Health Claims On Knowledge Of Diet-Disease Link

The use of health claims in the ready-to-eat cereal market also had a profound effect on consumers' knowledge of the link between diet and disease. FDA survey data show that consumer knowledge of the link between fiber and cancer was low and did not increase substantially during the 6 years prior to the introduction of health claims (1977-84).[4] For those with less than a high school education, there was no gain in knowledge; for high school graduates and those who attended some college, there were some modest gains (fig. 2).[5] For

4 These measures of knowledge are taken from the Health and Diet Surveys, a series of national telephone surveys directed by the Food and Drug Administration (FDA) in collaboration with the National Heart, Lung, and Blood Institute. The measures reported in figure 2 are derived from the question "Have you heard about any things people eat or drink that might help prevent cancer?" Respondents who mentioned fiber, roughage, whole grains, cereals, or bran in up to four responses were coded as knowing the relationship. For more detail about these results see Ippolito and Mathios (1991) and for a detailed description of the survey see Levy and Stephenson (1990).

5 The 1978 statistics were taken from Levy and Heimbach (1989), who combined the "some college" and "college graduate" categories.

Figure 2
Knowledge of fiber-cancer link



Source: Ippolito and Mathios, 1991.

example, in 1984, as in 1978, only 1 percent of those with less than a high school education knew of the link between fiber and cancer. After the introduction of health claims, all groups gained knowledge of the fiber-cancer link. For example, reported knowledge rose from 1.1 percent in 1984 to 18 percent in 1986 for those with less than a high school education. Knowledge levels also increased dramatically for other education groups as well.

In considering potential reasons why advertising had different effects on various groups, several major differences between the information distribution methods used by government and private advertisers are worthy of mention. Government and general information is usually disseminated in generic form ("increased soluble fiber consumption may reduce risks of coronary heart disease") and this information is concentrated in news and print media reports about the latest scientific studies on diet and health. In contrast, most cereal advertising is distributed through television, with a smaller portion in print media. Moreover, health claim advertising and labeling is product-specific so that advertising and labeling not only indicate the relationship between food characteristics and health, but also prominently feature a product that contains these characteristics.

Changes in Daily Intake Of Fats and Cholesterol[6]

The U.S. Department of Agriculture (USDA) periodically conducts large-scale national probability surveys in which detailed information on all foods and beverages consumed over a 24-hour period are collected and matched to nutrition data. To examine changes in consumption over time and to keep the analysis consistent, this study focuses on data for subpopulations that were consistently sampled by USDA in the years available and for which the basic variables of interest are available. In particular, this study analyzes 1-day recall data on food consumed in a 24-hour period in spring 1977, 1985, 1986, 1987/88, and 1989/90 for women and summer 1977, 1985, 1987/88, and 1989/90 for men age 19-50 who were heads of households and who consumed at least 300 calories on the interview day. Since the focus of the analysis is on 1985 policy effects, we analyze changes from 1977-85 and 1985-90.[7]

Average daily fat intake (measured as a percent of the 1977 intake level) for both men and women fell during 1977-85, and the rate of decline accelerated during the health claims period from 1985 to 1989/90 (fig. 3). Average fat intake for women declined from 73.3 to 69.6 grams per day from spring 1977 to spring 1985, and fell an additional 11.2 grams between 1985 and 1989/90. For men, fat intake in summer declined by 5.3 grams per day during 1977-85 (from 112.8 to 107.5 grams), and fell an additional 14.9 grams between 1985 and 1989/90.

Movements in saturated fat intake generally parallel changes in total fat intake. As with total fat, the absolute reductions in saturated fat intake were larger in the health claims period of 1985-1989/90 than in the pre-1985 period (fig. 3). For women, saturated fat intake dropped by 1.0 gram during 1977-85 and an additional 3.5 grams during 1985-1989/90. For men, average saturated fat intake declined by 1.0 gram between 1977 and 1985 and fell an additional 6.7 grams during 1985-1989/90.

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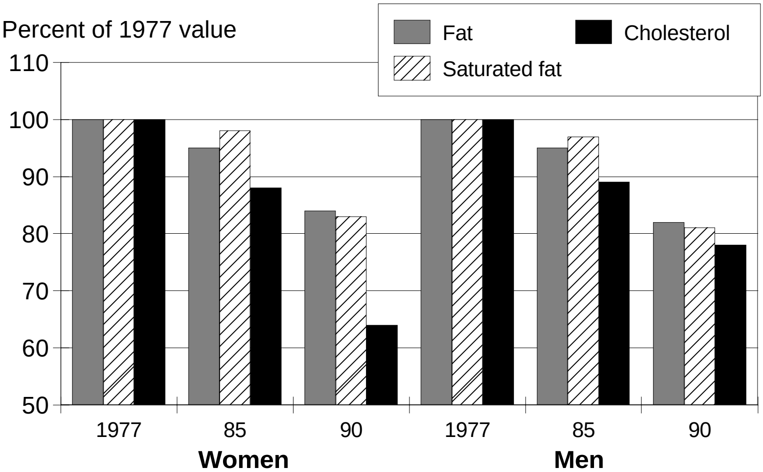
6 This section is based on Ippolito and Mathios, 1994a. That report also examined reductions in fat, saturated fat, and cholesterol at the food category level.

7 For a more detailed description of the data, see Ippolito and Mathios, 1994a.

Figure 3

Fat, saturated fat, and cholesterol intakes for women and men, 19-50 years of age



Source: Ippolito and Mathios, 1994a.

For women, cholesterol data show the same pattern of accelerated decline during the health claims period as found for fat and saturated fat (fig. 3). A change in the cholesterol data used for eggs beginning in the 1987 data suggests the need for caution in interpreting this result. For women, daily intake of cholesterol declined 40.4 milligrams (from 345.3 to 304.9) during the 8 years prior to 1985 and 83.7 milligrams during the following 5 years. The decline in average cholesterol intake is less sharp for men during the health claims period: 52.3 milligrams (from 498.9 to 446.6) during 1977-85 and an additional 57.6 milligrams between 1985 and 1990.

These data indicate that average intake of fat, saturated fat, and cholesterol declined from 1977 to 1989/90 and that the rate of decline was generally greater between 1985 and 1989/90, the period when diet-disease claims were permitted. This is consistent with the hypothesis that policy changes allowing producers to incorporate diet-disease issues in advertising and labeling added information to the market and sped improvement in consumers' diets.

Obviously, these types of data cannot establish that advertising and labeling claims were responsible for the increased rate of dietary improvement since, for instance, government and other public and private organizations continued their efforts to inform the public during this period and could have found more effective ways to accomplish their goals. Nonetheless, these data provide no support for the view that the introduction of producer health claims adversely affected consumer food choices overall or led consumers to reverse dietary improvements that were underway. Moreover, the data are consistent with the hypothesis that these claims, and the competition they spurred among producers, helped consumers to improve their diets more rapidly during the period when producers were freer to explain the importance of these nutritional characteristics.

Analysis of Per Capita Food Consumption Trends[8]

USDA annually calculates the amount of food available for human consumption in the United States (see Putnam and Allshouse, 1993). For most commodity categories, this available food supply is measured as the sum of annual production, beginning inventories, and imports minus exports, industrial nonfood uses, farm uses (seed and feed), and end-of-year inventories. Whenever possible, we use data reflecting retail-level production, which reduces the amount of waste reflected in the data.[9] Per capita consumption usually is calculated by dividing total food disappearance by the total U.S. population, including the Armed Forces overseas, on July 1 of a given year.

These data are collected by USDA directly from producers and distributors using techniques that vary by commodity. These data are not collected from individual consumers, and thus provide an independent basis for examining food consumption changes without the problems implicit in consumer survey data. If waste and other losses in the system are relatively constant over time, these data provide an

8 Large portions of this section are taken directly from Ippolito and Mathios (1994b).

9 For instance, more of the bone and other inedible parts of the animal are removed in the retail-level meat data, compared with the carcass-weight meat data, which reflect slaughter plant output.

independent measure of changes in food consumption patterns.[10] Thus, trends in per capita consumption data can also be used to test the hypotheses that government and general sources of diet-health information were affecting consumers' food choices prior to 1985 and that the change in the regulations governing health claims in 1985 provided an additional source of this information, with a corresponding incremental effect on consumption patterns.

This section summarizes the results for 6 of the 22 trends examined by Ippolito and Mathios (1994b). These six are typical of the results found for the other trends. Trends in food categories that comprise a sizable portion of fat in the overall diet are examined to determine if consumption shifted away from higher-fat and higher-cholesterol food categories toward lower-fat and lower-cholesterol categories. In particular, trends in per capita consumption of red meat, eggs, and animal fat (butter, lard, and edible beef tallow) are examined, as are those in lower-fat categories, such as flour and cereals, fruits, and vegetables.[11] The data are obtained from the USDA's *Food Consumption, Prices, and Expenditures, 1970-92* (Putnam and Allshouse, 1993). For each food group, changes in per capita consumption were analyzed between the years 1977-85 (pre-health claims) and 1985-90 (health claims).

Per capita consumption of red meat, which is a major source of fat and saturated fat in the U.S. diet, declined during both 1977-85 and 1985-90 (fig. 4). Consumption fell from 132.2 pounds per year in 1977 to 124.9 pounds in 1985. In the next 5 years, the decline accel-

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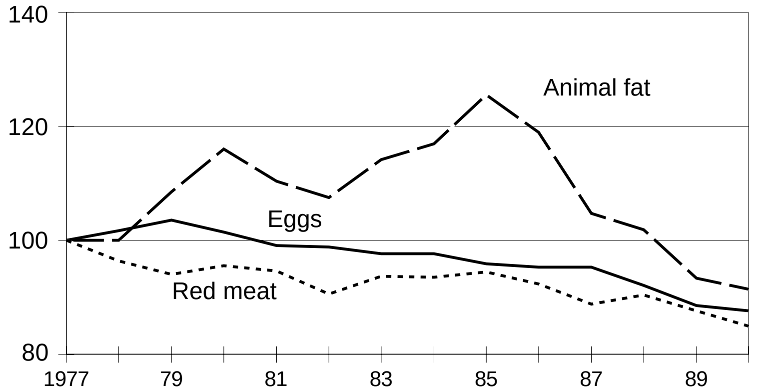
[10] These data include food that spoils prior to consumer purchase, as well as other waste in the system. If this spoilage and waste are not changing over time, estimates of changes in trend will be unbiased. However, if this waste is changing for some categories, bias may be introduced into the analysis. For instance, USDA highlights the fats and oils category as one where waste may be changing. Fast-food outlets and other restaurants generate significant amounts of waste grease, which is not consumed as food but is included in the fats and oils data. As the quantity of food consumed away from home has increased in the United States, the volume of waste grease has grown, and thus, the production data may overstate fat and oil consumption by a larger margin over time. A 1987 study estimated waste grease at approximately 6 pounds per capita, or approximately 9 percent of the 1992 data for this category (Putnam and Allshouse, 1993).

[11] Health claims have never been allowed on meat and poultry labels, which are regulated by USDA. Thus, any effects in these categories due to the change in health claims policy would be the result of general improvements in information from claims for other foods, rather than to the direct effect of health claims for lean meats and poultry.

Figure 4

Per capita supply of high-fat foods decreased after 1985

Percent of 1977 value



Source: Ippolito and Mathios, 1994b.

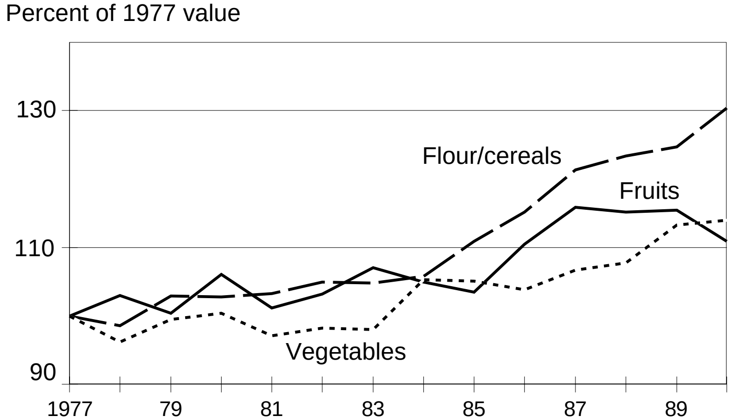
erated. Per capita consumption of red meat fell to 112.4 pounds in 1990, a decline of 12.5 pounds. Regression results reported in Ippolito and Mathios (1994b) indicate that the underlying negative trend was significant and that it fell further during the health claim period.

Per capita consumption of eggs also declined during both periods, from 34.3 pounds in 1977 to 32.9 pounds in 1985. During the next 5 years, consumption fell an additional 2.8 pounds, again showing an acceleration in the decline. Regression results show that the underlying trend was negative and significant, with a significant incremental reduction during the health claims period (Ippolito and Mathios, 1994b).

Surprisingly, per capita consumption of animal fat rose dramatically from 1977 to 1985 and then fell as dramatically during 1985-90 (fig. 4). Per capita consumption of animal fat was 10.6 pounds per year in 1977 and 13.3 pounds in 1985, a rise of 2.7 pounds. By 1990, per capita consumption had fallen to 9.7 pounds per year, a reduction of 3.6 pounds (27 percent) in just 5 years. Regression results indicate that during 1977-85 there was a significant upward trend in the per capita consumption of animal fat. In contrast, during the health claims period (1985-90), there was a significant reversal of the trend.

Figure 5

Per capita supply of low-fat foods increased after 1985



Source: Ippolito and Mathios, 1994b.

In each of the three cases analyzed, per capita consumption of high-fat, high-cholesterol foods declined during the health claims period. Moreover, this decline was more accelerated than during the period when producers were prohibited from using health claims. Of the 10 high-fat food trends considered in Ippolito and Mathios (1994b), all showed similar accelerated declines (relative to the underlying trend during 1977-85) during the health claims periods. Perversely, 6 of the 10 consumption trends had positive underlying trends during the pre-health claims period.[12]

Flour and cereal products, fruits, and vegetables are much recommended as replacement for fats in the U.S. diet. Per capita consumption of these foods increased during both periods, and the rate of increase accelerated during the health claims period (fig. 5). For example, between 1977 and 1985, per capita consumption of flour and cereal products increased by 15.4 pounds (from 140.7 to 156.1 pounds). In the next 5 years, consumption rose another 27.4 pounds to 183.5 pounds per capita. For vegetables, consumption rose 10.3 pounds (from 200.5 to 210.8 pounds) between 1977 and 1985, and

[12] The trends include red meat, eggs, cream products, cheese, animal fats, vegetable fats, whole milk, butter, ice cream, and creamed cottage cheese.

rose 17.7 pounds between 1985 and 1990. For fruits, consumption rose 3.4 pounds (from 96.1 to 99.5 pounds) between 1977 and 1985, and rose 7.1 pounds between 1985 and 1990. Regression results confirm that the upward trend was statistically significant for all three food categories and that this trend accelerated significantly during the health claims period for flour and cereal products and for vegetables. The trend also increased for fruit but not significantly. For six of eight low-fat food categories, Ippolito and Mathios (1994b) found accelerations in the positive trend during 1985-90.[13]

Consumption data for major food categories during 1977-85, when health claims were restricted, provide substantial evidence that information about fats, cholesterol, and disease was spreading to consumers, leading to improved diets. The evidence for this period in not entirely consistent, however. Per capita consumption of some higher fat products increased.

The picture is more consistent for 1985-90, when policy allowed producers to make explicit diet-disease claims. During this period, the trend in per capita consumption of food categories with high fat and high cholesterol levels either stayed the same or declined relative to the earlier period. None of the increments to the trends were significantly contrary to expectations under the information hypotheses, and thus provide no evidence that the addition of health claim advertising had adverse effects on the rate of improvement in dietary patterns. In fact, during the advertising period, movements away from the high-fat food categories increased for all major categories. Similarly, the data show a consistent pattern during the advertising period of additional movements toward lower fat food categories.

Conclusion

Examination of market share data in the ready-to-eat cereal market, consumer knowledge data, individual nutrient intake data, and per capita consumption data all indicate that diets improved during the period when producers were permitted to use health claims in advertising and labeling. Moreover, evidence from the ready-to-eat cereal market suggests that allowing producers to use health claims resulted

[13] The trends considered are poultry, fish, skim milk, flour/cereals, vegetables, fruit, low-fat cottage cheese, and icemilk.

in more healthful product innovations and motivated producers to compete on health. Of course, it is difficult to assess the precise effect that health claims have contributed to improvements in diet. Nevertheless, the data do not support the consumer confusion hypothesis—that health claims have adverse consequences on consumers.

The evidence presented here suggests that producer claims have significant potential to increase consumer awareness of diet-health issues and to improve consumer dietary choices, especially for groups not well reached by government and general sources of information. For these reasons, health claims policy should be designed to ensure that producers' incentives to make truthful health claims in advertising and labeling are preserved.

While this implication may seem unexceptional, it is often lost in the debate about health claims policy, where a policy's ability to control deception often becomes the major focus of the debate. All policies to control deceptive and misleading claims will also discourage some truthful claims. However, in considering alternative approaches to health claims policy, it is important to recognize that the magnitude of this effect on truthful information is as important to consumer welfare as the effects of deception. For example, current regulations prohibit all health claims not pre-approved by the FDA. While this clearly eliminates potentially deceptive advertisements and labels, it also limits the flow of evolving scientific information to that provided by the government and general sources of information. All the evidence presented here suggests that augmenting these sources of information with truthful producer health claims is likely to benefit consumers.

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Appendix 1: Dissemination of Diet-Disease Information to Consumers

Provision of Diet-Disease Information by Government and Other General Sources

As scientific understanding of the role of fats and cholesterol increased, information began to flow to the public through several channels. Public health organizations, government, and the press were all significant sources of this information. By the early 1960's, articles were appearing regularly in the popular press discussing the relationship between intake of saturated/polyunsaturated fat and blood cholesterol levels, and their relationship to heart disease.[1] By the early 1960's, the American Heart Association (AHA) had assumed a leading role in advising consumers that they could reduce their risk of heart attack by limiting saturated fat and cholesterol consumption. Other groups soon followed.

Government also played a role in disseminating this information, though considerably later than other sources. Prior to the 1970's, government

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[1] Examples of articles in widely circulating magazines include "Are You Eating Your Way to a Heart Attack?", *Saturday Evening Post*, December 1, 1956; "The Perilous Fat of the Land," *Readers Digest*, April 1961; "Fat, Food, and Heart Disease," *Consumer Reports*, August 1962; "Where Do We Stand On Medicine's Big Three? Cancer, Heart Disease, Stroke," *Better Homes and Gardens*, August 1962; "How Can I Help My Husband Avoid a Heart Attack?" *Readers Digest*, etc. There are many, many others.

dietary advice focused on the need to obtain sufficient energy and nutrients from foods to prevent nutritional deficiencies (see chapter 2). By the 1970's, however, the focus of national nutrition policy began to shift to dietary components associated with chronic disease. The shift in emphasis can be seen in rules for voluntary and triggered nutrition labeling adopted in 1973, which allowed labeling of fat content by types (Calfee and Pappalardo, 1989), but the shift is most clearly reflected in U.S. Senate hearings in 1974 (U.S. Senate, 1974), which culminated in dietary goals in 1977 (U.S. Senate, 1977). Quantitative recommendations were issued for several aspects of food consumption, including recommendations to increase consumption of complex carbohydrates (55-60 percent of energy) and to decrease consumption of refined and processed sugar (less than 15 percent of energy), fat (less than 30 percent of energy), saturated fat (less than 10 percent of energy), cholesterol (300 milligrams per day), and salt (3 grams per day). In 1979, the Surgeon General also published dietary advice for the public, including recommendations that Americans consume fewer calories if overweight, less saturated fat and cholesterol, less salt, and relatively more complex carbohydrates such as whole grains, cereals, fruits, and vegetables, etc. Similar public advice was given in 1980 (and revised periodically since) in the Dietary Guidelines for Americans (USDA). In 1988, *The Surgeon General's Report on Nutrition and Health* (DHHS, 1988) provided another major review of the scientific literature on the relationship between diet and health and issued similar dietary guidelines. In 1989, the National Research Council issued a major review with similar dietary recommendations in its report *Diet and Health: Implications for Reducing Chronic Disease Risk*.

In addition, the Food and Drug Administration (FDA) and the National Heart, Lung, and Blood Institute (NHLBI) began a sodium initiative in 1981, which publicized the relationship between sodium and hypertension (Heimbach, 1986); the NHLBI's *National Cholesterol Education Program* was initiated in 1985 to improve awareness, treatment, and control of high cholesterol levels (Schucker, 1991); and the National Cancer Institute's *5-A-Day Program* was initiated in 1991 to spread information about the potential protective effects of fruits and vegetables.

Thus, government and other general information sources appear to have made considerable efforts to communicate the growing scientific evidence linking diet to heart disease and cancer.

Regulatory Constraints on Producers' Diet-Disease Information

Food producers were also an information source throughout this period, though producers faced constraints in providing some types of information.

Claims on food labels are primarily regulated by the Food and Drug Administration and claims in advertising are primarily under the jurisdiction of the Federal Trade Commission (FTC). Labels on meat and poultry products are regulated by USDA. The types of claims allowed on labels regulated by FDA or in advertising have changed over time.

For example, after producers reformulated margarine and cooking oil products to reduce saturated fat levels and began promoting their products' heart-related characteristics in the late 1950's, the FDA prohibited any label claims regarding cholesterol or fat content by type.[2] By the early 1970's, enforcement of this ban had eroded, and by 1973 the labeling policy was changed to allow cholesterol and fat composition disclosures and simple nutrient claims.[3]

Despite the policy change, manufacturers' claims linking fat, cholesterol, or any other dietary component to disease risks were explicitly prohibited on FDA-regulated labels throughout the 1970's and into the 1980's.[4] Thus, for instance, from 1973 to the mid-1980's, a manufacturer could label the fiber, fat, saturated fat, and cholesterol content of a food product, but could not on the label cite the underlying health concerns.

The rules for advertising never formally prohibited diet-disease claims or other more general health-related claims. The FTC has allowed simple nutrient claims about fats and cholesterol as long as the claim was not deceptive or misleading.

Advertising cases are usually brought under the FTC's authority to pursue deceptive business practices. An assessment of what the agency considers deceptive must be determined from cases or other agency pronouncements during the period of interest. A variety of evidence suggests that diet-disease claims and other health-related claims in advertising raised substantial legal risk at the FTC from the mid-1970's to at least 1983 for disease claims, and until 1980 for more general health-related claims. A primary

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2 See "Vegetable Oils are Enjoying a Boom," *New York Times*, March 4, 1962, III-1; "Advertising: Dairy Men Open Counterattack," *New York Times*, August 7, 1962, 36; "Oil-Food Labels Held Misleading, Government Against Use of Polyunsaturated Label," *New York Times*, May 28, 1964, 75.

3 For a discussion of the history of FDA regulation of cholesterol, see Calfee and Pappalardo (1989).

4 For example, Hutt (1986, pp. 32-34) reports that in 1964 the agency seized Nabisco Shredded Wheat, because the label contained information linking serum cholesterol to heart disease. Other examples occurred in 1976, when the ITT Continental Baking Company was required to terminate a labeling campaign linking high-fiber foods to reduced risk of colon cancer, and in 1978 when Kellogg was required to stop a similar campaign.

indication of agency thinking at the time can be taken from the progress of the FTC's Food Rule, a broad rulemaking undertaken in the mid-1970's to regulate food claims in advertising. In the original 1974 proposal for the Food Rule, the FTC staff recommended a ban on all diet-disease claims as inherently deceptive in advertising, as in the FDA labeling restrictions, and proposed to prohibit other general health-related claims, such as the term "health food."[5] The Commission itself did not propose to ban all health claims, instead reserving its options while soliciting comments on the issue in the Rule's *Federal Register* notice. By 1978, staff recommendations explicitly dropped the proposal to ban heart-health claims; a formal public notice ended the Food Rule in May 1983, in favor of case-by-case enforcement against deceptive food claims of all types.[6]

Thus, by May 1983, these FTC decisions had created considerably less legal risk for truthful claims in food advertising, though no particular guidance was given on the form of such claims. A diet-disease claim in advertising, however, continued to raise the risk of prosecution by FDA, since under FDA law, a diet-disease claim in advertising allowed FDA to declare the product a "drug" subject to drug law requirements.

The policy banning health claims on labels, with its implications for advertising, was effectively relaxed in 1985 following Kellogg's highly publicized All-Bran advertising and labeling campaign, which used the National Cancer Institute's statements on the potential relationship between fiber and cancer to promote its high-fiber cereals. The FDA's decision not to challenge this prominent campaign, which was in direct violation of the prohibition of diet-disease claims on labels, presumably led firms to perceive a significantly reduced legal risk in using accurate and well-founded health claims in advertising and labeling. FDA published a proposed rule to govern health claims on labels under a general deception standard in 1987,[7] but agency officials had publicly supported a change in policy earlier and had announced that well-founded claims would not be prosecuted in the interim.[8]

Thus, regulatory events suggest that, possibly as early as 1983 in advertising and by sometime around 1985 in labeling, producers faced considerably less regulatory risk in making truthful claims about well-established diet-disease

[5] 39 *Federal Register*, Nov. 11, 1974, 39862; Rosch, 1975; or Weitzman, 1975.

[6] 48 *Federal Register*, May 24, 1983, 23270-71.

[7] 52 *Federal Register*, August 4, 1987, 28843.

[8] FDA officials were often quoted in trade press articles during 1985 and 1986 as supporting valid health claims and promising an official change in policy to allow them. See "Health Claims on Food Put FDA in a Corner," New York Times; and Hutt, 1986, citing speeches by FDA agency officials.

relationships in advertising and labeling. Initial claims focused on the relationship between fiber and cancer, but a number of food manufacturers soon began to promote the relationship between fats and cholesterol consumption and heart disease. Thus, beginning in 1985, the regulatory environment changed to allow producers to become an additional source of consumer information linking diet to health, as the policy debate continued on how best to regulate such claims. The regulatory uncertainties slowed firms, but claims were certainly made in 1986,[9] and by 1987, a number of firms were making heart-health claims in major advertising campaigns.

Consumer and Producer Behavior Under Alternative Sources of Information

Government and Public Health Organizations. Government has some advantages as a source of diet and health information. As with all public goods, government is in a unique position to tax the population in order to fund the development and dissemination of information and thus forgo attempting to price information. Moreover, if government is assumed to maximize social welfare, it would be an unbiased and credible information source that would dispense information whenever the benefits of the information justified the costs of spreading it. However, if government is the sole or major source of such information, this concentration of power can be a significant problem if the process is susceptible to errors. If other theories of government behavior apply, for instance, if the “capture” or “special interest” theories of government behavior are valid (Stigler, 1971; and Peltzman, 1976), special interest groups might have undue influence on the types of information developed and disseminated, possibly blocking or slowing dissemination adverse to their interests. Similarly, if bureaucratic incentives influence government actions, these decisions may be excessively risk-averse or otherwise unresponsive to changes in science and the marketplace (Niskanen, 1971).

Finally, the nature of government and the pressures to which it responds influence the way the information is likely to be dispensed. In the nutrition area, for instance, information is usually disseminated through the release of government studies or scientific panel recommendations. These releases are initially limited to one-time reports in the news media, though there is a sec-

9 For instance, Promise margarine, which was lower in saturated fat than margarines at the time, was introduced in 1986 with its “heart smart” theme and focus on the role of saturated fat in coronary disease risks. The major TV campaign by Nabisco for Fleischmann’s lower saturated fat margarine, featuring a 30-year-old man talking about his recent heart attack and discussing the role of diet in prevention, also ran in 1986 (“Ads pump low cholesterol claims,” *Advertising Age*, Nov. 2, 1987).

ond-round dissemination through the popular press that reports nutrition information.[10] This information is highly concentrated in the news and print media, and therefore likely to be absorbed disproportionately by those reached by these information channels and those most efficient at processing information.[11] Moreover, the information is generally released in generic form (e.g., "Reduced saturated fat consumption may reduce your risk of heart disease") and not in product-specific form (e.g., "Brand X margarine contains less saturated fat than other margarines, and less saturated fat may reduce the risk of heart disease"). Generic information requires that consumers have other sources of information and a greater understanding of the issue to turn the information into behavior, again creating a potential bias toward those most efficient in processing information and those with better access to health information.

Like government, major public health organizations tend to be credible information sources, providing broad guidance on diet-disease issues. These organizations generally do not provide detailed information on particular food choices that draw consumer attention to particular dietary substitution. These groups rely on voluntary contributions for funding, and thus, tend to have relatively limited resources to devote to public education.

Based on these theoretical considerations, we can formulate hypotheses about how government and related general sources of information might affect fiber, fat, and cholesterol consumption. Other things equal, we hypothesize that the continuous flow of government and general information about the health implications of diet on heart disease and cancer have led to a decline in the average consumption of fats and cholesterol, and an increase in the consumption of fiber, in the United States.

Producers As a Source of Diet-Health Information. Food producers are another potential source of diet-health information. Certain food products have been or can be formulated to have desirable nutritional characteristics that may not be well understood by potential consumers. If these potential consumers could be informed about these product features at a low enough cost, demand for the product would increase enough to create profit opportunities for producers. This mechanism creates an incentive for producers to

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[10] A number of studies have found that the effects of information that is not repeated frequently can be shortlived. See Russo and others (1986), for instance, for such a finding on the effects of nutrition information in supermarkets.

[11] Feick and others (1986), for instance, find that more educated consumers are significantly more likely to acquire nutrition information from print media than less educated consumers.

attempt to provide the missing nutrition information to potential consumers.[12]

Producers have several advantages as providers of diet-health information. First, they should be willing to devote substantial resources to information provision if there are significant deficiencies in public knowledge and if there are products that can be sold profitably as a result of providing this new information. Thus, producers are capable of adding large amounts of diet-health information to the market, when it is needed. Second, producers' incentives are to provide nutrition information in product-specific form. Thus, as compared with government information, producer-provided nutrition information is more directly tied to potential behavioral changes, making it easier to act upon. Finally, producers have strong incentives to find the best methods to communicate the information to those who do not have it and would use it if they had. These considerations should improve consumer access to the information, especially for groups within the population that do not have the information, and should reduce the information-processing requirements necessary to turn the information into behavior.

Producer-provided diet-health information also has potential disadvantages, however. One important issue is credibility. Since consumers cannot usually verify relationships between diet and health directly (especially for long-term effects), there is the potential for deception. Unless the market or government has mechanisms to punish firms that lie, or consumers can verify information in some way, consumers would be expected to be skeptical of producer-provided information, limiting food producers' incentives to make claims.

A second issue is the inherent bias of producer-provided information. Assuming they can be credible when they make claims, producers have strong incentives to provide nutrition information that is positive about their product, but they have no incentive to provide negative information. Despite this inherent bias at the individual firm level, economic theory suggests that in many cases competition among producers can eliminate this bias in the information provided by the market as a whole (Grossman, 1981). For instance, this theory would predict that if some firms advertise the no-cholesterol benefits of their product and are gaining sales by omitting information on other dimensions, such as saturated fat, competing firms

12 There are a host of issues related to producer provision of information that are beyond the scope of this chapter but that are important for understanding these incentives and for designing policy in the area. For example, if the information is provided in generic form, other producers of similar products will simply "free-ride" on the information and reduce the benefits to the original producer. Thus, producers are unlikely to provide health information unless they can tie it directly to their particular product. See Calfee and Pappalardo, 1989, and Ippolito (1986, 1988) for discussions of these general issues.

with no-cholesterol and low-saturated-fat products have incentives to advertise these facts. This “unfolding” theory suggests that despite firms’ initial reluctance to highlight “bad” nutritional characteristics in their products, competition will often induce all but the worst firms to disclose the features of available products, if the market values the information. As long as consumers are skeptical of firms that do not disclose features, they would then be able to rank products on most key features—for example, both cholesterol and saturated fat.

If producer claims are sufficiently credible, their advertising the health benefits of increasing fiber consumption and reducing fat and cholesterol consumption will add to the stock of information about heart disease and cancer, leading more individuals to make dietary improvements. Also, because advertisers are adept in reaching and conveying information to the public, such information should reach a broader population than that provided by the government and other general nutrition sources. Finally, if producers have the ability to communicate the value of improved health features of their products, the number of new products that are more healthful should increase.

Implicit in these hypotheses is a presumption that existing regulatory constraints are sufficient to discipline most deceptive claims that would lead consumers to make undesirable food changes. Alternatively, if producer health claims are so incomplete, misleading, or deceptive as to lead consumers to make inappropriate changes in diet, improvements in the fiber, fat, saturated fat, and cholesterol content of consumers’ diets will deteriorate. Thus, we would expect to see a decline in fat, saturated fat, and cholesterol consumption (and an increase in fiber consumption) in 1977-85 due to the flow of government and general information, and a slowing of that rate of improvement once producer health claims were allowed in the 1985-90 period.

Chapter 12

Nutrient Contribution of Food Away From Home

Biing-Hwan Lin, Joanne Guthrie, and Elizabeth Frazão

The increased popularity of dining out has raised some concerns about its impact on diet quality. Between 1977-78 and 1994-95, away-from-home foods showed smaller nutritional improvements than foods at home. Away-from-home foods generally contain more of the nutrients overconsumed and less of the nutrients underconsumed in the United States. Since there is no expectation that the trend toward increased eating out will reverse itself, nutrition policy, education, and promotion strategies are needed that focus on improving the nutritional quality of food away from home and consumers' food choices when eating away from home.

Introduction

Over the past decades, one of the most noticeable changes in eating habits of Americans has been the increased popularity of dining out. In 1970, the food-away-from-home sector captured about a quarter of total food spending. In 1995, about 40 percent of the food budget was spent on food away from home (fig. 1). A number of factors contribute to the increasing trend in dining out, including a growing number of working women, more two-earner households, higher incomes, more fast-food outlets making eating out affordable and convenient, increased advertising and promotion by large foodservice chains, and smaller families (Nayga and Capps, 1994).

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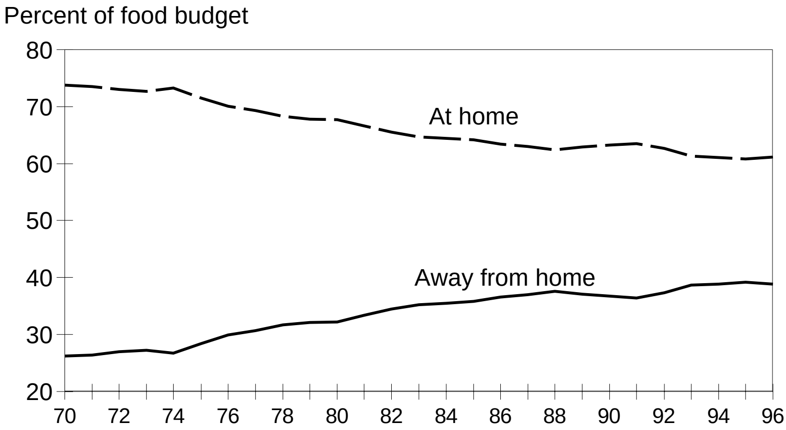
Figure 1

Percent of food budget spent at home and away from home, 1970-96



Source: Putnam and Allshouse, 1996.

The increased volume of food obtained away from home may adversely affect the nutritional quality of the diet. For example, Lin and others (1996) showed that away-from-home foods consumed by children were higher in fat and saturated fat and lower in fiber and calcium than home foods. Similarly, the nonprofit consumer advocacy group Center for Science in the Public Interest (CSPI) has called attention to the high fat, saturated fat, and sodium contents of many menu items in popular restaurants.

The social, demographic, and economic factors that have favored dining out are expected to continue boosting the away-from-home share of the food budget. Consequently, the increased popularity in dining out may represent a barrier to meeting dietary recommendations for fat, saturated fat, sodium, and other nutrients.

We analyzed food intake survey data collected over the past two decades to compare the nutritional qualities of home- and away-from-home foods and how they have changed over time. This historical comparison shows how dining out is likely to influence specific dietary components. We focus on the nutrients that are considered of current public health concern: excessive intakes of total fat, saturated fat, cholesterol, and sodium, and low intakes of fiber, calcium, and iron (IBNMRR, 1995).

The Data: 1977-95

The U.S. Department of Agriculture (USDA) has conducted household food consumption surveys in the United States since the 1930's. In spring 1965, USDA also began collecting national information on the dietary intakes of individual household members. USDA conducted two decennial Nationwide Food Consumption Surveys (NFCS) in 1977-78 and 1987-88. In 1985, USDA initiated the Continuing Survey of Food Intakes by Individuals (CSFII) for relatively small national samples in years between the decennial surveys. During 1989-91, USDA conducted three separate 1-year surveys of individual food intakes. These CSFII surveys drew year-round, national representative samples to describe food consumption behavior and to assess the nutritional content of American diets. Most recently, USDA conducted another three separate 1-year CSFII surveys for 1994-96.

Data from seven year-round, nationwide surveys of individual food intakes are used in this study: NFCS 1977-78, NFCS 1987-88, CSFII 1989, CSFII 1990, CSFII 1991, CSFII 1994, and CSFII 1995. The 1965 data were not included because they were conducted for the spring only, and surveyed only housekeeping households—households with at least 1 person having 10 or more meals from the household food supply during a 7-day period. The CSFII 1985-86 data were excluded because they did not include all age/gender groups. The CSFII 1996 was in progress when this study was underway.

The first five surveys, prior to CSFII 1994, collected dietary intakes for 3 consecutive days—a 1-day recall and a 2-day record. The 1994-96 CSFII collected 2 nonconsecutive days of dietary intake recalls. Self-reported dietary intake surveys, such as NFCS and CSFII, are subject to underreporting, and the degree of underreporting worsens with the number of days in the survey. Also, the method of collecting information—recall vs. record—can have an effect on the information obtained. To maximize comparability of data collected across the seven surveys, and to minimize the underreporting bias, only the first day of dietary recalls from each of the seven surveys were included in the analysis.

The surveys collected information on what and how much individuals eat and where the food was obtained. Because the *Dietary Guidelines for Americans* are not aimed at individuals under age 2, those individuals are excluded from this analysis. Pregnant and lactating women are also excluded from the analysis because their dietary needs differ considerably from the rest of the population. Although only the first day's intake was used in the analysis, individuals with incomplete dietary intake data (that is, less than 3 days of dietary intake data in the first five surveys and less than 2 days of data in the CSFII 1994-95) are also excluded to avoid any biases that may exist between those who completed and those who only partially completed the survey.

We define home and away-from-home foods based on where the foods are obtained, not where they are eaten. Food at home consists of foods purchased at a retail store, such as a grocery store, a convenience store, or a supermarket. Food away from home consists of foods obtained at various places other than retail stores (mainly foodservice establishments). Both food at home and food away from home can be eaten at home or away from home (except for food reported in 1977-78, when respondents only reported where the food was eaten. Because take-out was not very frequent in those days, most of the food obtained away from home was likely consumed at the place of purchase).

This definition differs from the definition used by the Agricultural Research Service (ARS), which defines any food consumed at home (for example, a pizza delivered to the home) as food at home (Borrud and others, 1996). Our distinction between home and away-from-home foods is related to the degree of control a consumer has over the nutritional content of the food. Although retail stores offer an increasing proportion of ready-to-eat foods (such as roast chicken and frozen entrees), much is still used as ingredients in meal preparation, and the consumer has some control over the nutritional quality of meals and snacks prepared at home. Away-from-home foods are typically ready-to-eat and consumed "as is," and the consumer has less control over and less knowledge of their nutritional content.

In response to the dynamic structure of the U.S. foodservice industry over the past two decades, categories of away-from-home foods were modified from survey to survey, making it impossible to have a consistent definition of away-from-home food sources for the seven surveys. In this study, sources of away-from-home foods are grouped into five categories: fast-food places, schools, restaurants, other public places, and others. Fast-food places include self-service restaurants and carryout places; schools—a separate category for children age 2-17—include day-care centers and summer camps; restaurants are those with waiter and waitress service; other public eating places include cafeterias, residential dining facilities, bars, taverns, lounges, soup kitchens, shelters, meals-on-wheels, and other community food programs; and others, a catchall category, include vending machines, gifts, and food eaten at someone else's home. Meals and snacks consisting of a combination of away-from-home and home foods are classified according to the component that contributes the most calories to that particular eating occasion.

Meal and Snack Eating Patterns

Over the past two decades, the number of meals consumed has remained fairly stable at 2.6 to 2.7 per day (table 1). However, snacking has increased, from less than once a day in 1987-88 to 1.6 times per day in 1995. The increased popularity in dining out is evident as the proportion of meals away from home increased from 16 percent in 1977-78 to 29 percent in 1995, and the proportion of snacks away from home rose from 17 percent in 1977-78 to 22 percent in 1995. Overall, eating occasions (meals and snacks) away from home increased by more than two-thirds over the past two decades, from 16 percent of all eating occasions in 1977-78 to 27 percent in 1995.

The increasing frequency of away-from-home eating occasions translates into a greater proportion of each nutrient's total intake being obtained from the away-from-home sector (table 2). For example, away-from-home eating occasions provided 38 percent of total fat intake in 1995, double the 19 percent it provided in 1977-78. Similarly, away-from-home eating occasions contributed 29 percent of total calcium intake and 27 percent of total iron intake in 1995, compared with 17 and 16 percent, respectively, in 1977-78. Thus, the nutritional quality of food away from home becomes increasingly important in determining the overall nutritional quality of diets in the United States.

Table 1—Meal/snack eating patterns of Americans 2 and over

Item	1977-78	1987-88	1989	1990	1991	1994	1995
				Number			
Meals/day	2.7	2.6	2.6	2.6	2.6	2.7	2.6
Snacks/day	1.1	0.9	1.2	1.2	1.4	1.5	1.6
				Percent			
Meals:							
At home	84	76	76	77	73	72	71
Away from home[1]	16	24	24	23	27	28	29
Snacks:							
At home	83	80	80	82	82	79	78
Away from home[1]	17	20	20	18	18	21	22
All eating occasions:							
At home	84	77	77	78	76	74	73
Away from home[1]	16	23	23	22	24	26	27
Restaurant	2	4	4	4	4	6	5
Fast food	3	7	7	7	7	8	9
School[2]	3	2	2	2	3	2	2
Other public	3	2	2	2	2	2	2
Others	6	8	8	7	8	8	9

[1] Away from home presents the aggregate of fast foods, restaurants, schools, other public places, and others.

[2] Schools are classified as a separate category for children only; for adults, they are included in the “others” category.

Source: Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, first-day intake data.

Nutritional Quality of Home and Away-from-Home Foods

We compare the nutritional quality of eating occasions from various locations using the nutrient-to-calorie density (nutrient density), which measures the amount of a nutrient or food component for each 1,000 calories provided by the eating occasion. However, because dietary recommendations for fat and saturated fat are expressed in terms of total calories consumed, we use the proportion of calories from fat and from saturated fat as measures of nutrient density.

For each nutrient or food component we also devised a “benchmark” density. Obtained by dividing the recommendation for a given nutri-

Table 2—Contribution of away-from-home foods, selected nutrients and food components, 1977-95

Item	1977-78	1987-88	1989	1990	1991	1994	1995
				Percent			
Calories:							
At home	82	73	73	74	71	69	66
Away from home[1]	18	27	27	26	29	31	34
Total fat:							
At home	81	72	71	72	68	65	62
Away from home[1]	19	28	29	28	32	35	38
Saturated fat:							
At home	na	72	71	72	69	67	63
Away from home[1]	na	28	29	28	31	33	37
Cholesterol:							
At home	na	74	75	75	70	68	66
Away from home[1]	na	26	25	25	30	32	34
Sodium:							
At home	na	73	74	74	70	68	66
Away from home[1]	na	27	26	26	30	32	34
Fiber:							
At home	na	78	77	78	75	74	73
Away from home[1]	na	22	23	22	25	26	27
Calcium:							
At home	83	77	77	78	75	74	71
Away from home[1]	17	23	23	22	25	26	29
Iron:							
At home	84	78	78	79	75	74	73
Away from home[1]	16	22	22	21	25	26	27

na = Not available.

1 Away from home presents the aggregate of fast foods, restaurants, schools, other public places, and others.

2 Schools are classified as a separate category for children only; for adults, they are included in the “others” category.

Source: Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, first-day intake data.

Table 3—Recommended daily intakes of dietary components

Gender/ age	Calories[1]	Fat[2]	Satur. fat[2]	Choles- erol[3]	Sodium[3]	Fiber[4]	Calcium[1]	Iron[1]
	Kcal	*--Percent--*		*----Mg----*		*Grams*	*----Mg----*	
All:								
2-3	1,300	< 30	< 10	300	2,400	Age + 5	800	10
4-6	1,800	< 30	< 10	300	2,400	“	800	10
7-10	2,000	< 30	< 10	300	2,400	“	800	10
Males:								
11-14	2,500	< 30	< 10	300	2,400	“	1,200	12
15-18	3,000	< 30	< 10	300	2,400	“	1,200	12
19-20	2,900	< 30	< 10	300	2,400	“	1,200	10
21-24	2,900	< 30	< 10	300	2,400	33	1,200	10
25-50	2,900	< 30	< 10	300	2,400	33	800	10
51+	2,300	< 30	< 10	300	2,400	26	800	10
Females:								
11-14	2,200	< 30	< 10	300	2,400	Age + 5	1,200	15
15-18	2,000	< 30	< 10	300	2,400	“	1,200	15
19-20	2,000	< 30	< 10	300	2,400	“	1,200	15
21-24	2,000	< 30	< 10	300	2,400	23	1,200	15
25-50	2,000	< 30	< 10	300	2,400	23	800	15
51+	1,900	< 30	< 10	300	2,400	22	800	10

[1] National Research Council, *Recommended Dietary Allowances*, 1989b.

[2] U.S. Department of Agriculture and U.S. Department of Health and Human Services, 1995.

[3] National Research Council, *Diet and Health*, 1989a.

[4] American Health Foundation for “age plus 5” per day for children 2-20 (Williams, 1995); FDA’s Daily Value for 11.5 grams/1,000 kcal for all others (Saltos and others, 1994).

ent or food component by an individual’s reported caloric intake in 1,000 calories, the benchmark density represents the nutrient density an individual’s diet would have to attain to meet the dietary recommendation at the individual’s caloric intake level.[1] When an individual consumes an excessive (insufficient) amount of a nutrient, the benchmark density of the nutrient will be lower (higher) than the nutrient density. Dietary recommendations of the *Dietary Guidelines for Americans* and other health authorities are summarized in table 3.

[1] For fat and saturated fat, the benchmark density is constant at 30 percent of calories from fat and 10 percent of calories from saturated fat.

We calculate benchmark densities for specific groups of individuals by summing the recommended intakes for all individuals in the group and dividing by the sum of those individuals' reported caloric intakes. Because caloric intakes vary over time, benchmark densities also vary from year to year. Since nutrient densities are based on caloric intake, food calories are discussed first.

Caloric Intake

Caloric intake is subject to underreporting (Mertz and others, 1991; Briefel and others, 1995). Therefore, caloric and nutrient intake estimates from dietary recall surveys such as the NFCS and CSFII represent a lower limit of actual intakes. Also, changes in methodology of conducting dietary recall interviews have been made (most notably in the 1994-96 CSFII) to improve the completeness of reporting. Therefore, some of the reported increases in caloric and nutrient intakes over time may be due to changes in survey methodology.

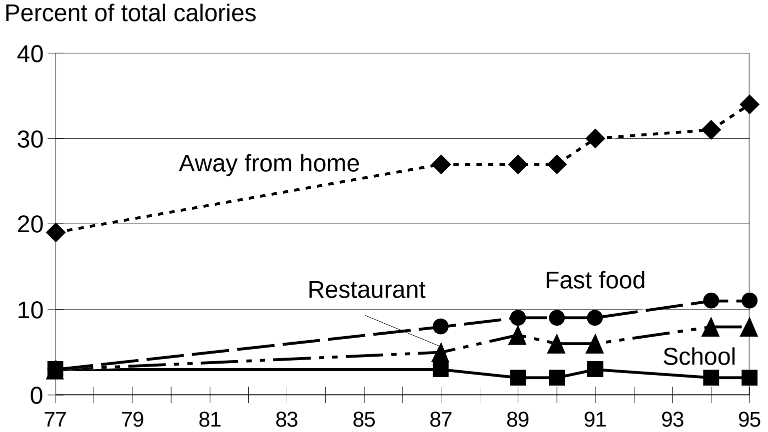
Average caloric intake declined from 1,876 calories per person per day in 1977-78 to 1,807 calories per person per day in 1987-88, then rose steadily to 2,043 calories per person per day in 1995 (see appendix table). The proportion of individuals age 2 and older who consume the recommended energy allowance (REA) or more rose from 22 percent in 1987-88 to 31 percent in 1995.

Although caloric intakes for most individuals fall below the average REA, overweight has become more prevalent. More than one in three adults (35 percent) in the United States were considered to be overweight in 1988-94, compared with one in four adults in 1976-80 (Centers for Disease Control and Prevention, 1997). Because overweight is associated with many chronic diseases and adverse health outcomes, the increased prevalence of overweight is a cause for public health concern. Decreased physical activity and hence decreased energy expenditure may also be a contributor to overweight (McPherson and others, 1995).

Some of the observed increase in caloric intake may be associated with the increase in eating out. The food-away-from-home sector contributed to 16 percent of all eating occasions in 1977-78 (table 1), and accounted for 19 percent of total caloric intake (table 2). In 1995, the away-from-home sector accounted for 27 percent of all eating occasions and 34 percent of total food energy consumption.

Figure 2

Proportion of total calories obtained away from home on the rise, 1977-95



Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day

These numbers suggest that, when eating out, people either eat more or eat higher-calorie foods—or both. Further, this tendency appears to be intensifying, since each percent of eating occasions away from home provided an average of 1.26 percent of total calories in 1995, up from 1.19 percent in 1977-78.

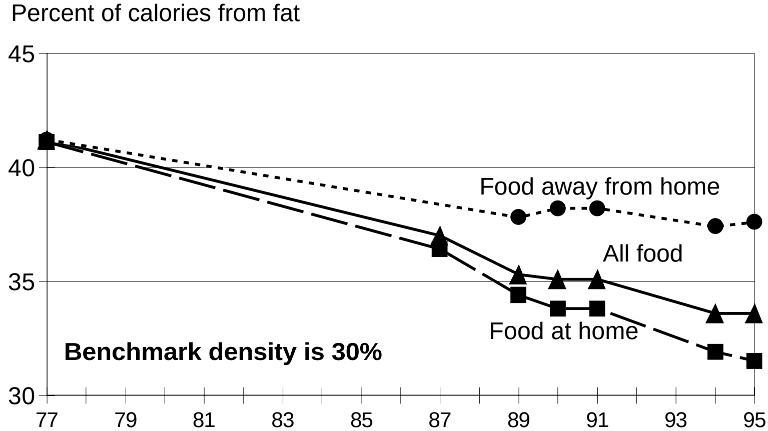
Consistent with the increasing share of eating occasions from fast-food places and restaurants over the past two decades, the proportion of total calories consumed from these locations has also risen (fig. 2). Whereas fast-food places and restaurants each accounted for 3 percent of total caloric intake in 1977-78, their shares of total calories increased to 12 percent and 8 percent, respectively, in 1995. The share of total caloric intake from schools has remained stable over the past two decades, at 2-3 percent.

Fat and Saturated Fat

According to the *Dietary Guidelines for Americans*, fat intake should be limited to no more than 30 percent of total calories and saturated fat should account for less than 10 percent of total calories. These

Figure 3

Away-from-home foods show smaller improvements in fat density than food at home, 1977-95



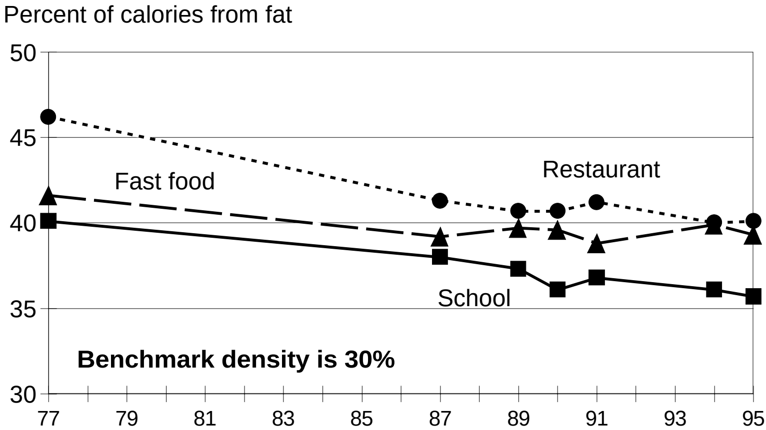
Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

recommendations represent the benchmark densities for fat and saturated fat.

Over the past two decades, Americans have made appreciable progress in reducing the fat density in the foods they consume.[2] Fat provided an average of 33.6 percent of total calories in both 1994 and 1995, considerably less than the 41.2 percent of total calories in 1977-78—albeit still higher than the recommended 30-percent limit (fig. 3). Although fat density declined for both home and away-from-home foods, Americans have been more successful in reducing the fat density in home foods than in away-from-home foods. In 1977-78, both home and away-from-home foods provided slightly more than 41 percent of their calories from fat. By 1987-88, the fat density of home foods had declined to 36.4 percent of total calories from fat, compared with 38.7 for away-from-home foods. Since then, the fat density of home foods declined steadily to 31.5 percent

[2] However, the total grams of fat consumed per person per day has steadily increased since 1989 (see appendix table).

Figure 4
Fat density of away-from-home food sources has declined slowly but steadily, 1977-95



Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day

of calories from fat, but declined only slightly to 37.6 percent of calories from fat for away-from-home foods.

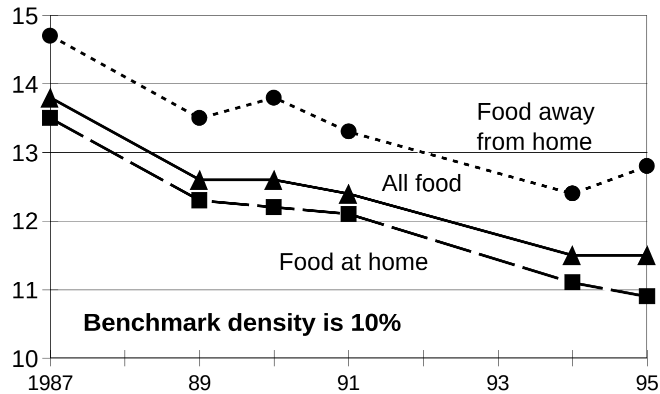
Restaurant foods had a considerably higher fat density than either fast foods or school foods in 1977-78, with fat providing over 46 percent of calories (fig. 4). Although the fat density of restaurant foods declined to 40.1 percent of calories in 1995, this was still higher than the fat densities of fast foods or school foods. Fast foods also experienced a considerable decline in fat density between 1977-78 and 1987-88, but the density has fluctuated slightly below 40 percent of total calories since 1987-88. The fat density in school foods has declined steadily from 40.1 percent in 1977-78 to 35.7 percent in 1995.

As with fat, the saturated fat density of American diets has also declined steadily since 1987-88 (when it was first measured) (fig. 5).[3] Home foods have typically had lower saturated fat density than away-from-home foods, and both experienced similar declines in the

[3] However, intake of total grams of saturated fat per person per day has been fairly stable since 1990 (see appendix table).

Figure 5

Home foods have lower saturated fat density than away-from-home foods, 1987-95



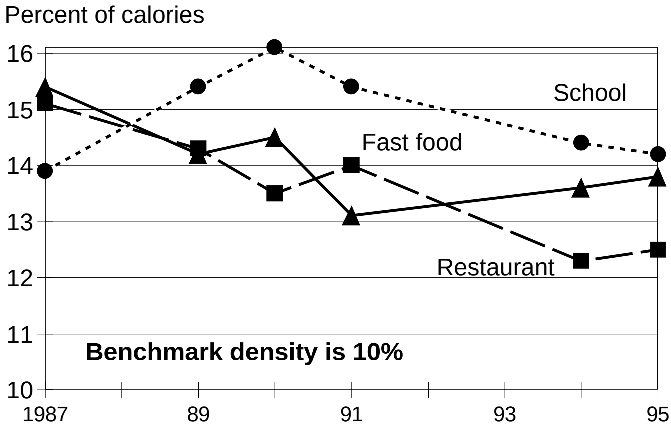
Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

proportion of calories from saturated fat until 1994. Between 1994 and 1995, the saturated fat density of home foods continued to decline but that of away-from-home foods rose from 12.4 to 12.8 percent of calories from saturated fat.

In 1987-88, restaurant and fast foods had similar saturated fat densities, higher than school foods (fig. 6). Between 1987-88 and 1989, the saturated fat density of both restaurant foods and fast foods declined sharply. The saturated fat density of restaurant foods continued to decline in the mid-1990's, while the saturated fat density in fast foods rose. The saturated fat density in school foods rose from 13.9 percent of total calories in 1987-88 to 16.1 percent in 1990, then declined steadily to 14.2 percent of total calories in 1995, higher than the saturated fat density of both restaurant foods and fast foods.

Overall, the fat and saturated fat densities of both home and away-from-home foods have been declining, although the away-from-home sector has shown less improvement. With the increasingly important role of the away-from-home sector in the overall diet, the fat and saturated fat densities of away-from-home foods will be a key to consumers' progress in reducing their fat and saturated fat intake.

Figure 6
Away-from-home food sources show erratic decline in saturated fat density, 1987-95



Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

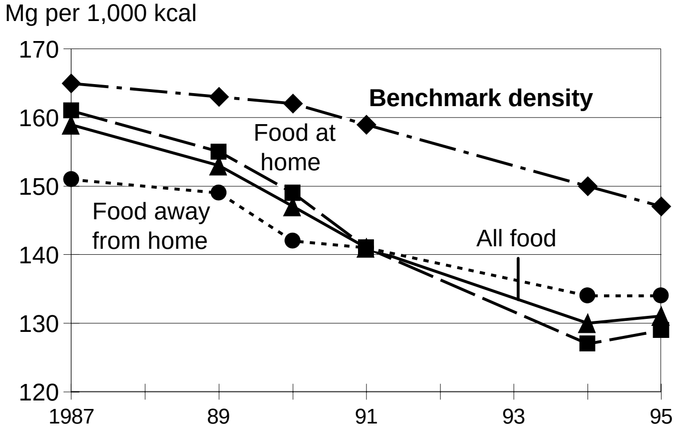
Cholesterol

Many health authorities recommend that daily cholesterol intake not exceed 300 milligrams (mg), regardless of age, gender, or overall caloric intake (National Research Council, 1989). Because average caloric intake has increased since 1987-88, the benchmark cholesterol density has declined since then (fig. 7).

Average cholesterol intake has been declining since 1987-88, when the cholesterol content of Americans' diets was first measured, from 286 mg to 268 mg in 1995. Between 1987-88 and 1990, the cholesterol density of home foods was actually higher than that of away-from-home foods. However, the relationship reversed after 1991, indicating that consumers have been more successful in reducing the cholesterol in home foods than in away-from-home foods. Nevertheless, cholesterol densities in both home and away-from-home foods have declined markedly during the past decade. Although restaurant foods have a higher cholesterol density than fast food and school foods, all three have experienced an overall downward trend (fig. 8).

Figure 7

Cholesterol density of all foods has declined in the past decade, 1987-95

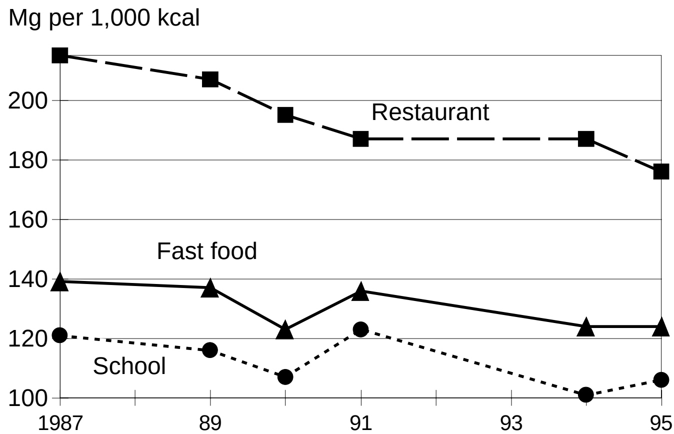


Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

Average cholesterol density has been below the benchmark density since 1987-88, indicating that average cholesterol intake was below the recommended limit of 300 mg per day. Sixty-six percent of individuals age 2 and older met the cholesterol guideline in 1987-88; by 1990, 70 percent did so, with little change after that. However, those who exceed the limit of 300 mg of cholesterol per day are concentrated in certain age/gender groups—namely adolescent boys and adult men. Adolescent boys and adult men tend to eat more than others, yet they face the same recommended cholesterol intake as others. Consequently, less than one in every six males age 12-59 met the recommended 300 mg or less of cholesterol per day in 1995. In 1995, males age 12-39 consumed an average of 2,763 calories per day, which translates into a benchmark cholesterol density of 109 mg per 1,000 calories. The cholesterol densities for home and away-from-home foods for that group were 122 and 127 mg per 1,000 calories, respectively. To meet the cholesterol guideline, adolescent boys and adult men have to reduce the cholesterol content of foods at home and away from home, especially at restaurants, where their cholesterol density was 158 mg per 1,000 calories in 1995.

Figure 8

Cholesterol density of food away from home: fast food, school, and restaurant, 1987-95



Source: Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

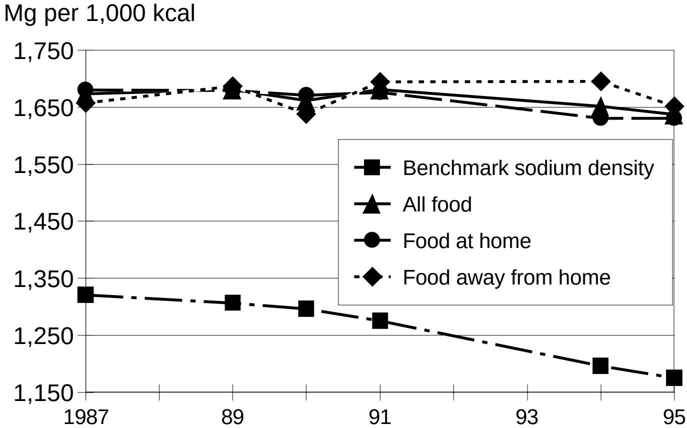
Sodium

The *Diet and Health* report recommends that consumption of sodium not exceed 2,400 mg per day, regardless of age and gender (National Research Council, 1989). As with cholesterol, individuals who eat more calories have lower benchmark density values than individuals who eat fewer calories. Sodium intakes in the NFCS and CSFII include sodium occurring naturally in foods, added via food processing, and used in food preparation. They do not include sodium added at the table. The surveys first measured sodium content in 1987-88.

Because of rising caloric intake, sodium benchmark density has declined over time (fig. 9), indicating that Americans need to limit the sodium density of their diets more than previously. Whereas the sodium densities of home and away-from-home foods are fairly similar, both are substantially higher than the benchmark density. More important, the gap between the sodium density and the benchmark density has widened during the past decade. As a result, the percentage of individuals age 2 and older who meet the sodium recommendation declined from 41 percent in 1987-88 to 34 percent in 1995. Obviously,

Figure 9

Sodium densities of all foods are substantially higher than benchmark density, 1987-95



Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

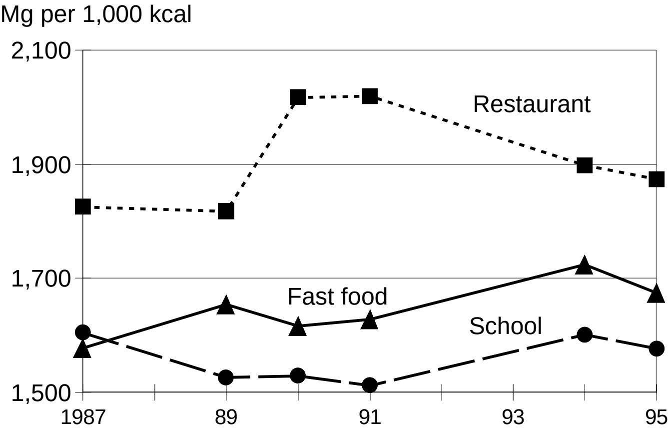
consumers have to exert greater efforts to reducing the sodium density of foods consumed both at home and away from home.

The sodium density of restaurant foods rose sharply between 1989 and 1990, but has declined since 1991 (fig. 10). The sodium densities of fast foods and school foods also increased between 1987-88 and 1994, declined in 1995, and remained considerably lower than restaurant foods. For example, the sodium density of restaurant foods was 1,873 mg per 1,000 calories in 1995, 12 percent higher than the level in fast foods and 19 percent above the level in school foods (see appendix table).

Overconsumption of sodium is a problem for most consumers, except for young children and senior women—who tend to consume the fewest calories. The problem is more severe for men than women because men tend to eat more than women. Males age 12-39, for example, had a sodium density of 1,646 mg per 1,000 calories in 1995, 89 percent above their benchmark sodium density of 869 mg per 1,000 calories.

Figure 10

Sodium density of restaurant food is higher than fast food and school food, 1987-95



Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

Dietary Fiber

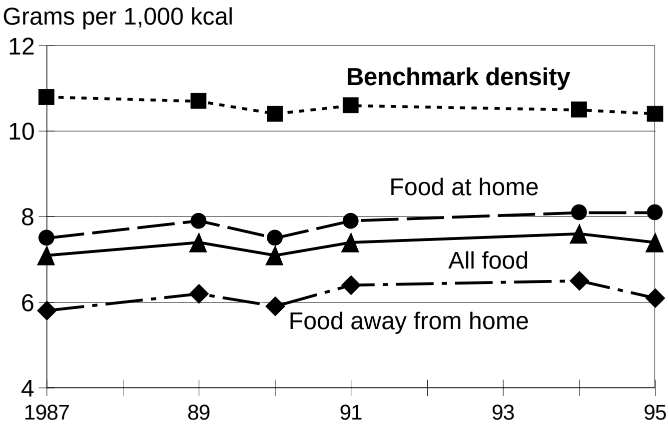
The American Health Foundation recommends a dietary fiber intake of “age plus five” (grams) for those age 2-20 (Williams, 1995), and the FDA uses a Daily Value (DV) of 11.5 grams per 1,000 calories (Saltos and others, 1994). We use the “age plus five” for those age 2-20 years, and the FDA’s DV for those older than 20 (table 3).

Over the past decade, fiber densities of home and away-from-home foods have increased slightly, but they still remain far below the benchmark fiber density (fig. 11). Home foods had a fiber density of 8.1 grams per 1,000 calories in 1995, about three-fourths of the benchmark fiber density, and away-from-home foods had a fiber density of 6.1 grams per 1,000 calories. In 1995, fiber intake averaged 15.2 grams per day, and only 24 percent of individuals age 2 and older met the fiber intake recommendations.

School foods have had the highest fiber density of the three main sources of away-from-home foods (fig. 12). However, after reaching its peak at 8.0 grams per 1,000 calories in 1990, the fiber density of school foods declined to 7.1 grams per 1,000 calories in 1994 and

Figure 11

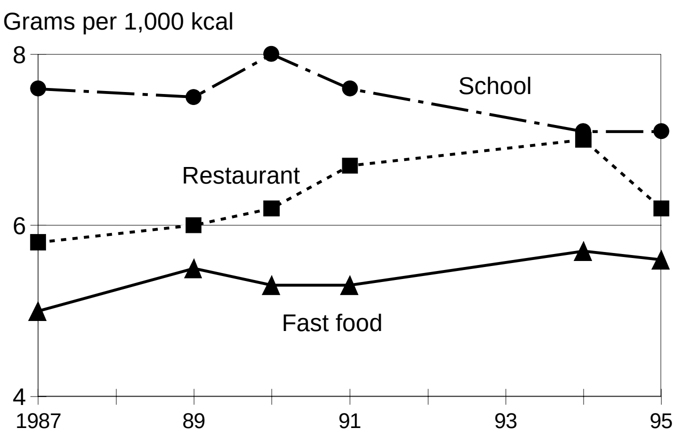
Fiber densities remain below benchmark, 1987-95



Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day

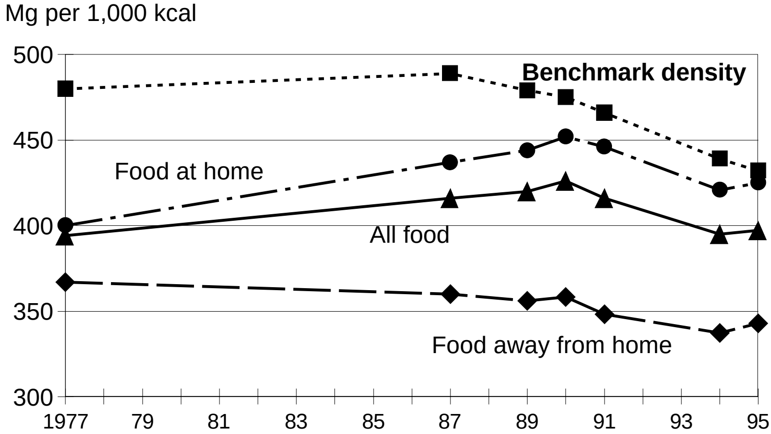
Figure 12

School foods have higher fiber density than restaurant foods or fast foods, 1987-95



Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

Figure 13
Calcium density of foods has declined since 1990



Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

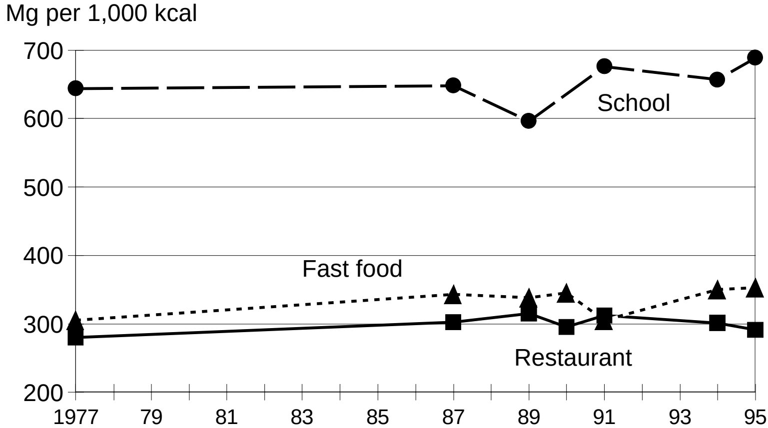
1995. The fiber density of fast foods has shown a general upward trend, although its 5.6 grams per 1,000 calories in 1995 was the lowest among all foods. The fiber density of restaurant foods increased from 5.8 grams per 1,000 calories in 1987-88 to 7.0 grams in 1994, then fell to 6.2 grams in 1995. Increased popularity in dining at fast-food places and restaurants may reverse the slight progress made in increasing the fiber density of foods at home and overall fiber intake.

Calcium

The Recommended Daily Allowances (RDA) for calcium are 1,200 mg for those age 11-24 and 800 mg for all others (National Research Council, 1989). Calcium density rose between 1977-78 and 1990, then declined (fig. 13). Meanwhile, rising caloric intake since 1987-88, associated with a declining benchmark calcium density since 1987-88, has narrowed the gap between average and benchmark calcium density. A higher proportion of individuals age 2 and older met the calcium RDA in 1995 than in 1977-78.

Calcium density in home foods showed a general upward trend, while in away-from-home foods it declined slightly. In 1995, the cal-

Figure 14
Calcium density of school foods higher than restaurant or fast foods, 1977-95



Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

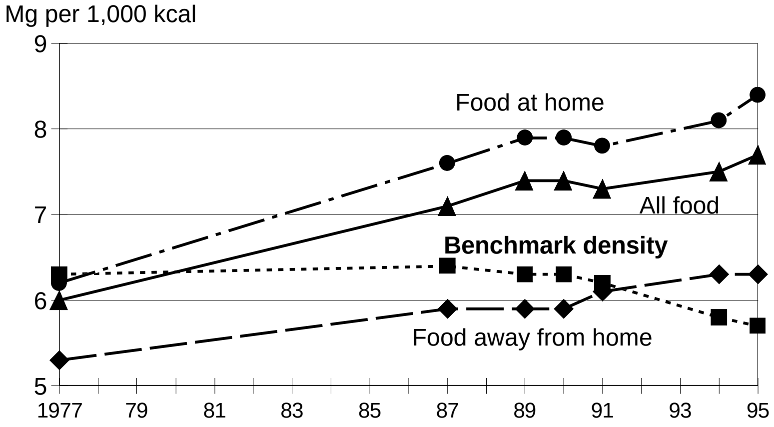
cium density of home foods was 425 mg per 1,000 kcal, fairly close to the benchmark density. Away-from-home foods—which contributed 34 percent of total caloric intake in 1995—had a calcium density of 343 mg per 1,000 calories, 21 percent below the benchmark.

The calcium density of school foods has always been considerably higher than that of restaurant or fast foods—or even home foods (fig. 14). School foods had a calcium density of 689 mg per 1,000 calories in 1995, considerably higher than the 425 mg for home foods, the 353 mg for fast foods, or the 291 mg for restaurant foods. Clearly, the trend toward increased consumption of fast foods or restaurant foods will slow any progress in reaching the guideline for calcium.

Insufficient calcium intake is a more severe problem for adolescent girls and adult women because of their higher calcium requirements and their lower overall food consumption. In 1995, only 18 percent of females age 12-17 met their calcium RDA's. Foods eaten by adolescent girls had an average calcium density of 413 mg per 1,000 calories, 64 percent of their benchmark density of 642 mg per 1,000

Figure 15

Iron density of at-home foods has risen more rapidly than that of food away from home, 1977-95



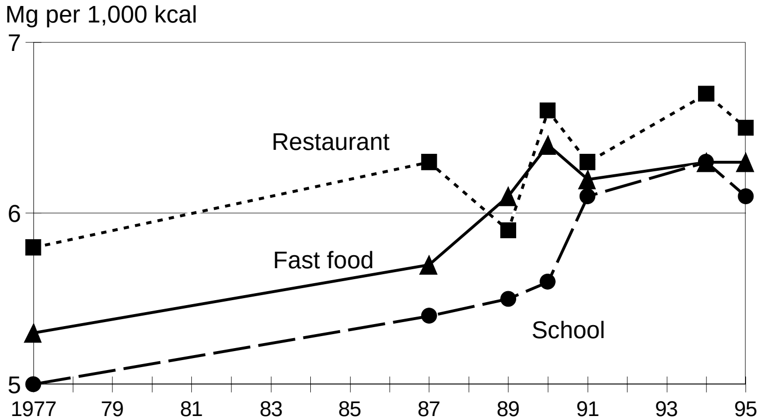
Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

calories. School foods eaten by adolescent girls had a calcium density of 544 mg per 1,000 calories, while school foods eaten by adolescent boys and children age 6-11 had calcium densities of 647 and 759 mg per 1,000 calories, respectively. In August 1997, the Institute of Medicine of the National Academy of Sciences issued new dietary recommendations for several nutrients, including calcium. The report raises the recommended calcium intakes (the term is changed from RDA to DRI—Dietary Reference Intake) for many Americans, especially children age 9 and older and adults age 25 and older (Institute of Medicine, 1997). Clearly, all groups, especially female adolescents and female adults, have to increase their calcium intakes.

Dietary Iron

The RDA's for iron are 12 mg for males age 11-18, 15 mg for females age 11-50, and 10 mg for others age 2 and older (National Research Council, 1989). Over the past two decades, the iron density of home foods has risen more rapidly than that of away-from-home foods (fig. 15). The increased iron density in home foods can be partially attributed to increased home consumption of iron-fortified breakfast cereals.

Figure 16
Iron densities show upward trend, 1977-95



Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1 day.

As with other nutrients, iron benchmark density has declined over time because of rising caloric intake. Meanwhile, iron densities of both home and away-from-home foods have risen (fig. 15). The result is that the mean daily dietary iron consumption of those age 2 and above has exceeded RDA's since 1987-88. In 1995, 61 percent of all individuals age 2 and older met their dietary iron RDA's, compared with only 42 percent in 1977-78 (see appendix table).

Iron densities of fast food, school food, and restaurant food have shown a general upward trend over the past two decades (fig. 16). Although restaurant food has a higher iron density than fast food or school food, the differences in the iron density among these three major away-from-home food sources have narrowed over time.

While most individuals consume recommended amounts of dietary iron, low iron intakes are common among adolescent girls and adult women—those with the highest requirements and typically low food consumption. For example, only one in every three women age 18-39 met their iron RDAs in 1995. Home foods consumed by those women had an iron density of 8.2 mg per 1,000 calories and away-from-home foods had 6.0 mg of dietary iron per 1,000 calories, compared with a benchmark density of 8.4 mg per 1,000 calories.

Therefore, the increased popularity of dining out may exacerbate the problem of low iron intakes among some women.

Conclusion

Improving the nutritional quality of diets in the United States is predicated on two basic challenges: increasing intakes of some nutrients and food components such as fiber, calcium, and iron; and reducing intakes of other nutrients such as fat, saturated fat, cholesterol, and sodium. Over the past two decades, Americans have made marked progress in reducing the densities of fat, saturated fat, and cholesterol in their foods and in increasing the iron density of foods they consume. However, little progress has been made in increasing the fiber or calcium density of foods or in reducing the sodium density of foods.

Overall, away-from-home foods have shown smaller nutritional improvements than foods at home. Away-from-home foods generally contain more of the nutrients overconsumed and less of the nutrients underconsumed in the United States. As a result, the increased popularity in dining out presents a barrier to dietary improvements—particularly in terms of reducing intakes of calories, fat, and saturated fat. For example, we calculate that if food away from home had the same average nutritional densities as food at home in 1995, Americans would have consumed 197 fewer calories per day, and reduced their fat intake to 31.5 percent of calories from fat (instead of 33.6 percent) and their saturated fat intake to 10.9 percent of calories from saturated fat (instead of 11.5 percent). In addition, Americans would have increased their consumption of calcium by 7 percent and their consumption of fiber and iron by 9 percent each. Cholesterol and sodium intakes would not have changed much.

Since there is no expectation that the trend toward increased eating out will reverse itself, nutrition policy, education, and promotion strategies are needed that focus on improving the nutritional quality of food away from home and consumers' food choices when eating away from home. In the case of meals provided to children at school, policy changes are addressing nutritional improvements. The Healthy Meals for Healthy Americans Act of 1994 (Public Law 103-448) now requires meals served as part of the National School Lunch and School Breakfast Programs to meet the *Dietary Guidelines for Americans* over a 1-week period. In addition, USDA's Team Nutrition provides nutrition education through schools, families, the community, and the media in an attempt to educate and motivate children to make more healthful food choices at school and outside of school.

For meals eaten at restaurants, fast-food places, and other foodservice establishments, however, other strategies for change are needed. There is no intrinsic reason why food away from home must differ nutritionally from food prepared at home. Indeed, professional chefs and foodservice organizations may be particularly adept at preparing good-tasting meals that meet dietary recommendations. However, consumer demand for such meals must be strong enough to create an economic incentive for increased marketing of nutritious items by restaurants, fast-food places, and other foodservice establishments. Currently, it appears that consumers are more likely to value the nutritional properties of foods when eating at home than when eating away from home. Several fast-food chains have introduced reduced-fat hamburgers, for example, but later withdrew them from the menu because they did not sell. A number of restaurant operators claim that although consumers say they want healthful foods, that is not what they typically order (Parseghian, 1992).

It may be that consumers have different attitudes about food away from home than food at home. Consumers may believe it less important to consider the nutritional quality of food away from home or be less willing to sacrifice taste when eating out—perhaps because they consider eating out to be an occasional treat that does not have the same impact on overall diet as food at home. This attitude may have been reasonable 20 years ago when eating out was much more infrequent, but as eating out has become more common that belief becomes increasingly inappropriate. Consumers may not realize the extent to which eating out has become a part of their usual diets or its effect on overall diet quality. To the degree that consumer attitudes are a barrier to change, nutrition education and promotion strategies are needed to inform consumers of the impact of food away from home on overall diet quality and help create positive attitudes about making healthful food choices when eating out.

Another factor may be related to differences in information, in that the nutritional quality of away-from-home foods may be less readily apparent to consumers as that for food at home, especially for foods consumers may not be used to preparing themselves. In addition, much of traditional nutrition education has focused on knowledge and skills that relate to home food purchase and preparation—such as providing tips on cooking without added fat. With the increasing trend toward eating out, more nutrition intervention activities are needed that focus on the attitudes, knowledge, and skills consumers need if they are to make more healthful food choices when eating away from home.

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Appendix table—Intake levels and nutrient densities of foods at home and away from home, individuals age 2 and over, 1977-95

	1977-78	1987-88	1989	1990	1991	1994	1995
Calories:							
Average intake (kcal)	1,876	1,807	1,837	1,853	1,883	2,006	2,043
% consuming > REA[1]	26	22	24	26	26	28	31
% of total calories:							
At home	82	73	73	74	71	69	66
Away from home[2]	18	27	27	26	29	31	34
Restaurants	3	5	7	6	6	8	8
Fast food	3	8	9	9	9	11	12
Schools[3]	3	3	2	2	3	2	2
Other public places	3	2	3	2	3	3	2
Others	6	9	7	8	9	7	9
Fat:							
Avg. intake (grams)	86.3	74.7	72.0	72.9	73.4	74.9	76.2
Avg. intake (% of cal.)	41.2	37.0	35.3	35.4	35.1	33.6	33.6
% meeting recom.[1]	13	21	20	29	30	36	37
Nutrient density (% of cal.):							
Benchmark density[4]	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Average nutrient density	41.2	37.0	35.3	35.4	35.1	33.6	33.6
Home foods	41.1	36.3	34.4	34.5	33.8	31.9	31.5
Away from home[2]	41.2	38.7	37.8	38.1	38.2	37.4	37.6
Restaurants	46.2	41.3	40.7	40.7	41.2	40.0	40.1
Fast food	41.6	39.7	39.7	39.6	38.8	39.9	39.3
Schools[3]	40.1	38.0	37.7	36.1	36.8	36.1	35.7
Other public places	41.4	41.2	34.8	40.9	42.3	30.3	32.6
Others	38.6	36.4	33.9	33.1	34.2	34.1	34.9
Saturated fat:							
Avg. intake (grams)	n.a.	27.7	25.7	26.0	26.0	25.6	26.2
Avg. intake (% of cal.)	n.a.	13.8	12.6	12.6	12.4	11.5	11.5
% meeting recom.[1]	n.a.	17	29	29	31	40	39
Nutrient density (% of cal.):							
Benchmark density[4]	n.a.	10.0	10.0	10.0	10.0	10.0	10.0
Average nutrient density	n.a.	13.8	12.6	12.6	12.4	11.5	11.5
Home foods	n.a.	13.5	12.3	12.2	12.1	11.1	10.9
Away from home[2]	n.a.	14.7	13.5	13.8	13.3	12.4	12.8
Restaurants	n.a.	15.5	14.3	13.5	14.0	12.3	12.5
Fast food	n.a.	15.4	14.2	14.5	13.1	13.6	13.8
Schools[3]	n.a.	13.9	15.4	16.1	15.4	14.4	14.2
Other public places	n.a.	15.2	12.0	14.6	13.8	9.8	9.8
Others	n.a.	13.7	12.0	11.8	12.0	11.1	12.1

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Appendix table—Intake levels and nutrient densities of foods at home and away from home, individuals age 2 and over, 1977-95, cont.

	1977-78	1987-88	1989	1990	1991	1994	1995
Cholesterol:							
Average intake (mg)	n.a.	286	282	272	265	260	268
% meeting recom.[1]	n.a.	66	66	70	70	71	69
Nutrient density (mg/1,000 kcal):							
Benchmark density[4]	n.a.	166	163	162	159	150	147
Average nutrient density	n.a.	158	153	147	140	130	131
Home foods	n.a.	161	155	148	143	127	129
Away from home[2]	n.a.	151	149	143	143	134	134
Restaurants	n.a.	215	207	195	187	187	176
Fast food	n.a.	138	137	123	136	124	124
Schools[3]	n.a.	121	116	107	123	101	106
Other public places	n.a.	160	161	189	152	103	114
Others	n.a.	131	116	117	116	113	122
Sodium:							
Average intake (mg)	n.a.	3,023	3,090	3,081	3,168	3,313	3,348
% meeting recom.[1]	n.a.	41	40	40	39	36	34
Nutrient density (mg/1,000 kcal):							
Benchmark density[4]	n.a.	1,328	1,307	1,296	1,275	1,196	1,175
Average nutrient density	n.a.	1,672	1,681	1,662	1,681	1,651	1,637
Home foods	n.a.	1,678	1,679	1,671	1,670	1,630	1,630
Away from home[2]	n.a.	1,656	1,686	1,638	1,708	1,695	1,651
Restaurants	n.a.	1,824	1,817	2,017	2,019	1,898	1,873
Fast food	n.a.	1,575	1,654	1,616	1,628	1,724	1,674
Schools[3]	n.a.	1,604	1,526	1,529	1,512	1,601	1,576
Other public places	n.a.	1,911	1,807	1,657	1,738	1,469	1,548
Others	n.a.	1,590	1,607	1,402	1,579	1,551	1,476
Fiber:							
Average intake (grams)	n.a.	12.7	13.7	13.1	14.0	15.2	15.2
% meeting recom.[1]	n.a.	18	20	20	20	24	24
Nutrient density (grams per 1,000 kcal):							
Benchmark density[4]	n.a.	10.7	10.7	10.5	10.6	10.5	10.4
Average density	n.a.	7.0	7.4	7.1	7.4	7.6	7.4
Home foods	n.a.	7.5	7.9	7.5	7.9	8.1	8.1
Away from home[2]	n.a.	5.8	6.2	5.9	6.4	6.5	6.1
Restaurants	n.a.	5.8	6.0	6.2	6.7	7.0	6.2
Fast food	n.a.	5.0	5.5	5.3	5.3	5.7	5.6
Schools[3]	n.a.	7.6	7.5	8.0	7.6	7.1	7.1
Other public places	n.a.	6.9	7.2	6.1	6.3	6.5	6.8
Others	n.a.	5.9	6.6	5.8	6.9	6.8	6.2

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Appendix table—Intake levels and nutrient densities of foods at home and away from home, individuals age 2 and over, 1977-95, cont.

	1977-78	1987-88	1989	1990	1991	1994	1995
Calcium:							
Average intake (mg)	743	756	773	791	785	794	813
% meeting recom.[1]	31	32	33	36	33	35	36
Nutrient density (mg/1,000 kcal):							
Benchmark density[4]	481	491	479	475	466	439	432
Average nutrient density	396	418	420	426	416	395	397
Home foods	402	439	444	448	446	421	425
Away from home[2]	368	360	356	365	350	337	343
Restaurants	280	302	315	295	312	301	291
Fast food	304	342	338	345	305	350	353
Schools[3]	645	648	596	707	676	657	689
Other public places	341	346	430	368	316	302	317
Others	308	330	326	316	321	286	296
Iron:							
Average intake (mg)	11.3	12.9	13.5	13.6	13.7	15.1	15.7
% meeting recom.[1]	42	47	50	51	50	57	61
Nutrient density (mg/1,000 kcal):							
Benchmark density[4]	6.3	6.4	6.3	6.3	6.2	5.8	5.7
Average nutrient density	6.0	7.1	7.4	7.3	7.3	7.5	7.7
Home foods	6.2	7.6	7.9	7.8	7.8	8.1	8.4
Away from home[2]	5.3	5.9	5.9	6.0	6.2	6.3	6.3
Restaurants	5.8	6.3	5.9	6.6	6.3	6.7	6.5
Fast food	5.3	5.7	6.1	6.4	6.2	6.3	6.3
Schools[3]	5.0	5.4	5.5	5.6	6.1	6.3	6.1
Other public places	5.4	6.1	5.9	5.7	5.6	5.3	5.5
Others	5.2	5.9	5.8	4.8	6.1	6.1	6.4

n.a. = not available

1 See recommendations in Table 3.

2 Away from home presents the aggregate of fast foods, restaurants, schools, other public places, and others.

3 Schools are classified as a separate category for children only; for adults, they are included in the “others” category.

4 Benchmark densities are obtained by dividing the recommended intake for each nutrient by the individual’s actual food energy intake. The benchmark density for specific groups of individuals is the sum of recommended intakes for all individuals divided by the sum of their actual caloric intakes.

Source: Compiled by ERS from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, and CSFII 1994-95, 1-day intake data.

Chapter 13

What People Know and Do Not Know About Nutrition

Joanne F. Guthrie, Brenda M. Derby, and Alan S. Levy

The tremendous growth in scientific knowledge of the relationship between diet and health has been integrated into current dietary recommendations and sparked national campaigns to educate Americans on healthier eating habits. In this chapter, we look at how much the typical American knows about nutrition, whether the average level of nutrition knowledge has increased, and what implications this has for changing eating habits.

Introduction

Recent years have seen a tremendous growth in scientific knowledge of the relationship between diet and health. This increase in knowledge has informed dietary recommendations to promote health and longevity and has sparked national campaigns to educate Americans on more healthful eating habits. But how has this affected the average person? Does the typical American know much about nutrition? Is the average level of nutrition knowledge on the rise? And what implications does this have for changing eating habits?

Using data from a variety of public and private sources—including the Food and Drug Administration's (FDA) Health and Diet Survey (HDS), the U.S. Department of Agriculture's (USDA) Diet and

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Health Knowledge Survey (DHKS), the Food Marketing Institute's (FMI) Trends Survey, and the American Dietetic Association's (ADA) 1995 Nutrition Trends Survey[1]—we examine the level of nutrition knowledge among American consumers and trends in nutrition knowledge levels over time. The extent and limitation of consumers' nutrition knowledge—what people know and do not know about nutrition—and the implications for changing dietary behavior will be considered.

Measures of Knowledge and Attitudes

Nutrition-related knowledge can range from an understanding of the chemical structure of nutrients to knowledge of low-fat cooking methods. Rogers (1983) identified three types of knowledge: (1) awareness (say, of diet-disease relationships), (2) knowledge of principles (e.g., cholesterol is found in animal foods only), and (3) how-to knowledge (e.g., how to select foods with less fat or how to read a food label accurately).

Attitudes can also play an important role in shaping behavior. Attitudes frequently assessed by nutrition surveys include belief in the relationship of diet and health, the importance of nutrition compared with other food attributes (taste, etc.), the importance of following specific dietary guidelines, and perceived barriers to dietary change.

Awareness of Diet-Disease Relationships

Awareness of a relationship between diet and health (diet-disease relationships) may stimulate interest in learning about nutrition and healthful eating habits, thus acting as a first step in acquiring the knowledge necessary for dietary improvement. The Health and Diet Survey (HDS), conducted by FDA, began tracking top-of-the-mind awareness of dietary risk factors associated with specific chronic diseases in 1982. A set of open-ended questions (e.g., "Have you heard about cancer being related to things people eat or drink?", "What things that people eat or drink might be related to cancer?") measures the levels of knowledge, awareness, and perceived importance of individual dietary risk factors at the same time. Respondents must have

[1] Additional information on each data source is provided in the appendix.

some knowledge and awareness of risk factors to make a given response, and the prevalence of any response indicates the perceived importance of that dietary factor.

American consumers show fairly high levels of awareness of the relationship between their diets and serious chronic diseases such as heart disease and cancer. This is particularly true of diet-disease relationships that have been targeted by major public health campaigns (Derby and Fein, 1995): sodium and hypertension; cholesterol, saturated fat, total fat and heart disease; and dietary fiber and cancer (Levy and Heimbach, 1989). Public health campaigns, along with growing media attention to diet and health topics and health-oriented marketing of food products, have raised awareness among less educated as well as more educated consumers (Ippolito and Mathios, 1996) (see also chapter 11).

Diet and Hypertension

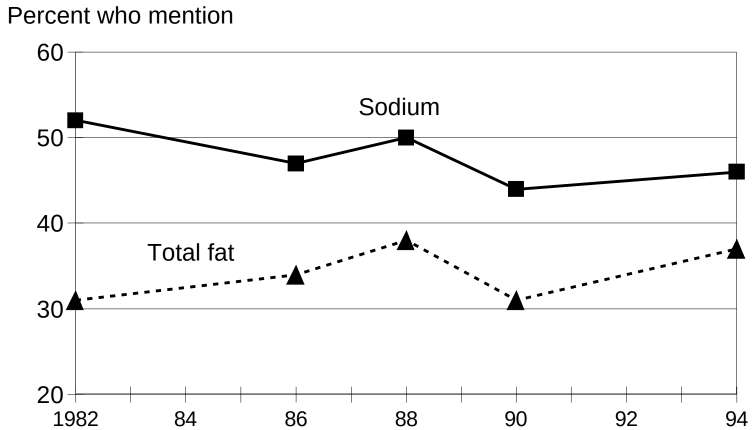
The relationship between sodium consumption and hypertension (high blood pressure) was one of the first to be widely publicized in a government-endorsed public health campaign. According to a national survey by the National Heart, Lung, and Blood Institute (NHLBI) (NIH, 1981), only 12 percent of consumers were aware of a link between sodium consumption and hypertension in 1978. By 1982, following an FDA/NHLBI-sponsored initiative to educate the public and encourage manufacturers to display sodium content on food labels, the proportion who mentioned sodium as a “likely cause of high blood pressure” nearly tripled, making sodium second to emotional stress as the most cited cause of hypertension (Heimbach, 1985). FDA and NHLBI tracked the impact of the sodium initiative from 1982 to 1994 (fig. 1), and sodium was consistently perceived as the dominant dietary risk factor for hypertension. Awareness has declined since 1982, and the difference between mentions of sodium and mentions of dietary fat—the second most mentioned dietary factor linked to hypertension—narrowed over time.

Diet and Heart Disease

The NHLBI initiated the National Cholesterol Education Program in 1985 to educate the public about the prevention of coronary heart disease by lowering blood cholesterol through diet. Awareness of fat

Figure 1

Trends in awareness of diet-hypertension relationships, 1982-94, selected years



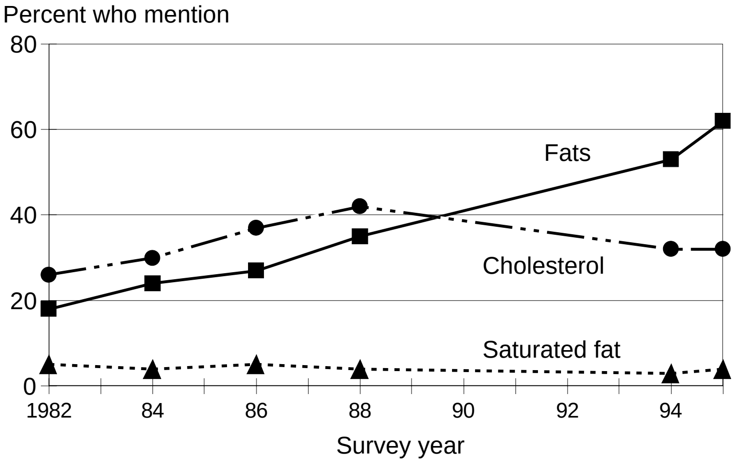
"Sodium" includes mentions of sodium or salt. "Total fat" includes mentions of fat in general, specific fats (saturated, polyunsaturated), and cholesterol. Mentions of specific foods or types of food that contain fat are not included in this analysis.
Source: FDA Health and Diet Surveys.

and cholesterol as dietary risk factors for heart disease was increasing after 1982 when the HDS began tracking awareness of dietary factors and continued to increase following the NHLBI program in 1985. During the early and mid-1980's, cholesterol was perceived as the most important dietary risk factor for heart disease, but it was displaced after 1988 by fat (fig. 2). By 1995, over 60 percent of consumers identified fat as a dietary factor related to heart disease. Awareness of cholesterol, on the other hand, increased to a high of 42 percent in 1988, subsequently declining to 32 percent in 1994 and 1995.

From 1982 to 1995, mentions of saturated fat as a risk factor for heart disease showed little change, despite the fact that saturated fat was highlighted in the program as being more atherogenic than dietary cholesterol. The failure of saturated fat to penetrate the public consciousness as an important dietary risk factor may be due to individuals' trying to simplify dietary guidance. The public may be less interested in learning the nuances of nutrition science, which complicate their food selection tasks, than in having practical rules of

Figure 2

Trends in awareness of diet-heart disease links, 1982-95, selected years (unweighted data)



For the purpose of this analysis, only mentions of the three specific nutrients are included. Mentions of specific foods are not included.

Source: FDA Health and Diet Surveys.

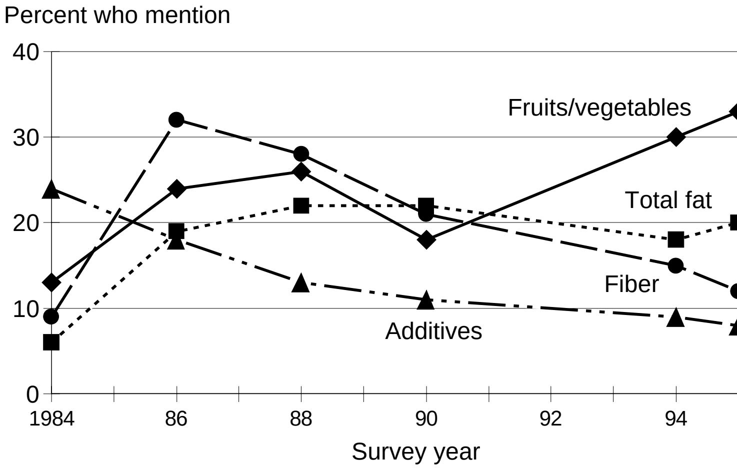
thumb (e.g., avoid fat) that apply broadly and easily to most food choices. This may be particularly true when concern about dietary risk factors expands beyond nutritionally informed consumers to the broader population, and when food product advertising and marketing are the primary channels by which consumers receive their information about nutrition.

Diet and Cancer

Awareness of diet-disease relationships for cancer has also increased significantly in recent years, but it remains at a lower level than for heart disease. In 1984, consumers were most likely to mention food additives—such as artificial colors, nitrates, and preservatives—as dietary factors related to cancer (fig. 3). Since then, other dietary factors—such as dietary fiber, fat, and fruits and vegetables—have become more important. Although fewer consumers associate fat with cancer than with heart disease, by 1995 about one in five consumers mentioned fat as a dietary risk factor for cancer.

Figure 3

Trends in awareness of diet-cancer relationships, 1984-95, selected years (unweighted data)

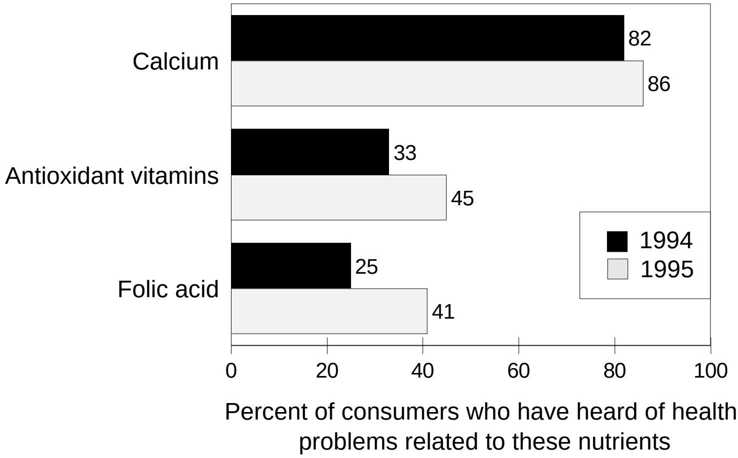


"Fat" includes mentions of fat in general, specific fats (saturated/polyunsaturated), cholesterol, or fried foods. "Additives" includes mentions of additives, artificial colors, nitrates, or preservatives. "Fiber" includes mentions of fiber, roughage, whole-grain cereals, or bran. "Fruits and vegetables" includes general and specific mentions of fruits and vegetables.

Source: FDA Health and Diet Surveys.

Dietary links between foods (fruits and vegetables) and cancer prevention show a change over time. In the mid-1980's, when dietary fiber received considerable attention from both public health authorities such as the National Cancer Institute and advertisers (e.g., the Kellogg high-fiber cereal campaign), fiber was the most frequently mentioned dietary factor for preventing cancer (Levy and Stokes, 1987). More recently, fruits and vegetables have received increasing recognition; by 1995, one in three consumers mentioned fruits or vegetables, nearly three times as many as mentioned fiber (Levy and Derby, 1996). Recently, the National Cancer Institute has emphasized the importance of fruit and vegetable consumption via its "Five-A-Day" campaign (Eisner and others, 1992), whereas, without continued reinforcement, the salience of the fiber message has diminished. However, since eating five fruits and vegetables per day is an effective way of increasing fiber intake while also obtaining other beneficial food components, this shift in awareness is appropriate for decreasing cancer risk.

Figure 4
Awareness of recent nutrition issues, 1994-95



Source: FDA Health and Diet Surveys (unweighted data).

Awareness of Emerging Diet-Disease Relationships

In 1994 and 1995, the HDS asked consumers if they had heard of health problems related to eating too much or too little of nutrients recently identified as having potentially important health effects. Awareness of the relationship of calcium to health was quite high (86 percent in 1995), while a smaller, but growing, proportion of consumers had heard about health problems related to not eating enough antioxidant vitamins (45 percent) or enough folic acid (41 percent) (fig. 4).

USDA's Diet and Health Knowledge Survey (DHKS) also examined consumers' awareness of nutrient relationships to health, with findings that were generally consistent with the HDS. Comparing DHKS data collected in 1989-91 with data collected in 1994, one of the most interesting findings was the increase in awareness of calcium-health relationships. Between the 1989-91 DHKS and the 1994 DHKS, awareness of health problems related to calcium intake rose from 63 percent of main meal planners to 85 percent. Among female meal planners, awareness rose from 65 percent to 88 percent. The higher awareness among women is not surprising, given that low calcium intakes have been publicized as a risk factor for osteoporosis, a condition that primarily affects women. The DHKS also found that almost all adults—95 percent—agreed that being overweight is a health problem.

Implications

Top-of-the-mind awareness reflects both awareness of particular diet-disease relationships and the salience of this information to consumers. The HDS data on trends in awareness indicate that public education media campaigns can be effective in increasing awareness and perceived importance of diet-disease relationships, especially those that apply broadly and relatively easily to food choices, such as decreasing fat. Consumers may be less interested in more detailed messages, such as those on saturated fat. Awareness may also shift in relationship to new information and/or new educational messages, as indicated by the decrease in mentions of fiber as a dietary factor associated with cancer and the increase in mentions of fruits and vegetables.

Although research has shown that awareness can be associated with dietary improvement (Variyam and others, 1995), the data presented here indicate that awareness by itself is not a panacea. Awareness of health problems related to overweight is all but universal, yet obesity remains a growing health problem in our society (Kuczmarski and others, 1994; American Heart Association, 1998). Similarly, despite the rise in awareness of the relationship between calcium and health, particularly among women, data from USDA's Continuing Survey of Food Intakes by Individuals (CSFII) indicate no change in calcium intake among women age 20 and over between 1989-91 and 1994—at both time periods, calcium intake averaged only 75 percent of the women's RDA[2] (Tippett and others, 1995; USDA, 1996).

Those seeking to effect dietary change must keep in mind that awareness is only one factor in shaping dietary behavior. For example, an analysis of 1990-91 CSFII-DHKS data indicated that although awareness of the relationship of calcium to health had a positive effect on women's likelihood of meeting their calcium RDA, other factors, such as eating more food away from home, were negatively related to calcium intake (Guthrie, 1996). Even though nutrition educators are successful in increasing awareness of the calcium-health relationship,

[2] Based on the RDA for calcium established in 1989 by the National Academy of Sciences.

other social changes, such as the rise in eating away from home, may counteract their efforts.

Also, individuals, although aware of diet-disease relationships, may have an erroneous perception of the nutrient adequacy of their own diets (see also chapter 15). For example, respondents to the 1994-95 DHKS were asked to estimate how their diets compared with “what is healthy” for selected nutrients. Of those who said their diets were about right in calcium, only 38 percent met the 1989 RDA for calcium.

Thus, it cannot be assumed that simply by increasing awareness of diet-disease relationships, dietary change will always occur. Other influential factors must also be considered in shaping dietary change efforts.

Knowledge of Nutrition Principles

Nutrition is concerned with the relationship of food and health, and one can think of nutrition knowledge as encompassing both health-oriented and food-related principles. Health-oriented principles (for example, knowledge that saturated fat acts differently on cholesterol levels than does unsaturated fat) can provide a deeper understanding of diet-health relationships than simple awareness, thereby improving an individual’s ability to understand and implement dietary change. Food-related principles (for example, that saturated fat is more likely to be solid at room temperature, whereas unsaturated fat is more likely to be liquid) also facilitate dietary improvement by providing relatively simple “decision rules” for consumers to use in making food choices. Food guides may also be seen as providing consumers with a set of principles for translating dietary recommendations into behavioral terms.

Knowledge of Fats and Cholesterol

To evaluate the impact of the NHLBI’s Cholesterol Education Campaign, the HDS has included a set of questions since 1984 related to consumer knowledge about dietary fats and cholesterol (table 1). Levy and others (1993) found that public knowledge about dietary fats and cholesterol was quite poor: only 3 of the 11 questions asked in 1988 were answered correctly by a majority of consumers. There was no overall increase in knowledge from 1984 to 1988. Total scores were highest for those who were more educated and middle-aged. Significant improvements were seen for respondents who had

Table 1—Trends in knowledge of dietary fat and cholesterol

Question (correct response in bold)	1984	1986	1988	1990	1994	1995
			Percent			
Are saturated fats usually found in:						
Animal products like meat and dairy products	55	60	62	69	NA	67
Vegetables and vegetable oils	15	10	11	11	NA	13
Not sure	30	30	27	20	NA	20
Are polyunsaturated fats usually found in:						
Vegetables and vegetable oils	55	55	55	61	NA	57
Animal products like meat and dairy products	13	12	13	16	NA	16
Not sure	32	33	32	23	NA	27
Which kind of fat is more likely to be liquid rather than a solid:						
Polyunsaturated fats	32	34	34	36	NA	NA
Saturated fats; equally likely to be liquids	32	28	30	38	NA	NA
Not sure	36	38	36	26	NA	NA
Which kind of fat is more likely to raise people's blood cholesterol level:						
Saturated fats	52	51	56	60	62	61
Polyunsaturated fats; both of them; neither of them	20	20	20	25	24	23
Not sure	28	29	24	15	14	16
Which kind of fat is higher in calories:						
Both the same	21	20	21	26	NA	26
Saturated fats; polyunsaturated fats	43	44	46	53	NA	49
Not sure	35	37	33	21	NA	25
Is cholesterol the same thing as:						
Neither	36	38	41	54	NA	49
Saturated fat; polyunsaturated fat	19	21	21	21	NA	15
Not sure	45	41	38	25	NA	36
If a food is labeled cholesterol-free, is it also:						
It could be either high or low in saturated fats	NA	29	35	50	40	39
Low in saturated fats; high in saturated fats	NA	48	44	41	46	46
Not sure	NA	23	21	9	14	15
If a product is labeled as containing only vegetable oils, would it be:						
It could be either high or low in saturated fat	NA	NA	29	33	40	46
Low in saturated fat; high in saturated fat	NA	NA	47	53	45	37
Not sure	NA	NA	24	14	15	17

--Continued

Table 1—Trends in knowledge of dietary fat and cholesterol, continued

Question (correct response in bold)	1984	1986	1988	1990	1994	1995
			Percent			
If a fat or oil has been hydrogenated, has it become:						
More saturated	10	11	17	26	25	26
Less saturated	26	27	32	37	36	32
Not sure	64	63	51	37	39	42
Is cholesterol found in:						
Animal products like meat and dairy	31	32	33	32	NA	28
Vegetables/vegetable oils; all foods containing fat/oil	55	53	53	59	NA	54
Not sure	14	15	14	9	NA	18
Have you ever heard of monounsaturated fats or oils?						
Yes	NA	NA	27	34	NA	49
No	NA	NA	73	66	NA	51
Have you heard of trans-fatty acids?						
Yes	NA	NA	NA	NA	NA	32
No	NA	NA	NA	NA	NA	68
Do trans-fatty acids raise blood cholesterol, lower blood cholesterol, or have no effect on blood cholesterol?						
Raise cholesterol	NA	NA	NA	NA	NA	11
Lower cholesterol; have no effect	NA	NA	NA	NA	NA	6
Not sure	NA	NA	NA	NA	NA	83
Sample size	4,007	4,004	3,201	1,198	1,945	1,001

NA indicates that the question was not asked in that year.

Source: 1984-1990 HHS/FDA Health and Diet Survey; 1994 HHS/FDA Food Label Use and Nutrition Education Survey; 1995 HHS/FDA Health and Diet Survey--Food Label Use and Nutrition Education Survey Replicate.

been diagnosed with high blood cholesterol and those on cholesterol-lowering diets (whether physician-recommended or self-initiated). A common mistake noted in this study was that consumers assumed saturated fat, high calories, and cholesterol tend to occur together in foods, leading to a good/bad categorization of foods.

Between 1988 and 1995, there were modest improvements in knowledge (table 1). The item showing the largest improvement was awareness of monounsaturated fats, with 49 percent saying they had heard of this type of fat (an increase of 22 percent since 1988). One in three had heard of trans-fatty acids but few consumers (11 percent) understood they would raise cholesterol, while the majority (83 percent) did not know their effect.

Some areas of knowledge remain low. Only one in four respondents knew that saturated and polyunsaturated fats have the same number of calories; more assumed saturated fats have higher calories. Only one in four understood that if a fat is hydrogenated it becomes more saturated (26 percent in 1995, up 9 percent since 1988); one in three believed a fat would become less saturated, while 42 percent could not answer. Knowledge that cholesterol is found only in animal products declined (28 percent in 1995, down 5 percent since 1988); 54 percent believed that cholesterol is found in all foods that contain oils.

A comparison of responses in 1988 and 1995 by education level showed that an education effect was maintained. Significantly fewer consumers with less than a high school education answered correctly, and there was no significant increase among this group in their knowledge of dietary fat and cholesterol over time. Those with at least a high school education improved on about half of the items tracked.

These results suggest that consumers still have limited knowledge about dietary fats and cholesterol, even though these are the nutrients they are most likely to express concerns about and to indicate they pay attention to in foods (Derby and Fein, 1995). To the extent consumers choose to rely on their existing knowledge and expectations about fats and cholesterol, they may misjudge the nutritional qualities of some foods. The Nutrition Facts label—which provides information on the total fat, saturated fat, and cholesterol content of most packaged foods—and health claims related to heart disease that may appear on qualifying low-fat, low-cholesterol foods can help overcome this lack of understanding.

Food Guides

Food guides have historically been used to provide consumers with a set of principles for translating dietary recommendations into behavioral terms. For example, an individual who wishes to consume the recommended amount of calcium can consult a food guide for foods that are good sources of calcium (e.g., the milk, yogurt, and cheese group) and the appropriate amount of food from that group to consume.

Table 2—Awareness of dietary advice

Item	1994	1995
	Percent yes	
Have you heard anything about the following information on diet and health:		
Dietary Guidelines for Americans	30	30
Food Guide Pyramid	33	43*
Five-A-Day Program	22	24

* Significantly higher at $p < 0.05$.

Source: 1994 HHS/FDA Food Label Use and Nutrition Education Survey (n = 1,945); 1995 HHS/FDA Health and Diet Survey--Food Label Use and Nutrition Education Survey Replicate (n = 1,001).

Food guides are a commonly used nutrition education tool with a long history. USDA, in particular, has been a leader in food guide development (see chapter 2). The first USDA food guide was developed in 1916 (Welsh, 1994). USDA has since revised its food guides periodically to conform to advances in nutrition knowledge and changes in dietary recommendations. The current USDA Food Guide was developed in the mid-1980's and was featured in the 1990 edition of the *Dietary Guidelines for Americans* (USDA/DHHS, 1990). It gained further prominence with the publication in 1992 of the *Food Guide Pyramid*, a graphic representation of the major principles of the Food Guide (Welsh and others, 1992). This graphic has appeared on a wide range of nutrition education and food marketing materials and has achieved a high level of consumer recognition in a short time.

In the 1994 and 1995 HDS, consumers were asked if they had heard of the *Dietary Guidelines for Americans*, the *Food Guide Pyramid* and the Five-A-Day program (a program to encourage consumption of fruits and vegetables) (table 2). In 1995, there was a significant increase in the percentage who had heard of the *Food Guide Pyramid*, and it was recognized by more consumers than either the Dietary Guidelines or Five-A-Day program (Levy and Derby, 1995).

Consumers' knowledge of food guide recommendations was assessed in both the 1990-91 DHKS and the 1994-95 DHKS, a time period of particular interest since the *Food Guide Pyramid* graphic was released by USDA in 1992. Table 3 compares the percentages of

Table 3—Knowledge of food guide recommendations among main meal planners, 1990-91 and 1994-95

Question 1994-95: Let's begin by talking about the number of servings from different food groups that a person should eat each day. How many servings from the [food group] would you say a person of your age and sex should eat each day for good health?

Question 1990-91: Let's begin by talking about your opinion of the amount of food, such as fruits, vegetables, and meats, that people should eat each day for good health. How many servings of [food group] should a person eat daily if one serving equals [amount]?

Food group [amount]	1990-91	1994-95
	Percent of meal planners reporting answer that corresponds to Food Guide Pyramid recommendation	
Fruit group[1]		
Fruit [1 piece whole fruit][2]	70	74
Vegetable group[1]		
Vegetables [a half cup of cooked vegetables][2]	33	55
Milk, yogurt, and cheese group[1]		
Dairy products [1 cup of milk or slice of cheese][2]	60	59
Bread, cereal, rice, and pasta group[1]		
Grain products [1 slice of bread or a half cup of cooked cereal, rice, or pasta][2]	2	8
Meat, poultry, fish, dry beans, and eggs group[1]		
Meat, poultry, or fish [a piece the size of a medium hamburger][2]	53	60

1 Phrasing used in 1994-95; sample serving amount not given in 1994-95.

2 Phrasing used in 1990-91.

Source: USDA Diet and Health Knowledge Surveys (weighted data).

main meal planners in each time period who reported believing that they needed to consume a number of servings daily from each of the five major food groups that corresponds to Food Guide Pyramid recommendations (2-4 servings per day of fruit, 3-5 servings per day of vegetables, etc.). Knowledge of recommendations varied considerably among food groups, ranging from a high of 74 percent of 1994-95 meal planners reporting the correct recommendation for the fruit group to a low of 8 percent for the bread, cereal, rice, and pasta group.[3] In 1994-95, the DHKS surveyed the general adult population as well as meal planners. Their knowledge of Food Guide Pyramid recommendations was similar to that of meal planners (data not shown).

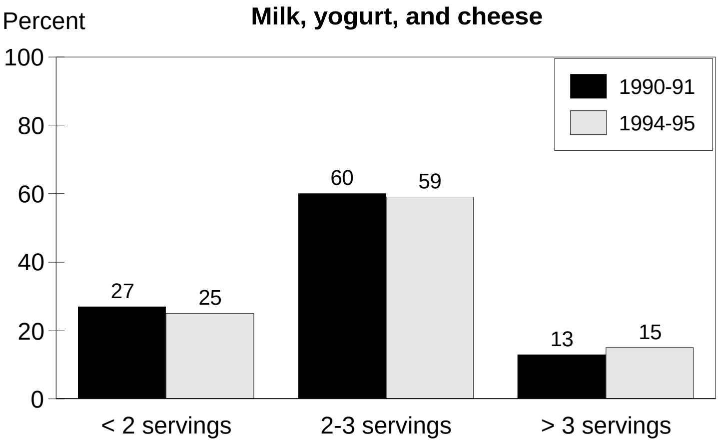
Except for the milk, yogurt, and cheese group, knowledge of recommendations for the major food groups increased between the two time periods, especially for vegetables—from 33 percent to 55 percent. Generally, those who did not know the recommendations gave answers that fell below the amounts recommended. However, for the milk, yogurt, and cheese group in both 1990-91 and 1994-95 and for fruit in 1994-95, there were appreciable minorities of respondents who believed they should consume more servings from these food groups than the *Food Guide Pyramid* recommends (fig. 5).

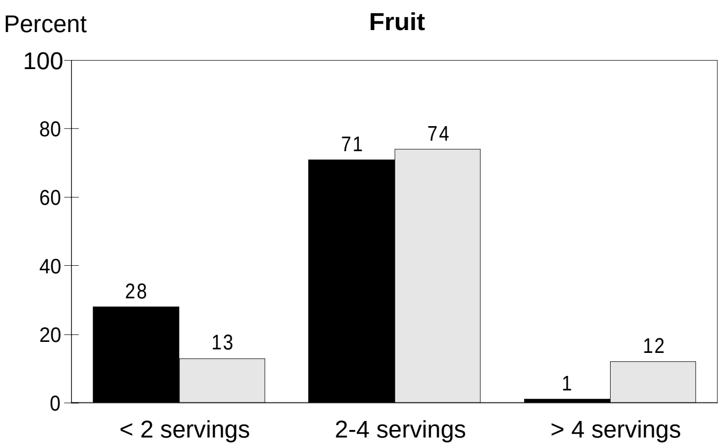
The difference in knowledge of recommendations regarding each of the major food groups raises questions as to how consumers are acquiring and assimilating knowledge of Food Guide Pyramid recommendations. Recommendations for some food groups have been publicized widely—for example, fruit and vegetable recommendations, as a part of the 5-A-Day program (Eisner and others, 1992). This may be a factor in what seems to be an increasing belief that these foods should be consumed in larger amounts. Since fruits and vegetables have been identified as underconsumed food groups (see chapter 5; also Kennedy and others, 1995), the increase in knowledge of fruit and vegetable recommendations could be highly beneficial to the diets of Americans.

The continued ignorance concerning recommended grain consumption may be due to the lack of a broad-based promotion program such as 5-A-Day, or to consumer confusion as to what the recommendation really means. Shaw and others (1996) note that for most food groups, the food guide serving amount is similar to the size of a portion most typically consumed (e.g., for vegetables, the Food Guide Pyramid serving is ½ cup cooked vegetable or 1 cup raw leafy greens, which corresponds well to the size of a typical portion). For

[3] For each of the five major food groups, a range of recommended servings appears on the Food Guide Pyramid graphic (2-4 servings fruit, 3-5 servings vegetables, etc.). The specific recommendation for a given person varies by age and sex. However, any answer within that range was accepted as correct, since it was felt that it was unreasonable to expect individuals to know their precise recommendation within the range.

Figure 5
Beliefs of main meal planners concerning intake of...





* 1 percent of individuals responded "don't know."
Source: Diet and Health Knowledge Survey, 1990-91 and 1994-95 (weighted data).

grains, however, the typical portion is approximately twice that of a Food Guide Pyramid serving (e.g., a typical portion is 1 cup rice or pasta, 1 whole hamburger bun, etc., whereas the Food Guide Pyramid servings are half those amounts). Thus, one reason for the difficulty in learning or accepting this recommendation may be confusion about serving amounts. Further examination of DHKS 1995 data indicates that 43 percent of consumers believe they should eat 3-5 servings of grains daily, which, if they are assuming a serving to be twice the size that the food guide serving actually is, would approximate the 6-11 serving recommendation.

Nevertheless, 1994-95 DHKS data also indicate that almost 50 percent of consumers believe they need fewer than three servings of grains daily. It appears that many consumers are not convinced of a health need for grains—perhaps because they do not have a clear understanding of the health value of grains or because they hold conflicting beliefs. For example, according to a 1995 survey by the Wheat Food Council and American Bakers Association, 40 percent of consumers think bread is fattening and 35 percent think starches should be avoided. Given the 1995 Dietary Guidelines Advisory Committee's urging that Americans learn to make grains the center of their plate (USDA, 1995), more investigation of barriers to recognition of the role of grains in the diet should be undertaken.

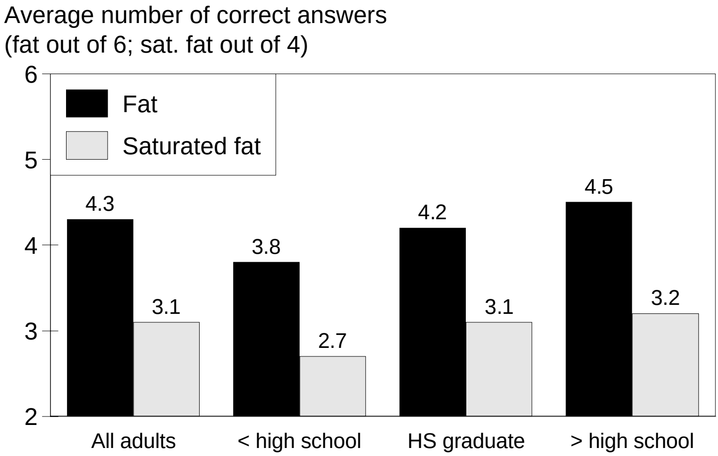
How-To Knowledge

Rogers (1983) describes how-to knowledge as the "information necessary to use an innovation properly." In other words, it is the very concrete, specific knowledge and skills guiding day-to-day implementation of a desired behavior, such as choosing a healthful diet. An example is the ability to discriminate between foods that contain desirable nutritional properties (e.g., are lower in fat or higher in fiber) and similar foods with less desirable nutritional characteristics, either by having a general knowledge of food composition or by reading and interpreting food label information properly.

Knowledge of Food Composition

The 1994 DHKS posed a series of questions designed to measure consumers' ability to select foods that are lower in fat or saturated fat and to assess their ability to interpret food label information correct-

Figure 6
Ability to identify foods higher in fat/saturated fat



Source: USDA Diet and Health Knowledge Survey, 1994 (weighted data).

ly. Consumers were asked to identify which, in a series of paired foods, was higher in fat (hot dogs or ham, yogurt or sour cream, etc.) or higher in saturated fat (liver or T-bone steak, butter or margarine, etc.). Almost 80 percent were able to identify the higher fat food in five of six paired comparisons of foods and 60 percent were able to identify the higher saturated-fat food in three of four food pairs. Better-educated respondents were more able, on average, to identify higher fat and saturated fat foods (fig. 6).

In 1989-91, DHKS respondents (primarily the household meal planners) were also asked to select the higher fiber food from six pairs of foods (fruit or meat, popcorn or pretzels, etc). Smallwood and Blaylock (1994) report that in 1989-90, about 80 percent of meal planners were able to identify the higher fiber food from five of the six sets of pairs. The most difficult paired comparison was lettuce and kidney beans—only 59 percent correctly identified kidney beans as the higher-fiber food. This is consistent with other research that has found that many consumers are not aware of the high fiber content of legumes (Guthrie, 1988). The USDA Food Guide has identified legumes as a category of foods that should be consumed in greater amounts by Americans (USDA, 1985). However, consumption of legumes by Americans remains relatively low (USDA, 1996). The 1995 Dietary Guidelines Advisory Committee (USDA, 1995) noted that the role of legumes in the diet is not well understood by consumers and added clarifying text in the 1995 edition of the *Dietary Guidelines for Americans* (USDA/DHHS, 1995). It will be interesting to assess any future changes in consumer knowledge and attitudes regarding this category of foods. Perhaps educational efforts to increase consumer awareness of legumes' fiber content would contribute to increased consumption.

Food Label Use

In the past, making healthful food choices required greater effort on the part of consumers in order to acquire relevant information. With the Nutrition Labeling and Education Act, implemented in 1994, consumers have a point-of-purchase tool for most packaged and some fresh foods that lessens the need to memorize nutritional information. Consumers concerned about a particular nutrient such as saturated fat can easily compare different foods. The regulations applied to front-label claims (i.e., nutrient content claims such as "low fat" or "reduced fat" and health claims concerning the relationship between fat and heart disease or cancer) also enable consumers to identify healthful foods without prior how-to knowledge. For example, consumers may become more aware of the high fiber content of legumes as more products include nutrient content and fiber-related health claims. Some canned foods—such as pea soup and pork and beans—have already begun including this information on their packages.

Different how-to knowledge may be required to deal with other food selections. Nutrition information in supermarkets for the top-selling fresh fruits, vegetables, seafood, and meats is often available on posters, shopping bags, or grocery store handouts as part of a voluntary labeling program, but consumers may fail to notice this information. Restaurants do not generally provide detailed nutritional profiles of their offerings, although some chain and fast-food restaurants have such information available by request. Although new restaurant regulations ensure that menu items identified as low-fat, for example, must comply with defined standards, consumers still must rely largely on their own knowledge to identify healthful menu options. Consumers with prior knowledge, such as that tested in the food comparisons in

Table 4—Ability to interpret quantitative information on food constituents

Question: If one serving of food contained [food constituent], would you consider that to be a low amount or a high amount?

Food constituent	Low[1]	High	Don't know[2]
		Percent	
100 milligrams of sodium	**22**	63	15
20 grams of fat	10	**78**	12
15 milligrams of cholesterol	**28**	44	28
5 grams of fiber	61	**17**	22
10 grams of saturated fat	14	**69**	17

[1] Correct answer in bold; definitions of "low" and "high" based on food labeling regulations.

[2] Percentages do not include those for whom a valid response was not ascertained.

Source: USDA Diet and Health Knowledge Survey, 1994 (weighted data).

the DHKS, would be able to make more informed food choices in situations where food labels are not available.

Food Label Interpretation

Research has demonstrated that most consumers are not knowledgeable about quantitative requirements or recommendations for various nutrients. This makes it difficult to accurately judge whether a food is high or low in specific nutrients, even those many consumers express concern about—such as fat, cholesterol, or sodium. The American Dietetic Association asked consumers to estimate the recommended levels for fat, calories, sodium, cholesterol, calcium, and blood cholesterol (ADA, 1993). About half correctly identified guidelines for calories, calcium, and blood cholesterol, but none answered correctly for sodium or cholesterol and less than 10 percent answered correctly for fat, saturated fat, or calories from fat.

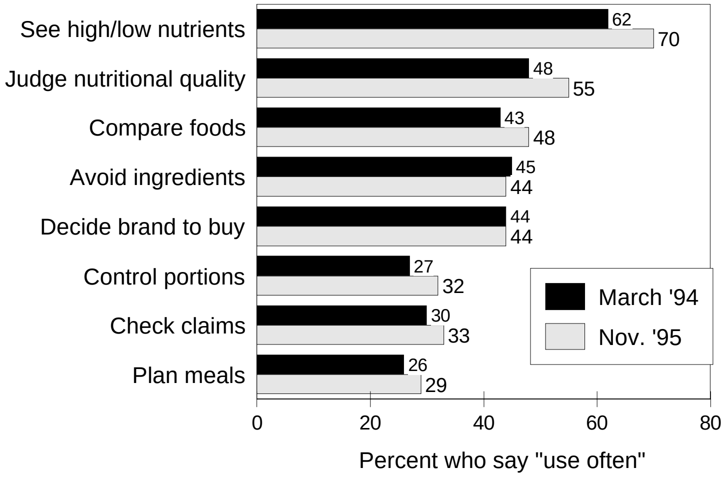
Similarly, in 1994, DHKS respondents were given sample amounts of food constituents that might be found in a serving of food and asked to identify them as being low or high amounts (table 4). In three of five cases—for sodium, cholesterol, and fiber—the correct response was given by less than 30 percent of respondents. Seventy-eight percent of respondents correctly identified 20 grams of fat as being a high amount per serving, and 69 percent correctly identified 10 grams of saturated fat as high. These mixed results indicate that quantitative information about food constituents is very difficult for consumers to interpret. This is probably not surprising since different quantitative measures are used for different food constituents (e.g., milligrams vs. grams). Moreover, what is a high absolute amount for one food constituent may not be for another (e.g., 5 grams of fiber is a high amount per serving but 5 grams of fat is not).

FDA conducted two experimental studies to examine options for presenting nutrient information on the food label (Levy, Fein and Schucker, 1991, 1992, 1996). The percent Daily Value (DV) information had the most consistently positive benefits for dietary management tasks. Consumers were better able to judge high and low nutrient levels and to recognize the implications of a product's nutrition profile for their daily diet with labels that included percent DV. With only metric information (grams and milligrams), even when the format also included reference DV's for the nutrients, consumers tended to respond to the absolute size of the numbers used to describe the nutrients. This led to errors such as perceiving 115 milligrams of sodium as high and 5 grams of saturated fat as low. These findings were instrumental in the decision to include percent DV on the revised food label. The 1994 and 1995 HDS surveys showed a significant increase in the use of food labels to compare products and to determine how high or low the food is in particular nutrients.

FDA is tracking changes in food label use (fig. 7). From 1994 to 1995, there were significant increases in the proportion of consumers who said they use food labels "to see how high or low the food is in things like calories, salt, vitamins, or fat"; "to get a general idea of the nutritional content of the food"; and "to compare different food items with each other." The information on nutrient amounts such as fat, sodium, and carbohydrate was the part of the label consumers reported using most often and that increased most in use from 1994 to 1995 (Levy and Derby, 1995), while there was no change in use of the ingredient list, serving size, or nutrient content descriptors.

In a recent survey by *Prevention* magazine and the Food Marketing Institute (1997), approximately one in four shoppers reported they had started buying a product because of something they read on the nutrition label, and one in three had stopped buying a product based

Figure 7
Why consumers use food labels



Source: FDA Health and Diet Surveys (unweighted data).

on the nutrition label. Cited most frequently as the cause of these changes was fat content.

Knowledge of food composition and label-reading skills are only two types of how-to information. Since food purchase and preparation involve numerous behaviors, many other types of how-to knowledge may be useful to consumers. For example, consumer research on promotion of fruit and vegetable use has shown that in addition to nutrition information, consumers also desire how-to information on selection, storage, preparation, and menu planning, as well as practical tips on how to incorporate fruits and vegetables into quick meals and meals eaten away from home (Guthrie and others, 1992). It is probably not feasible to incorporate assessment of such a wide range of types of how-to information into national surveys, but it is important for those seeking to promote dietary change to be aware of this issue. More targeted, in-depth consumer research that focuses on eliciting a fuller range of the types of how-to knowledge needed and desired by consumers may be an important first step in planning nutrition education and promotion campaigns.

Table 5—Importance of nutrition and other food attributes

Attribute	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
	Percent rating "very important"									
Nutrition	76	75	75	77	75	76	74	78	77	76
Taste	87	88	90	89	91	90	90	88	87	89
Price	64	66	71	75	74	70	69	66	66	64
Product safety	74	71	72	71	72	69	69	75	73	75
Storability	40	43	43	46	45	41	41	43	44	45
Food prep. time	37	36	38	41	36	36	35	38	39	36
Ease of preparation	36	33	34	36	37	34	35	36	37	37
Packaging can be recycled	--	--	48	45	41	38	34	34	31	31

-- indicates category not asked in that year.

Source: FMI, *Trends* '89; *Trends* '96; *Trends* '98.

Attitudes

Attitudes represent an individual's subjective feelings about an issue (e.g., whether following a healthful diet is important) or an object (e.g., whether low-fat foods taste good). Many behavioral theorists consider attitudes to be crucial predictors of behavior (Axelson and Brinberg, 1989). Whereas knowledge may provide the individual with the information necessary to implement a behavior change, attitude may determine whether the individual is motivated to implement that change.

For example, when choosing foods, nutrition is only one consideration, along with taste, price, convenience, etc. If consumers do not value nutrition as a factor in food selection or if they value other factors more highly, they may not choose nutritious foods even if they are knowledgeable about nutrition.

Since 1988, the Food Marketing Institute's (FMI) *Trends* survey has assessed the value consumers place on nutrition compared with other food attributes (table 5). Since 1989, the percentage of shoppers rating nutrition as "very important" has remained at or above 75 percent (except in 1995). Belief in the importance of product safety increased significantly in 1996 and has remained high. Nevertheless, taste remains the most important factor in food choice. Therefore, we cannot expect consumers to change to more healthful food choic-

Table 6—Perceived importance of dietary recommendations

	By gender			By education		
	All[1]	Male	Female	< high school	HS grad.	> high school
	Percent rating "very important"					
Use salt/sodium in moderation	55	47	61	57	53	55
Choose a diet low in sat. fat	57	51	62	54	54	59
Choose a diet with plenty of fruits and vegetables	67	61	73	69	66	68
Use sugars only in moderation	54	48	59	58	53	52
Choose a diet with adequate fiber	51	44	57	49	53	51
Eat a variety of foods	61	56	65	56	61	62
Maintain a healthy weight	75	70	80	71	74	77
Choose a diet low in fat	61	52	69	60	59	63
Choose a diet low in cholesterol	58	52	63	64	58	55
Choose a diet with plenty of breads, cereals, rice, and pasta	34	30	37	30	30	37
Eat at least two servings of dairy products daily	37	29	44	35	40	36

[1] All respondents; valid percent; weighted data.

Source: USDA 1994 Diet and Health Knowledge Survey.

es unless they also believe that those food choices taste good. In 1994, about 30 percent of consumers, responding to a poll conducted by the American Dietetic Association and the International Food Information Council, asserted that healthy foods do not taste good, indicating that taste preferences may be a significant barrier to dietary change.

Since the FMI *Trends* survey began tracking dietary concerns in 1983, concern about the fat content of the diet has grown astronomically—from 9 percent of consumers in 1983 to 65 percent in 1995. By 1998, concern had dropped slightly, to 59 percent of consumers, but fat content was still the primary dietary concern of most Americans. Concern about calories, on the other hand, remains quite low, and concern about the vitamin/mineral content of the diet has dropped so much that it was no longer included in the 1998 report.

USDA's 1994 DHKS used a different approach to assessing consumers' dietary concerns. Consumers were asked to rate the importance of following specific dietary guidelines (table 6). The results are somewhat, but not completely, consistent with the FMI *Trends* data. Based on DHKS data, 61 percent of consumers thought it was

Table 7—Importance of the Dietary Guidelines

To you personally, is it very important, somewhat important, not too important, or not at all important to...
IF NEEDED SAY: The question is not asking about your actual eating habits. It is asking about the ***importance*** *of the statement to* ***you personally****.*

	Importance			
Item	Very	Somewhat	Not too	Not at all
	Percent			
Choose a diet with plenty of fruits and vegetables	78	18	2	2
Eat a variety of foods	71	24	3	2
Choose a diet low in sat. fat	63	25	5	7
Choose a diet w/adequate fiber	60	28	7	5
Use salt or sodium only in moderation	57	23	9	11
Choose a diet low in cholesterol	52	31	10	7
Choose a diet with plenty of breads, cereals, rice, and pasta	52	33	9	6
Eat at least two servings of dairy products daily	41	32	16	11

Source: 1995 HDS/FLUNES replicate. n = 1,001 (unweighted data).

important to eat a low-fat diet, consistent with FMI data. However, some preoccupations not identified by the FMI *Trends* survey were rated as important by as many or more consumers.

Maintaining a healthy weight was considered very important by 75 percent of consumers, in contrast to the relatively low interest in caloric content of foods identified by the FMI *Trends* survey. Given the increasing prevalence of overweight in our society, it might be useful to examine further what seem to be contradictory findings.

The importance of eating a variety of foods is the first dietary guideline message and one consumers seem to accept—61 percent agreed that this is very important. If variety is defined by consuming foods from the five major food groups in the USDA *Food Guide Pyramid* in the recommended proportions, however, some aspects of variety seem to be more important to consumers than others. Two-thirds—67 percent—considered it very important to choose a diet with plenty of fruits and vegetables, but only 37 percent considered it very important to consume two servings of dairy daily and only 34 percent consider it very important to choose a diet with plenty of grains. More information about what variety really means may be necessary

Table 8—Importance of the Dietary Guidelines, by sex and education

To you personally, is it very important, somewhat important, not too important, or not at all important to...

	Gender		Education		
Item	Male	Female	< HS	HS grad.	> HS
	Percent rating item "very important"				
Choose a diet with plenty of fruits and vegetables	69	84	73	76	81
Eat a variety of foods	69	72	49	68	76
Choose a diet low in saturated fat	53	69	50	62	66
Use salt or sodium only in moderation	49	61	44	50	63
Choose a diet low in cholesterol	46	55	55	54	50
Choose a diet with adequate fiber	53	64	48	59	64
Choose a diet with plenty of breads, cereals, rice, and pasta	45	57	41	51	55
Eat at least two servings of dairy products daily	29	48	43	43	40
Sample size	365	636	123	325	547

Source: 1995 HDS/FLUNES replicate. n = 1,001 (unweighted data).

to help translate their belief in the importance of a varied diet into consumption of a diet that meets food guide recommendations.

Women generally rated the importance of following dietary guidelines higher than men, but both sexes agreed in their relative prioritization of most guidelines (table 6). Maintaining a healthy weight and choosing a diet with plenty of fruits and vegetables were the guidelines rated "very important" by the highest percentages of both men and women. Education seemed to have little impact on consumers' ratings.

The 1994 and 1995 HDS corroborated the results, with strong majorities rating the guidelines to eat plenty of fruits and vegetables and a variety of foods as personally very important (table 7). Majorities also endorsed nutrient-specific guidelines related to saturated fat, dietary fiber, and cholesterol as very important. As in the DHKS, fewer consumers regarded eating plenty of grains or at least two dairy servings as very important, although nearly half of the women considered consuming two servings of dairy products to be very important (table 8). Most respondents realize that health suffers from consuming too little calcium, but their view of how much is enough differs from what dietary experts recommend.

Table 9—Importance of the Dietary Guidelines, by age group

To you personally, is it very important, somewhat important, not too important, or not at all important to...

Item	Age 18-34	35-49	50-64	65+
	Percent rating item "very important"			
Choose a diet with plenty of fruits and vegetables	76	79	79	80
Eat a variety of foods	62	72	77	76
Choose a diet low in saturated fat	58	67	67	60
Choose a diet with adequate fiber	46	66	65	67
Use salt or sodium only in moderation	55	58	57	57
Choose a diet low in cholesterol	46	51	60	57
Choose a diet with plenty of breads, cereals, rice, and pasta	54	55	51	46
Eat at least two servings of dairy products daily	45	42	36	39
Sample size	317	342	187	155

Source: 1995 HDS/FLUNES replicate. n = 1,001 (unweighted data).

Again, women were more likely than men to rate each item as personally very important, in particular eating at least two servings of dairy products daily, choosing a diet low in saturated fat, and choosing a diet with plenty of fruits and vegetables (table 8). Respondents with more than a high school education tended to rate the guidelines as more important. Younger respondents (age 18-34) were less likely to consider a diet with adequate fiber and low in cholesterol as very important (table 9).

FDA has found evidence that rating these dietary guidelines as personally important—in particular the guidelines related to specific nutrients (dietary risk factors)—is associated with dietary management behaviors such as using food labels and monitoring caloric and nutrient intake (Levy and Derby, 1995).

Attitudinal Barriers to Dietary Change

Negative attitudes about some of the perceived consequences of changing dietary behavior may be barriers to dietary change. One major attitudinal barrier mentioned previously is the belief by many consumers that healthy foods do not taste good. Similarly, the ADA *1995 Nutrition Trends Survey* found that 38 percent of consumers believed that to improve their diets they would have to give up favorite foods.

Another issue is cost. In a survey conducted by FMI and *Prevention* magazine (1995), 51 percent of consumers agreed with the statement, “It costs more to eat healthy foods.” For low-income consumers, this may be a serious barrier to change. This belief may be derived from the cost of some products marketed as nutritionally improved. Frazao and Allshouse (1996) found that food products modified in fat, sodium, or other food components generally cost more than their standard counterparts. If consumers believe that dietary change requires buying these specialty foods, they will perceive change to be more expensive. However, one can also follow a healthful diet less expensively by using standard food products that are naturally moderate in fat and sodium (McAllister and others, 1994). Nutrition education messages, especially those directed toward low-income consumers, need to emphasize that healthful diets can be purchased and prepared at a variety of cost levels and to provide examples of healthful diets of varying costs.

Time constraints were cited as an obstacle to change by 21 percent of consumers (ADA, 1995). Mothersbaugh and others (1993) found that time constraints had a negative effect on an individual’s performance of recommended dietary practices. However, when an individual had more nutrition knowledge, the negative effect of time constraint was near zero. Nutrition knowledge may mitigate the effects of time constraint by teaching planning and preparation skills or by giving consumers more information on their options for planning a healthful diet. Given the increasing feelings of time constraint expressed by consumers, it would be interesting and useful to explore further how nutrition education can help consumers to overcome time constraint as an obstacle to dietary change.

A final obstacle to dietary change cited by many consumers is confusion about dietary advice. Responding to the ADA *Nutrition Trends Survey* (1995), 21 percent of consumers agreed that there are so many conflicting studies they don’t know what to believe, and 8 percent said they did not know or understand dietary guidelines. The development of the Dietary Guidelines for Americans as a clear, consistent message to consumers about what they should eat to be healthy was meant to alleviate consumer confusion as a barrier to dietary change. Continued promotion of the Dietary Guidelines as a source of consistent, reliable advice may help overcome this barrier (Sutton and others, 1995).

Self-Reported Behavioral Effects Of Information

Because so many factors affect food-related behavior, it can be difficult to assess the effects of nutrition information on actual food selection and consumption. However, some insight can be gained from examining consumers' own perceptions of their use of nutrition information. In the FMI *Trends 1997* survey, shoppers were asked what types of information had led them to make changes in food purchases. Sixty-one percent reported having changed food purchases because of information on the nutrition label, whereas 27 percent had changed purchases because of the *Food Guide Pyramid* and 23 percent had changed purchases because of the "Five-a-Day" campaign. It is not surprising that nutrition labeling would have the greatest effect on food purchasing, since it offers consumers information that can be used to compare specific food products when making a purchase. However, the general guidance offered by the *Food Guide Pyramid* and the promotional messages conveyed by the 5-A-Day Program also seem to be having effects on food purchase and may affect other food-related behaviors as well (e.g., meal planning, cooking practices, etc.).

Conclusion

Several aspects of consumers' nutrition knowledge appear to have increased in recent years, although many gaps remain. One notable change in recent years is consumers' increased knowledge of recommendations to increase fruit and vegetable intake. Based on data from USDA's DHKS, knowledge of USDA Food Guide recommendations for fruit and vegetable intake increased markedly between 1990-91 and 1994, at least among household meal planners. In addition, by 1995, eating more fruits and vegetables had replaced eating more fiber or less fat as the dietary behavior consumers were most likely to mention as reducing risk of cancer. The period between 1990-91 and 1995 coincided with the release of the *Food Guide Pyramid* and ongoing activities of the National Cancer Institute's 5-A-Day campaign. These educational and promotional activities may have been influential in increasing consumers' knowledge of fruit and vegetable recommendations.

By contrast, awareness of saturated-fat intake as a risk factor for heart disease did not increase, despite being emphasized in educational messages from the National Cholesterol Education Program. This illustrates the difficulty of communicating more complex nutrition information, even with large public health education efforts. If nutrition educators want consumers to act on more detailed nutrition information, such as the fatty acid composition of foods, they may need to develop new strategies for simplifying their information communication or behavioral recommendations.

Along with the *Food Guide Pyramid*, another major nutrition information tool released in recent years is the revised nutrition label, which now appears on virtually all packaged foods (see also chapter 11). Consumers report high rates of label use, and FMI data indicate that the nutrition label appears to influence food purchase decisions. However, research indicates that most consumers are unaware of quantitative recommendations for the nutrients on the food label. Nutrition education that focuses on interpreting label information correctly and making use of simplifying tools such as the percent Daily Value may help translate consumer enthusiasm for the new label into improved food selection.

In general, to develop effective nutrition education and promotion messages, nutritionists need to consider what types of knowledge are most needed and how much knowledge average individuals can reasonably be expected to assimilate. This is complicated by the fact that changing from a typical American diet to one that meets the recommendations of the *Dietary Guidelines for Americans* does not require one simple behavioral change but, rather, numerous changes. The type and extent of knowledge needed to accomplish a dietary change may vary, depending on the nature of the change being made. For example, it may be relatively easy to add to one's diet a desired food component, like fiber for which a few foods are particularly good sources, if one is aware of the relationship of that food to health and knows some general principles of food selection (e.g., fruits, vegetables, and grains are good sources of fiber). However, it may be harder to subtract from one's diet a food component like fat that is present to a varying extent in a wide range of foods. In the first case, awareness and some knowledge of basic principles, such as familiarity with the *Food Guide Pyramid*, may be sufficient for dietary change. In the second case, more specific, how-to information—such as knowledge of low-fat cooking methods or of how to read and interpret nutrition labeling—may be needed.

Given the complexity of dietary change, it is also important to consider how much people can reasonably be expected to learn. Nutrition is a complex subject that many consumers find confusing. For example, foods are mixtures of many compounds and may contain both nutrients consumers are encouraged to consume in larger amounts (e.g., calcium) and those they have been urged to moderate (e.g., sodium or fat). This may frustrate consumers who, reasonably, feel they should not need an indepth knowledge of food composition to successfully negotiate a grocery shopping trip. As new food products proliferate and the food supply becomes more varied and complex, simplifying tools such as the *Food Guide Pyramid* and the nutrition label may be extremely important in reducing the amount of consumer knowledge needed to a more manageable level. FMI data indicate that consumers seem to be finding these tools useful and applying them to their food selection behavior, but further examination of their impacts on food choice and diet quality is needed.

Despite the emphasis of this chapter on nutrition knowledge, it is important to keep in mind that nutrition knowledge is not a panacea. Many other factors affect food choice. Those seeking to effect changes in diet may meet resistance because of consumers' taste preferences and time and cost constraints. To create dietary change, strategies for overcoming these obstacles also must be developed. These strategies can take multiple forms. Changes in food production and processing may lead to the development of more healthful, good-tasting food choices. In addition, behavioral strategies to overcome taste prejudices against healthful foods may help to change behavior. For example, the developers of a campaign to promote low-fat milk consumption in a Latino community used free "taste tests" to overcome negative perceptions of the taste and quality of low-fat milk (Wechsler and Wernick, 1992).

Another frequently cited factor in behavior change is the environmental setting. For example, eating away from home has been found by several researchers to be associated with differences in diet quality (Haines and others, 1992; Guthrie, 1996; Lin and Guthrie, 1996) (see also chapter 12). Possible reasons may be the more limited choice in away-from-home eating environments or the fact that consumers have less information about the nutrient content of foods served in restaurants and other eating establishments. Also, consumers may view eating away from home as an exception to their normal dietary habits, regardless of how frequently it occurs, and an opportunity to "splurge." Therefore, effective dietary change strategies may need to include both environmental modification and efforts to change consumer attitudes toward eating out. Some examples of environmental modifications would be changes in institutional meal patterns, as with USDA's current School Meals Initiative to reduce fat and saturated fat in school meals, or provision of increased information on away-from-home food choices.

In conclusion, an important step in promoting dietary change is to identify the nutrition-related knowledge and skills most needed by consumers and to develop simplifying tools such as the *Food Guide Pyramid* or the nutrition label to communicate them. But it is also important to identify the other factors necessary for success, such as positive attitudes toward healthful eating and a supportive environment for dietary change, and to develop effective promotion strategies for putting those factors into place.

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Appendix: Data Sources

Health and Diet Survey (HDS)

The FDA conducts this periodic omnibus survey of American consumers to track consumer attitudes, knowledge, and reported behaviors related to diet and health issues—including cholesterol awareness and practices, dietary management practices, dietary fat and cholesterol knowledge, awareness of diet-disease risk factors, food label use, dietary supplement use, and awareness of dietary guidance. The National Heart, Lung, and Blood Institute (NHLBI) cosponsored four of the surveys to evaluate the effectiveness of the national Cholesterol Education Campaign (Schucker and others, 1991, 1987). The Food Safety and Inspection Service (FSIS) at USDA and the Office of Disease Prevention and Health Promotion at the Public Health Service joined FDA in sponsoring the 1994 survey, designed to provide baseline data on food label use prior to implementation of new labeling regulations (Derby and Levy, 1994).

The HDS was initiated in 1982 and repeated in 1984, 1986, 1988, 1990, 1994 (as the Food Label Use and Nutrition Education Survey), and 1995. The surveys include recurring questions on key topics to provide trend data (e.g., diet-disease awareness) and one-time questions that address specialized topics or emerging issues (e.g., perceptions of the new food label). The HDS is based on telephone interviews with nationally representative samples of American adults age 18 and older in the continental United States.

Diet and Health Knowledge Survey (DHKS)

This survey, conducted by USDA, collects information on diet-related knowledge, attitudes, and practices of Americans. It was begun in 1989, as a telephone followup to USDA's 1989-91 Continuing Survey of Food Intakes by Individuals. At that time, DHKS respondents were individuals who identified themselves as the main meal planners for their households. When a second cycle of the DHKS was begun in 1994, the sampling procedure was changed to include adults 20 and older, regardless of meal planner status. Those who are the household's meal planner are still identified as such, allowing comparison between the two time periods. However, there were also some changes in questions between the 1989-91 and the 1995 DHKS. Therefore, it is not always possible to make comparisons between the two time periods, even for meal planners. In both time periods, the DHKS oversampled low-income respondents. Survey weighting factors have been applied to all results presented here, however, to present findings that are more applicable to the American population as a whole.

FMI *Trends* Survey

The Food Marketing Institute (FMI), a nonprofit association primarily made up of food retailers and wholesalers, began surveying food shoppers to assess trends in food shopping and related behaviors in 1973. In 1983, a segment on nutrition-related attitudes and practices was added to the survey. The survey is conducted on an annual basis; the sampling methodology results in a nationally representative cross-section of shoppers.

ADA 1995 *Nutrition Trends Survey*

The American Dietetic Association (ADA), an association of nutrition professionals, conducted this survey in May 1995 and assessed consumer beliefs about nutrition, attitudes toward dietary change, and awareness of nutrition information sources, such as the Food Guide Pyramid.

Food Label Format Studies

Prior to the Nutrition Labeling and Education Act (NLEA),[1] many packaged foods did not have labels, and existing food labels did not consistently provide the nutrition information of greatest public health concern (Institute of Medicine, 1990). Since limited data were available on options for the food label format, research was needed to compare the relative effectiveness of alternative label formats in terms of how easily consumers could use them for everyday purposes and make correct inferences about the nutritional characteristics of the food.

The FDA nutrition label format studies tested format elements (e.g., adjective descriptors, nutrient amounts in metric units or percentages) for a variety of label use tasks (e.g., product comparison, use of the daily value concepts) to identify a format that met the objectives of the NLEA—that the food label provide information consumers can readily comprehend and understand in the context of a total daily diet.

A shopping mall intercept methodology was used to test alternative presentation formats for conveying nutrient and health information to consumers. This methodology was chosen because it allows consumers to observe alternative presentations and provides geographically and demographically diverse samples of shoppers. Participants were interviewed individually. The 1991 Label Format Study (Format Study 2) tested seven label formats (three from the 1990 Label Format Study and four new formats) with an expanded set of five tasks (Levy and others, 1996).

[1] Public Law 101-535, November 9, 1990, 104 Stat. 2353-2367.

Chapter 14

Role of Demographics, Knowledge, and Attitudes

Fats and Cholesterol

Jayachandran N. Variyam

Among the numerous factors affecting dietary choices, nutrition knowledge and beliefs about foods and health—or "diet-health information"—is the most amenable to change. Presumably, heightened awareness of diet-health relationships, favorable attitudes about healthy eating, and better knowledge of the nutrient content of foods lead to healthier food choices. But, does nutrition information translate into better diets? For the case of dietary fats and cholesterol, the answer is an unqualified yes. Statistical analysis confirms that, holding a variety of consumer characteristics constant, better awareness of fat- and cholesterol-related health problems and better attitudes about avoiding too much fat and cholesterol are associated with significant reductions in the intakes of these nutrients. This result points to the powerful role that nutrition education can play through a strategy of promoting diet-disease awareness.

Introduction

The U.S. Department of Agriculture (USDA) is one of the leading agencies providing information to help consumers improve their food choices and, ultimately, the nutritional quality of their diets. USDA has published the *Dietary Guidelines for Americans* (jointly with the Department of Health and Human Services) and the popular *Food*

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Guide Pyramid, as well as other training materials for foodservice personnel to improve the nutritional content of school lunches and breakfasts.

While many factors—stress levels, genetic predisposition, activity levels, and smoking—influence an individual's risk of chronic disease, diet is certainly an important factor. Medical evidence suggests that poor diets are often linked to the onset of chronic diseases, contributing to increased morbidity, reduced quality of life, and premature mortality. Diets high in fat, saturated fats, cholesterol, and sodium, and low in fruits, vegetables, and whole grains are linked to increased risk of coronary heart disease, certain types of cancers, stroke, diabetes, overweight, and hypertension. In fact, the top three causes of death in the United States—heart disease, cancer, and stroke—are associated with diets that are too high in calories, total fat, saturated fat, and cholesterol, or too low in fiber-containing foods.

Among the numerous factors affecting dietary choices, nutrition knowledge and beliefs about foods and health—or "diet-health information" in short—is the most amenable to change (Thomas, 1991). Presumably, heightened awareness of diet-health relationships, favorable attitudes about healthy eating, and better knowledge of the nutrient content of foods lead to healthier food choices. Consequently, providing diet-health information has been the major thrust of public sector dietary improvement efforts.

While the role of diet-health information in promoting dietary improvements is clear in theory, little is known about the consumer's practical use of the information. To what extent does diet-health information influence dietary choices vis-a-vis socioeconomic factors such as age, sex, race, ethnicity, income, and education? Are some population subgroups more disadvantaged than others by a lack of diet-health information? Are some forms of diet-health information more persuasive than others in encouraging people to eat more healthful foods? Answers to these questions are critical for designing nutrition education programs, for food marketing and promotion, and for forecasting food consumption trends.

Economists have long recognized the role of information in consumer health decisions (Grossman, 1972). A persistent positive correlation between education and health suggests that a person with more education is better able to maintain his or her own health than a person with less education (Grossman and Kaestner, 1997). Education may create a better awareness of the costs and benefits of various health habits, may increase an individual's ability to obtain health information, and may better enable a person to process or act upon that information.

Despite its acknowledged role, diet-health information has not been widely incorporated in economic studies of food and nutrient choice (Behrman and Deolalikar, 1988). In the few studies where the role of information has been recognized, direct measures of information have seldom been used due to the lack of appropriate data. Instead, variables such as education, income, and household structure, which may account for information differences among individuals, have been used as proxies to capture information effects (e.g., Ippolito and Mathios, 1990; Kushi and others, 1988; Putler and Frazao, 1994). A limitation of this approach is that such variables may have a direct effect on food choices beyond their indirect effect on food choices through information.

With the availability of USDA's 1989-91 Continuing Survey of Food Intakes by Individuals (CSFII) and its associated Diet and Health Knowledge Survey (DHKS), it is now possible to examine the links between diet-health information and the intake of various dietary components using direct information measures. This study uses the 1989-91 CSFII-DHKS data and focuses on three dietary components that have received widespread publicity for their adverse health impact: fat, saturated fat, and cholesterol. The chapter examines whether higher levels of diet-health information help individuals reduce their intake of these macronutrients. If yes, are some population subgroups more successful than others in acquiring and using diet-health information? These questions are answered by estimating the relationship between the fat, saturated fat, and cholesterol information levels of the CSFII-DHKS household meal planners and their intake of these nutrients, controlling for an exhaustive set of personal characteristics that affect both information and intake.

We can measure meal planners' intakes of fat, saturated fat, and cholesterol from the 1989-91 CSFII data by summing the level of these nutrients in each of the foods reported as consumed over 3 consecutive days. Meal planners (sample = 3,845), on average, consumed 63 grams of total fat and 22 grams of saturated fat, accounting for 35 percent and 12 percent of their total energy intake (table 1). (The

Table 1—Dietary fat and cholesterol intake by socioeconomic group, 1989-91

Group	Fat		Saturated fat		Cholesterol
	Grams	*% calories*	*Grams*	*% calories*	*Mg*
All	63.0	34.6	22.0	12.0	238.2
Age:					
Under 30	67.6	34.3	24.5	12.4	256.1
30-49	66.4	35.4	23.3	12.4	251.1
50-69	58.9	34.2	20.0	11.6	220.5
70 and over	53.8	33.3	18.6	11.4	207.6
Sex:					
Male	82.3	35.0	29.3	12.4	330.4
Female	58.3	34.5	20.3	12.0	215.7
Race:					
White	63.5	34.7	22.3	12.1	233.5
Black	60.5	34.3	20.7	11.7	275.0
Other	58.5	33.1	20.2	11.5	236.3
Ethnicity:					
Hispanic	56.6	33.7	19.7	11.8	239.3
Non-Hispanic	63.4	34.6	22.2	12.1	238.2
Yearly per capita income:					
$3,800 or less	61.8	35.2	21.9	12.4	258.1
$3,801-$5,400	58.1	34.6	20.2	12.0	221.6
$5,401-$10,200	59.7	34.5	20.9	12.1	224.9
Over $10,200	65.3	34.6	22.8	12.0	243.0
Education:					
Less than high school	58.7	34.6	20.3	12.0	242.3
Completed high school	62.5	35.4	22.0	12.4	236.8
More than high school	65.2	34.0	22.7	11.8	237.6
Vegetarian:					
Yes	59.6	32.6	20.7	11.4	218.9
No	63.1	34.7	22.1	12.1	238.8
Smoker:					
Yes	64.7	35.4	23.0	12.6	252.3
No	62.4	34.3	21.7	11.9	233.6
Participation in WIC or FSP:[1]					
Yes	62.5	35.7	22.3	12.8	266.4
No	63.0	34.5	22.0	12.0	235.9

[1] Women, Infants, and Children (WIC) program; Food Stamp Program (FSP).
Source: USDA/ERS.

Dietary Guidelines recommend that no more than 30 percent of energy come from fat, and that less than 10 percent come from saturated fat.) The average cholesterol intake, at 238 milligrams, is below the 300 milligrams recommended by many health authorities.

Factors helping to explain variations in dietary intakes as well as variations in diet-health information levels fall into three broad categories: household, individual, and dietary characteristics. Household characteristics include income, food program participation, household size, and location of residence. Sex, race, education, and age are individual characteristics. Dietary or health-related characteristics include smoking and vegetarianism. Statistical methods allow us isolate the impact of nutrition knowledge and awareness of diet-disease relationships from individual characteristics on the intake of foods or nutrients.

Table 1 also lists the average intakes for our sample of meal planners by selected household, individual, and dietary categories. The differences in intake of fat and saturated fat among categories within a characteristic are large when measured in absolute amounts (grams), but much smaller when measured in terms of percentage of calories. For example, meal planners under 30 years of age consume, on average, 68 grams of fat compared with 54 grams for meal planners 70 and over. However, the share of calories from fat intake is much closer (34 and 33 percent).

Measuring Diet-Health Information

The DHKS data provide measures of a meal planner's (1) attitudes about avoiding too much fat and cholesterol, and (2) awareness of health problems linked to excess fat and cholesterol. We refer to these measures as diet-health information.

Three survey questions asked how important it is to the respondent to avoid too much fat, saturated fat, and cholesterol. The responses were categorized into "very important" or "not very important"; those reporting "very important" were considered to have better attitudes about following a healthy diet (table 2). More people reported that avoiding too much cholesterol was very important (49 percent) than avoiding too much fat (44 percent) or saturated fat (45 percent). In all cases, the share of those reporting "very important" increases

Table 2—Attitudes about fats and cholesterol, 1989-91

How important is it to you personally to avoid too much:

	Fat	Saturated fat	Cholesterol
	Percent responding "Very Important"		
All	44.1	44.8	49.3
Age:			
Under 30	36.4	35.2	41.2
30-49	39.1	40.7	42.1
50-69	52.7	53.7	64.4
70 and over	53.7	53.1	54.4
Sex:			
Male	33.7	36.0	41.7
Female	46.7	47.0	51.2
Race:			
White	43.3	44.8	49.1
Black	47.4	46.2	54.4
Other	53.2	42.1	38.6
Ethnicity:			
Hispanic	42.9	48.5	45.1
Non-Hispanic	44.2	44.6	49.6
Yearly per capita income:			
$3,800 or less	44.9	41.8	47.0
$3,801-$5,400	49.3	44.2	48.6
$5,401-$10,200	44.2	48.2	51.8
Over $10,200	43.2	44.0	48.8
Education:			
Less than high school	45.7	46.4	50.7
Completed high school	43.7	45.4	51.6
More than high school	43.8	43.7	47.0
Vegetarian:			
Yes	50.4	57.1	59.2
No	43.9	44.5	49.0
Smoker:			
Yes	40.3	40.9	45.6
No	45.4	46.1	50.6
WIC or FSP:[1]			
Yes	45.8	43.4	47.0
No	44.0	44.9	49.5

[1] Women, Infants, and Children (WIC) program; Food Stamp Program (FSP).

Source: USDA/ERS.

sharply for people age 50 or older. Higher percentages of women, nonsmokers, and vegetarians also reported it was very important to avoid too much fat, saturated fat, and cholesterol compared with men, smokers, and nonvegetarians. Differences in attitudes are much smaller among income and education groups.

Awareness of diet-disease relationship is measured by questions asking meal planners if they have heard about health problems related to how much fat, saturated fat, or cholesterol a person eats, and, if so, what those health problems are. Only respondents who listed cancer or heart disease were considered to be "aware" in this analysis (table 3). Again, more were aware of health problems related to cholesterol (72 percent) than to fat (67 percent) and saturated fat (57 percent). Unlike the previous pattern, awareness increases with income and education.

To better understand variations in diet-health information and intakes, statistical models were used to isolate the influence of one household, individual, or dietary/health characteristic (such as income, race, and vegetarianism) from another.

Diet-Health Information: Who Has It, Who Doesn't

Results of statistical analyses confirm that the characteristics of a person with better attitudes toward more healthful foods are not the same as those of a person with better awareness of diet-disease relationships.[1] The person most likely to be armed with better attitudes is a woman, older, and vegetarian. For example, holding all other characteristics constant, women are 8.7 percent more likely than men to think it is very important to avoid too much fat, 7.4 percent more likely to think it is very important to avoid too much saturated fat, and 5.4 percent more likely to think it is very important to avoid too much cholesterol. Likewise, holding all other characteristics constant, an additional year of age is associated with about 0.2 percent greater likelihood of thinking it is very important to avoid too much saturated fat in the diet. This is likely to stem from the differing dietary needs and concerns of the elderly.

[1] For brevity, we are not reproducing these statistical results here. The full set of results can be found in Variyam, Blaylock, and Smallwood (1997).

Table 3—Diet-disease awareness, 1989-91

Have you heard about any problems related to:

	Fat	Saturated fat	Cholesterol
	Percent responding "Yes" and identifying correct health problem		
All	66.5	57.4	72.4
Age:			
Under 30	55.7	49.1	72.7
30-49	70.9	61.9	74.8
50-69	70.1	61.0	73.9
70 and over	57.6	45.7	60.9
Sex:			
Male	62.5	57.6	69.3
Female	67.5	57.4	73.1
Race:			
White	68.1	60.2	74.7
Black	55.0	36.3	56.9
Other	63.9	58.6	66.0
Ethnicity:			
Hispanic	51.8	40.5	49.8
Non-Hispanic	67.4	58.5	73.8
Yearly per capita income:			
$3,800 or less	49.4	40.2	57.3
$3,801-$5,400	53.2	44.5	61.8
$5,401-$10,200	63.4	52.8	68.6
Over $10,200	72.6	64.3	78.1
Education:			
Less than high school	51.7	40.2	56.2
Completed high school	62.2	54.2	71.6
More than high school	75.8	67.1	79.6
Vegetarian:			
Yes	76.2	60.2	78.8
No	66.2	57.4	72.2
Smoker:			
Yes	63.9	49.8	73.1
No	67.3	60.0	70.1
WIC or FSP:[1]			
Yes	44.1	40.1	53.1
No	68.3	58.9	74.0

[1] Women, Infants, and Children (WIC) program; Food Stamp Program (FSP).

Source: USDA/ERS.

While gender, age, and vegetarian status have significant influence on attitudes, these variables have no effect on an individual's diet-disease awareness, at least for fat and saturated fat. Older people tend to be less aware of cholesterol-health links than younger people. Diet-disease awareness is much influenced by a person's level of education, household income, race, and ethnicity. These results suggest that those aware of diet-disease relationships are not necessarily those with better dietary attitudes and vice versa.

As income increases, so does the probability that a person has heard about health problems related to fat, saturated fat, and cholesterol. For a $1,000 rise in income, the probability rises by 0.34 percent for fat, 0.29 percent for saturated fat, and 0.25 percent for cholesterol. The effects of education are larger. For an additional year of schooling, the probability that a person has heard about health problems rises by 2.3 percent for fat, 3 percent for saturated fat, and 2.3 percent for cholesterol.

Blacks are less likely than whites to be aware of diet-disease relationships. The same holds true for Hispanics versus non-Hispanics. While 68 percent of white meal planners had heard about health problems related to fat, only 55 percent of black meal planners had (table 3). The gap is wider for awareness of health problems related to cholesterol: 57 percent of blacks versus 75 percent of whites. Only 50 percent of Hispanics were aware of health problems related to cholesterol, compared with 74 percent of non-Hispanics.

The above differences between racial and ethnic groups persist even after taking socioeconomic characteristics into account. Multivariate statistical analyses showed that, between two meal planners similar in all respects except race, the black meal planner is about 13.8 percent less likely to have heard about health problems related to cholesterol than the white meal planner. Similarly, a Hispanic meal planner is 18 percent less likely to have heard of health problems related to cholesterol than a non-Hispanic meal planner. These findings probably relate to cultural differences in the use of print and electronic media sources for information.

Meal planners from households that participate in the Women, Infants, and Children program (WIC) or the Food Stamp Program (FSP) appear to have lower diet-disease awareness levels than households that do not participate (table 3). For example, only 44 percent of meal planners from WIC/FSP households were aware of fat-disease relationship, compared with 68 percent of meal planners from other households. However, statistical analysis showed that this difference disappears when other characteristics are held constant.

Better Awareness Equals Lower Dietary Fats and Cholesterol

Statistical analysis confirms that, holding a variety of consumer characteristics constant, better awareness of fat- and cholesterol-related health problems and better attitudes about avoiding too much fat and cholesterol are associated with significant reductions in the intakes of these nutrients. Between the two diet-health information variables, diet-disease awareness has the larger impact on consumption of dietary fats and cholesterol. This may be because avoiding health problems has the most immediate and transparent economic benefit to the consumer. This suggests that nutrition education programs aimed at increasing public awareness of fat- and cholesterol-health links will likely have large payoffs in terms of lowering dietary fat and cholesterol intake levels.

While the benefits of diet-health information apply to all population subgroups in the study, differences become clear when we consider the direct and indirect channels through which various consumer characteristics affect fat and cholesterol intake. For example, income has a positive direct effect on fat intake because richer people may consider grain and cereal products to be inferior to meat products. At the same time, income also has a negative indirect effect on fat intake because richer people have more resources to obtain greater nutrition information, which in turn affects intake.

For income and education, the direct and indirect effects on intakes are mixed (table 4). Both income and schooling have positive direct effects on intakes. This implies that, holding other characteristics and the diet-health information level constant, those with higher income or education tend to consume diets richer in fats and cholesterol than do those with lesser income or education. At the same time, those with higher income or education tend to have substantially greater diet-disease awareness, which translates into substantially lower intakes of total fat, saturated fat, and cholesterol. For example, the direct effect of income on total fat intake—5.3 additional grams

Table 4—Predicted change in fat, saturated fat, and cholesterol intake, by soci

Variable	Total fat (effect)				Saturated fat (effect)			
	Direct	Indirect		Total	Direct	Indirect		Total
		Attitude	Awareness			Attitude	Awareness	
	Grams				*Grams*			
Income[1]	5.316*	0.126	-3.667*	1.775*	1.630*	-0.042	-0.968*	0.621*
Education[2]	1.554*	-0.032	-1.091*	0.431*	0.566*	-0.038*	-0.430*	0.097
Age[3]	-0.199*	-0.016	-0.020	-0.235*	-0.088*	-0.013*	0.003	-0.097*
Female	-15.380*	-1.189*	-1.697	-18.265*	-5.760*	-0.522*	-0.415	-6.697*
Black	-4.923*	0.214	2.927*	-1.782	-3.306*	0.028	1.971*	-1.307*
Hispanic	-6.499*	0.507	1.538	-4.455*	-3.082*	0.111	0.906*	-2.065*
Vegetarian	-4.585	-1.723*	-0.113	-6.420*	-1.935*	-0.447	-0.196	-2.578*
Smoker	-1.521	0.221	-0.420	-1.720*	-0.572	-0.701	0.318	-0.324
WIC or FSP[4]	1.570	-0.598	1.912	2.883*	1.315*	-0.041	-0.067	1.208*

Note: An asterisk indicates that the corresponding coefficient estimate was statistically significant at leas

[1] Figures are for a doubling of income.

[2] [3] Figures are for an additional year of education and age, respectively.

[4] Women, Infants, and Children (WIC) program; Food Stamp Program (FSP).

Source: Variyam, Blaylock, and Smallwood (1997).

per day—is lowered by 3.7 grams due to the indirect effect of income through diet-disease awareness. Similarly, the direct effect of education on saturated fat intake—0.6 gram—is lowered by 0.4 gram due to the indirect effect of education through diet-disease awareness. For cholesterol, the negative indirect effect of schooling on diet-disease awareness is large enough to make the total effect negative, nearly 1 milligram lower.

Intakes of all three nutrients decrease with age. Holding diet-health information and other socioeconomic variables constant, an additional year of age decreases intakes by 0.2 gram of fat, 0.1 gram of saturated fat, and 0.8 milligram of cholesterol. The indirect effects of age through diet-health information on all three nutrients are modest.

Women's intakes are lower than men's. All else held constant, the direct effects reduce women's intake of fat, saturated fat, and cholesterol by 15 grams, 6 grams, and 85 milligrams compared with men's intake of these nutrients—probably because women tend to eat less than men. Female meal planners, however, also benefit from the greater importance they attach to avoiding too much fat and saturated fat. This indirect effect reduces their fat and saturated fat intake by an additional gram and half-gram compared with male meal planners. For cholesterol, the indirect effects are small relative to the direct effect.

For a given information level, black meal planners have significantly lower intakes of fat and saturated fat than white meal planners. Black meal planners, however, also have lower awareness of health problems related to these nutrients. This lower awareness level increases their fat and saturated fat intake and reduces the total effect. The pattern is similar for Hispanic meal planners, although their diet-disease awareness level is higher than that of blacks. The total effect of Hispanic ethnicity is to lower fat intake by 4 grams and saturated fat intake by 2 grams compared with non-Hispanic meal planners. The indirect effect of the lower diet-disease awareness levels of black and Hispanic meal planners is much more substantial for cholesterol than for fats. The lower diet-disease awareness of blacks compared with whites contributes nearly three-fourths (20 mg) of their higher intake (27 mg) of cholesterol. For Hispanics, the direct effect that lowers their cholesterol intake compared with other ethnic groups is offset by the indirect awareness effect that increases their cholesterol intake, netting 9 mg higher cholesterol intake (not statistically significant). The clear implication of these results is that blacks and

Hispanics stand to benefit considerably from better information about diet-health relationships.

Vegetarians have substantially lower intake of all three nutrients than nonvegetarians. The direct effect rather than indirect effect is predominant, indicating that a vegetarian diet in itself—rather than higher information levels—contributes to lower intakes. The only statistically significant effect of smoking is on total fat intake. Once the effect of other sociodemographic characteristics and nutrition information are taken into account, smokers tend to have about 2 grams of lower total fat intake than nonsmokers.

Meal planners whose households participate in the Food Stamp or WIC programs have significantly higher intakes of all three nutrients. Since information effects are insignificant—particularly for saturated fat and cholesterol—much of the effect is direct, through dietary differences unrelated to information. This suggests that nutrition education programs targeted at program participants need to examine participants' diets before focusing on their diet-health knowledge.

Implications for Nutrition Education

Information is the fuel that will drive the engine of dietary change. Nutrition information demonstrably lowers intake of dietary fats and cholesterol. This result, combined with a similar result for dietary fiber (Variyam, Blaylock, and Smallwood, 1996), points to the powerful role that nutrition education can play through diet-disease awareness.

An effective nutrition information message that can be relayed to consumers is that there are well documented links between some diseases and high intakes of dietary fats and cholesterol. People aware of these links tend to consume less fats and cholesterol than those less informed. A positive attitude toward avoiding too much fat and cholesterol also helps decrease consumption of fat and cholesterol.

Like any campaign to change people's consumption—be it of soft drinks, cars, or dietary fats—the likelihood of success increases dramatically if the proper message is conveyed to the proper audience. In the case of fats and cholesterol, the message might be more effective if geared toward individuals and groups that tend to have low levels of diet-disease awareness or blasé attitudes toward avoiding too much fat and cholesterol. Groups with these characteristics include less educated individuals, lower-income people, the young, men, blacks, and Hispanics.

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Chapter 15

Who Knew? Perception and Reality of Cholesterol in Our Diets

John Bishow, Jayachandran N. Variyam, and James Blaylock

Determining how accurately consumers are able to assess their cholesterol consumption could offer insights into how well existing nutritional guidance is being understood. Analysis of the 1989-91 Continuing Survey of Food Intakes by Individuals and its accompanying Diet and Health Knowledge Survey shows that 26 percent of respondents had excessive cholesterol intakes. Twelve percent of the respondents were "realists" who recognized their cholesterol intakes were high, and 14 percent were "optimists", who incorrectly believed their high cholesterol intakes were "about right." This has implications for nutrition education. For example, there is no reason to expect the optimists to attempt to change their eating habits, since they are unaware of their high cholesterol intake. On the other hand, the realists, who are aware of their high cholesterol intakes, could prove more reluctant to change their eating habits.

Introduction

A healthy diet should be low in cholesterol—good advice, but perhaps not always easy to follow. Monitoring nutrient consumption requires that people know the nutritional content of a wide variety of foods served in myriad combinations. Keeping tabs on your cholesterol consumption can get complicated, even for meals prepared in

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your own kitchen. The task becomes more difficult still when it comes to that fast-food lunch, dinner at a fine restaurant, or the pizza delivered to your front door.

People who are genuinely concerned about maintaining a healthy diet might easily eat more than the recommended limit of cholesterol without realizing it. Such consumers present a special challenge for the development of nutritional education policy. While this group could benefit from additional nutritional education, they may not be receptive to it if they already believe their diets are healthy.

Determining how accurately consumers are able to assess their cholesterol consumption could offer insights into how successfully existing nutritional guidance is being understood. Further, determining whether the accuracy of self-assessed intakes follows noticeable trends with respect to respondents' nutritional awareness or sociodemographic characteristics could prove useful to the development of nutrition education programs.

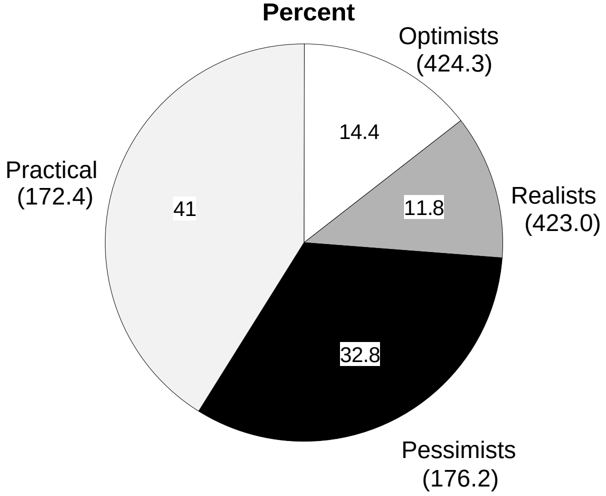
Realists, Optimists, Pessimists, and the Practical

The information used to compare respondents' actual and self-assessed intakes of cholesterol was obtained from the U.S. Department of Agriculture's 1989-91 Continuing Survey of Food Intakes of Individuals (CSFII) and the companion Diet and Health Knowledge Survey (DHKS). The CSFII gathered information about actual food consumption for members of a representative sample of U.S. households over a period of up to 3 consecutive days. The meal planners of CSFII households were asked to participate in the DHKS, which includes a series of questions about their dietary perceptions, knowledge, and attitudes. Only meal planners who supplied 3 days' worth of food intake information and completed the DHKS are included in this analysis. Additional restrictions regarding the completeness of responses resulted in a final sample size of 3,732. However, because all respondents were meal planners, the results may not be applicable to all adults.

Actual cholesterol intakes were measured by adding the cholesterol content of the foods reported consumed over 3 consecutive days and averaging over the 3 days. Respondents whose consumption of cho-

Figure 1

Over 14 percent of respondents are optimists who mistakenly assess their cholesterol intake to be "about right"



Note: Mean intake in milligrams in parentheses.

Source: USDA/ERS.

lesterol exceeded 300 milligrams (mg) per day—the amount recommended by several health authorities and listed as the Daily Value by the Nutrition Facts Label on processed foods—were rated as having high actual intakes, while those at or below the recommended level were rated as having low actual intakes.

About one-quarter of the meal planners averaged a daily intake of more than 300 mg of cholesterol. Because most meal planners are female, the sample considered here is predominantly female (79 percent). A sample more representative of the male population would probably show a greater prevalence of excessive intakes because men tend to eat more than women.

Self-assessed intakes were inferred from response to the following DHKS question:

> "Let's talk about *your own* diet. In your opinion, should your diet be lower or higher (in the amount of) cholesterol or is it just about right compared with what is most healthful?"

If a person responded "lower," we take his or her self-assessed intake level to be high—that is, above the healthful level. If "about right," we take his or her self-assessed intake level to be low—that is, at or below the healthful level. Respondents (3 percent) who answered "should be higher" were excluded from the analysis.

For comparing self-perceived intakes to actual intakes, we established four categories of accuracy for respondents' assessments. Those who correctly assessed high actual intakes as "should be lower" were the *realists*, while those who correctly assessed acceptable levels of actual intake as "about right" were the *practical*. Respondents who assessed high actual intakes as "about right" were the *optimists*, while those who assessed acceptable levels of actual intake as "should be lower" were classified as *pessimists*.

Twelve percent of the respondents were realists, and 14 percent were optimists, for 26 percent of respondents had excessive cholesterol intakes (fig. 1). The mean intake for individuals consuming too much cholesterol was about 424 mg per day. The mean intake for the remaining 74 percent of respondents—41 percent practical, 33 percent pessimists—was 172 and 176 mg/day respectively. (For variations in mean intakes of realists and optimists by sociodemographic characteristics, see table 1.)

Assessment and Sociodemographic Characteristics[1]

In each of the accuracy categories, more than 80 percent of the respondents were aware of health problems associated with dietary cholesterol (fig. 2). The rating of nutrition as a "very important" consideration in food choice was most prevalent among respondents in the practical category. Conversely, the lowest prevalence of respondents rating nutrition as "very important" was among realists. Rating the avoidance of excessive cholesterol consumption as "very important" was most prevalent among pessimists and practical respondents.

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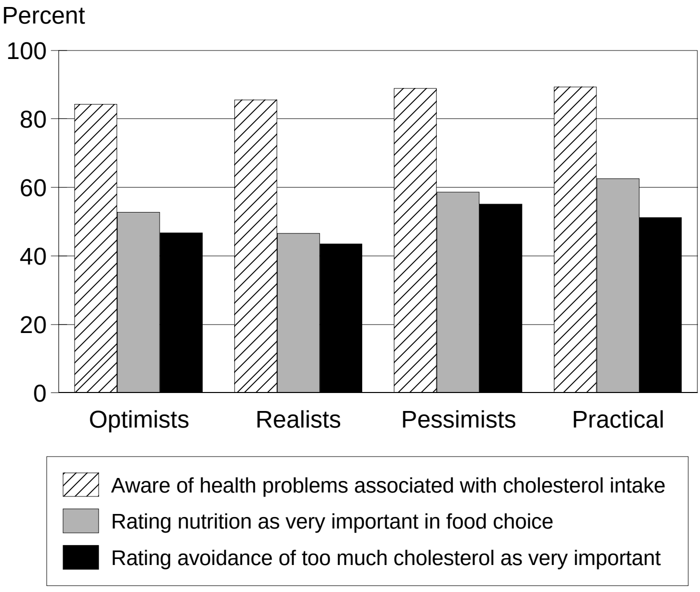
[1] Differences in accuracy of assessment across sociodemographic characteristics are presented here for illustrative purposes, and have not been tested for statistical signficance.

Figure 2
Awareness of health problems associated with cholesterol intake was high in all self-assessment categories



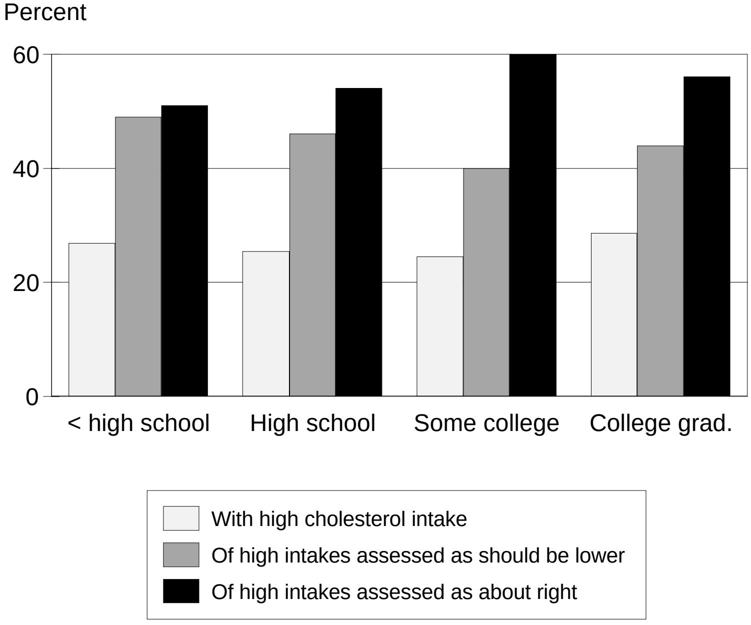
Source: USDA/ERS.

In general, we would expect people who are more educated to be more adept at maintaining a healthy diet, or at least more able to accurately assess their own nutrient intakes. However, there was no consistent trend with regard to high cholesterol intakes or the accuracy of assessment and years of education. Excessive cholesterol intakes were most prevalent among college graduates and those with less than a high school education (29 percent and 27 percent respectively) (fig. 3). In each education category, a slightly higher percentage of excessive intakes were assessed as "about right" than as "should be lower." The mistaken assessment of high intakes as "about right" was slightly more prevalent in the "some college" and "college graduate" categories than among respondents with a high school education or less.

Similarly, we might expect accuracy of assessment to improve with income, at least to the extent that wealthier people can better afford access to diet and health information. However, inaccurate assess-

Figure 3

Education did not affect self-assessment accuracy as expected



Source: USDA/ERS.

ments of high intakes were most prevalent among those in the two highest income categories (fig. 4).

The share of respondents consuming excessive amounts of cholesterol decreased consistently with age, from 33.2 percent for those under 30 to 15.3 percent for those over 70. However, older respondents with high intakes appeared more likely to mistakenly assess their intakes as “about right” (fig. 5).

Twenty percent of the women in the sample had cholesterol intakes that exceeded the recommended level. In contrast, almost half of the men consumed too much cholesterol—the highest percentage in any demographic category (fig. 6). Fifty-seven percent of men with high intakes mistakenly assessed their high intake as “about right,” compared with 53 percent of women with high intakes. Men who mistakenly assessed their high cholesterol consumption as “about right” had a mean intake of 773.8 mg per day—the highest of any demographic group in any accuracy category (table 1).

Table 1—Share of *optimists* and *realists* by sociodemographic group

Group	Share of sample in the group[1]	Share of optimists	Mean intake	Share of realists	Mean intake
	Percent	*Percent*	*Mg*	*Percent*	*Mg*
Income:[2]					
Less than 130 percent	16.6	13.0	446.8	12.7	447.5
130-185 percent	11.2	7.8	395.7	12.9	471.7
186-350 percent	28.0	15.5	410.1	11.4	410.0
More than 350 percent	44.2	16.0	429.7	11.4	406.9
Education:					
Less than high school	29.2	13.7	423.6	13.2	448.4
High school graduate	36.2	13.6	426.3	11.8	428.0
Some college	19.3	14.7	422.9	9.8	408.8
College graduate	15.4	15.9	423.7	12.7	407.3
Gender:					
Male	20.8	28.4	773.8	21.2	464.8
Female	79.2	10.7	390.0	9.3	397.8
Race:					
White	85.6	14.2	418.9	10.9	409.6
Black	10.7	16.7	470.1	20.2	476.4
Other	3.7	12.3	390.6	8.2	450.7
Ethnicity:					
Hispanic	5.9	13.9	395.6	13.5	426.1
Non-Hispanic	94.1	14.5	426.0	11.7	420.1
Age:					
Under 30	16.0	18.0	434.4	15.2	418.3
30-49	45.0	16.3	425.0	14.1	427.0
50-69	26.0	11.6	409.7	8.5	405.7
70 and over	12.0	9.1	433.3	6.2	452.6
Smoking:					
Smoker	24.4	13.5	442.3	16.0	423.5
Nonsmoker	75.6	14.7	419.0	10.4	422.7

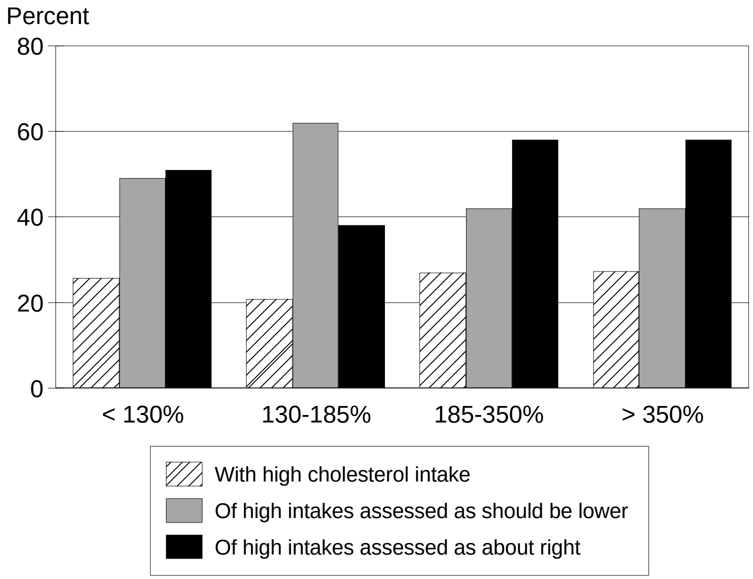
[1] Sample size is 3,732.

[2] Income expressed as a percentage of the poverty threshold.

Source: USDA/ERS.

Figure 4

The two highest income groups were more likely to inaccurately assess their cholesterol intake



Note: Income is expressed as a percent of the poverty line.

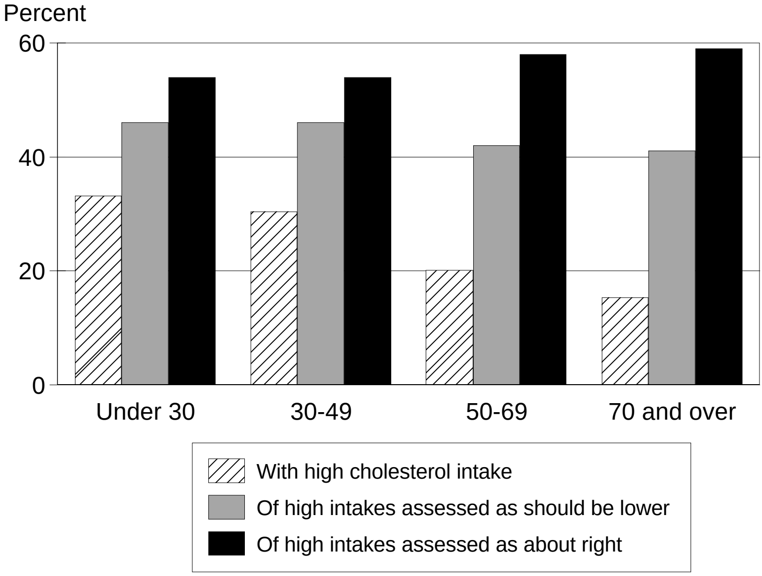
Source: USDA/ERS.

Excessive cholesterol consumption appears to be more prevalent among Blacks than Whites. Thirty-seven percent of Black respondents had high cholesterol intakes, compared with 25 percent of White respondents (fig. 6). Blacks appeared more likely than White respondents to correctly assess their intake as "should be lower."

Hispanics and non-Hispanics differed little in terms of high cholesterol intakes. However, Hispanics appear to be more accurate in their assessment of high intakes (fig. 6).

Excessive cholesterol consumption was more prevalent among smokers than nonsmokers. Interestingly, even given their higher intakes, smokers appeared to be more aware of their adverse nutritional status compared with nonsmokers (fig. 6). Fifty-four percent of the smokers with high intakes correctly assessed their cholesterol consumption as too high, compared with 41 percent of nonsmokers with high intakes.

Figure 5
Accuracy of cholesterol self-assessment is inversely related to age



Source: USDA/ERS.

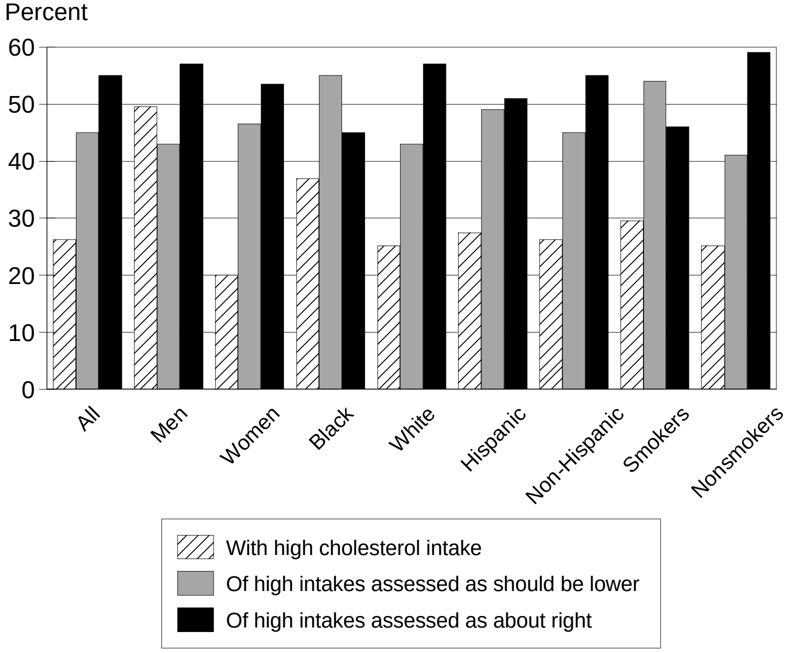
Conclusion

One-fifth of the women and men considered in this study were found to be consuming excessive amounts of cholesterol. For both men and women, more than 50 percent of respondents with high intakes do not realize they are consuming too much cholesterol. Furthermore, the highest mean intake of cholesterol was found among men who were unaware that their cholesterol consumption was high.

Most cigarette smokers—at least to some degree—know that quitting would improve their long-term health prospects. Whether they ever actually quit or not, this knowledge keeps the possibility active in their minds. Conversely, people who mistakenly assess their high intakes of cholesterol as low—our *optimists*—are unaware that their nutritional choices may be detrimental to their health, and there is no reason to expect them to attempt to change their eating habits. Additional health and diet information might help respondents in this

Figure 6

Excessive cholesterol intakes and inaccurate assessments are more prevalent among men than women



Source: USDA/ERS.

group better control the amount of cholesterol in their diets if made aware of their mistaken self-assessments.

People who are aware of their high cholesterol intakes—our realists—could prove more reluctant to change their eating habits. Many considerations—not just the nutritional value of food—affect dietary choices. Many of these respondents may have decided to accept the health risks associated with their diets because they enjoy the taste or convenience of foods that are high in cholesterol. Influencing the dietary behavior of this group might require a convincing demonstration that healthier eating can be as affordable, convenient, and satisfying as their present diets.

In the real world, where resources are limited, it seems likely that targeting efforts toward the *optimistic* respondents would offer the highest return per dollar devoted to nutrition education. The realists are already aware of their excessive cholesterol intakes, but are perhaps less than eager to do anything about it. Changing these respondents' perceptions of "healthy eating" could prove a costly proposition. In contrast, *optimists* may be very willing to eat more healthfully, and could perhaps readily do so if they are simply made aware of their dietary errors.

Confusion on the part of consumers in sorting out huge volumes of nutritional and health information has been well documented in both the popular press and in professional literature. A recent development that may enable consumers to more accurately judge the nutritional content of foods was the introduction of the "Nutrition Facts" label in 1994, listing the content of calories, fat, saturated fat, and cholesterol (in addition to other nutrients) in each serving of most packaged food items.

However, studies indicate that the effectiveness of the new label in promoting healthier diets varies greatly with the motivations of individual consumers. Hence, while the new label may help the *optimists* to monitor their cholesterol consumption more closely, it may be of less use in improving the dietary habits of *realists*, since these respondents already appear to have a reasonably accurate understanding of the cholesterol content of the foods they eat. Alternatively, increased availability of healthier versions of familiar foods could help reduce the cholesterol intakes of *optimists* and *realists* alike. The development of a wider variety of tasty low- cholesterol and cholesterol-free products may help to persuade a broader range of consumers to make healthy eating a part of their daily routine.

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Chapter 16

Dietary Impacts of Food Assistance Programs

J. William Levedahl and Victor Oliveira

With 1 in 6 Americans receiving some type of food assistance, there is great interest in understanding how their diets might be affected. This chapter reviews the available evidence on the dietary impact of the Nation's food assistance programs on the diet of recipient households.

Introduction

In fiscal 1998, about 1 in 6 Americans received food assistance from at least 1 of the Nation's 15 food assistance programs (see box on domestic food-assistance programs). The U.S. Department of Agriculture (USDA) administers most of these programs, designed to provide needy persons with access to a more nutritious diet, to improve the eating habits of the Nation's children, and to help America's farmers by providing an outlet for distributing foods purchased under farmer assistance authorities.

The Nation's domestic food assistance programs provide an important source of food for many low-income people. However, even with these programs, some low-income households may still not get enough to eat. The 1995 Food Security Survey found that nearly 12 percent of all U.S. households experienced food insecurity at some point during the year, including 4.1 percent of all households that experienced some level of hunger (Hamilton and others, 1997). Even when low-income households get enough to eat, they may not consume the types of foods and levels of nutrients required for good health. A recent review of the dietary and nutritional status of the

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U.S. population concluded that the risk of nutrition-related health problems and prevalence of health conditions related to poor nutritional status are generally greater among people with low incomes than among people with higher incomes (Federation of American Societies for Experimental Biology, 1995).

In this chapter, we summarize evidence on the dietary impact of the Nation's food assistance programs on the diets of recipient households.

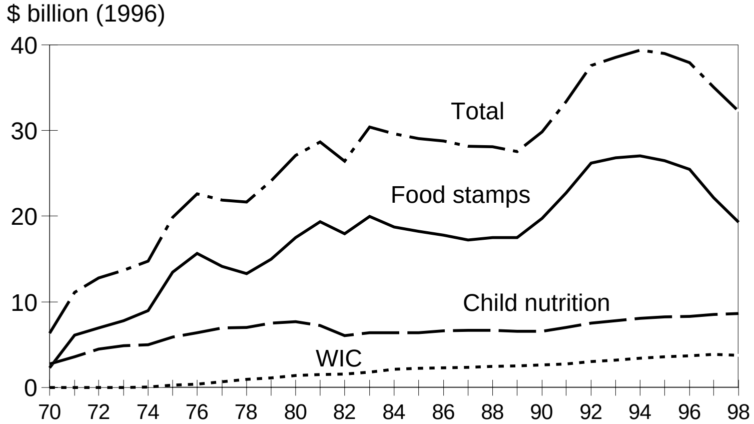
Trends in Food Assistance

Food assistance programs were first established during the Great Depression in the 1930's. Although one of the objectives of the programs was to help alleviate hunger, their primary purpose at the time was to reduce the stocks of surplus agricultural commodities purchased by the Federal Government in stabilizing farm prices and incomes. The level of food assistance depended on the amount of available surplus commodities, increasing when surpluses were large and falling when surpluses decreased.

In the 1960's, documented instances of both underconsumption and undernutrition in the United States increased public awareness and concern about the food problems of the poor (Kotz, 1969). These instances focused national attention on the need for food assistance programs to address poverty-related hunger and malnutrition. Consequently, Federal outlays for food assistance programs increased, in real terms, by over 500 percent from fiscal 1970 to 1994 (fig. 1). While the growth of the Food Stamp Program (FSP) accounted for most of this increase, new programs—such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)—also signaled an increased commitment to food assistance during this period.[1] Expansion of the food assistance programs has slowed in recent years: real outlays actually decreased about 18 percent from fiscal 1994 to fiscal 1998. The Nation's strengthening economy has reduced the demand for food assistance, particularly the FSP, which has seen a reduction in the number of

[1] The modern Food Stamp Program began as a pilot project in 1961, was authorized as a permanent program to those States wishing to take part in 1964, and went nationwide in 1974. WIC started initially as a 2-year pilot project in 1972, and went nationwide in 1974.

Figure 1
Food assistance spending, 1970-98



Adjusted by CPI for all items, using 1966 as the base.
Source: USDA/ERS.

participants recently and in the real benefits per participant. In addition, the recent welfare reform legislation reduced the benefits provided by the food assistance programs and restricted their use to certain individuals. These changes, however, are smaller than those affecting the cash welfare programs, magnifying the importance of the food assistance programs as part of the social safety net.

The increase in Federal outlays for food assistance programs begun in the 1960's occurred at the same time as a reduction in differences between the diets of low income and other households. Surveys of the eating habits of the American people provided by USDA's Nationwide Food Consumption Surveys (NFCS) found that between 1965-66 and 1977-78, a period that marked the national expansion of the FSP and the introduction of WIC, the gap between the diets of low-income and other families narrowed. During this period, the share of low-income households with diets that met 100 percent of the Recommended Dietary Allowances (RDA's) for seven key nutrients essential to good health grew from less than 40 percent to about 50 percent, more than double the growth rate of the general population. This period has also been associated with a reduction in the incidence of stunting in preschool children, and an improvement in the prevalence of low birth weights and anemia in low-income preschool children (USDA-FCS-ERS, 1995; Yip and others, 1987; Yip, 1989). However, the question remains as to how much of this improvement can be attributed to the food assistance programs.

Food Assistance Programs Take a Variety of Forms

The food assistance programs administrated by USDA take a variety of forms, providing different types of food benefits to various target recipients. However, three programs account for 85 percent of the total $33.6 billion spent on food assistance in 1998: the Food Stamp Program ($18.8 billion), the National School Lunch Program ($5.8 billion), and the WIC Program ($3.8 billion).

The Food Stamp Program (FSP) is the principal food assistance program, and it is designed to provide the basic nutritional needs of all eligible low-income households. Unlike the other food assistance programs that target specific groups, the Food Stamp Program is available to most households (subject to certain work and citizenship requirements) that meet income and asset criteria. This program provides recipients with a monthly allotment of coupons that can be redeemed for food at authorized retail food stores. The allotment is based on USDA's Thrifty Food Plan, a low-cost model diet that meets standards for a nutritious diet. Few restrictions are placed on what foods recipients can purchase.[2] However, USDA tries to influence food choices by reimbursing half the cost of approved FSP nutrition education and promotion activities by the States. Currently, 46 States have approved nutrition education plans.

Other USDA programs provide more specific food benefits to more narrowly defined sets of recipients. For example, WIC is designed to provide benefits to low-income pregnant and postpartum women and to infants and children up to 5 years of age who are found to be at nutritional risk. This program provides vouchers redeemed at retail stores for specific foods that are nutritionally important to these

[2] Food stamps can be used to buy any food or food product for human consumption, and seeds and plants for use in home gardens to produce food. Food stamps cannot be used to buy alcohol, tobacco, vitamins, medicines, pet foods, hot foods ready to eat, foods intended to be heated in the store, lunch counter items, or foods to be eaten in the store.

recipients, including foods high in protein, calcium, iron, and vitamins A and C.[3] Recipients are free to choose items within the set of designated foods. In addition, WIC provides recipients with nutrition education, health care referrals, and immunization screening. The desire to provide WIC recipients with fresh unprepared foods such as frtuis and vegetables led to the development of the WIC Farmers' Market Nutrition Program in 1992, which provides additional coupons that can only be used at farmers' markets.

The Child Nutrition Programs, which include the School Lunch, School Breakfast, Child and Adult Care Food, and Summer Food Service Programs, target children enrolled in public and nonprofit private schools, child-care institutions, and summer recreation programs. In recent years, an increased emphasis has been placed on the nutritional content of food assistance benefits provided through these programs. Concern has centered, in particular, on the high fat content of commodities, such as cheese and butter, distributed by The Emergency Food Assistance Program (TEFAP) and as bonus commodities to the school lunch and breakfast programs. Although surplus quantities of these commodities are no longer available at their previous levels, nutritional concerns led USDA, in 1995, to implement the School Meals Initiative for Healthy Children. This initiative was designed to improve school meals by supplying schools with educational and technical resources to motivate children to eat healthy meals in addition to providing new tools and techniques to help foodservice staff prepare nutritious, appealing meals. In an effort to improve the nutritional quality of school meals, USDA also wrote new regulations to ensure that school meals supply specific amounts of certain nutrients and comply with the Dietary Guidelines for Americans (USDA, 1990) (see chapter 18).

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[3] The authorized foods are iron-fortified infant formula, infant cereal, milk, cheese, eggs, iron-fortified breakfast cereal, fruit or vegetable juice that contains vitamin C, dry beans and peas, and peanut butter. Women who exclusively breastfeed also receive vouchers for canned tuna and carrots.

Effects of Food Assistance Programs On Participants' Diet

Participation in a food assistance program can affect diet in two ways. First, it can increase the quantity of food consumed. Second, it can lead to the intake of foods with higher nutritional quality.

Empirically, participants in food assistance programs have been found to consume a greater quantity of food than nonparticipants with an equal amount of "total" income (income plus the value of food assistance benefits). However, typically, a dollar of food assistance benefits does not increase food consumption or expenditure by the full dollar of benefits. This happens because recipients substitute a portion of the food assistance benefits for food that would have been bought or consumed anyway. Estimates reported by Fraker (1990) indicate that, on average, an additional dollar of food stamp benefits increases food expenditures by 26 cents. Seventy-four cents of each dollar of benefits replaces expenditure on food previously bought with income and is used by recipients to increase nonfood expenditures. Another example of this type of substitution is the distribution of surplus cheese undertaken by TEFAP in the early 1980's. In this case, each dollar of donated cheese was estimated to increase cheese consumption by about 65 cents, with the remaining 35 cents displacing previous purchases of cheese (USDA, FNS, 1987). Substitution by program benefits has also been observed in WIC (Rush, 1986) and in the school lunch/breakfast programs (Devaney and others, 1993).

In general, the net increase in food consumption or expenditure associated with a food assistance program depends in part on how or in what form benefits are provided. The more restricted the benefits, the greater the net increase. Commodity donation programs and WIC, which target the consumption of specific foods, generally increase food consumption more than a similar amount of food stamps, which can be spent on most types of food. However, the cost of administering a program increases as the food benefits become more narrowly defined (USDA, ERS, 1995).

Although food assistance programs have been shown to increase the quantity of food consumed by recipients, the effect of food assistance programs on improving the quality of the participants' diets has proven more difficult to ascertain. The next section summarizes the evidence of the success of the main USDA food assistance program at increasing both the quantity and the quality of recipients' diets.

Food Stamp Program (FSP)

The large size of the FSP means that any impact on the dietary patterns of recipients will be important. We divide evidence of the FSP's effect on the diet of recipients into its effect on (1) how much and what types of food participants buy, and (2) the quality of nutritional intake by individual participants. Individual intake is considered in terms of average intake of micronutrients as a percentage of RDA's and the percentage of calories from total fat.

Total Food Expenditures and Budget Shares

Many empirical studies have demonstrated that food assistance benefits provided in the form of food stamps result in greater food expenditures than an equal amount of income (see Fraker, 1990, for a review of these studies).

Basiotis and others (1998) also report finding that food stamp benefits increase the probability of consuming at least the recommended levels of 3 of the 5 food groups defined by the Food Guide Pyramid. Households that receive food stamps also, on average, spend more on food at home than similar nonparticipating low-income households, but less on food away from home. Meals away from home incorporate the cost of services, so they tend to be more expensive per unit of nutrients than home meals. Thus, FSP participants obtain greater nutrients per dollar of food expenditures. Morgan and others (1985b) report, in fact, that FSP recipients had higher levels of food energy, protein, calcium, iron, and magnesium per food dollar than low-income nonrecipients in 1977/78. However, only the difference in calcium was statistically significant.

Unlike other food assistance programs, such as the commodity distribution programs (and, to some degree, WIC), food stamp recipients have a great deal of discretion in deciding what foods to buy. Do FSP households and other similar nonparticipating low-income households buy the same types of food?

Nelson (1979), using data collected from a direct examination of cash register receipts instead of using the recall method employed in the

Table 1—Expenditure shares for at-home food items by low-income households in 1977/78 and 1987/88, by FSP participation

	1977/78		1987/88	
Food item	FSP	Non-FSP	FSP	Non-FSP
	Percent of food expenditures			
Meat, poultry and fish	37.2	35.3	33.3	31.5
Eggs, nuts and legumes	3.2	3.6	3.1	3.0
Fruits	7.1	8.1	8.3	8.9
Vegetables	10.9	11.5	10.3	11.3
Grain products	15.2	14.3	14.1	13.8
Milk products	10.7	11.3	13.3	12.8
Fats and sugars	6.1	6.5	6.2	5.8
Others[1]	9.7	9.6	11.5	12.8

[1] Includes food consumed in mixtures, nonalcoholic beverages, soups, sauces, gravies, and condiments.

Source: 1977/78 and 1987/88 NFCS.

NFCS, reports similar average expenditure shares by FSP households and eligible nonparticipating households. A comparison of average expenditure shares by low-income households that are and are not FSP participants in both 1977/78 and 1987/88 also suggests that, despite some differences, the two groups buy similar market baskets of food (table 1).[4]

Has the FSP changed the composition of the market basket bought by recipients? Comparing average expenditure shares in 1977/78, just after the FSP became a national entitlement program, to their levels 10 years later provides a potential measure of the cumulative impact of the FSP on the eating habits of the low-income population. Based on the results reported by Morgan and others (1985a), only the larger expenditure share for meat, poultry, and fish and the smaller expenditure share for fruit by FSP recipients compared with low-income nonrecipients in 1977/78 are statistically significant (table 1). Whereas FSP recipients still allocated a larger expenditure share to meat, poul-

[4] Low-income households are households that have income less than or equal to 130 percent of the poverty threshold. Some low-income households not receiving food stamps may be ineligible to receive food stamps because they do not meet the asset eligibility criterion. Other low-income households not receiving food stamps may be eligible but choose not to participate. In general, low-income households not receiving food stamps have higher average income and asset levels than households that receive food stamps. USDA last collected household food expenditure data in 1987/88.

try, and fish and a smaller share to fruit than did low-income nonparticipants in 1987/88, the differences in expenditure shares are slightly smaller in 1987/88, and it is not known whether these differences are statistically significant. The reduction in the share of meat, poultry, and fish by both recipients and nonrecipients follows the general trend toward lower consumption of red meats and increased consumption of cheese in the United States during this period (Lutz and others, 1992). The increased share spent on fruit, however, is counter to the general trend in the population during this period.[5]

Caution must be exercised when using any cross-sectional data set, such as in the NFCS, to compare the food choices of FSP recipients and nonrecipients. Because these surveys are only snapshots of the population at a moment in time, it is not possible to discern, for example, whether a proportion of the behavior of households currently not participating in the FSP might have been influenced by past participation. In fact, similar budget shares may simply reflect the fact that the FSP has been successful in attracting those that need food assistance most. Therefore, the available data do not preclude a significant impact of the FSP simply because the diets of FSP participants and nonparticipants are similar at various points in time.

Nutrient Intake

Besides measuring household food expenditures, USDA also collects data on the nutrient intake of individuals. Table 2 reports the average nutrient intake of FSP participants and low-income nonparticipants in 1977/78 and 1989/91, as a percentage of RDA's. An average intake below the RDA does not necessarily mean that people are malnourished. The RDA's are set high enough to meet the requirements of most healthy people, and therefore exceed the requirements of many individuals. However, the risk of some individuals having inadequate intakes increases as the average intake falls further below the RDA. Similarly, average intake levels above the RDA increase the likelihood that most individuals are consuming sufficient amounts of that particular nutrient.

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[5] A formal evaluation of differences in the market baskets would have to address the impact of some differences in the methodologies between the two surveys and concerns about the level of nonresponse in the 1987-88 survey (LSRO, 1991).

Table 2—Average 1-day intake as a percentage of RDA by FSP participation, 1977/78 and 1989/91[1]

Nutrient	1977/78[2]		1989/91[3]	
	FSP	Non-FSP	FSP	Non-FSP
	Percent of 1980 RDA		*Percent of 1989 RDA*	
Protein	169	158	185	155
Vitamin A (IU)	126	124	123	133
Vitamin C	141	134	157	153
Thiamin	117	111	136	124
Riboflavin	129	128	143	131
Niacin	119	112	130	123
Vitamin B-6	76	68	98	89
Vitamin B-12	144	148	284	250
Calcium	79	83	84	83
Phosphorus	122	127	124	125
Magnesium	79	79	111	93
Iron	88	95	107	112
Vitamin E	na	na	85	80
Vitamin A (µg RE)	na	na	110	110
Folate	na	na	193	161
Zinc	na	na	80	75

[1] Because RDA's have changed, it is not possible to compare the percentages between the two time periods.

[2] USDA-HNIS (1982), Preliminary Report No. 11, tables 3.3-2/3, measured as a percentage of 1980 RDA's.

[3] Tippett and others (1995), table 10.3, measured as a percentage of 1989 RDA's.

na = not available.

Since the RDA'S for certain nutrients changed during these time periods, a direct comparison of the percentage of the RDA's between the two time periods is not appropriate. However, within each time period, average intake patterns of FSP participants and nonparticipants are quite similar. Except for magnesium in 1989/91, those nutrients that are underconsumed by FSP participants are also underconsumed by nonparticipants. Again, caution must be exercised when interpreting differences in the diets of FSP recipients and nonrecipients measured using cross-sectional data.

Statistical methods have been used to identify the effect of the FSP as distinct from other factors—such as age or household composition—on the intake of micronutrients. The impact of both FSP participation

Table 3—Average 1-day intake of total fat as a percentage of energy for total population and by FSP participation

Household	1965/66	1977/78	1985/86[1]	1989/91
	Percent of calories from fat			
Low-income households[2]	41.7[3]	38.5[4]	35.7[5]	34.4[6]
FSP	na	38.0	35.7	35.0
Non-FSP	na	38.9	35.8	34.0
U.S. total	43.2[3]	41.2[7]	37.2[8]	35.1[9]

na = not available.

1 For females age 19-50.

2 In 1965/66, low-income households were those with annual income less than $3,000. For the remaining years, a household was defined to be low income if its income was less than or equal to 130 percent of the corresponding poverty index.

3 Calculated from USDA-ARS (1969), Report No. 62-18, table 1a/1b.

4 USDA-HNIS (1982), Preliminary Report No. 11, tables 3.2-1/3.

5 USDA-HNIS (1986), Report No. 85-2, table 5B, and USDA-HNIS, Report No. 86-2, table 5B.

6 Tippett and others (1995), table 11.3.

7 Calculated from USDA-HNIS (1984), Report No. I-2, appendix J, table 1.

8 Calculated from USDA-HNIS (1987), Report No. 86-1, table 2.1.

9 Tippett and others (1995), table 11.1.

and the size of the food stamp allotment have been measured. Results indicate that whereas the FSP can have both a positive and a negative impact on the intake of specific micronutrients, very few of the estimates are statistically significant (Fraker, 1990; Butler and Raymond, 1996; Rose and others, 1998). Butler and Raymond (1996) suggest that the level of education, or knowledge of nutrition, may be a more important factor than the receipt of food stamps in explaining nutrient intake decisions.

Intake of Total Fat

Concern about the high consumption of fat in the United States has led to Federal dietary recommendations that total fat provide no more than 30 percent of calories. Simple descriptive measures indicate that the percentage of calories from total fat for low-income households has, on average, been lower than that of the general population (table 3). However, in recent years, this difference has grown smaller as the population has reduced its consumption of fat (see chapters 3 and 11). Since the 1970's, the intake of calories from total fat for both FSP participants and nonparticipants has fallen. However, like the average intake pattern of the micronutrients, consumption of total fat by FSP participants and nonparticipants is quite similar.

National School Lunch Program (NSLP)

The NSLP is available to 98 percent of public school children and to over 90 percent of all school-age children. Comprehensive studies by Akin and others (1983) and by Wellisch and others (1983) report the positive nutritional impacts of this program.

Akin and others (1983), using intake data from the 1977/78 NFCS, found that participation in the NSLP was associated with greater daily consumption (over 24 hours) of food energy, protein, and 10 vitamins and minerals (calcium, iron, niacin, thiamine, riboflavin, vitamins A, B-6, and B-12, magnesium, and phosphorus). Only for vitamin C did they find no significant effect of the NSLP. They also concluded that the NSLP had a significantly positive effect on both low- and high-income children, but that the impact was greater for low-income children.

The data used by Akin and others (1983) did not identify the actual meals in which foods were eaten, and, therefore, they were not able to establish a causal link between the NSLP and greater nutritional intake. Wellisch and others (1983), on the other hand, using data from the National Evaluation of School Nutrition Programs (NESNP), were able to examine lunches eaten by students. They found that school lunch participants consumed lunches containing significantly higher amounts of food energy, vitamins A and B-6, calcium, magnesium, phosphorus, riboflavin, protein, niacin, and thiamin—but significantly less vitamin C—than the lunches consumed by nonparticipants. Fraker (1988), using the same data as Wellisch and others but a different methodology, confirmed these results for macronutrients except for energy.

Wellisch and others (1983) concluded that the positive nutritional impacts of the NSLP were not due solely to more food being consumed but also from a higher nutrient density. Unlike Akin and others (1983), Wellisch and others (1983) concluded that the NSLP had no differential effect on students from different income classes.

The School Nutrition Dietary Assessment (SNDA) study was conducted in 1992. The survey updated the experience of the school lunch and breakfast programs, and facilitated the evaluation of these programs in light of advances in our understanding of the relationship between diet and health. Using data from this study, Devaney and others (1993) confirmed the positive nutritional impact of the NSLP. Lunches consumed by NSLP participants contained more food energy, more protein, and, with the exception of vitamin C, more vitamins and minerals than lunches eaten by nonparticipants. However, Devaney and others (1993) also found that NSLP participants consumed more fat, saturated fat, cholesterol, and sodium, and less carbohydrates at lunch than nonparticipants. The higher consumption of vitamin C at lunch by nonparticipants was almost entirely due to their higher consumption of vitamin C-fortified sweetened beverages such as juice drinks or fruitades. Results were similar for both high- and low-income students.

The SNDA study also found that, for most vitamins and minerals, the nutrient effects of the school lunch did not carry over 24 hours. Only the higher consumption of vitamin A by NSLP participants, and their lower consumption of vitamin C, were found to significantly differ over 24 hours. However, participation in the NSLP was associated with significantly higher consumption of fat and saturated fat (as a percentage of food energy), and a significantly lower consumption of carbohydrates (as a percentage of food energy) throughout the day.

School Breakfast Program (SBP)

Results from the SNDA study found that the availability of the SBP did not increase the likelihood that a student will eat breakfast (Devaney and others, 1993). On a typical school day in 1992, approximately 12 percent of students did not eat breakfast. This percentage was the same for students in schools that participated in the SBP and for those in schools that did not. This result, however, appears to be sensitive to how breakfast is defined and to family income (Devaney and Stuart, 1998).

Devaney and others (1993) report that participation in the SBP is associated with higher intakes of food energy, calcium, riboflavin, phosphorus, and magnesium at breakfast. Wellisch and others (1983) compared students who participated in both the school lunch and breakfast programs with those who consumed USDA lunch but non-

USDA breakfast. Students who participated in both programs consumed more calcium and magnesium but less vitamins A and B-6 and iron.

Devaney and others (1993) also found participation in the SBP is associated with a higher percentage of breakfast food energy from fat, saturated fat, and protein, and a lower percentage of food energy from carbohydrates. Unlike school lunch participants, however, most differences between the breakfast intakes of SBP participants and nonparticipants persisted over 24 hours. However, the differences at breakfast in the percentage of food energy obtained from fat and carbohydrates becomes statistically insignificant over the full day.

The Special Supplemental Nutrition Program For Women, Infants, and Children (WIC)

WIC provides supplemental foods high in nutrients determined by nutritional research to be generally lacking in the diets of the targeted population. Empirical studies have generally concluded that this program has been successful in providing these nutrients to its target population.

The most comprehensive evaluation of the WIC program is provided by *The National WIC Evaluation*, commissioned by USDA's Food and Nutrition Service in the early 1980's (Rush, 1986). This evaluation makes a number of observations about the impact of WIC on the diets of recipients targeted by this program: (1) pregnant women participating in WIC, in comparison with a control group, were found to have greater intake of all 11 measured micronutrients with the exception of vitamin A;[5] (2) infants enrolled in WIC had greater mean intake of iron and vitamin C than the control group, and the proportion of infants consuming diets low in iron, vitamin A, and vitamin C was smaller among WIC participants; and (3) children in WIC had greater mean intake of iron, vitamin C, vitamin B-6, thiamin, and niacin than the control group, and the proportion of children consuming diets low in iron, vitamin A, riboflavin, and vitamin B-6 was smaller among WIC participants. However, this evaluation noted that

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[5] These micronutrients consist of calcium, iron, magnesium, phosphorus, thiamin, riboflavin, niacin, and vitamins A, B-6, B-12, and C.

"the improvements are limited to those currently enrolled, with little or no residuum from past participation in the program" (p. II-9).

The improvement in nutrient intake associated with participation in the WIC program was also reported by Rose and others (1998) and Chavas and Keplinger (1983). Rose and others focus on the intake of preschoolers between age 1 and 5. They report that WIC participation increased the intake of preschoolers for 10 out of 13 micronutrients.[6] In addition, Basiotis and others (1998) report that WIC participation is associated with improved scores on USDA's Healthy Eating Index (HEI).[7] Chavas and Keplinger also concluded that the effectiveness of WIC appeared to decrease with increases in income and to be greater for Whites than for Blacks.

The National WIC Evaluation reported that total food expenditures were not (statistically) different between WIC and non-WIC households, but that WIC households had significantly greater expenditures on WIC-type foods than did non-WIC households. The impact of the program is felt, therefore, mostly in terms of its impact on food composition rather than on total food expenditures (Arcia and others, 1990).

The evaluation also notes how WIC affects the eating patterns of recipient households. For example, WIC households spent less per month on meals away from home than did non-WIC households. This suggests that WIC program participation contributes to a larger proportion of home-cooked meals in the household diet. Since meals away from home have an implicit cost of service, they tend to be more expensive per unit of nutrients than home-cooked meals, implying that the WIC program is able to foster a more efficient use of the household's food budget, that is, more nutrients per dollar (Arcia and others, 1990).

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6 These micronutrients included protein, thiamin, riboflavin, niocin, vitamin B-6, vitamin E, folate, magnesium, iron, and zinc.

7 The HEI consists of 10 equally weighted components, each based on different aspects of a healthy diet—grains, vegetables, fruit, dairy, meat, total fat, saturated fat, cholesterol, sodium, and diet variety—that reflect how well diets conform to the 1995 *Dietary Guidelines for Americans* and the USDA Food Guide Pyramid.

Conclusion

Evidence from 30 years indicates that food assistance programs can affect the amount and the types of foods consumed by the low-income population. The clearest evidence is that these programs increase the quantity of food consumed. However, their effect on the quality of the recipient's diet has so far been uncertain. Certainly, greater food expenditure does not necessarily imply a more healthful diet.

For the more narrowly targeted programs, such as WIC or the School Lunch Program, nutrient intake is typically increased (at least while recipients remain in the program). However, for the FSP—the largest program in both expenditure and number of recipients—there is no convincing body of evidence that this program improves the overall quality of the recipients' diet, although there is some indication that it has increased the intake of some nutrients.

Current data preclude establishing a link between the FSP and diet quality. Surveys have collected detailed information on the food consumption behavior of households that are actual and potential recipients of this program, but only at one point in time. These surveys have been replicated at various intervals, but never for the same set of households. Without observations from which to compare previous food choices, it is difficult to identify program effects as distinct from previous habits.

A more robust statistical design may be required to establish a positive relationship between FSP participation and diet quality, one that measures past food purchases and program experience by both actual and potential recipients. This type of design has been used in evaluating WIC and the School Lunch and Breakfast programs. Data that track low-income individuals over time can illustrate changes in the diet associated with FSP participation. Perhaps, these data will show that differences in diet quality would have been larger if the FSP had not existed.

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Appendix:
Domestic Food Assistance Programs

The Federal Government administers a number of domestic food assistance programs that together form a nutritional safety net for needy people and help ensure that everybody, regardless of income, has access to an adequate and nutritious diet.

• The **Food Stamp Program**, with outlays of $18.8 billion in fiscal 1998, is the single largest Federal food assistance program. Unlike the other food assistance programs that target specific groups, such as children or the elderly, the FSP is designed to address the basic nutritional needs of all eligible low-income families or individuals. Eligibility and benefits are based on household size, household assets, gross and net income, and certain work and citizenship requirements. Most recipients are provided with monthly allotments of coupons that can be used like cash at more than 200,000 authorized retail foodstores. However, a growing number receive an Electronic Benefits Transfer (EBT) card, which operates like a bank card. The size of a household's monthly allotment is based on USDA's Thrifty Food Plan, a low-cost model diet that meets standards for a nutritious diet.

The FSP served an average of 19.8 million people residing in 8.2 million households each month in fiscal 1998. Typically, more than half of all food stamp beneficiaries are children. Average monthly benefits were $71.99 per person.

• The Food Stamp Program in Puerto Rico, the Northern Marianas, and American Samoa was replaced in 1982 by the **Nutrition Assistance Programs**. These modified food stamp programs receive Federal funds through block grants, which allow these areas to operate food assistance programs designed specifically for their low-income citizens. Recipients receive either food coupons or cash.

• The **National School Lunch Program**, the second largest food assistance program behind food stamps, accounted for 17 percent of total outlays for all food assistance programs in fiscal 1998. The program provides lunches to children in public and nonprofit private schools and residential child-care institutions. Schools receive cash and some commodities from USDA to offset the cost of food service. In return, the schools must serve lunches that meet Federal nutritional requirements and offer free or reduced-price lunches to needy children. Any child at a participating school may participate in the program. Children from families with incomes at or below

130 percent of the poverty level are eligible for free meals, and those from families between 130 and 185 percent of the poverty level are eligible for reduced-price meals. Children from families with incomes over 185 percent of the poverty level pay a full price, although even those are subsidized to some extent. About 26.6 million children in almost 98,600 schools and residential childcare institutions participated in the program each school day in 1998. More than half of these children received a free or reduced-price lunch.

In 1995, USDA implemented the School Meals Initiative for Healthy Children to improve school meals by suppling schools with educational and technical resources to motivate children to eat healthy meals in addition to providing new tools and techniques to help foodservice staff prepare nutritious, appealing meals.

• The **School Breakfast Program** provides breakfasts to school children, with students from low-income families receiving free or reduced-price meals. Although eligibility is similar to that of the School Lunch Program, the School Breakfast Program is considerably smaller, serving 7.1 million children in 71,100 schools and residential childcare institutions each school day in fiscal 1998.

• The **Child and Adult Care Program** provides healthy meals and snacks to children in non-residential childcare centers and family daycare homes. (The adult care portion of the program, which provides meals to the elderly and functionally impaired adults in adult daycare settings, accounted for only 2 percent of total program costs in fiscal 1998.) Children from low-income families are eligible for free or reduced-price meals. A total of 1.6 billion meals were served under this program in fiscal 1998.

• The **Summer Food Service Program** provides free meals to children (age 18 and under) during school vacations in areas where at least half of the children are from households with income at or below 185 percent of the Federal poverty guidelines. There is no income test for eligibility; any child in the program's operating area may participate. The program is operated at the local level by local sponsors who are reimbursed by USDA. Local sponsors may be government agencies, public or private nonprofit schools, public or nonprofit colleges and universities operating the National Youth Sports Program, and public and nonprofit summer camps. In fiscal 1998, the program served over 136 million meals or snacks. During the peak month of July, an average of 2.3 million children participated each day.

• The **Special Milk Program** provides funding for milk in public and nonprofit schools, childcare centers, and camps that have no other federally assisted food programs. Milk is provided either free or at low cost to all children at participating schools. Schools may elect to serve free milk to children from families with incomes at or below 130 percent of the poverty level. In fiscal 1998, 131 million half-pints of milk were served under this program, about 6 percent of which were served free. Participation in this program has dropped in recent years, due primarily to a drop in program participation as a result of the expansion of the National School Lunch and School Breakfast Programs, which include milk with the meals.

• The **Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)** improves the health of low-income pregnant and postpartum women, as well as infants and children up to their fifth birthday, who are determined by health professionals to be nutritionally at risk. This is usually achieved by providing vouchers for foods that are rich in nutrients typically lacking in the WIC target population, and by providing eligible recipients with nutrition education and referrals to healthcare services. Participants receive vouchers that can be redeemed at retail foodstores for specific foods that are high in protein, calcium, iron, and vitamins A and C. The WIC program encourages breastfeeding among low income mothers, providing them with more vouchers and allowing them to stay in the program longer than mothers who do not breastfeed.

To increase access to fresh produce, WIC recipients in 32 States, the District of Columbia, and 2 Indian Tribal Organizations are currently provided additional coupons that can be used to buy fresh fruits and vegetables from authorized farmers or from farmers' markets through WIC's Farmers' Market Nutrition Program.

An average of 7.4 million people per month participated in the WIC program in fiscal 1998, of whom 24 percent were women, 26 percent were infants, and 51 percent were children. In terms of participation, WIC has been one of the fastest growing food assistance programs, as the number of participants more than doubled since fiscal 1988.

• The goal of the **Commodity Supplemental Food Program (CSFP)**, like WIC, is to improve the health of low-income pregnant and postpartum women, and infants and children up to their 6th birthday. Unlike the much larger WIC program, the CSFP also serves the elderly (60 or older), who now comprise over half of the program's participants. Instead of vouchers, CSFP provides food tailored to the nutritional needs of the participants. Authorized food distributed under this program includes iron-fortified infant formula and cereal, adult cereals, grits, oatmeal, canned juice, evaporated milk and/or nonfat milk, canned vegetables and/or fruits, canned meat, poultry or tuna, egg mix, dehydrated potatoes, rice or pasta, and peanut butter or dry beans. In addition to authorized food, CSFP participants sometimes receive surplus food acquired through USDA's commodity price-support programs. CSFP often operates in areas where WIC is not available. Eligible people cannot participate in both programs at the same time. An average of almost 377,000 people participated in the program each month during fiscal 1995.

• The **Food Distribution Program on Indian Reservations** provides commodities to American Indians living on or near participating Indian reservations and who choose not to participate in the Food Stamp Program. The program provides an alternative to the FSP for many American Indians far from foodstores. Program recipients receive a monthly food package weighing about 50 to 75 pounds. It contains a variety of foods selected to meet the health needs and preferences of American Indians. Commodities either come from agricultural surpluses or are purchased by USDA specifically for the program. Household eligibility is based on income, resources, and proximity to a reservation. One of the smaller food assistance programs, it served an average of 124,700 people per month in fiscal 1998.

• The **Nutrition Program for the Elderly** provides cash and commodities to States for meals for senior citizens. Administered by the U.S. Department of Health and Human Services, the program receives commodity foods and financial support from USDA. Food is served through meals-on-wheels programs or in senior citizen centers and similar settings. There is no income test for eligibility; all people age 60 or older and their spouses are eligible for the program. Recipients can contribute as they wish toward the cost of the meal, but the meal is free to those who cannot contribute. Almost 250 million meals were served under this program in fiscal 1998.

• The **Disaster Feeding Program** is administered by the Federal Emergency Management Agency (FEMA), which is responsible for coordinating disaster relief. However, USDA purchases food commodities for assistance in major disasters or emergencies under this program when other food supplies are not readily available.

• The **Emergency Food Assistance Program (TEFAP)**, which began as a cheese-giveaway program in 1982, was implemented as a way to reduce inventories and storage costs of surplus commodities through distribution to needy households. In 1989, Congress appropriated funds to purchase additional commodities specifically for this program. USDA buys the food, processes and packages it, and ships it to the States. Within broad guidelines, each State sets its own eligibility criteria and selects local emergency feeding organizations to distribute the commodities. Expenditures for this program have fallen dramatically in recent years along with the inventory of surplus commodities.

• Under the **Food Distribution Programs for Charitable Institutions and Summer Camps**, USDA donates food to non-profit charitable institutions serving meals on a regular basis to needy persons and to summer camps for children. These include church-operated community kitchens for the homeless, orphanages, soup kitchens, temporary shelters, and homes for the elderly.

• USDA purchases food specifically to distribute to soup kitchens and food banks under the **Food Donation Programs to Soup Kitchens and Food Banks**. Commodities are allocated to the States based on a formula that considers the number of people in each State below the poverty level and the number unemployed. Within each State, priority is given to institutions that prepare food for the homeless.

Chapter 17

How Government Policies and Regulations Can Affect Dietary Choices

Katherine Ralston

Regulations—regardless of whether or not they are directed specifically at the food sector—can affect the varieties and qualities of foods available for purchase, the prices consumers face, the information consumers receive about a product, and consumer confidence in the food supply. This chapter reviews four important categories of policies and regulations—farm assistance programs, food safety regulations, information regulations, and regulations covering other sectors—and their potential impacts on consumer dietary choices.

Introduction

Policies and regulations that directly or indirectly affect the supply or prices of food products, their safety and nutritional composition, or the information consumers receive about food all influence the food choices consumers make and, ultimately, the nutritional quality of their diets. The effect of policies and regulations on ultimate dietary choices depends on how the policy affects the cost of producing commodities, how those costs relate to final retail prices, how responsive consumers are to price changes, and how the policy directly influences the consumers' preference for the product.

This chapter reviews four important categories of policies and regulations that affect the food sector, and discusses their potential effects on consumer dietary choices (table 1, p. 358). While there are no comprehensive studies on the quantitative effects of these regula-

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tions, several examples in each category illustrate the types and magnitudes of these effects. The first category—farm assistance programs—includes Federal price and income support programs as well as producer-funded marketing orders and research and promotion agreements. The price and income support programs have historically affected the marketed supply of many foods, although many provisions were suspended in 1996. Some marketing orders set quality standards for marketed supplies of foods, and promotion programs attempt to influence demand for commodities through generic advertising (see also chapter 10). The second category—food safety regulations—includes inspections of processing plants and food products, approval of food additives, and restrictions on pesticide use and animal drugs. These regulations can affect food prices or availability, and their implied assurance of safety is information that can also affect demand for the food. The third category—information regulations—includes labeling requirements and advertising restrictions, standards of identity, and product grades. These directly influence the kind of information consumers receive about foods, and therefore affect their demand for foods. The fourth category—regulations covering sectors other than agriculture—includes environmental requirements and worker safety, restrictions on mergers, and trade policies. These regulations also may affect the price and/or availability of specific food products.

Most of these policies have little real effects on dietary choices overall, partly because consumer responsiveness to resulting price changes is low. Yet the regulations have been shown to affect some individual foods or population groups, significantly in some cases. Keep in mind that increased consumption of a particular food may or may not be nutritionally desirable, depending on its own nutritional qualities, its substitution effects, and any increase in complementary foods. For example, lower prices of ground beef may increase consumption of hamburgers as well as other complementary foods, such as buns, ketchup, and potato chips (see chapter 8).

Many other government regulations and programs not covered in this chapter also affect food choices. In addition to the food assistance programs described in chapter 16, changes in welfare assistance regulations can increase or decrease household income and thereby affect consumer food choices. The types and amounts of government-funded research can also affect dietary choices by determining the areas of interest and the focus of research. For example, research conducted by the U.S. Department of Agriculture's (USDA) Agricultural Research Service led to the development of Oatrim, a fat substitute made from processed oat fiber that has the additional benefit of lowering blood cholesterol levels. Oatrim has the potential to provide consumers with tasty lower fat products and a wider range of choices.

Farm Assistance Programs

Federal and State price support programs for wheat, rice, feed grains, oilseeds, milk, peanuts, and sugar are intended to stabilize and/or support prices and, in some cases, producer incomes for these commodities. In addition, producers of milk, fruits, vegetables, and specialty crops are permitted to organize marketing orders to facilitate orderly marketing. Finally, several commodities are also covered by federally authorized research and promotion agreements.

Federal Price and Income Support Programs

Introduced with the Agricultural Adjustment Act of 1938, partly in response to the Great Depression, price and income support programs have been modified several times. Programs have combined several forms of assistance, including deficiency payments to cover the gap between target prices and market prices, (nonrecourse) loans to farmers that could be defaulted if prices fell below a specified level, government purchases of surplus production to support prices, short- and long-term programs paying farmers to idle certain land from production at a targeted level and limiting acreage planted to certain crops (the Acreage Reduction Programs and the Conservation Reserve Program), export subsidies, and import restrictions. Many of these provisions were eliminated or suspended with the 1996 Farm Bill.

While some of the programs did raise farm commodity prices, consumer dietary choices were affected very little. Farm prices are a fraction of final retail prices, and consumer responsiveness to price changes for most foods is low. For example, the peanut program was estimated to increase peanut prices to 27 percent above the break-even price (Sanford and Evans, 1995). However, the farm price of peanuts represents only about a quarter of the final retail price of peanut butter (Elitzak, 1997). Thus, even if the whole price increase had been passed on to consumers, the price of peanut butter would have risen only about 7 percent (0.27 x 0.25 = 0.7). Because consumers are not very responsive to the price of peanut butter, the actual effect on peanut butter purchases would have been much lower than this percentage. The price elasticity of demand (percentage change in demand resulting from a 1-percent change in price) for nuts (peanuts and tree nuts together) is only -0.16 (Huang, 1993). If consumers have the same price response to changes in the price of peanut butter,[2] then a 7-percent increase in the price of peanut butter would result in a 1.1-percent decline in the quantity of peanut butter purchased ($7 \times -0.16 = -1.12$). Researchers have also found that price impacts of the sugar and wheat programs on consumption are 1 percent or less for sugar (Uri and Boyd, 1994) and for wheat (Hoffman and others, 1995).

Similarly, the feed grain program raised feed costs for meat, milk, and egg producers, but the effects on consumption of the final products were probably very minor. Price elasticities of demand for milk and eggs are low (-0.04 for fluid milk, -0.11 for eggs) (Huang, 1993). Even consumption of beef, which is more sensitive to price changes (price elasticity of demand = -0.62), probably was not greatly affected, because feed grain costs are a fraction of the costs of producing beef, and the farm price is only about half of the final retail price. Further, the increase in feed grain costs would have increased costs for pork and poultry as well; the price elasticity of demand for all these meats together is even lower than for beef.

Consumer prices for fluid milk were higher than they would have been without milk price supports before phaseout of supports began in 1996. Because consumer response to price changes is low, however, supports probably reduced consumption less than 1 percent (Blayney and others, 1995). Milk and milk products, such as cheese and butter, are also affected by Federal milk marketing orders, which are under reform as part of the 1996 Farm Bill but still in operation. Federal milk marketing orders establish regional price differentials for different classes of fluid grade milk in different regions of the country (Manchester and others, 1994).

The milk marketing order system historically resulted in below-market prices for most manufactured dairy products (Blayney and others

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[2] The "nuts" category in Huang's estimated demand system is dominated by peanut butter, so this price elasticity is an acceptable approximation of the elasticity of demand for peanut butter.

1995), which could continue under current reforms. Below-market prices for manufactured dairy products can occur when the pricing structure creates an incentive to produce a surplus of milk above fluid demand; the excess milk is then available for use in the manufacture of dairy products, resulting in greater supply and lower market-clearing prices for these products.

Because some manufactured dairy products, such as cheese, are high in saturated fat, some nutritionists have expressed concern that lower prices for cheese may lead to higher cheese consumption, contributing to increased saturated fat in the diet (Sims, 1998). However, while consumers respond more strongly to the price of cheese (elasticity = -0.25) than to the price of fluid milk (elasticity = -0.04) (Huang, 1993), the response to the cheese price is still low. Taking into account the full complementarity among foods, the net effect of a 10-percent reduction in the price of cheese is only a 0.74-percent increase in saturated fat intake, equivalent to 0.37 gram of saturated fat per capita daily (Huang, 1997).

While commodity programs have had minimal effects on dietary choices of the population as a whole, the distribution to low-income individuals of surplus commodities that result from some of these programs has been shown to have an important impact on dietary choices for that group. For example, in the 1980's, the dairy support program resulted in a buildup of surplus cheese; the surplus was donated directly to low-income individuals under The Emergency Food Assistance Program (TEFAP), roughly doubling the consumption of cheese for this group (Zellner and Morrison, 1988). While cheese is the most extreme example, consumption of other commodities has been affected in some years by surplus distribution programs. For example, USDA purchases of surplus peanut butter for TEFAP accounted for 6.5 percent of U.S. retail volume of peanut butter in 1992/93;[3] this was nearly half as large as the largest percentage of cheese marketings accounted for by USDA purchases—15 percent in 1983 (Blayney and others, 1995). Thus, while data on the number of recipients and their usual peanut butter consumption are not avail-

3 Government purchase data from USDA's National Agricultural Statistics Service (NASS), various issues. Breakdown of peanut butter purchases by program provided by Bonnie Taylor, USDA's Food and Nutrition Service. Data on total U.S. consumption of peanut butter from Sanford and Evans, 1995.

able, this volume of peanut butter could have significantly increased peanut butter consumption for low-income consumers that year.

The 1996 Farm Bill eliminated or began to phase out many program components, continuing the reduction in the Government's influence in the agricultural sector through traditional commodity programs (Young and Shields, 1996; Young and Westcott, 1996). The 1996 Farm Bill suspended price-dependent income support payments for wheat, rice, and feed grains, and limited price supports for these crops as well as for sugar and peanuts. Dairy price support levels were cut back and will be eliminated in 2000, while Federal milk marketing orders are to be reformed by consolidating the number of orders and by considering changes in how classified prices in the new orders are to be determined. The short-term Acreage Reduction Programs were eliminated, while the longer term Conservation Reserve Program was reoriented to provide additional environmental benefits. The changes in the Conservation Reserve Program continue the expansion of priorities from erosion to include improvements in wildlife habitat and air quality.

Just as these programs have had minor effects on consumer choices, the 1996 changes are believed to have had very small impacts on dietary choices because retail prices for food are only marginally different (Young and Westcott, 1996). While retrospective studies are not yet available, prices were projected to be about 1 percent lower on average for dairy products and slightly lower for peanuts. Prices were projected to be slightly higher for rice due to the elimination of deficiency payments, which created an incentive to overproduce without corresponding supply control. Prices of foods based on grains—including meats, as well as cereals and bakery goods—were projected to be unchanged. Overall livestock feed costs were projected to be similar to those under previous legislation, although the mix among feed grains and forage may be different. While wheat prices were projected to drop, ingredients are a fraction of cereals' and bakery goods' retail cost. Availability of fruits and vegetables is not affected by these changes because payments are reduced for fruits and vegetables planted in excess of their historical plantings on farms with a production flexibility contract. Programs distributing commodities to low-income households, however, will probably be greatly affected with the reduction in price support purchases of surplus commodities. Expenditures in 1996 for the TEFAP, for example, were 50 percent lower than in 1995 (USDA, Food and Consumer Services, 1996).

Marketing Orders for Fruits, Vegetables, and Specialty Crops

Federal marketing orders for fruits, vegetables, and specialty crops are self-help commodity programs proposed, governed, and financed by commodity industries and authorized by Federal legislation (Neff and Plato, 1995). In contrast to Federal marketing orders for milk, marketing orders for fruits, vegetables, and specialty crops operate with no direct price controls and limited quantity control. Fruit, vegetable, or specialty crop marketing orders may limit the total marketed quantity, the flow among market segments, or the flow over time to stabilize or increase prices. They may also set quality standards and container/pack standards to increase demand through quality assurance and/or to restrict supply. They currently include oranges, grapefruit, tangelos, limes, avocadoes, nectarines, peaches, kiwifruit, apricots, cherries, fresh and dried prunes, grapes, pears, papayas, cranberries, olives, potatoes, onions, tomatoes, melons, almonds, hazelnuts, walnuts, spearmint oil, dates, and raisins. Additional commodities are covered by State marketing orders.

Direct quantity control provisions are used in only a few marketing orders for specialty crops—such as certain nuts, specific berries and dried fruits, and spearmint oil—with minimal impact on dietary choices. The strongest supply control tools available in marketing orders are producer allotments and reserve pools. Producer allotments assign a maximum quantity a handler can market from each producer in a single season. The total quantity allowed can increase based on increased demand, but prices are maintained by the control of supply in each season. These provisions are authorized only for cranberries and spearmint oil. Reserve pools withhold marketable supply if total supply exceeds estimated market demand at a given price. The surplus can be released later or diverted for sale in a secondary food market (such as frozen or processed) or for nonfood use. Reserve pools are allowed only for California walnuts, Far West spearmint oil[4], California raisins, and California dried prunes. Market allocations, used in four marketing

[4] The Far West spearmint oil order covers Washington State, Idaho, Oregon, Nevada north of 37th parallel, and Utah west of the 111th meridian.

orders (California almonds, Oregon-Washington hazelnuts, California walnuts, and California prunes), specify the maximum quantity that can be sold for a given use, thus increasing revenues by limiting the supply of product going to the market segment that is less responsive to price. Markets can be separated into fresh and processed or domestic and export, for example.

Minimum quality standards are part of almost all marketing orders, and may limit the marketed supply of some commodities. Consumers willing to purchase lower quality produce at lower prices may be priced out of the market by quality controls. This could be especially relevant to the dietary guidelines because fruits and vegetables are an important component of the guidelines, and because consumers are more responsive to the prices of fruits and vegetables than to other food groups. However, minimum quality standards also appear to have increased demand by standardizing quality at a high level (Neff and Plato, 1995).

National Research and Promotion Programs

Many marketing orders authorize research and promotion programs, and some such programs operate outside of marketing orders. Assessments on producers, processors, and often growers and handlers, fund research to improve grower/handler efficiency and consumer research for use in marketing and generic advertising. National research and promotion programs are authorized for beef, dairy, eggs, honey, mushrooms, popcorn, pork, potatoes, soybeans, watermelons, and wheat. Many other commodities are covered by State programs.

Recent research on the effects of beef advertising are mixed. Some researchers have found no impact from generic beef advertising, but positive effects from branded advertising (Brester and Schroeder, 1995). Ward and Moon (1997), on the other hand, found that generic advertising may have increased beef consumption by as much as 8 percent. Studies have suggested strong effects of generic advertising on demand for Washington apples (14.5-percent increase) and catfish (13 percent), and lower effects for orange juice (2.7 percent) (Forker and Ward, 1993). Even when effects on individual commodities are large, the effect on diet quality is less clear. Increased consumption of one commodity may displace another commodity in the same group. The effects of dairy promotion are discussed in chapter 10.

Food Safety Regulations

Programs to ensure consumer safety include food safety inspections, pesticide use and residue restrictions, animal drug approval, and food additive approval. Since the relative safety of a food may be unobservable to consumers, they are unable to give producers sufficient incentive to spend money providing these qualities. Food providers who invest more in technology that enhances food safety may have higher costs of production and be unable to increase prices or use increased safety as a selling point because consumers cannot verify that the food is safer. Thus, producers who provide safer goods are sometimes penalized. Further, when the risk of foodborne pathogens or other hazards undermines confidence in the food supply, the economic harm is not limited to providers of unsafe food but extends to all food providers. Regulations that ensure an acceptable level of safety reassure consumers and level the playing field for producers.

Food safety regulations could have two possible effects on dietary choices. On the one hand, the cost of meeting higher standards could either increase prices or reduce availability of certain foods, thus decreasing consumption of those foods. On the other hand, ensuring the safety of the food supply probably increases demand for many foods that consumers might otherwise avoid due to health concerns.

When a well-publicized outbreak of foodborne illness occurs, consumer confidence in the safety of the food product can temporarily deteriorate, leading to a drop in sales. For example, the outbreak of *E. coli* 0157:H7 resulting from undercooked fast-food hamburgers in Washington State caused a decline in demand for hamburgers from that chain (Knutson and others, 1995), although sales have steadily recovered (Foodmaker, Inc., 1998). Similarly, demand for strawberries and raspberries reportedly dropped temporarily after the outbreaks of Hepatitis-A linked to strawberries in 1997 and *Cyclospora* linked to raspberries in 1996 (Zepp and others, 1998).

Consumer confidence in the safety of the food supply can also be undermined by concerns over health effects of pesticide residues. In contrast to the more isolated nature of concerns about foodborne pathogens, concerns about pesticides may be ongoing and have a spillover effect on other fruits and vegetables. For example, 8 percent of California consumers reported reducing their consumption of fruits and vegetables in response to pesticide concerns (Bruhn and others, 1992).

Consumers' reactions to food safety problems may also provide evidence of their overall confidence in the food supply. Consumers avoided hamburgers only from the fast-food chain linked to the 1993 *E. coli* outbreak, not all fast-food hamburgers. Similarly, consumers did not avoid all fruit following the Hepatitis-A and *Cyclospora* outbreaks. Concerns over pesticide residues appear to influence the dietary choices of a limited minority of consumers. This suggests that most consumers trust that the problems are isolated and their resolution assured.

Food Inspections

Most foods crossing State lines or imported from foreign countries are sampled for inspection by the U.S. Department of Health and Human Services' (DHHS) Food and Drug Administration (FDA), except for meat, poultry, and liquid egg products, which are inspected by USDA's Food Safety and Inspection Service (FSIS), and shell eggs, inspected by USDA's Agricultural Marketing Service (AMS).[5] Retail establishments, restaurants, and food produced for in-state sale are inspected by State and local authorities, under nonbinding guidance from the FDA Food Code (U.S. General Accounting Office (GAO), 1990). Meat products inspected locally are required to meet standards at least equal to Federal standards, and local systems are monitored by FSIS. These agencies also regulate technologies used to ensure food safety.

FDA inspections. The Food and Drug Administration monitors the safety of foods in its jurisdiction by conducting inspections of products as well as processing facilities (Zepp and others, 1998). FDA conducts research on contamination detection and prevention practices and sets standards for enforcing Federal regulations and guidelines on food sanitation and safety. It also monitors the safety of the food system by inspecting manufacturing plants and feed mills producing medicated or nutritionally supplemented animal feeds that are part of the human food chain. FDA also has responsibility for ensuring the safety of imported fruits and vegetables. By law, imported products must meet the same standards as domestic goods. The bulk

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[5] FSIS inspects products containing over 3 percent fresh meat or 2 percent or more cooked poultry. Liquid egg products inspected by FSIS are sold in liquid form, frozen, or as dried egg products.

of FDA-regulated imports are cleared for immediate distribution based on the Agency's review of the shipment's records; these records include information on safety assurance practices maintained during processing of the food being shipped. If a problem is suspected, inspectors then physically examine the shipment or take a sample for laboratory analysis. Imports from a particular processor or an entire country can be detained or blocked until the problem is resolved.

In a recent case, imports of raspberries from Guatemala were blocked from March 1998 through August 1998 following the 1997 outbreaks of *Cyclospora* linked to the raspberries (DHHS, 1998). Because the organism is difficult to detect, the safety of incoming raspberry shipments could not be verified by testing. Thus, imports were blocked until the source of contamination could be identified and eliminated.

Such actions could well affect the availability of some fruits and vegetables, yet are essential to maintain confidence in the food supply. Foodborne disease outbreaks have been linked to both domestic and imported produce. Four of the 13 foodborne disease outbreaks linked to produce during 1990-96 were from imported produce, although the outbreaks from imported produce accounted for about two-thirds of the resulting illnesses (Tauxe, 1997). While the evidence on the risks of imported produce is limited, without strict enforcement of safety standards, imported produce could develop a bad reputation. This could have important effects on dietary choices, especially since imports account for an increasing share of all fresh fruit and vegetable consumption (Zepp and others, 1998).

FSIS inspections. FSIS monitoring covers all aspects of slaughter and processing for meat and poultry. Under the Federal-State cooperative inspection program, FSIS monitors State inspection systems for products that do not cross State lines. In about half of all States, FSIS conducts direct inspection because the State has chosen to end its inspection program or cannot maintain FSIS standards (GAO, 1990).

FSIS issued new regulations for meat inspection in 1996, requiring all federally inspected meat processing establishments to document standard operating procedures for sanitation and implement a food safety management system called Hazard Analysis and Critical Control Points (HACCP). This system requires identification and monitoring of critical control points in the process to ensure that pathogens are not introduced into the process and to destroy or prevent the growth of pathogens that may be present. The regulations require the establishment to test for generic *E. coli* as an indicator of fecal contamination.[6] The regulations also require FSIS to test for *Salmonella*, and require that the plant not exceed a legal tolerance for presence of *Salmonella*. The new requirements do not replace, but rather supplement, the previously established organoleptic inspection system—in which inspectors examine animals and carcasses for symptoms of disease and other abnormal conditions—by requiring additional microbiological testing and improved records of the plants' own food safety system (Crutchfield and others, 1997).

These regulations can have several effects on food choices. The new standards themselves impose costs on meat suppliers, and thus may add to the cost of the product. The minimum cost of just the new regulations themselves—developing new sanitation plans and HACCP plans, training costs, labor costs for monitoring the new systems, and *E. coli* testing—is projected to be 0.006 to 0.12 cent per pound of meat and poultry (Crutchfield and others, 1997). Any additional equipment or labor required to meet the microbial standards would add further costs. Costs per unit are expected to be at the higher end of the projected range for small-scale producers because those producers have higher fixed costs relative to their overall costs. Thus, the regulations could influence the variety of meat products available if small-scale producers are unable to comply with the regulations profitably. Small firms were not exempted from the new regulations, although they were given longer to comply.

Food Safety Technology Approval

The Federal Government also approves technologies for use in food safety assurance. For example, FDA approved the use of irradiation to rid fruits, vegetables, beef, poultry, grains, and spices of pathogens. FSIS developed regulations for the use of irradiation on poultry and beef. FSIS also certified a steam pasteurization technolo-

[6] Generic *E. coli* are bacteria present in large amounts in the gut and fecal material of the slaughtered animal. Generic *E. coli* should not be confused with certain types of *E. coli*, such as *E. coli* O157:H7, which are very pathogenic at very low levels. Because it is so abundant in fecal material, generic *E. coli* is relatively easy to detect if there has been fecal contamination of meat that could also transmit harmful bacteria more difficult to detect.

gy as significantly reducing pathogens that may be present on animal carcasses after slaughter. The regulation of these approvals and certifications provides assurance to both food suppliers using the technology and end-use consumers that the technology is safe and effective. More recently, however, FSIS has dropped requirements for approval of specific pathogen reduction technologies, leaving firms free to use any technology to reach the standards for *Salmonella* contamination (Hudnall, 1998). This could reduce costs of slaughter and processing by giving firms more flexibility to use technology that fits the scale of their operations.

Food Additive Approval

FDA approves the use of additives in food to ensure that such additives—for example, colorings, synthetic flavorings, and preservatives—are safe for human consumption (GAO, 1990). Because these additives can play a large role in the appearance, palatability, and shelf life of foods, their approval or prohibition could have a significant impact on food choices and nutritional outcomes.

The approval process can be lengthy and expensive, thus slowing the availability of new additives and restricting development to those with sufficiently high potential profits. Yet the process also ensures consumer confidence in the safety of the food supply.

The recent case of olestra, a fat substitute, illustrates the potential magnitude of these effects. Olestra was approved in 1996, 9 years after the petition was first submitted (DHHS, 1996b). Olestra is the first fat substitute with the ability to withstand heat that has been approved by FDA for use in many popular baked and fried salty snack foods, such as potato chips and crackers. In the process of obtaining approval for olestra, Procter and Gamble submitted more than 150 studies on the effects of olestra in humans and animals (DHHS, 1996b). The studies indicated that olestra inhibits the absorption of some fat-soluble vitamins and other fat-soluble nutrients, and can cause some people to experience abdominal cramping and loose stools. In granting final approval, FDA required olestra to be supplemented with vitamins A, D, E, and K in order to compensate for the effect of olestra on the absorption of these vitamins. FDA also required products containing olestra to be labeled with information about the potential for gastrointestinal symptoms and the effect on nutrient absorption. In this case, the approval process functioned together with labeling authority to make the additive available while ensuring the safety and confidence of the public. In spite of the labeling requirements for products containing olestra, some consumer groups have continued to express concern about the safety of olestra. The Center for Science in the Public Interest (CSPI) has petitioned the Federal Trade Commission to require warning statements as part of advertisements for products containing olestra (CSPI, 1996) and has asked FDA to remove the approval for olestra or require stronger warning labels on products containing olestra (CSPI, 1998).

The availability of nonfat snacks with flavor and texture similar to the original versions could have a considerable impact on dietary choices, although the net nutritional effect is uncertain. A survey by the Calorie Control Council—an association of low-calorie and diet food manufacturers—suggests that nearly two-thirds of the adult U.S. population consume low- or reduced-fat or reduced-calorie foods and beverages (DHHS, 1996b). Many of these consumers may wish to consume fat-free snacks in an effort to reduce fat and/or calorie intake. However, it is not certain that intake of fat and calories would decline as a result of fat-free snacks. Research suggests that some individuals may compensate or even overcompensate after consuming a fat-free product with higher fat and/or caloric intakes from other foods (Foltin and others, 1992; Shide and Rolls, 1995).

Pesticide Regulations

The Environmental Protection Agency (EPA) sets "tolerances" or limits on the amount of pesticide residue that can lawfully remain on food. FDA then tests nonmeat foods in order to enforce these residue limits. Prior to 1996, previous law required EPA to give appropriate consideration "to the necessity for the production of an adequate, wholesome, and economical food supply" when setting tolerances to protect the public health. EPA has traditionally assessed both the risks and benefits of a pesticide's use as part of the tolerance-setting process. For certain pesticides that appeared to present significant risks, EPA carefully weighed the risks against the benefits to evaluate tolerances. A benefits evaluation provides information on the way a pesticide is used, the economic and consumer impacts of discontinuing a use and on the availability and practicality of alternative pesticides or treatment methods. Benefits assessments allowed EPA to determine whether a certain risk could be justified in light of the serious economic consequences or disruption to the food supply that would occur if a use were denied or discontinued because a tolerance could not be set. In practice, economic considerations have not driven tolerance decisions or been the basis for granting tolerances that allow unsafe pesticide residues in food.

In certain narrow circumstances, the 1996 Food Quality Protection Act (FQPA) allows tolerances to remain in effect that would not otherwise meet the new safety standard, based on the benefits afforded by the pesticide. Pesticide residues would only be "eligible" for such tolerances if use of the pesticide prevents even greater health risks to consumers or the lack of the pesticide would result in "a significant disruption in domestic production of an adequate, wholesome, and economical food supply." Tolerances based on benefits considerations would be subject to a number of limitations on risk and more frequent reassessment than other tolerances. All tolerances would have to be consistent with special provisions for infants and children.

Therefore, this provision narrows the range of circumstances in which benefits may be considered and places limits on the maximum level of risk that could be justified by benefits considerations. It would also apply only to "non-threshold" risks posed by pesticides, e.g., carcinogenic effects for which conservative quantitative risk assessment is appropriate.

When use of a pesticide is banned, producers are forced to turn to alternatives that may be more expensive, less effective, or both. Higher costs are passed on to consumers to whatever degree the market will bear. Less effective pest and disease control can reduce both yields and quality. Both higher pest control costs and lower yields can lead to higher prices and/or lower supplies. This could lead to decreased consumption of the commodity if imports are not available to fill the gap. Even when overall effects are small, some producers may be placed at a competitive disadvantage. This can change the supply of certain varieties of fruits and vegetables or other foods. On the other hand, the absence of such regulations could undermine consumer confidence in foods and suppress demand.

Prior to the 1996 FQPA, all pesticide registration decisions by EPA considered the benefits of the pesticide in ensuring a plentiful food supply. EPA, and in some cases USDA, estimated the effects of each proposed pesticide decision on yields, producer income, and consumer food costs. For example, the proposed cancellation of propargite was projected to reduce the quantities of peaches, nectarines, plums, prunes, and strawberries by between 2 and 2.7 percent, with much larger effects in some regions where the pesticide was more important to production (USDA, National Agricultural Pesticide Impact Assessment Program, 1994). Unfortunately, there are very few studies of effects after an agricultural chemical was actually canceled, although there is some anecdotal evidence. For example, while overall apple production was not greatly reduced by the voluntary withdrawal of Alar, a growth regulator, many growers in the mid-Atlantic can no longer grow particular varieties which depended on the growth regulator (Gianessi 1993).

In practice, EPA often grants registrations for an alternative in conjunction with cancellation of a pesticide in order to minimize losses (Gianessi, 1993). USDA can also target research funds to develop alternatives. However, the regulatory process can affect consumer choices even without a cancellation. Pesticide manufacturers sometimes withdraw their application for a pesticide registration in response to a requirement for additional data, and many potential pesticides are never introduced (Gianessi, 1993).

The 1996 FQPA resulted in some changes in the regulation of pesticide residues that could affect prices or availability of some foods. Some of the provisions could result in lower allowable levels of pesticide residues on foods, which could lead to higher costs because alternatives are more expensive, or lower yields because alternatives are less effective.[7] Other provisions allow safe levels of residues on foods where no residues would have been permitted under previous law, which could lower crop protection costs or increase yields (EPA, 1996).[8] The EPA is aware of these issues and is working with

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[7] The FQPA narrowed the range of circumstances that would allow the consideration of pesticide benefits in tolerance decisions. The FQPA also requires greater consideration of risks to children, essentially requiring an assumption of greater risk when information about safety to children is lacking. Further, the FQPA requires EPA to develop new tests for possible effects of pesticide residues on the endocrine system (EPA, 1996).

[8] The FQPA replaced the Delaney Clause, a provision that in practice prohibited tolerances for some pesticides if the residue had the potential to concentrate in a processed product, and carried a cancer risk that was so low that it would have been allowable on other foods. The FQPA allows residues in processed foods as long as they are "safe," defined as "a reasonable certainty that no harm will result from aggregate exposure" to the pesticide (EPA, 1996).

USDA, the agricultural community, and other parties to produce an implementation approach that meets the health standard of the Act while minimizing the harm to agriculture and maintaining availability of reasonably priced food.

In addition, the FQPA contains a potentially important provision that could influence information available to consumers about pesticide residues and thereby influence their food consumption choices. The new law requires EPA to publish a short pamphlet containing consumer-friendly information on the risks and benefits of pesticides. This information would be distributed each year to "large retail grocers for public display (in a manner determined by the grocer)." In addition, petitions for tolerances by pesticide manufacturers must include informative summaries that can be published and made publicly available. This information can either decrease consumer concerns (if it can show how low pesticide residue risks compare with other sources of risk) or increase them (by simply drawing attention to the risk because consumers often react to the fact that a risk is nonzero) (Magat and Viscusi, 1992).

Animal Drug Approval

FDA approves drugs for use in animals, including livestock, dairy, poultry, and aquaculture. In addition to treatment or prevention of disease, animal drugs can be used to affect rates of production variables such as growth, weight gain per unit of feed, or milk production in the case of dairy animals. These factors influence the costs of production, so the approval or restriction of a (production) drug can affect prices and availability and, therefore, consumption of meat, poultry, and dairy products. Further, animal production drugs can affect the composition of the final product—such as the fat content of meat—so approval of a drug can increase the availability of leaner meats in some cases. As with pesticides and additives, consumer perception about the safety of the drugs used can also affect consumer demand.

The case of bovine somatotropin illustrates the tradeoffs between supply gains from the use of animal production drugs and the potential for consumer distrust. Recombinant bovine somatotropin (rbST) is a synthetic hormone injected into dairy cows that increases milk output by 12-15 percent per cow (Martin and others, 1990). On November 5, 1993, FDA approved an rbST product after determining, among other things, that it was safe for treated animals and that the food products from the animals were safe for human consumption. FDA also found that there is no difference in hormone levels or nutritional composition of the milk produced by cows treated with rbST. Opponents have claimed that use of rbST could cause health problems in humans, stress on dairy cows, and increased pressure on small dairies (Ben & Jerry's Homemade, Inc., 1997; Mothers and Others, 1997). Douthitt and others (1996) found that 5 percent of surveyed consumers reported having reduced their consumption of milk after rbST was introduced, 0.3 percent reported having stopped buying milk altogether, and 8 percent reported buying only milk identified as from untreated cows. However, ERS researchers were unable to detect any effect of rbST introduction on demographic, price, and income coefficients in a model of monthly per capita milk consumption for 12 milk marketing orders from December 1978 through September 1996 (Aldrich and Blisard, 1998). While consumer distrust may not have materialized as predicted, consumers with strong concerns benefit from labels to identify characteristics of interest to the consumer, such as "from cows not treated with rbST." Regulations influencing labels are discussed in the next section.

Information Regulations

Information regulations aim to correct the market failure associated with information asymmetry (when sellers have more information about a product's characteristics than buyers, or vice-versa). Information asymmetry occurs frequently with food products because consumers are unable to verify certain food characteristics, such as its level of safety, its ingredients, or its nutritional composition. As a result, producers have insufficient incentive to produce the optimum level of these characteristics. Government regulations can reduce or eliminate the asymmetry by providing consumers with direct information about the relevant food characteristic, or by establishing standards of identity and quality grades that indirectly provide consumers with some assurance regarding the food characteristic in question.

Food Labels and Advertising

Food labeling regulations under FDA and FSIS stipulate what information is required on labels, as well as what information is permitted and not permitted on labels. Similarly, advertising regulations under the Federal Trade Commission prohibit advertising that is untruthful or misleading. Nutrition information, nonhealth information—such as "dophin-safe"—and safe handling labels are all controlled to varying degrees by regulations.

Nutrition labeling. Current regulations require that all food ingredients and specific nutrition information be listed on the label of most processed food products. Regulations introduced in 1993 also set clear standards for the use of nutrient content claims and health claims. For example, a "high fiber" food must contain at least 5 grams of fiber per serving and either meet the definition for a low-fat food (no more than 3 grams of fat per serving) or provide the level of total fat next to the high fiber claim (Stehlin, 1993).

The 1993 nutrition labeling regulations by FDA and USDA encourage providers of fresh produce, seafood, and meats to voluntarily provide nutrition information on the most commonly consumed raw foods (in the same format as nutrition information on labels of processed foods). Although providing nutrition information for raw foods is voluntary, it could become mandatory if less than 60 percent of grocery stores nationwide do so voluntarily.[9]

Although little research is available on the impact nutrition regulations might have on consumer food choices, the regulatory impact analyses for the 1993 nutrition labeling regulations estimated that (1) compliance costs would translate into small price effects with little, if any, impact on overall food consumption (DHHS, 1991; USDA, Food Safety and Inspection Service 1991a); (2) a small-business exemption would eliminate any likely effect on the variety of products available resulting from small-scale producers of specialty items being unable to comply profitably because of higher fixed costs (DHHS, 1993); and (3) the nutrition information itself would have a beneficial effect on consumer food choices (DHHS, 1991).

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[9] FDA is required by the NLEA to make labeling of the 20 most frequently eaten fruits and vegetables and raw fish mandatory if voluntary compliance is less than 60 percent of stores. FSIS is not required by law to make labeling of raw meat and poulty mandatory, but will initiate rulemaking to determine whether a mandatory program would be beneficial if less than 60 percent of stores provide nutrition information for 90 percent of the 45 major cuts of meat and poultry.

The latter expectation was based on results of a nutrition information program introduced by Giant Food, which used shelf-tags to identify products low in fat or sodium or high in fiber. In the test stores, the market share for products that were low or reduced in fat, cholesterol, sodium, and/or calories increased more rapidly (or declined less rapidly) than in the control stores where tags were not used (Levy and others, 1988). Based on these results, researchers predicted that the changes in food choices resulting from the new nutrition labels would translate into reductions in consumption of fat, saturated fat, and cholesterol of 1.4 percent, 0.7 percent, and 0.1 percent for women, and 1.4 percent, 1.3 percent, and 0.1 percent for men (DHHS, 1991). Furthermore, these changes were believed to underestimate the true changes, since the presence of nutrition information on the labels would encourage food manufacturers to improve the nutritional profile of their products (see chapter 11).

Data on new food product introductions show that interest in reduced- or low-fat foods increased after the new nutrition labeling regulations took effect. In 1996, 15.6 percent of all new food products made a fat-related claim, up from 3.4 percent in 1988 and 9.6 percent in 1994 (Friedman, 1995). Introductions of low-fat versions were most common for peanut butter, crackers, cheese, and tortilla/corn chips (*Food Labeling and Nutrition News*, 1997b). Nutritionally improved foods were found to command a price premium (Frazão and Allshouse, 1996).

The initial interest may be waning, however, as the novelty effect subsides. Fat-related claims fell to 11 percent of new food products in 1997 (Dornblazer, 1998), and sales of some of these products have begun to flatten or even decline (*Food Labeling and Nutrition News*, 1997a). The percent of surveyed consumers who reported changing purchases because of nutrition label information fell from 70 percent in 1996 to 61 percent in 1997 (Food Marketing Institute, 1997).

Survey results suggest that the new nutrition regulations may have had some effect on individual food choices, although the expected reduction in overall fat intake is elusive. Intake of fat as a share of calories dropped from 34 percent in 1989-91 to 33 percent in 1994-96 (USDA, ARS, 1998). However, average total fat intake has increased from 71.8 grams per day during 1989-91 (Tippet and others, 1995) to 74.4 grams per day in 1994-96 (USDA, ARS, 1997). (Calorie intake increased from 1839 per day in 1989-91 to 2002 per day in 1994-96.) Individuals who consume low-fat foods may compensate with higher intakes of fat and/or calories in subsequent meals (Shide and Rolls, 1995; Foltin and others, 1992).

Non-health information. Other information on labels can also influence food choices. Food label regulations permit foods to be identified as "organic," "natural," "not irradiated," "kosher," "dolphin-safe," or "made in Texas," as long as such claims are truthful and not misleading. This allows the development of niche markets in which consumers can identify products with a characteristic of interest to them. Some consumers might otherwise avoid foods not labeled to proclaim such an attribute. In cases where consumer avoidance is based on fear of health effects, however, permission to label could be misleading if it creates the impression that another product is unsafe.

Milk produced from cows treated with rbST is an example of these labeling issues. To allow consumers to be informed while preventing deception, FDA issued interim guidance on voluntary labeling of milk and milk products from cows not treated with rbST (DHHS, 1994). FDA recommended that labels identifying products as "from cows not treated with rbST" also include a statement, "No significant difference has been shown between milk derived from rbST-treated and non-rbST-treated cows." FDA also recommended that firms using "from cows not treated with rbST" labels should have a record-keeping system to verify the label's claim since it is not possible to distinguish milk from treated vs. nontreated cows by current laboratory methods.

Safe handling labels. Safe handling labels are required on fresh meat and poultry products. These labels instruct consumers to refrigerate the product, cook it thoroughly, and avoid cross-contamination of other surfaces that could contact food. Industry concern that these labels might frighten consumers into avoiding fresh meat and poultry products has not been borne out. The labels have instead contributed to some improvement in handling practices, with nearly 60 percent of consumers reporting they have seen the label and, of those, over 40 percent reporting they have changed their practices as a result (Food Marketing Institute, 1996).

Standards of Identity

Standards of identity require food products to be what they claim to be, that is, peanut butter must be made from and contain a minimum amount of peanuts. Standards of identity cover hundreds of foods, including milk, specific cheese types, processed meat products, juices, and baked goods. The minimum and maximum compositional requirements prevent economic deception by protecting against the addition of water or other fillers that could dilute the value of the nutrients in the food. The standards enable consumers to try new brands with some assurance about the nature of the product. Without this assurance, manufacturers would be vulnerable to unfair competition from inferior products and consumers would lose confidence in the food supply (DHHS, 1995b).

With rising consumer concern about nutrition, however, standards of identity have been criticized for restricting access to more healthful alternatives (Public Voice, 1991; National Research Council, 1988). Because many standards include minimum requirements for fat content or other fat-containing ingredients, lower fat versions that did not meet the food's standard were required to carry labels identifying them as "alternative," "replacement," or "substitute"—which were seen as pejorative—or had to be given a different product name. For example, under standards adopted in 1938, a product labeled "ice cream" had to have a minimum of 10 percent milkfat (8 percent if the ice cream included bulky flavors) or it was deemed to be misbranded or adulterated. Frozen dairy products containing only 5 percent milkfat were called ice milk. Standards for frankfurters, bologna, and sausages, on the other hand, limit the amount of fat and added water, but also restrict the addition of binding and emulsifying ingredients that could substitute for fat, such as starch vegetable flour and lecithin.

Manufacturers argued that lower fat versions were not nutritionally inferior, and that such products should be identified with an appropriate descriptor of nutrient content and a commonly understood name (USDA, FSIS, 1995). FDA and FSIS recognized that the 1993 nutrition labeling regulations—which require a more complete list of ingredients and nutrition information—provided much of the protection that the standards of identity were intended to provide, and ensured that consumers would have vastly more information about the makeup of a particular food product than was available when the standards were first adopted in 1938.

Therefore, FSIS and FDA have begun revising standards of identity, both in response to requests by manufacturers and consumer groups, and more broadly as part of efforts to reduce unnecessary regulation (HHS, 1995b; USDA, FSIS, 1995). For example, FSIS has proposed a rule that would allow low-fat processed meat and poultry products to use the standard terms instead of requiring them to be identified as "imitation" meat (USDA, FSIS, 1995).[10] The proposed label for low-fat processed meat and poultry product requires additional ingredients to be listed on the ingredient statement—such as water and fat-replacing ingredients—with a designation that these ingredients are either in excess of amounts permitted in the standard product or are not in the standard product. Labels would also have to inform consumers of any differences in functional properties resulting from the reformulation. For example, if the lower fat version of frankfurters does not hold up under freezing, the label would need to state "do not freeze." If the low-fat version of cream cheese does not perform well in baked recipes, the label should state, "not recommended for baking" (USDA, FSIS, 1995). Thus, the label can inform the consumer of deviations from the standard product while still conveying that the product will be similar in flavor and texture to the standard product.

Similarly, in response to manufacturers' and consumer groups' requests, FDA removed the standard of identity for ice milk in 1994 (DHHS, 1995b). Products formerly labeled as ice milk may now be labeled as "reduced-fat ice cream" or "low-fat ice cream" depending on the total fat content of the food. Manufacturers may also make other versions of ice cream, such as "nonfat ice cream" or "light ice cream." These changes increase the variety of products available, while safeguarding the integrity of traditional standardized products. Consumers are informed by the product labeling of the differences between the traditional standardized product and the modified version (DHHS, 1995b).

On the other hand, earlier standards of identity for certain lower fat milk, sour cream, and yogurt products were inconsistent with current definitions for lower fat products. To eliminate this inconsistency, FDA revoked the standards of identity for these products in 1996. In order to be labeled "low fat," "reduced fat," or "light/lite," these

[10] A Policy Memo provided guidance on this issue as early as 1991, but at that time the label for low-fat hamburger would have been required to identify the food as "low-fat hamburger, water, and carrageenan product" (USDA, FSIS, 1991b). A 1995 Policy Memo permitted a less pejorative label such as "low-fat pepperoni" (USDA, FSIS, 1995).

products must now use the same definitions used by all other food products (DHHS, 1996a).

Quality Grades

The Commodity Standardization Program of the USDA Agricultural Marketing Service (AMS) establishes quality grades for many fresh food commodities, including eggs, milk, fruits, vegetables, meat, poultry, and grains, as well as bulk processed commodities such as frozen vegetables. Commodity graders are Federal employees or federally licensed State inspectors, but the grading services are voluntary and paid for by the firms requesting it. These grades aid in the marketing of agricultural commodities by providing (1) a common language of trade and (2) a means of measuring value to establish prices (GAO, 1990). The grade conveys information about the size, shape, maturity, and blemishes of the commodity so the buyer can compare prices for commodities of similar quality. In other cases, such as grains, the grade conveys information on characteristics that are not observable by visual inspection, such as the protein content and moisture of the grain. This more efficient transmission of information about the commodity helps reduce the cost of marketing the commodity. Lower marketing costs can either lower prices for producers or increase profits for producers or suppliers, which can increase the probability that a particular item will be available for sale.

When grades do not reflect consumer preferences, producers may not have an incentive to supply the desired characteristics because consumers cannot convey that they would be willing to pay a premium for the attribute. Consumers may consume less of a food if there is a risk that the quality is below their expectation. For example, a survey found that inconsistencies in flavor, tenderness, and juiciness—factors cited by consumers in Virginia to explain why they have decreased their purchases of beef—could explain part of the decline in market share of beef throughout the 1980’s (Purcell, 1993).

Grade names also have the potential to appeal to consumers. The “Good” beef grade, which applied to leaner beef, reflected historical preferences for higher fat content; beef with higher fat marbling is graded as “Choice” or, for even higher fat, “Prime.” Preferences began to shift to lower fat content, but the “Good” grade name may have had the connotation of a mediocre product (Sims, 1998). To appeal to consumers interested in lower fat content, the grade name for leaner beef was changed from "Good" to "Select" in 1987. The change may have had a significant impact on consumption of that grade: the proportion of beef graded good increased from 1.8 percent in 1986 to 9.3 percent in 1989 (Sims, 1998). The "Select" grade was further restricted to younger animals in 1997, which could further increase consumer interest in leaner beef, since younger beef is generally more tender for a given fat content.

Regulations Covering Other Sectors

Food choices can also be affected by regulations such as environmental control, worker safety, protection of competition, and trade policies that, while not aimed specifically at the food sector, influence food production or marketing.

Environmental Controls

Water and air quality standards at the Federal and State level are intended to minimize the contamination of streams and ground water from livestock, dairy, and poultry wastes, as well as air quality problems associated with ammonia, methane, and odors (Christensen and Krause, 1993). Some farm operations may also be controlled by regulations to address other problems, such as dust, insects, rodents, noise, and degradation of aesthetics. Such controls generally impose added costs on producers and eventually are passed on to consumers (Christensen and Krauss, 1993). Higher prices could lead to a reduction in consumption.

In general, there has been little research on the effects of environmental regulation on food choices, but the impending ban on methyl bromide has been studied in some detail because its effects on some crops could be severe. The Clean Air Act (as revised in 1998) includes a phaseout of the fumigant methyl bromide—cutting use by 25 percent in 1999, 50 percent in 2001, 70 percent in 2003, and 100 percent in 2005—because it reduces ozone in the atmosphere. Quarantine and shipping uses are exempt and critical agricultural uses will be exempt after 2005. Because alternatives to methyl bromide are very limited, this cancellation could cause large yield losses for Florida and California strawberries and Florida tomatoes if these crops do not qualify as critical uses. Imports may only partly substitute for lost domestic production, especially in the short run, and overall consumption of strawberries and tomatoes may decline at least temporarily (USDA, National Agricultural Pesticide Impact Assessment Program, 1993).

Worker Safety

Agricultural producers are also subject to worker safety restrictions, which influence the cost of production and thus influence food prices and food choices. Producers are subject to safe labor requirements enforced by the Occupational Safety and Health Administration of the U.S. Department of Labor. In practice, employers of 10 or fewer employees have often been exempted by annual congressional action (Runyan, 1992). In addition, agricultural employees are protected from pesticide hazards by the Federal Insecticide, Fungicide, and Rodenticide Act, enforced by EPA. Applicators of restricted use pesticides are required to be certified through training, competency exams, and State licencing. EPA pesticide protection standards for other pesticide handlers (e.g., workers involved in mixing pesticides) as well as harvesters and other farm workers were revised in 1992 (EPA, 1992). The new standards require training, protective equipment in some cases, more specific field re-entry restrictions, notification of pesticide applications, supplies for washing spilled pesticides (such as water, soap, and paper towels), and emergency assistance. These changes were projected to cost $94.3 million across all farms in the first year and $49.4 million in subsequent years (1992 dollars). While these amounts are small relative to the total value of agricultural production ($226 billion for all commodities in 1996; see USDA, ERS, 1997a), some crops or varieties could be disproportionately affected by the employee training requirements because they involve more employee turnover or require more frequent pesticide applications (EPA, 1992).

Protection of Competition

Mergers and anticompetitive behavior in the food industry are regulated by the U.S. Department of Justice; the Federal Trade Commission; the Commodity Futures Trading Commission; and USDA's Grain Inspection, Packers, and Stockyards Administration to prevent the development and exercise of monopoly/monopsony power.

Industry concentration could result in monopoly power, with consumers facing a small group of sellers, or in monopsony power, with input suppliers facing a small number of intermediate buyers. Firms with monopoly power raise consumer prices above competitive levels and sell their products in quantities below the competitive level. Longstanding market power could shield firms from competitive pressures, eroding processing productivity and raising costs. But increased consolidation may also result in greater efficiency, which could lower prices to consumers. Thus regulation of competition may have complex effects, which regulators attempt to take into account.

Trade Policy

Trade policies that restrict food imports, such as the sugar import quota under the sugar program, can result in lower consumption of foods at higher prices. Trade policies that encourage exports—such as the Food for Peace Program, which provides for concessional sales, donations, and grants—can also result in lower domestic availability, although for commodities that are produced in surplus (such as wheat and feed grains), this may have little impact on food choices.

Under several multilateral and bilateral trade agreements, countries have agreed to relax trade restrictions. Under the North American Free Trade Agreement (NAFTA), the United States eliminated tariffs on imports of several commodities in 1994, with additional tariff removals scheduled for later years. While many factors, such as weather and exchange rates, influence fluctuations in imports and exports, ERS (1997b) has estimated that, in 1996, agricultural imports from Mexico and Canada were about 3 percent and 5 percent higher, and agricultural exports to Mexico and Canada were about 3 percent and 7 percent higher, than they would have been without the agreement. Imports of several fruits and vegetables were higher in 1996 than they would have been without NAFTA, including fresh tomatoes (6-15 percent higher), frozen broccoli and cauliflower (6-15 percent higher), and orange juice (2-5 percent higher). The agreement also fostered increases in two-way trade; for example, U.S. beef exports to Canada were about 100 percent higher in 1996 because of NAFTA, while U.S. imports of beef from Canada were about 50 percent higher.

NAFTA and the Uruguay Round Agreements of the General Agreement on Tariffs and Trade (GATT) require any sanitary and

Table 1—Selected regulations/policies affecting dietary choices

Program/reg	Foods affected	Effects on dietary choices	Size of effects
Farm assistance programs (current and historical)			
Price and income support programs sugar	Wheat, rice, feed grains, oilseeds, dairy, peanuts,	Surplus purchases reduce marketed supply, increase price. modities, feed crops Import restrictions reduce domestic supply, increase price. Acreage restrictions reduce supply, increase price. Deficiency payments may increase supply, but paymentsusually linked to acreage restrictions.	Small—low price elasticity of demand for affected com only part of meat, poultry, dairy, egg prices. Can be large for a pop. group when surpluses are distributed to that group.
		Milk marketing orders set regional minimum prices for milk for different uses; may lead to below-market prices for cheese.	Small--due to low price elasticity of demand
Fruit/vegetable marketing orders	Federal orders: 27 fruits/vegs., and spec. crops. Others covered in State orders.	Some marketing orders set quality limits, which may limitavailability, but also increase demand by reducing quality variability.	No estimates available.
Research and promotion	Federal programs: beef, dairy, eggs, honey, mush-rooms, popcorn, pork, potatoes, soybeans, water-melons, wheat. State programs for many fruits and vegetables.	Producer assessments fund generic advertising; can increase consumer demand for the commodity.	Dairy—see Chpt. 10 Beef: mixed evidence. Catfish: large. Orange juice: limited
Food safety			
Food inspection	All foods	Safety requirements may increase costs, and price of foods. Confidence in the food supply may increase demand.	Small impact on costs, except for small firms. Effect of lower consumer confidence large in short run.

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Table 1—Selected regulations/policies affecting dietary choices, cont.

Program/reg.	Foods affected	Effects on dietary choices	Size of effects
Food additive approval	All processed foods	Can increase shelflife, lowering costs; can provide characteristics of interest to consumers, increasing demand.	No estimates available, but demand effects could be large for some additives leading to low-fat or fat-free foods.
		Approval process expensive, restricting development to high-profit foods, but maintains consumer confidence	No estimates available.
Pesticide regulations	All foods	Restrictions may decrease supply, increase price	Overall impacts small, may be large for certain varieties.
		Confidence in the food supply may increase demand.	Effects of lower consumer confidence large in short run.
Animal drug approval	Meat, poultry, eggs, dairy, farm-raised seafood	Approvals allow use of drugs, which increase supply, decrease costs of production.	Small—low farm-price-to-retail-price ratio, low price elasticity of demand.
		If consumers don't accept new drug, could decrease demand.	Effects of consumer concerns usually temporary.
Information regulations			
Labels/advertising	All processed foods (fresh food labels voluntary, but any labels standard format)	Information affects demand for foods.	Small effect of information.
		Information affects formulation decisions.	Effect of formulation changes may be larger (see chpt. 11)
		Label regs. increase costs, price of foods.	Small effect on price except for small firms.
Standards of identity	Over 200 processed foods	Prior to revisions, lower fat versions required to be labeled as "imitation" or other pejorative term, which suppressed demand for more healthful products.	Revisions may have had a large effect for some items (low-fat ice cream/hot dogs).

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Table 1—Selected regulations/policies affecting dietary choices, cont.

Program/reg.	Foods affected	Effects on dietary choices	Size of effects
Quality grades	Dairy, eggs, poultry, beef, many fruits and vegetables	Standardization lowers information costs for marketing. Where grades used at retail level (such as for beef), grade name can affect consumer demand.	No estimates available.
Other regulations			
Environmental controls	Potentially all foods	Environ. controls could increase costs (or prevent cost-decreasing changes).	Could be large for individual fruits/vegetables with high price elasticity of demand.
Worker safety	All foods	Protection of farmworkers and food storage and processing personnel could increase costs.	Small for farm-workers; other estimates not available.
Protection of competition	All foods	Restrictions of mergers prevent monopoly power, which could decrease supply and increase prices. Increased consolidation may also result in greater efficiency, which could lower prices.	No estimates available.
Trade policy	All traded foods	Policies that restrict imports or encourage exports decrease domestic supply and increase price.	Small for dairy and sugar with low price elasticity of demand. Larger for fruits and vegetables with higher price elastici-ty of demand.

phytosanitary restrictions on imports, either for food safety or for crop protection, to be based on fair science-based rules. In February 1997, USDA's Animal and Plant Health Inspection Service (APHIS) partially lifted a 1914 ban on Mexican avocados set to protect U.S. avocado production from Mexican avocado pests that might be accidentally imported with the fruit. To minimize the risks of imported pests, Mexican avocados are allowed only into 19 Northeastern States and the District of Columbia, which do not produce avocados. APHIS projected that, as a result, the price of avocados could fall by anywhere from 8 to 41 percent in these States, with consumption increasing 8.6 to 44 percent (Roberts, 1997). This case illustrates the potentially large magnitude of effects on individual foods from changes in trade policy.

Conclusions

Regulations—whether or not they are directed specifically at the food sector—can affect the varieties and qualities of foods available for purchase, the prices consumers face, the information consumers receive about a product, and consumer confidence in the food supply. The examples described here illustrate that the impact of regulations that affect the supply of commodities depends on how the regulations affect retail food prices and how responsive consumers are to those prices. Ingredient costs are a small fraction of retail prices for many processed foods, but commodity prices are a larger fraction of retail prices for fresh meat, fish, poultry, eggs, milk, cheese, and produce. Consumers are not very responsive to prices for poultry, eggs, fish, milk, and cheese, but are more responsive to the prices of some fresh fruits and vegetables, as well as beef and pork. From the standpoint of dietary guidelines, policies that may affect the consumption of individual fruits and vegetables considerably may not affect overall consumption of fruits and vegetables by very much. Yet even when overall impacts of regulations are small, the impacts on different agricultural regions, or firms of different sizes, can be large. And even when impacts on the diet of the population as a whole are small, the impact on specific population groups can be significant, as in the case of food surplus distribution programs.

Regulations that affect the information that consumers receive have the potential to at least temporarily influence individual food choices, either the direct effect of the information on consumers or from product reformulation by food manufacturers. Yet individual food choices, such as consumption of lower fat foods, are not necessarily associated with lower fat intake overall. Even generic advertising for commodities, which shows strong effects in some cases, may increase consumption of one commodity at the expense of another in the same group.

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Chapter 18

National School Lunch and School Breakfast Program Reforms

Policy Development and Economic Impacts

Steven M. Lutz, Jay Hirschman, and David M. Smallwood

This chapter summarizes the development and analysis of USDA's policy to bring the National School Lunch Program and School Breakfast Program into compliance with the Dietary Guidelines for Americans. The analysis shows that the impact of the school lunch reform on the major commodity markets and related farm programs would be minimal. Commodity prices, producer marketings and receipts, and farm program outlays would not vary significantly from current projections. On the consumption side, the health of our Nation's children may be improved by offering them healthier meals and educating them on the importance of long-term healthy eating habits.

Introduction

The U.S. Department of Agriculture (USDA) has long been committed to promoting nutritious diets, and this commitment was recently translated into sweeping new requirements for school meals.

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Concerns that meals served in schools were not meeting current dietary advice led to the development of the School Meals Initiative for Healthy Children. At the heart of the proposal was the belief that federally subsidized meals should meet Federal nutrition standards and help develop healthy eating habits among school-age children.

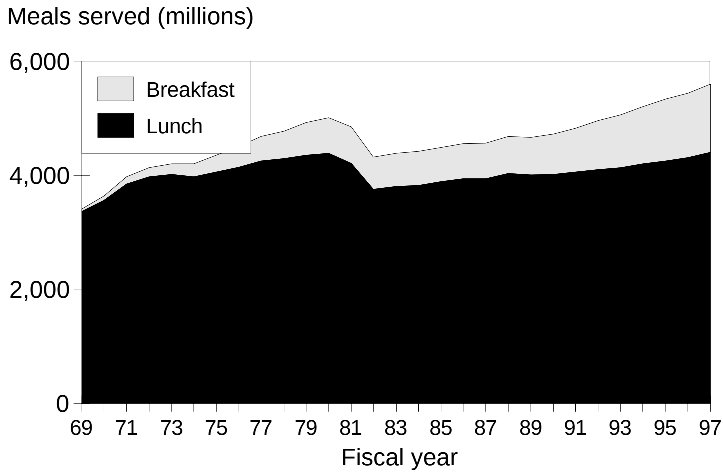
However, USDA must balance its responsibility to provide healthy school meals with its responsibility to support and promote U.S. agricultural production. Potential tradeoffs between diet quality and the use of various agricultural commodities result in seemingly competing interests, with important implications for agriculture, childhood nutrition, and Federal food policy. For example, red meats such as beef have a relatively high fat content compared with vegetables, but also contain vitamins and minerals that are essential to good health and are not readily available from vegetables. USDA maintains that there are no “good” or “bad” foods, instead stressing the importance of balanced diets.

This chapter summarizes USDA’s efforts to bring the National School Lunch Program and School Breakfast Program into compliance with the Dietary Guidelines for Americans issued by USDA in conjunction with the U.S. Department of Health and Human Services (USDA and DHHS, 1990). Additional details are available in the regulatory impact analysis conducted for the School Meals Initiative for Healthy Children, published in the Federal Register (USDA, 1994a).

Policy Development of School Meal Programs

Federal efforts to address citizens’ concerns about the quality of their diets have been in existence for over 50 years. In earlier years, Federal food assistance served two purposes: fighting hunger and malnutrition among schoolchildren, and disposing of surplus farm commodities. The economic hardships experienced by many families during the Great Depression were felt by millions of schoolchildren who were unable to pay for their lunches. Temporary legislation was passed to provide funding and, by early 1942, about 6 million school children were being served low-cost meals, partially subsidized by USDA surplus agricultural commodities and Works Progress Administration laborers who worked in the cafeterias.

Figure 1
School meal service resumed growth after dip in 1980's



Source: USDA/ERS.

From 1944 to 1946, Congress appropriated $50 million per year to operate school food programs, but local school boards were reluctant to participate without permanent funding. Thus, in 1946, Congress passed Public Law 79-396, the National School Lunch Act, and student participation began to rise in the 1946-47 school year.

The Child Nutrition Act of 1966 was the first major change in the National School Lunch Program (NSLP). This act placed USDA in charge of food services to ensure uniform standards of operation, expanded administrative support, and started the School Breakfast Program (SBP) as a pilot project that was made permanent in 1975.

Growth in the number of meals served has remained fairly constant, with the exception of a downward dip in the early 1980’s (fig. 1). The Omnibus Budget Reconciliation Act of 1981 (OBRA) reduced reimbursement rates paid by the Federal Government to States for school meals. This in turn caused States to raise prices of school meals, lowering participation.

Most schools in the Nation participate in the NSLP and many participate in the SBP. Under the law, all students enrolled at participating schools are entitled to take part in the programs. In the 1996-97 school year, about 94,000 schools served NSLP meals to an average of 26 million students per day. During the same period, 68,000 schools served about 7 million children per day under the SBP.

Children from homes with income at or below 130 percent of the Federal poverty level ($20,865 for a family of four in the 1997-98 school year) can receive their meals free. Children from homes with income between 130 and 185 percent of the Federal poverty level are eligible for reduced-price meals, for which students can be charged no more than 40 cents. Children in other households pay a higher price for the meal, but these are also subsidized. In the 1997-98 school year, for each free meal that qualifies for reimbursement, schools receive about $1.89 from USDA.[1] They receive about $1.49 for each reduced-price meal and 18 cents for each full-price meal served.

In addition to reimbursing State agencies for meals served and providing administrative support, USDA also makes “entitlement” agricultural commodities (such as nonfat dry milk) available at a value of 15 cents per meal. States select entitlement foods for their schools from a list of more than 60 different kinds of food purchased by USDA. Participating schools are also eligible to receive “bonus” agricultural commodities that USDA procures from surplus stocks. They are only offered as they become available through agricultural surplus. The variety and quantity of both entitlement and bonus food commodities in schools depends on their availability and price.

Since the school meal programs are entitlement programs—all eligible children are able to participate—total program costs are related to the reimbursement rates and the total number and types of meals served. USDA uses the food-away-from-home price index to determine year-to0year change in annual reimbursement rates.

The total cost to the Federal Government in fiscal year 1997 was about $6.4 billion for the two programs. While the amount spent on the programs has increased, when adjusted for inflation the cost to the Government remained fairly constant through the 1980’s (fig. 2). The increase in the 1990’s was due to efforts to increase participation in the School Breakfast Program.

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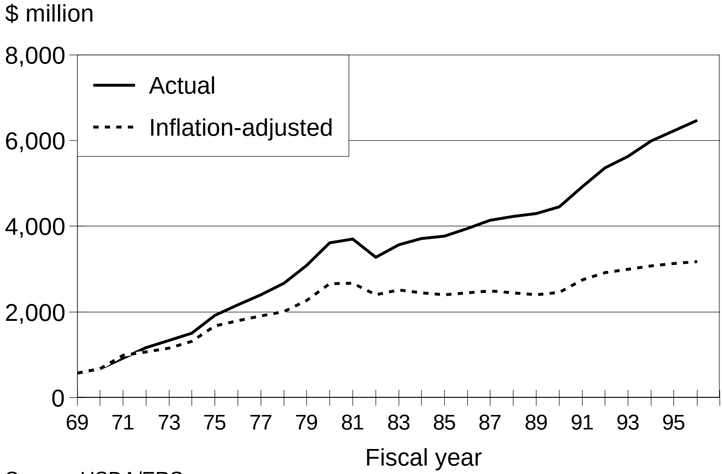
[1] Not all meals served in participating schools qualify for reimbursement. For example, if a student selected mashed potatoes and pie in an a la carte line, it would not meet qualifying Federal standards for a meal and therefore would not be subsidized.

Figure 2

Federal cost of school food programs has grown



Source: USDA/ERS.

USDA's 1989-91 Continuing Survey of Food Intakes by Individuals (CSFII) showed that children's diets, including meals served in schools, met few of the recommendations in the Dietary Guidelines. Of particular concern was the high fat content of children's diets, since high fat intake is associated with increased risk for coronary heart disease, stroke, and some types of cancer (see chapter 1). Data from the 1994-95 CSFII reveal that fat consumption in school-age children has decreased slightly but is still higher than recommended.

In 1992, USDA sponsored the School Nutrition Dietary Assessment (SNDA) study, which focused on the foods and nutrient content of meals offered to the students as well as what was actually eaten (Devaney and others, 1993). While school lunches met or exceeded the required one-third of the Recommended Dietary Allowance (RDA) for key nutrients, they provided 38 percent of calories from total fat and 15 percent of calories from saturated fat — considerably more than the 30 and 10 recommended. The study also showed that while school breakfasts fared better in terms of total fat (31 percent of calories), they still derived 14 percent of calories from saturated fat.

Based on this knowledge, USDA began developing the School Meals Initiative for Healthy Children in 1993 by holding a series of public hearings and inviting written comments from interested parties unable to attend the hearings. From the testimony and written comments, USDA developed a proposed rule in 1994. The final rule was published in the Federal Register in 1995.

School meals have always been required to meet certain nutritional goals. In the past, the nutritional goals focused solely on providing sufficient calories, protein, vitamins, and minerals. This was accomplished by offering specified amounts of foods from the four food groups. Today, school meals must not only provide sufficient amounts of six nutrients (calories, protein, vitamin A, vitamin C, iron, and calcium), but must also meet the Dietary Guidelines recommendations and limit the amounts of fat and saturated fat. In particular, lunches must provide at least one-third of the RDA for each of the specified six nutrients, and breakfasts, one-fourth. No more than 30 percent of the calories offered are to come from total fat and less than 10 percent are to come from saturated fat. Schools' compliance with both the Dietary Guidelines and the RDA's is measured over a week's menu cycle.

The School Meals Initiative for Healthy Children represents the largest change the National School Lunch Program and the School Breakfast Program have undergone since their inception. School menus have changed to reflect the *Dietary Guidelines for Americans*. Schools had until the 1996-97 school year to implement the new regulation, but some received authorized waivers until the 1998-99 school year.

Determining Economic Impacts

The regulation recognized that simply offering a nutritious meal serves no use unless it is actually eaten. Therefore, in addition to meeting Federal nutrition standards, federally subsidized meals served in the Nation's schools should taste good and be acceptable to children. Furthermore, the initiative is designed to minimize impacts on agricultural commodity markets and to control program costs.

To model the likely impacts of different alternatives, USDA's Economic Research Service, in cooperation with the Food and Nutrition Service (formerly the Food and Consumer Service), developed and analyzed projected behavioral and economic impacts of the initiative. A mathematical programming model to reflect how children were likely to react to changes in their lunch menu formed the basis of the analysis. The model incorporated information on the kinds, amounts, nutrient content, and costs of foods served in school lunches. Foods and recipes were constrained to those actually offered in schools. Food consumption patterns were allowed to vary from baseline food group and serving size regulations so long as nutritional, cost, and policy constraints (such as the requirement to offer whole milk) were maintained.

Data for the model were obtained from a number of sources. Data on the foods offered in the NSLP were obtained from the 1992 USDA School Nutrition Dietary Assessment (SNDA) survey conducted by Mathematica Policy Research Inc., an independent consulting firm (Devaney and others, 1993). Interviews of 3,550 students (grades 1-12) in about 545 schools throughout the country yielded detailed information on the kinds and amounts of foods they consumed over a 24-hour period. Only data on foods offered as part of credited school lunches were used in order to focus on Federal requirements for the meals.[2] The SNDA survey contained over 600 foods offered in the NSLP. These foods were coupled with nutritional content information from USDA's nutrient database and grouped into over 50 food groups, including high-fat and low-fat versions of different food categories, such as baked goods, meats, etc.

Food price information was obtained from a nationally representative sample of schools included in USDA's School Lunch and Breakfast Cost Study (USDA, 1994). The survey took place during the 1992-93 school year and included food costs as well as other direct and indirect costs of providing school meals.

These food prices were matched to the SNDA data to calculate food costs. The 1992-93 median cost of producing NSLP and SBP meals, which included both direct costs (such as labor, supplies, and utilities) and indirect costs (such as administrative, facilities, services, and employee benefits), was about \$1.63, compared with the 1992-93 Federal subsidy for free meals of \$1.84. Food costs were estimated to be about 77 cents per meal for meals meeting former NSLP crite-

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[2] Not all meals served qualify for reimbursement. See footnote 1.

ria. The balance was accounted for in direct costs other than food and indirect costs.

The optimal solution generated by the model was the meal pattern that deviated least from the actual meal pattern observed in the SNDA survey (for sake of acceptability) and met all of the nutrition, food group, and cost requirements.

School Meals Will Change

A wide variety of alternative scenarios were explored using the model to gain an understanding of the economic impacts and alternative meal patterns that could occur under the School Meals Initiative for Healthy Children. This chapter looks at three of those scenarios to illustrate the numerous options available.

All the scenarios explored met the nutritional requirements specified in the regulation based on the nutritional recommendations that were in effect at the time—the 1990 *Dietary Guidelines* and the 1989 RDA's (National Research Council, 1989). All the scenarios also enforced policy constraints, such as the requirement that fluid milk be offered with lunch and that food costs not be increased. In addition, it was assumed that schools would no longer use butter.

The first and third scenarios (see table 1) demonstrate the range of market impacts associated with either minimizing the change in food offerings or minimizing the change in agricultural commodity markets. The second scenario was designed to show how the results could change if lower-fat preparation techniques were followed in only one of the commodity groups. Although chicken was used in this example, other commodities, such as beef or pork, might show similar changes if substitutions were made between high- and low-fat alternatives. The three scenarios estimate impacts using 1992-93 market prices for foods available and in use by schools. To the extent that products are reformulated and additional lower fat products become available, both consumption patterns and costs would probably be affected.

Minimum Change in Current Offerings

This scenario established the amounts of foods from each of the food groups required to meet dietary, cost, and milk requirements with as

Table 1—Estimated food use in school lunches under different scenarios

	1993 market size			Estimated food use under alternative scenarios		
	U.S. farm-level disappearance	School lunch use	Lunch use as %	Minimum change	Reduced-fat chicken prep.	No change
	Million pounds		*Percent*	*Million pounds*		
Butter	1,007	55	5.5	0	0	0
Cheese[1]	6,633	135	2.0	53	47	135
Broilers	19,855	245	1.2	125	283	245
Turkey	4,591	105	2.3	53	121	105
Beef	24,040	485	2.0	385	359	485
Pork	17,268	280	1.6	296	280	280
Fruit and juices	61,055	1,097	1.8	1,815	2,234	1,097
Vegetables	71,018	1,218	1.7	1,307	1,253	1,218
Potatoes	34,079	674	2.0	376	372	674
Peanuts	2,050	44	2.1	50	50	44
Rice[2]	180	1	0.7	2	2	1
Wheat[3]	2,500	16	0.6	30	28	16

[1] Milk equivalents.
[2] Million hundredweight.
[3] Million bushels.

little deviation as possible from the eating choices of children as captured in the 1992 SNDA. This resulted in meal patterns that contained considerably less meat and cheese and more grains and fruits (table 1). Beef was often chosen to be used in mixtures such as spaghetti with meat sauce, as opposed to roasts.

Lower Fat Chicken Preparation

This scenario illustrates the dietary change when lower-fat preparation techniques are used in one food category while holding food preparation techniques in other food categories constant. In this scenario, high-fat chicken preparation techniques (such as fried chicken nuggets) were entirely replaced by lower fat preparation techniques (such as baked or broiled chicken parts). This scenario showed that diets can be reformulated without removing the foods children enjoy eating. This scenario resulted in meal patterns that used more chicken, grains, and fruits, and less cheese (table 1).

No Change in Commodity Markets

This scenario was designed to show what dietary changes might be achieved while keeping major agricultural commodity groups at their baseline market levels (with the exception of butter). Consumption of various foods was allowed to vary within the commodity groups, but not outside them. For example, beef could be consumed alone as a roast or as ground beef in a mixture such as lasagna, but the total level of beef served was required to be the same as the baseline (table 1). In general, this adaptation required that low-fat foods be chosen within food groups, such as nonfat milk instead of whole milk. Notable exceptions included serving high-fat chicken and potatoes, probably to provide sufficient calories. Also, food cost became more of a limiting factor in this scenario. Many of the fattier or more costly foods were eliminated from the solution.

Agricultural Impacts Minimal

Most foods used in the NSLP and SBP account for only a minor share of overall food supply. For example, potatoes are a heavily used commodity, yet school use is only 2 percent of the potato market (table 1). Consequently, the estimated impacts of program changes on most agricultural commodities were found to be relatively small. The models used to estimate the impacts were developed by commodity specialists at ERS (USDA, 1994a). The estimated impacts of the two first scenarios on the dairy, poultry, and the fruit and vegetable markets are discussed below and detailed in tables 1 and 2 (the third scenario does not affect the commodity markets other than butter).

Dairy Sector

Estimated impacts differed across the fluid milk, butter, and cheese components of the dairy sector. In all scenarios, fluid milk was still required to be offered, although low-fat milk could be substituted for whole milk. The amount of cheese used was reduced, and butter was eliminated entirely. Hence, the major impacts were found for processed product markets as opposed to the fluid market.

If butter were totally eliminated from school lunches, it would displace 55 million pounds of butter annually in the 1.0-billion pound U.S. market (table 1). Displacement of butter was estimated to have

Table 2—Farm price, revenue, and program impacts for major agricultural commodities

Commodity	Farm receipts	Minimim change in current offerings: School lunch use	Farm price	Farm revenue	Farm program cost	Reduced-fat chicken prep.: School lunch use	Farm price	Farm revenue	Farm prog. cost
	$ billion	*Million lbs.*	*%*	*$ million*		*Million lbs.*	*%*	*$ million*	
Cheese[1]	19.4	- 82	-0.6	-166	23	-88	-0.6	-178	25
Broilers	11.0	-120	-1.8	-134	0	38	0.4	19	0
Turkey	2.9	- 52	-2.1	-36	0	16	0.5	4	0
Beef	28.3	-100	-0.9	-143	0	-126	-0.9	-103	0
Pork	10.7	16	0.2	11	0	0	0.0	0	0
Fruit/juices	10.2	718	0.1	124	0	1,137	0.2	200	0
Vegetables	9.4	89	0.0	12	0	35	0.0	5	0
Potatoes	2.0	-298	-0.1	-20	0	-302	-0.1	-20	0
Peanuts	1.0	6	0.1	1	0	6	0.1	1	0
Rice	1.3	1	0.6	9	-8	1	0.5	7	-6
Wheat	7.3	14	0.7	45	-35	12	0.7	45	-35

[1] Milk equivalents.

minimal impact on producer prices, incomes, and government farm programs since virtually all of the butter used in school programs is donated by the Commodity Credit Corporation (CCC) from stocks acquired under price support operations. The school lunch portion of CCC stocks is small and could be donated to other institutions or programs.

Under the first scenario, consumption of cheese in schools would decline by 82 million pounds annually, a 1.2-percent drop in U.S. cheese disappearance (table 2). The decline would lower farm milk prices 7-8 cents per hundredweight, causing a decline in production and lowering farm revenues by about $166 million per year (from a 1990-93 base of $19.4 billion). CCC dairy program costs would increase $23 million to purchase the excess production. Given the size of the dairy market, these impacts are small, and the substitution and introduction of reduced-fat cheese or other dairy products could moderate the impacts.

Broiler and Turkey Sector

Impacts on the broiler market were estimated to be minimal. In 1993, the NSLP used about 245 million pounds of broilers in a U.S. market of 19.9 billion pounds. The broilers were most frequently served as high-fat chicken nuggets or sandwiches. Under the first scenario, NSLP broiler use would decline by about 120 million pounds, lowering broiler prices by about 1.8 percent and farm revenues by 1.2 percent. However, under the second scenario, when lower-fat cooking techniques are used to prepare chicken, broiler use increases by 38 million pounds, broiler prices increase by 0.4 percent, and farm revenues rise by 0.2 percent.

As with broilers, use of turkey in the NSLP is small (105 million pounds) relative to the total U.S. market of about 4.6 billion pounds. Under the first scenario, turkey use in school lunches would decline by 52 million pounds, driving prices down about 2 percent and reducing farm revenues by about $36 million, 0.01 percent of current revenues. In the second scenario, consumption would increase by 16 million pounds, increasing prices by 0.5 percent and farm revenues by $4 million.

Fruit and Vegetable Sector

Schools use fruits and vegetables in a variety of forms, including fresh, frozen, canned, and as ingredients in commercially processed mixtures such as lasagna. In spite of the relatively large increase in the use of fruits under the School Meals Initiative for Healthy Children, the impact on the fruit market would be minimal since schools account for less than 2 percent of the market. For example, in the first scenario, fruit use would increase 718 million pounds, but prices would increase by only 0.1 percent and farm revenues would increase by $124 million in the $10.2-billion market. The second scenario would increase fruit school consumption by 1.1 billion pounds, increasing farm revenues by $200 million.

Potato consumption would decrease substantially under the first two scenarios since the majority of potatoes used in school meals are deep-fried and contain a lot of fat. French fries would likely be served less often under the program reforms. Even so, the impact on potato prices would be minimal—prices would decline by 0.1 percent— and farm revenues would decrease by $20 million (a 1-percent decline). However, as illustrated in the second scenario for chicken, if potatoes are prepared in a lower-fat manner, schools could make adjustments that would help moderate the market impacts.

Use of other types of vegetables in the NSLP is expected to increase under the reform measures. Vegetable use would increase by about 89 million pounds annually in the first scenario and 35 million pounds in the second scenario. In the 71-billion-pound U.S. vegetable market, this increase has no impact on prices, and farm revenue increases less than 0.01 percent.

Conclusions

The National School Lunch Program serves lunches to over 26 million children per day and thus represents a ready tool to improve the diet quality and health of school children. The impact of school lunch reform on the major commodity markets and related farm programs would be minimal. As detailed in this chapter for three illustrative scenarios, commodity prices, producer marketings and receipts, and farm program outlays did not vary significantly from baseline projections. Use of lower-fat versions of commodities could result in increased use of these items.

The adjustments needed to make school meals conform to the Dietary Guidelines appear feasible economically; we assume the meals can be made palatable to children. While nutritionists, program administrators, and foodservice workers contributed to the regulatory impact analysis and the details of the regulation, it is not yet known how smoothly the implementation of the new regulation will go if actual costs and impacts differ from estimates, or whether children will eat what is offered.

Data on the opinions of frontline administrators and school foodservice personnel on the implementation of the new regulations are now being collected and analyzed. The analysis should provide practical information on the benefits and problems encountered in the new regulations and indicate further refinements.

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Chapter 19

Accelerating the Trend Toward Healthy Eating

Public and Private Efforts

Jon Weimer

Federal and State agencies, the private sector, and voluntary organizations have been actively engaged, particularly in the past decade, in myriad efforts to improve the nutritional health and well-being of Americans through informed food choices. These efforts have involved empowering people, via nutrition education/information programs and materials, with the knowledge to make wise nutritional choices.

Introduction

There is no doubt that Americans are interested in improving their diets. Evidence suggests that many are changing their diets and moving closer to dietary recommendations made by science and health groups. However, the direction and magnitude of these changes vary considerably, both among individuals and among food groups. For example, survey data show a trend toward lower fat diets in the last decade—a move in the right direction. The same survey data, however, also show that individuals are not increasing their consumption of fruits and vegetables as recommended, and that the prevalence of obesity is rising (see chapters 3, 4, and 6).

With increasing evidence of the role of diet in reducing the risk of chronic diseases, the food industry, voluntary organizations (e.g., the American Heart Association), and Federal and local government

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agencies, either independently or cooperatively, have stepped in to accelerate the trend toward healthy eating by promoting diets that conform to Federal recommendations. These efforts have focused on (1) providing nutrition information and education to persuade and guide Americans to consume more healthful diets, and/or (2) directly altering the nutrient content of foods or meals.

Nutrition Education and Information Efforts

Within the last few decades, there have been myriad nutrition education and information efforts to guide Americans to more healthful diets; these efforts have originated from both the government and private sectors. Some of these efforts are targeted to “healthy” Americans, that is, those who are not on prescribed diets to treat medical conditions. Other educational efforts target population groups considered to be nutritionally at risk due to low income and/or age or physiological condition (e.g., pregnant women, young children, the elderly), and who may be eligible to participate in food assistance programs. And some activities target nutrition education intermediaries—allied professionals, teachers, and school foodservice workers.

Nutrition education and information efforts can be categorized in terms of target audience(s), locale, or delivery method. In addition, this chapter characterizes them as either informational or educational programs. Informational programs (such as nutrition labeling or placard displays of nutrition principles) aim to produce nutritionally literate consumers by altering the informational environment. Educational programs emphasize dietary behavior change as a result of the educational intervention—a more active approach than simply imparting information.

National Interventions/Campaigns Directed at the Public

The purpose of these broad-based targeted programs (at least implicitly) is either to increase awareness of anticipated consequences of diet and/or to increase knowledge about behaviors to reduce risk, or (as in the case of nutrition labeling) to heighten consumers’ awareness and knowledge about a food product’s nutritional content.

Dietary Guidelines and the Food Guide Pyramid

The Federal Government's nutrition policies and recommendations should provide a consistent context and serve as the focal point for the delivery of nutrition messages and interventions. The *Dietary Guidelines for Americans* serve that very purpose—a cornerstone for nutrition policy. Published jointly by the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (DHHS) and updated every 5 years, the *Dietary Guidelines* currently contain seven recommendations for a healthful diet for healthy people age 2 and older. Those recommendations provide the focus of nutrition education programs to improve the health and well-being of the Nation (USDA and DHHS, 1995).

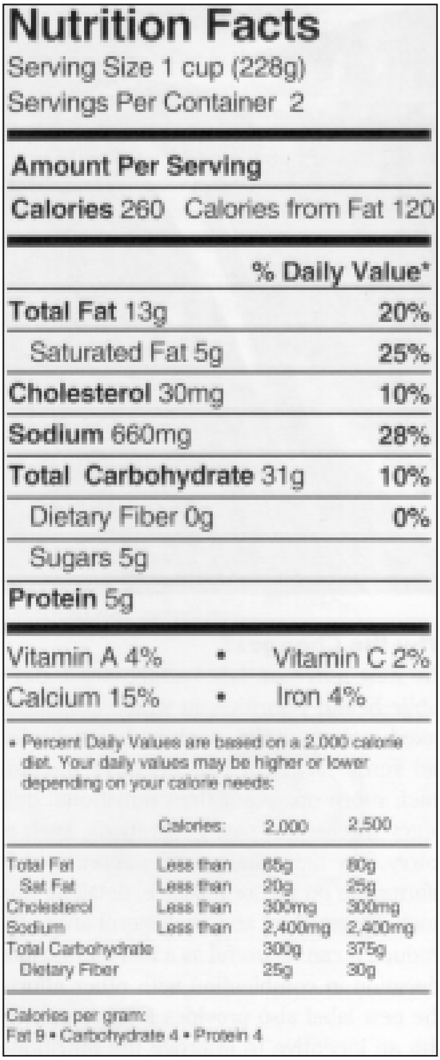
The *Food Guide Pyramid* is a graphic representation of what constitutes a good diet—-an educational tool to help consumers put the *Dietary Guidelines* into practice. Released in 1992, the Pyramid has been well received by both the professional community and the public (USDA, 1992).

In addition to extensive use within the Federal Government, the Pyramid has been used by the food industry, media, educators, and others in the private sector (the Pyramid graphic is in the public domain and, thus, can be used by anyone). Publishing companies, for example, have updated high school and college nutrition books to include the Pyramid. Trade associations—such as the Wheat Foods Council, National Pasta Association, and the USA Rice Council—have used the Pyramid in their nutrition education materials for the public. The *Food Guide Pyramid* graphic is appearing more frequently on food packages. Two recent publications further the cause: (1) *The Food Guide Pyramid...Your Personal Guide to Healthful Eating*, a brochure for consumers produced by USDA in cooperation with the International Food Information Council Foundation and the Food Marketing Institute; and (2) *Check It Out! The Food Label, The Pyramid, and You*, a brochure also for consumers explaining how to use the new Nutrition Facts label and the Pyramid together to choose healthful diets.

Nutrition Labeling

Providing nutrition information to the public is accomplished largely through nutrition labeling. The Nutrition Labeling and Education Act

Figure 1



(NLEA), passed by Congress in 1990, had the express purposes of heightening people's awareness of the nutritional makeup of foods and encouraging food manufacturers to improve the nutritional attributes of their products. The resulting nutrition labeling regulations, which became fully effective in mid-1994, provide consumers with an unprecedented amount of nutrition information by mandating nutrition labeling on virtually all processed foods and promoting voluntary labeling of fresh meat and produce. The required Nutrition Facts label panel on a product (fig. 1) reflects perhaps one of the most tumultuous changes the food industry has ever faced.

A consumer survey conducted in early 1995 by the Food Marketing Institute indicated that the label may be causing some dietary change (see also chapters 11 and 13). Of those who had seen the label (43 percent of the shoppers interviewed), 22 percent indicated it had caused them to start buying and using food products they had not used before, and 34 percent said they had stopped buying products they had regularly purchased (Food Marketing Institute, 1995). Another survey, conducted under the auspices of the American Dietetic Association, indicated that 56 percent of the people interviewed claimed to have modified their food choices using this new labeling information (American Dietetic Association, 1995).

Despite concern that the regulations' strict definitions for making claims such as "low-fat" and "reduced-fat" would be overly burdensome, the food industry responded with more low- and no-fat foods than ever before. And, as *Prepared Foods* (a food industry publication) has indicated, the attention drawn by labeling legislation to issues regarding fat and calories from fat has been a boon to some food manufacturers who have found a growing and profitable niche market (*Prepared Foods*, 1995).

A recent labeling development for milk was the result of a partnership between the milk industry and the Center for Science in the Public Interest (CSPI), a consumer advisory group. The Milk Industry Foundation (MIF) and CSPI jointly filed a petition with the Food and Drug Administration to change how milk is labeled. Concerns about the high fat content of milk appear to have caused many people to avoid milk, but the new labeling regulations (passed in November 1996) will make it clearer that there are fat-free and low-fat options.

5-A-Day for Better Health

Jointly sponsored by the National Cancer Institute (DHHS) and the Produce for Better Health Foundation, this nationwide effort aims to increase the average fruit and vegetable consumption to at least five servings per day by year 2000. The program, initiated in 1992, includes a national media campaign (e.g., newsletters to editors of food columns, public service announcements), point-of-choice activities in supermarkets, and community interventions. A food consumption survey by USDA in 1996 indicated that the average daily intake of vegetables by Americans was 3.4 servings and that of fruits was

1.5 servings (USDA, 1998). A baseline study conducted by the Institute in 1991 indicated that just 8 percent of American adults thought they should eat five or more servings of fruits and vegetables each day (Lefebvre and others, 1995). Data from a 1997 omnibus tracking study found that 38 percent of Americans now believe they should eat five or more servings of fruits and vegetables each day (National Cancer Institute, 1997).

Project LEAN (Low-fat Eating for America Now)

This program was initiated by the Henry J. Kaiser Family Foundation in 1987, and represents a national public awareness campaign to promote low-fat eating as part of an overall healthful eating pattern. Since 1991, the project has been sponsored by the American Dietetic Association's National Center for Nutrition and Dietetics (American Dietetic Association, 1995). Project LEAN is, in part, designed to help individuals become aware of dietary fats and to restrict their fat intakes to no more than 30 percent of total caloric intake. The project also provides resources to food, nutrition, and culinary professionals that allow them to provide facts, tools, and educational support material necessary to promote low-fat lifestyles.

Voluntary Associations' Activities

National voluntary associations have, for years, sponsored and overseen major public education programs, targeted both to the general public and to particular segments of the population with a specific health concern. The American Heart Association (AHA), for example, promotes a set of dietary guidelines in such publications as *An Eating Plan for Healthy Americans* and *Nutrition for Fitness*. These guidelines, which closely mirror the Federal Government's *Dietary Guidelines*, were developed for people concerned with preventing heart attacks. The AHA has also instituted a food certification program called *On-Pak* to help consumers select groceries that can be part of a balanced, "heart-healthy" diet. Food companies can join AHA's *On-Pak* program and have their foods labeled with a heart-check symbol, signifying that the designated food is low in fat, saturated fat, and cholesterol. As of mid-1996, 30 companies, representing 251 food products, had joined this program.

The American Cancer Society (ACS) also oversees programs for nutrition education. *Eating Smart*, for example, is an adult nutrition program with practical tips on how to follow ACS dietary guidelines. In addition to reinforcing the *Dietary Guidelines*, the ACS guidelines include nutrition principles to reduce cancer risk, such as limiting consumption of salt-cured, smoked, and nitrite-processed foods. ACS is also working with schools and parent groups; the Society's instructional material *Changing the Course*, for example, includes a manual for school foodservice managers and curricula for classroom teachers for grades K-12.

Programs Targeted at Preschool And School-Age Children

Because social and cultural pressures contribute to food habits, a number of programs target nutritional messages to preschoolers and school-age children to instill lifelong healthy eating habits. These programs also provide inservice training of schoolteachers and school foodservice personnel. A couple of these programs are discussed below.

Children's Nutrition Campaign

To support changes in the National School Lunch and School Breakfast programs (see below), USDA has established the Children's Nutrition Campaign—sometimes referred to as "Team Nutrition." The focus of this comprehensive effort is to bring science-based nutrition messages to children while strengthening social support for children's healthy food choices among parents, educators, and foodservice professionals.

To accomplish this goal, USDA is building partnerships with public and private sector organizations. The Walt Disney Company, for example, provided "spokestoons" Timon and Pumbaa (from *The Lion King*) to help deliver messages that promote health and nutrition to elementary-age children. Scholastic, Inc., has developed age-specific nutrition curricula for teachers. This campaign also provides training and technical assistance to teachers and foodservice personnel.

Nutrition Education and Training Program (NET)

Although the "Team Nutrition" campaign began fairly recently (1995), USDA's NET program has been in existence since 1977.

Under NET, States receive funds in the form of grants, usually to State education agencies. The States use NET funds to help teachers learn the principles of nutrition and how to make them meaningful to students, to provide training opportunities for foodservice personnel, and to develop educational materials. The size of a State's grant depends on the number of children enrolled in or eligible to participate in USDA child nutrition programs. These programs are operated by schools, daycare centers, family daycare homes, summer camps, residential institutions, and other sponsors. Whereas the Team Nutrition effort has a more centralized focus (i.e., standardized materials, coordination at the Federal level), the States receiving NET funds have a great deal of latitude in terms of developing plans to address their self-identified needs and to establish funding priorities. In 1997, 31,839 schools participated, involving 117,090 educators and 91,487 school foodservice personnel. The underlying base for the development of new educational material and for the dissemination of nutrition principles to both teachers and food service personnel is the *Dietary Guidelines for Americans*.

Worksite Interventions

Worksites can be an important setting for nutrition education and risk reduction programs. The workplace can support health-promoting behaviors, and has been a focus of health promotion in the past decade. The percentage of worksites that offer nutrition education nearly doubled between 1985 and 1992, increasing from 48 percent to 78 percent for large worksites (more than 750 employees) and from 9 percent to 22 percent for small worksites (50-100 employees) (DHHS, 1992).

Most programs in the workplace have been conducted by dietitians, nutrition educators, or other health professionals, and frequently include cafeteria or other environmental interventions. The worksite programs have tended to focus most often on weight control, but have also included general health promotion, cardiovascular disease risk reduction, and other nutrition topics.

Methods to encourage nutritious choices by workers include (l) placing point-of-choice nutrition information in workplace cafeterias; (2) improving the quality of foods available at the cafeteria or in vending machines; and/or (3) implementing certain incentives and policies, such as allowing work-release time to employees to attend nutrition education classes. In general, worksite interventions appear to be expanding to include all employees rather than only high-risk individuals.

Supermarket Interventions

Grocery stores are becoming vehicles for the delivery of nutrition information to consumers. Various instore nutrition programs have been developed to take advantage of shopping time as an opportunity to communicate nutrition information to customers. Some of these programs have been initiated by nutrition educators with the permission of store managers; others have been initiated by corporate nutritionists or consumer representatives employed by grocery stores or chains. These promotions/campaigns may also be a joint effort between a store chain and a voluntary health group, as in 1987 when the National Cancer Institute launched a 2-year supermarket intervention with Giant Food, Inc., a major chain in the mid-Atlantic area. The "Eat for Health" program was intended to stimulate changes in knowledge and food-purchasing behavior consistent with the Institute's dietary recommendations for cancer risk reduction. Program elements included special shelf labels indicating if that product was high in fat, saturated fat, sodium, or fiber; a food guide containing calorie, fat, cholesterol, sodium, and fiber values for all items containing the special price labels; a monthly bulletin containing nutrition information and recipes; and signs in the produce department (Rodgers and others, 1994).

Similarly, a "Shop Smart for Your Heart" grocery program was launched in Minnesota to (1) inform consumers at point-of-purchase about foods that constitute a heart-healthy eating pattern, (2) promote the selection of heart-healthy foods by consumers, (3) allow consumers to try low-fat, low-sodium foods through periodic taste-testing in stores, and (4) foster development of food selection and preparation skills to change people's eating patterns (Mullis and others, 1987). The basis for these stated objectives are the *Dietary Guidelines* and food labeling regulations.

Most of these interventions involve the placement of large posters, shelf signs, and brochures in high-traffic areas. This type of nutrition program appears to be an entrenched feature of the supermarket business landscape.

Community-Based Nutrition Education Interventions

Within the last decade, community networks have formed to provide "integrated" approaches to nutrition education/information. In some instances, these community interventions reflect well-funded projects conducted by research-oriented universities designed to mobilize community resources and peer support to change behavior—for example, to reduce risk factors for cardiovascular disease. Recently, the Federal Government has promoted these community endeavors, which can incorporate everything from media campaigns to supermarket and worksite interventions. However, what distinguishes these community intervention efforts is the ongoing involvement of community leadership, organizations, and volunteers until the agenda becomes infused into the life of the community.

South Carolina Cardiovascular Disease Prevention Project

One such project—"Heart to Heart"—was conducted between 1988 and 1991 in two medium-sized communities in South Carolina (50,000 people). At each site, a communitywide effort, coordinated by a local health unit, recruited all segments of the community to promote cardiovascular health and healthful lifestyles. Nutrition education programs included community classes, grocery store tours, speakers' bureaus, professional education classes, home-study courses, and worksite nutrition education programs, reinforced by local radio and television public service announcements and talk shows, newspaper articles in the food sections, and supermarket advertisements. Residents of these two communities, compared with those at control communities, displayed a significant reduction in use of animal fats and an increase in the use of liquid or soft vegetable fats (Croft and others, 1994). Similar results were obtained in a comparable project in Stanford, California.

USDA's Community Nutrition Education Cooperative Agreements

Principal to a community-based approach is the empowerment of the community to identify its needs, mobilize its resources, and solve its perceived problems.

To this end, USDA is helping communities across the country to implement and evaluate nutrition education programs that reach food assistance recipients. In 1994, 10 such projects were funded totaling approximately $2.6 million over 2 years. Nutrition education messages are delivered at diverse sites as farmers' markets, childcare centers, and food pantries. Approaches include interactive teaching demonstrations, demonstrations by volunteer chefs, parent workshops, grocery store tours, taste testings, and cooking clubs. And, as might be expected with a program supported by USDA, the nutritional messages delivered by these various projects are consistent with the *Dietary Guidelines*. Each of the 10 projects has developed consortiums within their communities and formed advisory councils that include program participants.

Improving the Nutrient Content of Meals and Foods

A second method of promoting healthful diets involves changing the nutritional composition of the foods people eat. This passive method does not require consumer knowledge, understanding, or commitment to change food consumption behavior, but instead involves the Federal Government and the food industry in improving the nutritional composition of the foods themselves.

Federal Efforts To Improve the Nutrient Content of Meals

Federal programs that provide meals to specific population groups have undergone revisions to ensure that, in addition to providing a certain proportion of the recommended dietary allowances for energy, vitamins, and minerals, the meals are also consistent with *Dietary Guidelines* recommendations, such as choosing a diet with plenty of grain products, vegetables, and fruits, and low in fat, saturated fat, and cholesterol. In particular, nutritional improvements in the National School Lunch Program and the School Breakfast Program target school-age children. Other Federal programs provide target audiences with nutritious foods they may not have otherwise received during vulnerable periods in the life cycle.

Improving the nutritional quality of meals served is expected not only to improve the dietary intake of the target population, but also to serve as an educational tool by showing that meals can be both healthful *and* tasty.

National School Lunch And Breakfast Programs

USDA oversees two national school meal enterprises—the National School Lunch Program and the School Breakfast Program. At its inception in the late 1940's, the School Lunch Program was developed to provide balanced meals by focusing on minimum amounts of specific components (e.g., meat, bread, vegetables, fruit, milk) rather than on the nutrient content of the entire meal.

A 1992 study, however, showed that the meals served in schools did not conform to *Dietary Guidelines* recommendations (Burghardt and Devaney, 1993). School lunches, specifically, exceeded the recommended levels of fat and saturated fat; also, children who ate the school lunch consumed a higher amount of calories from fat than children who brought their lunch from home or obtained a lunch from vending machines or elsewhere at school (see also chapter 16). It was obvious that the school meal patterns had not kept up with scientific knowledge about diet, and USDA considered it necessary to set nutrition criteria for reimbursable school meals, incorporating the recommended dietary allowances for key nutrients, energy allowances for calories, and the most current nutritional standards, as outlined in the *Dietary Guidelines*.

These concerns and the perceived urgency in rectifying the situation set off a rapid sequence of events. In June 1994, USDA proposed regulatory changes through the School Meals Initiative for Healthy Children. In November 1994, Congress passed the Healthy Meals for Healthy Americans Act of 1994, which codified the major provisions of the School Meals Initiative for Healthy Children and requested compliance with the *Dietary Guidelines* by school year 1996-97 (schools could request a waiver to this compliance up to July 1, 1998). June 1995 saw the publication of the final rule on the School Meals for Healthy Children. The Department has developed a strategic training plan, including technical assistance, to help schools implement the *Dietary Guidelines* into their meals (for more details, see chapter 18).

The new school meals menu is expected to reduce overall intake of fat and saturated fat among school-age children by 12 percent. Further, since school meal participation rates are higher for low-income children, health benefits from improved school meals will be concentrated on that population, who face the greatest risk of nutrition-related chronic diseases (*Federal Register*, 1995).

Head Start

This program, now under the auspices of the Administration on Children and Families in the Department of Health and Human Services, was implemented in 1965 as a demonstration program to provide low-income children and their families with comprehensive services, including nutrition. Head Start now serves approximately 751,000 children and their families each year. Children in the program are served a minimum of one hot meal and snack each day so they meet at least one-third of their recommended dietary allowances for energy, vitamins, and minerals.

Under its Child and Adult Care Food Program, USDA channels both commodities and cash to Head Start. In 1994, Congress passed the Head Start Act to expand and improve the program. This legislation included revision of "performance standards"—Head Start centers are to add fruit or vegetables to the snack, are not to serve overly sweet and sticky foods, are to attempt to reduce the amount of fat in recipes and in food preparation, and are to provide food that does not need added salt.

Nutrition Program for the Elderly

A title amendment to the Older Americans Act, this program provides grants to State agencies to support congregate and home-delivered nutrition services to older individuals. The Older Americans Act is administered by the Administration on Aging of the DHHS. USDA supports the program with commodities or cash in lieu of commodities for each meal served. In fiscal year 1996, about 119.1 million congregate meals were served to 2.1 million older individuals, and 118.6 million home-delivered meals were served to 875,000 older individuals.

States are to provide to each participating older individual a minimum of one-third of the daily recommended allowances for vitamins, minerals, protein, and food energy if the project provides one meal a

Table 1—Number of new food products bearing nutrient content claims, 1988-97

Claim[1]	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Reduced or low fat	275	626	1,024	1,198	1,257	847	1,439	1,914	2,076	1,405
Reduced or low calorie	475	962	1,165	1,214	1,130	609	575	1,161	776	742
Low or no cholesterol	126	390	694	711	677	287	372	163	223	78
Reduced or low salt	202	378	517	572	630	242	274	205	171	106
Reduced or low sugar	52	188	331	458	692	473	301	422	373	87
Added or high fiber	56	73	84	146	137	51	26	40	12	33
Added or high calcium	4	27	20	15	41	14	23	21	35	28
Total new food products[2]	8,183	9,192	10,301	12,398	12,312	12,893	15,006	16,883	13,266	12,398

[1] Nutrient content claims are not additive, as new products may carry more than one claim.

[2] Includes pet food.

Source: *New Product News.*

day, two-thirds if two meals, and 100 percent if three meals. In addition, a 1993 amendment to the Act specified that States also had to ensure that meals complied with the *Dietary Guidelines for Americans*.

Food Industry's Efforts To Improve the Nutrient Content of Foods

The food industry plays an integral role in influencing consumers' eating habits (see chapters 9-11 on the role of advertising). It is a symbiotic role as well, as the food industry tries to respond to what it perceives to be salient concerns of the consumer. Meat producers, for example, have responded to consumers' health concerns by producing a leaner product. Since the 1980's, the average cuts of beef and pork have slimmed down in fat content by roughly 30 percent.

Producers are breeding leaner herds, feeding the animals less fattening diets, and taking them to market earlier (the younger the animal, the less the fat content).

According to food industry sources, development of reduced-fat food products tops the list for research and development investments (table 1). For example, 2,076 new food products introduced in 1996 claimed to be reduced in fat or fat free—nearly 16 percent of all new food products introduced that year, and more than twice the number just 3 years earlier. The number dropped in 1997, but it is not yet clear whether that represents a backlash to health concerns. Overall, there were 7 percent fewer new food products introduced in 1997 than in 1996, and, except for claims about fiber content, fewer new products made any nutrient content claims. Despite the drop in number of new food products making fat content claims, claims about fat content far outnumbered claims about any other nutrient.

Further down the marketing chain, retailers are also adopting procedures that reflect healthy eating concerns and encourage healthy eating practices. Retailers now offer consumers three or four kinds of ground beef with progressively lower fat content. Similarly, the array of fruits and vegetables available at retail outlets has increased to accommodate consumers' interest in healthful eating. Supermarket produce departments carry over 400 produce items today, up from 250 in the late 1980's and 150 in the mid-1970's (Putnam and Duewer, 1995). Most supermarket chains now have salad bars and a variety of prepared salads.

Conclusion

Federal and State agencies, the private sector, and voluntary organizations have been actively engaged, particularly in the past decade, in myriad efforts to improve the nutritional health and well-being of Americans through informed food choices. These efforts have provided people, via nutrition education/information programs and materials, with the knowledge to make wise nutritional choices.

In addition, the Federal Government has geared its efforts at providing meals (e.g., Federal-sponsored meal delivery/assistance programs) that are consistent with current scientific nutritional recommendations, as reflected by the *Dietary Guidelines for Americans*.

Similarly, the food industry has responded to consumer demand for more healthful foods by reformulating and creating a number of food products with improved nutritional profiles.

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Chapter 20

Moving Toward the Food Guide Pyramid

Implications for U.S. Agriculture

C. Edwin Young and Linda Scott Kantor

Many consumers and health officials have looked to the agricultural and food industries, with their capacity to manipulate the quantity and nutrient content of foods offered in the marketplace, to help consumers improve their diets. This chapter quantifies some of the potential adjustments in agricultural production, trade, nonfood uses, and prices that might occur as the average U.S. diet moves toward the dietary recommendations specified in the Food Guide Pyramid.

Introduction

Recent studies show that average diets differ considerably from Federal dietary recommendations outlined in the *Dietary Guidelines for Americans* and *Food Guide Pyramid* (see chapters 3, 4, and 5). These differences are quite large for some food groups, and for others in which consumption trends are moving in the right direction, growth rates are far short of those needed to meet recommendations within 10 years (see chapter 4).

Many consumers and health officials have looked to the agricultural and food industries, with their capacity to manipulate the quantity and nutrient content of foods offered in the marketplace, to help consumers improve their diets (Frazao and Allshouse, 1996). In his pioneering paper on the implications of more healthful diets for U.S. agriculture, (O'Brien, 1995) speculates on "the adjustments American

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Food Guide Pyramid Recommendations

The *Food Guide Pyramid* recommends the type and quantity of foods to eat from five major food groups—bread, cereals, rice, and pasta; vegetables; fruit; milk, yogurt, and cheese; and meat, poultry, fish, dry beans, eggs, and nuts. The number of servings that are right for any one person varies depending on age, sex, and physiological status.

Food Guide Pyramid serving recommendations for sample diets

Food group	1,600 cal.	2,200 cal.	2,800 cal.
	Servings per day		
Grain group	6	9	11
Vegetable group	3	4	5
Fruit group	2	3	4
Dairy group[1]	2-3	2-3	2-3
Meat group	5	6	7
Total fat[2]	53	73	93
Added sugars[3]	6	12	18

[1] Women who are pregnant or breastfeeding, teenagers, and young adults to age 24 need 3 servings.
[2] Recommendations for total fat are suggested upper limits in grams.
[3] Recommendations for added sugars are suggested upper limits in teaspoons.
Source: USDA, CNPP, 1996.

Within major food groups, adherence to specific subgroup recommendations is implied by supporting documentation for the *Food Guide Pyramid* (USDA, CNNP, 1996; Cronin and others, 1987). Specifically, vegetable servings should be divided evenly between three subgroups, dark-green leafy and deep yellow vegetables; dry beans, peas, and lentils and other starchy vegetables; and other vegetables. Within these groups, deep yellow vegetables and other starchy vegetables should account for 4/7 of total servings. Fruit servings should be evenly split between two subgroups—citrus, melons, and berries, and other fruits. Several of a consumer's daily grain group servings should come from foods made from whole grains. Similarly, the *Dietary Guidelines* suggest that consumers choose low-fat milk products, lean meats, fish, poultry, beans, and peas often to get the essential nutrients provided by the dairy and meat groups without substantially increasing calorie and saturated fat intakes (USDA/DHHS, 1995).

The *Food Guide Pyramid* also suggests that consumers use fats, oils, and sweets sparingly (USDA, CNNP, 1996). The Dietary Guidelines recommend that consumers limit total fat intake to no more than 30 percent of calories to help reduce their chance of getting certain diseases and to maintain a healthy weight (USDA/DHHS, 1995). To avoid getting too many calories from sugars, the *Dietary Guidelines* suggest that consumers use sugars in moderation—and sparingly for persons with low caloric needs. To meet this objective, the *Food Guide Pyramid* bulletin suggests limiting consumption of added sugars (USDA, CNNP, 1996).

agriculture would face if called upon to respond to—and hopefully, to facilitate—a large-scale move toward healthier diets" as defined by Federal dietary recommendations. This chapter builds on that research by quantifying some of the potential adjustments in agricultural production, trade, nonfood uses, and prices that might occur if the average U.S. diet fully complied with the specific serving recommendations quantified in the Food Guide Pyramid (see box for details on Food Guide Pyramid recommendations). It summarizes a more detailed study on this topic that will be published by the Economic Research Service (ERS) early in 1999 (Young and Kantor, forthcoming).

Estimating the Required Change in Food Supplies

The extent to which agriculture would have to adjust to provide the healthful diets specified in the *Food Guide Pyramid* (USDA, CNNP, 1996) can be quantified by measuring the gap between the number of per capita Pyramid servings provided by the food supply in 1995 and (Food Guide) Pyramid servings recommendations. The number of Pyramid servings provided by the food supply were generated from food supply and utilization data compiled and published annually by the U.S. Department of Agriculture's (USDA) Economic Research Service (Putnam and Allshouse, 1997). (See chapter 4 for more information about the food supply data and per capita Pyramid servings estimates.)

Estimated per capita Pyramid servings were compared with the Pyramid recommendations for a sample diet of 2,200 calories, which approximates the daily Recommended Energy Allowance (REA) of 2,247 calories derived from a population-weighted average of REA's for different age and sex groups of the U.S. population (see "Food Guide Pyramid" box and chapter 4).

The food supply servings estimates suggest that the average American diet is out of balance with Food Guide Pyramid recommendations (table 1). To meet these dietary targets, most Americans need to sharply reduce their consumption of added fats and sugars while increasing servings of fruits, vegetables, whole grains, lean meats and meat alternates, and low-fat dairy products. It is important to note that the ERS estimates of food supply servings for some food groups differ from servings estimates from USDA's *Continuing*

Table 1—1995 food supply servings compared with Food Guide Pyramid recommendations

Food group	Food Guide Pyramid recommendation for a 2,200-calorie diet[1]	1995 food supply servings	Change needed to meet Pyramid recommendation
	Servings	*Servings*	*Percent*
Grains	9.0	9.4	—
Vegetables	4.0	3.7	8
Dark green leafy and deep yellow vegetables	1.3	0.3	333
Dry beans, peas, and lentils[2]	0.6	0.2	200
White potatoes and other starchy vegetables	0.8	1.3	-38
Other vegetables	1.3	1.9	-32
Fruit	3.0	1.3	131
Citrus, melons, berries	1.5	.6	150
Other fruit	1.5	.7	114
Milk, yogurt, and cheese[3]	2.2	1.8	22
	Ounces	*Ounces*	
Meat, poultry, fish, dry beans, eggs, and nuts[4]	6.0	5.7	5
	Grams	*Grams*	
Added fats and oils[5]	38	59	-36
	Teaspoons	*Teaspoons*	
Added sugars[6]	12	32	-63

[1] USDA, CNPP, 1996; Cronin et al., 1987.

[2] Dry beans, peas, and lentils can be counted in either the vegetable or meat groups. Counting these foods toward "vegetable group" servings is consistent with other dietary assessment studies.

[3] Recommendation based on a weighted average of recommended servings for different age groups of the U.S. population.

[4] Food supply servings reflect both the lean and fat portion of meat and poultry.

[5] The Food Guide Pyramid does not make a recommendation for added fats and oils. The upper limit reported here is based on the assumption that added fats and oils contribute the same 52 percent of total fat in the food supply as in 1994, and that total fat is to no more than 73 grams or 30 percent of total calories for a 2,200-calorie diet.

[6] The recommendation for added sugars is a suggested upper limit based on caloric intake.

Source: USDA, Economic Research Service.

Survey of Food Intakes by Individuals (USDA, ARS, 1998). For some food groups, these differences are significant and could affect the magnitude of the adjustments detailed here (see chapter 4).

Estimating Agricultural Sector Adjustments

Adjustment scenarios for the agricultural sector were developed by applying the percent change in food supply servings needed to meet recommendations to USDA supply, use, and trade data for 1991-95. Adjustments were first assumed to occur in the domestic production sector. Crop acreage adjustments were subsequently developed by evaluating potential changes in trade and other uses as well as cross-commodity effects. All adjustment scenarios assume that average diets would meet Pyramid recommendations regardless of price effects—essentially fixing demand across broad commodity sectors at the point where average consumption meets these targets. We also assumed that only U.S. consumers change their eating habits. If consumers in other countries were to make similar adjustments, many of the impacts discussed here would be magnified.

The scenarios presented here are not intended to be exhaustive. The scale and complexity of the U.S. food system presupposes that a diverse and almost infinite number of foods, production methods, end uses, and trade adjustments could achieve the desired outcome. Food consumption is just one of several components of demand for agricultural products along with animal feed, exports, and nonfood or industrial uses. While shifts in food demand due to increased compliance with Federal dietary recommendations may initially result in increased food prices for some foods, for example, these demand shifts would likely result in offsetting shifts in production, trade, and nonfood uses, which would tend to moderate food price impacts.

The analysis is further complicated by interactions among different agricultural commodity markets. Products can substitute for each other in consumers' diets depending on relative prices.

Increased prices for rice, for example, may prompt consumers to shift consumption to pasta or potatoes. Similarly, farmers can often shift production among commodities on the same piece of land depending on price changes. Wheat, corn, and vegetables are examples of such commodities. Also, producers and processors can alter the supply of final food products depending on relative prices and changing technologies, for products produced jointly from the same agricultural commodity, like milk. Dairy manufacturers, for example, could meet increased consumer demand for low-fat milk products by producing more low-fat yogurt and skim milk and less ice cream, butter, and cheese.

Furthermore, consumption trends suggest that dietary change is a slow process for most consumers. Thus, the agricultural sector is likely to have a long lead time to respond to such demand shifts. Existing domestic farm legislation and U.S. commitments under global trade agreements, which may affect the pace of adjustment in some sectors, are also subject to change and will affect some commodity sectors much more than others.

How Much Would Agriculture Have To Adjust?

Table 2 summarizes estimated adjustments in crop acreage that may occur if food supply servings were to meet Food Guide Pyramid recommendations. The net adjustment of 5.6 million acres is relatively small in relation to total planted area—about 2 percent of average 1991-95 agricultural cropland, and well below the almost 22 million acres of cropland idled under Federal planting constraints during 1991-95.[1] However, this modest net adjustment masks more significant acreage changes anticipated for single commodity groups like sweeteners, fats and oils, fruits, and some vegetables. Also, because of land and climatic differences, adjustments for some commodities may be concentrated in certain regions.

Caloric Sweeteners

The estimated 63-percent decline in domestic caloric sweetener use (cane and beet sugar and corn sweeteners) (table 1) would sharply reduce domestic sweetener prices, resulting in reduced production of sugar and corn sweeteners and declining sugar imports (the United States imports negligible quantities of corn sweeteners) (table 3).

Without offsetting increases in sugar exports or nonfood uses or declining imports, domestic sugar production would decline by 4.5

[1] Authority for these programs expired in 1996 with the passage of the 1996 Farm Act.

Table 2—Maximum acreage adjustments implied by the Food Guide Pyramid serving recommendations

Crop	Average planted area 1991-95	Area adjustments
	Million acres	
Fruits:		
Citrus	0.9	1.4
Melons and berries	0.6	0.7
Other noncitrus	1.9	2.1
Vegetables:		
Dark green and deep yellow	0.4	1.4
Starchy vegetables	2.4	-0.9
Other vegetables	1.6	-0.5
Dry beans, peas, and lentils	2.1	2.7
Peanuts	1.7	--
Tree nuts	0.7	--
Wheat	70.7	--
Rice	3.1	--
Feed grains	98.2	
From sweeteners	5.6	-3.5
From lower oilseed production	0	2.0
From meat and dairy	55.7	5.0
Soybeans	60.5	-3.0[1]
Sugar		
Beet	1.4	-1.1
Cane	0.9	-0.7
Land used for food crops	247.1	5.6
Other cropland[2]	108.7	--
Total cropland	355.8	5.6

Note: Maximum adjustment assumes all adjustments occur in domestic production without offsetting adjustments in trade or other uses.

-- = less than 0.1 million acres.

1 Direct estimation of the impact on soyoil production implies a 12-million-acre decline. Demand for soymeal would limit the overall decline.

2 Includes idled land plus land planted to cotton, hay, sileage, and miscellaneous crops, but excludes the Conservation Reserve Program.

Source: USDA, Economic Research Service.

Table 3—Caloric sweeteners: Changes in demand, price, and supply to meet Food Guide Pyramid recommendations

Component	Cane and beet sugar	Corn sweeteners
Demand:		
Food use	↓	↓
Exports	*	*
Industrial use	*	*
Prices	↓	↓
Supply:		
Domestic production	↓	↓
Imports	↓	*

*These uses are relatively small and were not evaluated.

Source: USDA, Economic Research Service.

million tons while corn sweetener production would drop by 6.5 million tons. Sugarcane and sugarbeet acreage would drop by up to 0.7 and 1.1 million acres (table 2). Some adjustments in sugar imports would also likely occur. If the adjustment were borne proportionately between domestic production and imports, sugar imports would decline to under 1 million tons from a 2.1-million-ton annual average during 1991-95. Domestic sugar acreage would decline by 0.6 million acres of sugarcane and 0.9 million acres of sugarbeets (assuming proportionate reductions in cane and beet sugar production).

Adjustments in the sugar sector would be complicated by U.S. sugar legislation under the 1996 Farm Act. Domestic sugar production is supported through a system of price supports and import restrictions or tariff-rate quotas (TRQ) administered by USDA (Lord, 1997). Under the raw sugar TRQ, quota-holding countries are each allocated a fixed amount of sugar that they may ship to the United States annually at zero or low duty. Any sugar above the quota pays a duty, which is generally high enough to prevent imports above the quota amount. The TRQ is established annually (and sometimes adjusted within a given year) to control supply and is set to fill the gap between forecasted domestic consumption and production.

The TRQ acts as a price support only so long as the gap between U.S. sugar consumption and production remains above 1.5 million tons. Were domestic consumption to fall by the estimated 63 percent to meet recommendations, the TRQ would likely drop below 1.5 million tons, resulting in a suspension of the price support program. With the price support program suspended, farmlevel sugar prices would fall to world levels and production and imports would adjust to balance the domestic market.

Adjustments in the corn sweetener sector would include a 400-million-bushel decline in field corn used to produce corn sweeteners and a measurable reduction in supplies of high-value corn gluten meal and other bypoducts of the wet-milling industry that produces corn sweeteners. Some of these adjustments may be mitigated by increased corn sweetener exports (see “Grains” section). However, the United States exported less than 3 percent of total high-fructose corn syrup (HFCS) output during 1991-95, suggesting that export opportunities for HFCS may be limited, at least in the short term.

Fats and Oils

Adjustments in the fats and oils sector are the most complex that the agricultural sector is likely to face. Reducing total fat intake to no more than 30 percent of total calories (as suggested by Federal dietary guidance) implies sharp reductions in the consumption of both naturally occurring fats—found in meats and dairy products—and added edible fats and oils like butter, vegetable oil, shortening, and other baking fats. Adjustments in naturally occurring fats are considered in the meat/poultry/fish and dairy sections of this chapter.

To meet dietary guidance, supplies of added fats and oils would need to decline by 36 percent (table 1). Soybean oil dominates the U.S. edible fats and oils industry, so this reduction would likely be concentrated in the soybean sector and its related industries (table 4).

Reduced demand for soybean and other vegetable oils could force large declines in vegetable oil prices and reduce the value of major oilseed crops like soybeans. For example, without offsetting market adjustments, a 36-percent reduction in soyoil consumption would imply about a 2-million-ton decline in soyoil output—the equivalent of 12 million acres of soybeans. Such a reduction would reduce soybean output to production levels of the mid-1970’s.

Market forces, however, would likely moderate such a sharp production drop. For example, reducing soyoil production would be complicated by the dual nature of soyoil production. The same soybeans that are crushed for soyoil also yield soybean meal, a high-protein

Table 4—Added fats and oils: Changes in demand, price, and supply to meet Food Guide Pyramid recommendations

Component	Soybeans	Soybean oil	Soybean meal	Other fats and oils
Demand:				
Food use**	*	↓	*	↓
Exports	↑	↑	↓	↑
Industrial use	↑		*	↑
Prices	↓	↓	↑	↑
Supply:				
Domestic production	↓	↓	↓	↓
Imports	*	*	↑	*

*These uses are relatively small and were not evaluated.
**Soybeans and soybean meal are used mainly for animal feed.
Source: USDA, Economic Research Service.

animal feed particularly important to poultry and hog production. In fact, soybean meal currently accounts for over 60 percent of the value of processed soybeans. As a result, any reduction in soybean acreage in response to lower soyoil prices would be largely offset by the livestock industry's bidding up soymeal prices to maintain supplies of soymeal feed.

Declining soyoil prices would increase export demand and industrial uses, which would also tend to moderate acreage declines for soybeans. Increasing soyoil exports by the entire 2-million-ton surplus implied by the Pyramid consumption targets would increase U.S. soyoil exports 3-fold. Exports of this magnitude would lower world soyoil prices. Lower soyoil prices would increase the competitiveness of U.S. soyoil with other fats and oils on the world market—presumably increasing U.S. market share. Such a decline in world soyoil prices may also stimulate additional export demand for U.S. soybeans, which has declined dramatically over the past 30 years.

Surplus soyoil and other edible fats may also be diverted to the industrial market. Animal and vegetable fats are used in a wide variety of industrial applications including printing inks, soaps, cosmetics, lubricants, paints, varnishes, solvents, resins, plastics, and fuel additives. While less than 3 percent of total edible fats and oils were used in industrial applications in 1991-95 (Sanford, 1996), reduced food demand may increase the attractiveness of these fats for nonfood purposes. Alternative food uses for soyoil include fat substitutes such as Olean. Meat analogs and other food products made from soybeans like tofu, particularly in the niche organics market, might represent a small but growing alternative market for soybean producers.

Food uses and prices of other edible fats and oils (corn, sunflower, palm, canola, etc.) would also decline substantially were average diets to meet the suggested upper limit on total fat consumption. A reduction or elimination of imports, which would mostly affect availability of tropical oils (palm, cottonseed, etc.), olive, and canola oils, could reduce adjustment pressures on the domestic fats and oils sector. Reducing imports of tropical oils, which are relatively high in saturated fat, may improve the nutrient profile of edible oil consumption; but reducing or eliminating imports of olive and canola oils would buck publicity surrounding the health benefits of those oils, which helped to more than double their consumption over the past 10 years.

Fruits and Vegetables

Increasing per capita consumption of fruits and vegetables to the Pyramid recommendations would require sharp adjustments in both the quantity and variety of fruits and vegetables supplied to the U.S. marketplace. Such adjustments could be complicated by the seasonal nature and limited geographic suitability of some fruit and vegetable production, increasing dependence on fruit and vegetable imports for year-round produce supplies, and the perishable nature and short shelf life of most fresh produce. Changes in the share of total fruit and vegetable consumption consumed in frozen, canned, or other processed form may help to ease adjustments in fresh produce sectors.

Vegetables

While the net increase in average per capita vegetable consumption needed to meet Pyramid recommendations is less than 10 percent, this aggregate adjustment masks larger changes in the types of vegetables that would be included in the new market basket. An average diet, for example, would include four times as many dark green leafy and dark yellow vegetables; three times as many dry beans, peas, and lentils; and fewer servings of starchy and other vegetables.

Table 5—Vegetables: Changes in demand, price, and supply to meet Food Guide Pyramid recommendations

Component	Dark green/ deep yellow	Dry beans, peas, lentils	Starchy	Other
Demand:				
Food use	↑	↑	↓	↓
Exports	*	↓	*	*
Industrial use	*	*	*	*
Prices	↑	↑	↓	↓
Supply:				
Domestic production	↑	↑	↓	↓
Imports	↑	*	*	*

*These uses are relatively small and were not evaluated.
Source: USDA, Economic Research Service.

A net increase in domestic vegetable production of 2-3 million acres would be needed to yield the additional 9 billion pounds (farm-weight) of vegetables needed to bring average consumption up to Pyramid serving recommendations (table 2). This net acreage expansion would include an additional 1.4 million acres of dark green leafy and deep yellow vegetables, 2.7 million acres of dry beans, peas, and lentils, and a 1.4-million-acre decline in starchy and other vegetable production. Significant price adjustments would have to occur to induce these acreage adjustments (table 5).

Although some U.S. regions, such as California, have distinct climate and soil advantages for growing vegetables, vegetables are grown across the United States. Depending on the specific type of vegetables that made up the additional consumption, the anticipated adjustments would likely be spread across a wide geographic region. However, production of some tender-season vegetables like tomatoes, lettuce, peppers, and summer squash could be particularly constrained during the winter months, and high off-season prices would likely prompt additional imports.

Trade adjustments could also boost domestic supplies of vegetables, particularly fresh winter vegetables. Mexico is already the main import supplier of fresh winter vegetables for the United States, and low-cost imports would be likely to capture at least a portion of the increased vegetable consumption (O’Brien, 1995). Some U.S. pro-

Table 6—Fruit: Changes in demand, price, and supply to meet Food Guide Pyramid recommendations

Component	Citrus fruit	Melons/berries	Other
Demand:			
Food use	↑	↑	↑
Exports	↓	↓	↓
Industrial use	*	*	*
Prices	↑	↑	↑
Supply:			
Domestic production	↑	↑	↑
Imports	↑	↑	↑

*These uses are relatively small and were not evaluated.
Source: USDA, Economic Research Service.

ducers would probably invest in Mexico as a way of meeting U.S. demand. Some of this type of investment is already occurring. Higher domestic prices relative to the world market may also result in additional supplies of some vegetables diverted to domestic use from the export market.

Fruit

Fruit consumption would more than double under an average U.S. diet that met Pyramid recommendations. Consumption of citrus, melons, and berries would increase 150 percent, and other fruits 114 percent. These consumption targets contrast sharply with recent trends in which fruit servings increased a total of 11 percent between 1981-85 and 1991-95. In the aggregate, increased fruit demand would result in higher fruit prices and, in turn, increased domestic fruit production and fruit imports (table 6).

Meeting the projected consumption increase with domestic production alone would imply an increase of 3-4 million acres in total fruit area and lead times of 3-5 years for fruit trees to begin bearing. While melon and berry production could begin more quickly, additional domestic expansion would be particularly difficult for citrus crops where production is limited by susceptibility to freezes and other climate constraints. Thus, trade adjustments are likely to play an important role in meeting increased consumer demand. More than a quarter of U.S. fruit consumption came from imports in 1991-95.

Table 7—Dairy: Changes in demand, price, and supply to meet Food Guide Pyramid recommendations

Component	Low-fat milk products	Dairy fats
Demand:		
Food use	↑	↓
Exports	*	↑
Industrial use	*	↑
Prices	↑	↓
Supply:		
Domestic production	↑	↓
Imports	↑	*

* These uses are relatively small and were not evaluated.
Source: USDA, Economic Research Service.

Trade agreements, such as the North American Free Trade Agreement and the Uruguay Round Agreement, will be particularly important in lowering trade barriers and limiting price increases.

Higher prices would also be likely to induce U.S. producers to divert exports to the domestic market. However, any significant export diversion would be complicated by well-established trading relationships between the United States and foreign buyers, particularly Canada and Japan.

Dairy

Dairy product consumption would need to grow by more than one-fifth for average diets to meet recommendations for the milk, yogurt, and cheese group. However, because many dairy products are naturally high in fat, saturated fat, and cholesterol, consumers are likely to seek reduced-fat or nonfat versions of existing dairy foods to help meet dietary targets for these nutrients.

Since the United States produces most of its own dairy products, most of the increased dairy consumption would likely be met with domestic production (table 7). Increased yields have increased milk output about 8 percent over the past 10 years despite a decline in herd size.

Milk yields are projected to increase another 20 percent by 2005 (Westcott, 1997). This yield increase, combined with a 5- to 10-per-

Table 8—Meat, poultry, and fish: Changes in demand, price, and supply to meet Food Guide Pyramid recommendations

Component	Lean meats, poultry, and fish	Animal fats
Demand:		
Food use	↑	↓
Exports	↓	↑
Industrial use	*	↑
Prices	↑	↓
Supply:		
Domestic production	↑	↓
Imports	↑	*

* These uses are relatively small and were not evaluated.

Source: USDA, Economic Research Service.

cent increase in the dairy herd over 1991-95 levels, should be sufficient to meet the estimated increase in dairy product demand. Increased demand for low-fat products, however, would require the diversion of skimmed milkfats to other markets.

A portion of the surplus milkfat is likely to end up on the export market, either as butter or cheese or alone as an intermediate ingredient for other food products. While the United States has not historically been a major exporter of dairy products, a substantial fall in domestic prices for milkfats could create additional export opportunities by increasing U.S. competitiveness on the world market.

Meat, Poultry, and Fish

The *Food Guide Pyramid*'s emphasis on lean meat products implies that consumers would need to meet the requisite 5-percent increase in meat group servings with increased consumption of lower-fat meat and meat alternates. Since the mid-1980's, increased consumer concerns about saturated fat and cholesterol and shifting relative prices for meat group products have reduced consumption of beef relative to pork and poultry, and increased the demand for reduced-fat meat products of all types. As consumers reduce their fat intake to meet dietary guidance, poultry production would likely increase its market share while the cattle and hog sectors would likely build on existing breeding and management techniques that have already reduced the fat content of their products (O'Brien, 1995) (table 8).

Increased demand for lean meats would tend to raise retail prices for these cuts, while higher fat products would move to nonfood industrial uses or export markets. Such a shift would also have a measurable effect on the feed grains sector. Given current fat-to-lean ratios in hogs and cattle, more animals would be needed to produce additional supplies of lean meats. More than a third of U.S. grain production is used domestically for animal feed. Increased lean meat production implies an equivalent increase in the demand for feed grains and high-protein supplements like soymeal. The magnitude of this adjustment would depend largely on the mix of products that make up the new consumption basket. Poultry production uses roughly half the feedgrains and oilseeds that pork production uses, and a quarter of the feedstuffs required to produce beef. Substantial increases in poultry consumption relative to beef or pork could reduce the magnitude of the feed grain and soybean sector adjustments (see "Grains" section).

Changes in meat trade could also help to ease the adjustments faced by domestic agriculture. Surpluses of fatty meat parts like organ meats, chicken legs, and meat trimmings, resulting from increased demand for lean meat, could be exported. Rising incomes in other regions, particularly Asia, Russia, and Mexico, have increased export markets for these foods. However, economic difficulties in Asia and Russia in 1998 slowed export demand in these markets.

Other commodity sectors in the meat group—including peanuts, tree nuts, and eggs—are unlikely to be significantly affected. Presumably, nut acreage, especially peanuts, could be reduced if consumers reduced nut consumption—especially peanut butter—as a means of reducing fat intake. However, since tree nuts and peanuts accounted for only 3 percent of total meat group servings and 4 percent of the food supply's dietary fat, such a consumption change would not have a measurable impact on total food production.

Grains

Changes in food grain use (for flour, pasta, etc.) will be relatively minor. However, larger grain sector adjustments will result from adjustments in the feedgrains sector and will be closely linked to changes in the sweetener, oilseed, meat, and poultry industries. Increased planting flexibility under the 1996 Federal Agricultural Improvement and Reform Act (FAIR Act) could help to facilitate feed

Table 9—Grains: Changes in demand, price, and supply to meet Food Guide Pyramid recommendations

Component	Food grains	Feedgrains: From sweeteners	From lower oilseed prod.	From meat and dairy
Demand:				
Food use	↑	↓	*	*
Exports	--	↑	--	--
Industrial use	*	*	*	--
Prices	↑	↓	↑	↑
Supply:				
Domestic production	↑	↓	↑	↑
Imports	*	*	*	*

-- = unchanged.

* These uses are relatively small and were not evaluated.

Source: USDA, Economic Research Service.

sector adjustments by allowing producers to shift acreage among soybeans and feed grains in response to changing price incentives. There is some evidence that farmers are already exercising such flexibility (Westcott and Young, 1997).

Food Grain Use

With average consumption of wheat flour and other grain products close to recommended levels, adjustments in food grain use are likely to be relatively small compared with shifts in the feed grain and corn sweetener markets. Increased consumption of foods made from whole grains is likely to increase the share of grains, like wheat and rice, consumed in their whole-grain form, while decreasing production of less fiber-dense grain products like white rice and white flour. Such changes would largely occur at the milling, rather than production, level. However, because more product can be extracted per pound of grain—one pound of wheat, for example, yields 0.98 pound of whole-wheat flour compared with 0.74 pounds of white flour—increased consumption of whole-grain foods could lower food grain demand (table 9). Over 30 million acres of cropland are used to produce food grain; thus, even a 1- to 2-percent decline in food grain demand could reduce total grain area by 0.3-0.6 million acres.

Feed Use

With more than a third of total agricultural area in the United States devoted to feedgrain production for domestic use, even a small increase in demand for meat or poultry products implies measurable adjustments in the feedgrain sector. Increased poultry consumption relative to red meat, for example, would increase demand for both feedgrains (mostly corn) and oilseeds (mostly soymeal). To meet this shift in demand with domestic production would imply an increase of 2-5 million acres in feedgrain output. An additional 2 million acres could move into feedgrain production as soymeal increases in price relative to feedgrains and livestock and poultry producers substitute feedgrains for soymeal.

Corn Sweetener Use

Reduced prices for corn sweeteners relative to feed grains would also induce producers to shift corn production from corn sweeteners to feed use. About 660 million bushels of corn, or 8 percent of total field corn output, were used annually in 1991-95 to produce HFCS and other corn sweeteners. In the absence of offsetting market factors, reduced corn sweetener consumption would reduce demand for field corn by about 400 million bushels, or about 3 million harvested acres.

Depending on relative prices, strong world demand could bid surplus field corn out of domestic feed grain use and onto the world market. While it is unlikely that all of the surplus would end up on the export market, a 23-percent increase in U.S. corn exports implied by such a change is well within the bounds of the average annual variation in U.S. corn exports during 1991-95.

Conclusion

This chapter quantifies selected adjustments in agricultural production, trade, industrial uses, and prices that would be expected if the U.S. food supply were to meet Pyramid recommendations. While the net change in planted acreage is projected to be relatively small (less than 5 percent of total U.S. crop area), large adjustments are forecast for commodity groups like caloric sweeteners, fats and oils, fruits, and some vegetable subsectors. Also, for some commodities like sugarcane where production is concentrated in a few regions, the large adjustments forecast nationally are likely to have significant regional impacts.

U.S. agriculture has a long history of successfully responding to changes in consumer demand—particularly when price signals are clear (O'Brien, 1995). However, many of the dietary adjustments will be large compared with previous changes. Cropland use, farm income, farm and retail prices, the environment, food safety risks, and world trade will be affected. Advances in agricultural production and food processing technologies will be helpful in mitigating the adjustments in some sectors. Trade adjustments are likely to play a pivotal role in balancing the market, particularly for commodities like citrus fruits where climatic constraints sharply limit additional domestic production.

Past consumption trends suggest that dietary change is a slow process for most consumers. Thus, the agricultural sector is likely to have a long lead time to respond to changing consumer preferences. Existing domestic farm legislation and U.S. commitments under global trade agreements, which may affect the pace of the adjustment in some sectors, are also subject to change over time and will affect some commodity sectors more than others. While our estimates of potential agricultural sector adjustments are inexact, and the adjustment scenarios limited, they identify important public policy issues that deserve closer attention.

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Appendix table 1--Per capita consumption of major food commodities, 1970-97 1/

Year	Meat, poultry, and fish							Eggs
	Red meat			Poultry		Fish and shell-fish	Total 4/	
	Beef	Pork	Total 2/	Chicken	Total 3/			
	Pounds, boneless, trimmed equivalent							Number
1970	79.6	48.0	131.7	27.4	33.8	11.7	177.3	308.9
1971	79.0	52.6	135.5	27.4	34.0	11.5	181.0	309.9
1972	80.3	47.8	131.8	28.3	35.4	12.5	179.7	303.0
1973	75.8	43.0	121.8	27.1	33.7	12.7	168.2	288.4
1974	80.6	46.7	130.4	27.0	33.8	12.1	176.3	283.0
1975	83.0	38.7	125.8	26.4	32.9	12.1	170.9	276.0
1976	88.8	40.3	133.0	28.5	35.5	12.9	181.4	269.8
1977	86.3	42.3	132.3	29.0	35.9	12.6	180.9	267.0
1978	82.2	42.3	127.5	30.4	37.3	13.4	178.2	271.5
1979	73.5	48.6	124.4	32.8	40.1	13.0	177.6	276.6
1980	72.1	52.1	126.4	32.7	40.8	12.4	179.6	271.1
1981	72.8	49.9	125.1	33.7	42.1	12.6	179.7	264.4
1982	72.5	44.9	119.8	33.9	42.2	12.4	174.4	264.1
1983	74.1	47.4	123.9	34.0	42.7	13.3	180.0	260.2
1984	73.9	47.2	123.7	35.3	44.0	14.1	181.7	260.1
1985	74.6	47.7	124.9	36.4	45.5	15.0	185.4	254.7
1986	74.4	45.2	122.2	37.2	47.4	15.4	184.9	253.5
1987	69.6	45.6	117.4	39.4	51.0	16.1	184.5	253.8
1988	68.6	48.8	119.5	39.6	51.9	15.1	186.6	246.6
1989	65.4	48.4	115.9	40.9	53.9	15.6	185.4	237.0
1990	63.9	46.4	112.3	42.4	56.3	15.0	183.5	234.3
1991	63.1	46.9	111.9	44.2	58.3	14.8	185.1	233.7
1992	62.8	49.4	114.1	46.7	60.8	14.7	189.5	235.0
1993	61.5	48.9	112.1	48.5	62.5	14.9	189.5	235.6
1994	63.6	49.5	114.7	49.3	63.3	15.1	193.2	237.7
1995	64.4	49.0	115.1	48.8	62.9	14.9	193.0	235.4
1996	65.0	45.9	112.8	49.8	64.4	14.7	191.8	237.1
1997	63.8	45.6	111.0	50.9	64.8	14.5	190.3	238.7
1998	64.9	49.1	115.6	51.6	65.8	14.5	195.9	243.8

See footnotes at end of table.

continued--

Appendix table 1--Per capita consumption of major food commodities, 1970-97 1/--continued

Year	Dairy Products						
	Fluid milk products				Fluid cream products		
	Beverage milk						
	Whole	Lower fat & fat free	Total 4/	Yogurt	Cream 5/	Sour cream	Total 6/
	--------- Gallons ---------			-------------- Half pints ---------------			
1970	25.5	5.8	31.3	1.5	7.2	2.0	9.8
1971	25.0	6.3	31.3	2.0	6.7	2.2	9.6
1972	24.1	6.9	31.0	2.4	6.4	2.4	9.7
1973	23.0	7.5	30.5	2.5	6.7	2.4	9.8
1974	21.7	7.7	29.5	2.7	6.4	2.7	9.8
1975	21.1	8.4	29.5	3.6	6.3	3.1	10.0
1976	20.4	9.0	29.3	3.9	6.3	3.0	10.1
1977	19.5	9.5	29.0	4.3	6.2	3.1	10.2
1978	18.7	9.8	28.6	4.5	6.2	3.2	10.1
1979	18.0	10.2	28.2	4.5	6.3	3.3	10.3
1980	17.0	10.5	27.6	4.6	6.3	3.4	10.5
1981	16.3	10.8	27.1	4.5	6.5	3.5	10.8
1982	15.5	10.9	26.4	4.8	6.5	3.7	11.0
1983	15.2	11.1	26.3	5.8	6.9	3.9	11.7
1984	14.8	11.6	26.4	6.6	7.6	4.2	12.7
1985	14.3	12.3	26.7	7.3	8.2	4.3	13.5
1986	13.5	13.0	26.5	7.7	8.8	4.4	14.2
1987	13.0	13.3	26.3	7.9	8.8	4.6	14.3
1988	12.3	13.5	25.8	8.2	8.7	4.6	14.3
1989	11.3	14.7	26.0	7.7	9.0	4.7	14.7
1990	10.5	15.2	25.7	7.4	8.7	4.7	14.3
1991	10.2	15.5	25.6	7.8	8.7	4.9	14.5
1992	9.8	15.6	25.3	7.8	9.1	5.1	15.0
1993	9.3	15.4	24.8	7.9	9.2	5.1	15.1
1994	9.2	15.6	24.8	8.6	9.2	5.2	15.2
1995	8.8	15.6	24.3	9.4	9.5	5.5	15.9
1996	8.7	15.7	24.4	8.9	10.2	5.4	16.4
1997	8.5	15.5	24.0	9.5	10.7	5.6	17.0
1998							

See footnotes at end of table. continued--

Appendix table 1--Per capita consumption of major food commodities, 1970-97 1/--continued

	Dairy Products						
	Cheese					Frozen dairy	
Year	Cheddar	Mozza-rella	Cream 7/	Total 8/	Cottage cheese	Ice cream	Total 9/
	Pounds						
1970	5.8	1.2	0.6	11.4	5.2	17.8	28.5
1971	5.9	1.4	0.6	12.0	5.3	17.7	28.2
1972	6.0	1.6	0.6	13.0	5.4	17.6	28.0
1973	6.1	1.8	0.7	13.5	5.2	17.5	28.0
1974	6.3	1.9	0.7	14.4	4.6	17.5	27.7
1975	6.0	2.1	0.7	14.3	4.6	18.6	28.6
1976	6.4	2.3	0.8	15.5	4.7	18.0	27.5
1977	6.8	2.5	0.8	16.0	4.7	17.6	27.5
1978	6.9	2.7	0.9	16.8	4.7	17.6	27.3
1979	6.9	2.8	0.9	17.2	4.5	17.3	26.5
1980	6.9	3.0	1.0	17.5	4.5	17.5	26.4
1981	7.0	3.0	1.0	18.2	4.3	17.4	26.5
1982	8.7	3.3	1.1	19.9	4.2	17.6	26.4
1983	9.1	3.7	1.2	20.6	4.1	18.1	27.1
1984	9.5	4.0	1.2	21.5	4.1	18.2	27.2
1985	9.8	4.6	1.2	22.5	4.1	18.1	27.9
1986	9.8	5.2	1.3	23.1	4.1	18.4	27.9
1987	10.6	5.6	1.4	24.1	3.9	18.4	28.2
1988	9.5	6.0	1.5	23.7	3.9	17.3	27.7
1989	9.2	6.4	1.6	23.8	3.6	16.1	28.7
1990	9.0	6.9	1.7	24.6	3.4	15.8	28.4
1991	9.1	7.2	1.8	25.0	3.3	16.3	29.2
1992	9.2	7.7	2.0	26.0	3.1	16.3	28.9
1993	9.1	7.5	2.1	26.2	2.9	16.1	29.3
1994	9.1	7.9	2.2	26.8	2.8	16.1	29.9
1995	9.1	8.1	2.1	27.3	2.7	15.7	29.4
1996	9.2	8.5	2.2	27.7	2.6	15.9	28.6
1997	9.6	8.4	2.3	28.0	2.7	16.2	28.7
1998							

See footnotes at end of table.

continued--

Appendix table 1--Per capita consumption of major food commodities, 1970-97 1/--continued

Year	Fats and Oils						
	Butter	Marg-arine	Lard and beef tallow	Short-ening	Salad and cooking oils	Total, Product weight 10/	Total fat content 10/
	Pounds						
1970	5.4	10.8	4.6	17.3	15.4	55.8	52.6
1971	5.2	10.9	4.2	16.8	15.6	55.0	51.8
1972	5.0	11.1	3.7	17.6	16.8	56.6	53.4
1973	4.8	11.1	3.3	17.0	17.7	56.5	53.3
1974	4.5	11.1	3.2	16.9	18.1	55.5	52.4
1975	4.7	11.0	3.2	17.0	17.9	55.8	52.6
1976	4.3	11.9	2.9	17.7	19.5	58.3	55.1
1977	4.3	11.4	2.5	17.2	19.1	56.4	53.3
1978	4.4	11.3	2.4	17.8	20.1	58.0	54.9
1979	4.5	11.2	2.9	18.4	20.8	59.5	56.4
1980	4.5	11.3	3.6	18.2	21.2	60.3	57.2
1981	4.2	11.1	3.5	18.5	21.8	60.5	57.4
1982	4.3	11.0	3.8	18.6	21.9	61.3	58.2
1983	4.9	10.4	4.1	18.5	23.6	63.1	60.0
1984	4.9	10.4	3.8	21.3	22.5	64.6	61.6
1985	4.9	10.8	3.7	22.9	23.6	67.5	64.3
1986	4.6	11.4	3.5	22.1	24.4	67.7	64.5
1987	4.7	10.5	2.7	21.4	25.6	66.2	63.2
1988	4.5	10.3	2.6	21.5	26.3	66.5	63.6
1989	4.4	10.2	2.1	21.5	24.4	63.8	60.8
1990	4.4	10.9	2.4	22.2	24.8	65.9	62.8
1991	4.4	10.6	3.1	22.4	26.7	68.4	65.4
1992	4.4	11.0	4.1	22.4	27.2	70.4	67.4
1993	4.7	11.1	3.9	25.1	26.8	73.3	70.2
1994	4.8	9.9	4.7	24.1	26.3	71.5	68.6
1995	4.5	9.2	4.9	22.5	26.9	69.6	66.9
1996	4.3	9.2	5.3	22.3	26.1	68.6	65.8
1997	4.2	8.6	4.7	20.9	28.7	68.2	65.6
1998							

See footnotes at end of table.

continued--

Appendix table 1--Per capita consumption of major food commodities, 1970-97 1/--continued

Year	Fruit			Vegetables			
				Fresh		Processing	
						Canning	
	Fresh	Proces- sing 11/	Total fruit 4/	Pota- toes	Total	Tomatoes	Total
	------------------------- Pounds, fresh-weight equivalent --------------------------						
1970	101.2	136.5	237.7	61.8	152.9	62.1	100.7
1971	100.3	141.7	242.0	56.1	146.7	68.3	107.7
1972	94.8	136.8	231.5	57.9	149.9	64.9	104.5
1973	96.4	138.4	234.9	52.4	146.6	58.4	98.1
1974	95.6	138.6	234.2	49.4	144.5	61.3	99.3
1975	101.8	150.3	252.1	52.6	147.1	61.9	97.8
1976	101.5	155.5	257.0	49.4	146.4	65.7	103.3
1977	99.7	170.4	270.1	50.1	147.0	62.8	101.7
1978	103.4	154.4	257.8	46.0	141.6	58.8	96.7
1979	100.1	149.7	249.8	49.3	146.5	64.3	100.5
1980	104.8	157.5	262.4	51.1	149.3	63.6	102.7
1981	103.6	156.5	260.2	45.8	142.8	59.3	97.1
1982	107.4	154.7	262.1	47.1	148.6	60.1	95.1
1983	110.0	168.5	278.6	49.8	148.5	60.9	96.5
1984	112.6	153.5	266.0	48.3	154.0	68.5	102.6
1985	110.6	158.8	269.4	46.3	156.1	63.2	99.4
1986	117.3	159.0	276.3	48.8	156.2	63.6	99.8
1987	121.6	164.0	285.5	47.9	162.4	65.2	99.1
1988	120.9	151.9	272.8	49.6	167.4	61.3	94.8
1989	122.8	156.3	279.1	50.0	172.2	69.4	102.4
1990	116.3	157.1	273.5	46.8	167.2	75.4	110.7
1991	113.0	153.6	266.6	50.4	167.2	77.4	113.3
1992	123.5	144.5	268.0	48.6	171.1	73.7	111.6
1993	124.9	160.5	285.4	49.3	171.9	76.4	112.1
1994	126.5	157.8	284.3	50.3	177.4	73.6	107.8
1995	124.6	160.8	285.4	49.2	175.1	75.6	110.2
1996	129.0	160.8	289.8	50.0	181.8	74.2	108.5
1997	133.2	161.5	294.7	47.9	185.6	72.7	105.9
1998							

See footnotes at end of table. continued--

Appendix table 1--Per capita consumption of major food commodities, 1970-97 1/--continued

Year	Vegetables							Total fruit and vege-tables 4/
	Processing						Total vege-tables 4/	
	Freezing		Dehydra-ting	Potatoes for chips	Pulses	Total		
	Pota-toes	Total						
	Pounds, fresh-weight equivalent							
1970	28.5	43.7	13.2	17.4	7.6	182.5	335.4	573.2
1971	30.1	45.4	13.8	17.2	7.5	191.6	338.3	580.3
1972	30.3	45.5	13.3	16.7	6.7	186.7	336.6	568.2
1973	34.2	50.5	14.3	16.3	7.9	187.1	333.8	568.6
1974	35.3	51.4	16.0	15.7	6.2	188.6	333.2	567.3
1975	37.1	52.7	16.7	15.5	7.2	189.9	337.0	589.1
1976	41.8	57.7	17.1	15.8	7.0	200.9	347.3	604.3
1977	42.2	59.4	12.7	16.2	6.9	196.9	343.9	613.9
1978	42.6	59.0	13.4	16.5	5.9	191.5	333.1	590.8
1979	38.5	55.5	13.1	16.7	6.8	192.5	339.1	588.9
1980	35.4	51.6	10.6	16.5	5.8	187.2	336.4	598.8
1981	41.5	58.3	11.6	16.6	6.0	189.6	332.4	592.6
1982	38.6	54.3	12.4	17.0	6.9	185.6	334.3	596.4
1983	39.2	55.7	11.7	17.8	7.0	188.6	337.1	615.6
1984	43.7	62.8	11.8	18.0	5.5	200.6	354.6	620.7
1985	45.4	64.5	12.8	17.6	7.6	201.9	358.1	627.5
1986	46.3	64.5	12.8	18.1	7.3	202.6	358.7	635.1
1987	47.9	67.0	12.3	17.6	5.7	201.6	364.0	649.5
1988	43.3	64.2	12.1	17.1	7.5	195.7	363.1	635.9
1989	46.8	67.6	12.4	17.4	6.3	206.0	378.2	657.3
1990	46.5	66.8	14.6	16.4	7.1	215.6	382.8	656.3
1991	51.2	72.7	15.5	17.3	7.8	226.6	393.9	660.5
1992	50.2	70.8	14.3	17.2	8.2	222.1	393.2	661.1
1993	52.9	75.1	15.5	17.5	7.7	227.9	399.8	685.1
1994	57.4	79.5	14.7	17.0	8.5	227.4	404.8	689.1
1995	56.9	79.9	14.7	16.6	8.5	229.9	405.0	690.4
1996	60.4	83.9	17.6	16.4	8.0	234.5	416.2	706.1
1997	59.0	81.5	18.6	15.9	8.5	230.4	416.0	710.8
1998								

See footnotes at end of table.

continued--

Appendix table 1--Per capita consumption of major food commodities, 1970-97 1/--continued

Year	Flour and cereal products 12/				
	Wheat flour	Rice 13/	Corn products 14/	Oat products	Total 15/
	Pounds				
1970	110.9	6.7	11.1	4.7	135.6
1971	110.5	7.6	10.4	4.7	135.1
1972	109.8	7.0	9.7	4.7	133.1
1973	112.8	6.9	9.8	4.7	136.3
1974	111.0	7.5	10.2	4.7	135.5
1975	114.5	7.6	10.8	4.4	139.1
1976	119.1	7.1	11.0	4.2	143.0
1977	115.5	7.5	12.2	4.1	140.9
1978	115.2	5.6	12.4	4.0	138.9
1979	116.4	9.4	12.8	3.9	144.1
1980	116.9	9.4	12.9	3.9	144.7
1981	115.8	10.9	13.3	3.8	145.6
1982	116.9	11.8	13.8	3.9	147.9
1983	117.7	9.8	14.7	3.8	147.6
1984	119.1	8.6	16.0	3.7	149.1
1985	124.6	9.1	17.2	4.0	156.6
1986	125.6	11.7	19.4	4.0	162.3
1987	129.8	13.8	21.7	4.4	171.3
1988	131.7	14.3	21.7	6.4	175.5
1989	129.6	15.2	21.8	6.4	174.5
1990	136.0	16.2	21.9	6.5	182.0
1991	136.9	16.8	22.0	6.5	183.6
1992	138.8	17.5	22.1	6.5	186.2
1993	143.3	17.6	22.3	6.5	191.0
1994	144.5	19.2	22.5	6.5	194.0
1995	141.8	20.1	22.7	6.5	192.5
1996	148.8	18.9	22.9	6.6	198.4
1997	149.7	19.5	23.1	6.5	200.1
1998					

See footnotes at end of table. continued--

Appendix table 1--Per capita consumption of major food commodities, 1970-97 1/--continued

Year	Caloric sweeteners: Refined cane and beet sugar 16/	Caloric sweeteners: Corn sweet-eners 17/	Caloric sweeteners: Total 18/	Carbonated soft drinks: Diet	Carbonated soft drinks: Regular 19/	Carbonated soft drinks: Total 4/
	------ Pounds, dry basis ------			------------ Gallons ------------		
1970	101.8	19.1	122.3	2.1	22.2	24.3
1971	102.1	19.9	123.4	2.2	23.3	25.5
1972	102.3	21.2	125.0	2.3	23.9	26.2
1973	100.8	23.4	125.6	2.7	25.0	27.6
1974	95.7	25.1	121.9	2.9	24.7	27.6
1975	89.2	27.4	118.0	3.2	25.0	28.2
1976	93.4	29.2	123.9	3.8	27.0	30.8
1977	94.2	31.1	126.6	4.3	28.7	33.0
1978	91.4	31.7	124.6	4.6	29.5	34.2
1979	89.3	34.9	125.7	4.9	29.8	34.7
1980	83.6	38.2	123.0	5.1	29.9	35.1
1981	79.4	41.6	122.2	5.3	30.0	35.4
1982	73.7	45.4	120.4	5.5	29.8	35.3
1983	70.3	50.3	121.9	6.0	29.3	35.2
1984	66.7	56.6	124.6	6.6	29.3	35.9
1985	62.7	64.8	128.8	7.1	28.7	35.7
1986	60.0	65.5	127.0	7.6	28.2	35.8
1987	62.4	67.7	131.6	9.4	32.4	41.9
1988	62.1	69.3	132.7	10.1	34.5	44.7
1989	62.8	69.0	133.1	10.7	34.7	45.4
1990	64.4	71.1	137.0	10.7	35.6	46.3
1991	63.8	72.8	137.9	11.7	36.3	47.9
1992	64.6	75.2	141.2	11.6	36.9	48.5
1993	64.4	78.7	144.4	11.7	38.4	50.1
1994	65.0	81.0	147.4	11.8	39.6	51.3
1995	65.5	83.0	149.9	11.8	39.8	51.6
1996	66.6	82.8	150.7	11.7	40.3	52.0
1997	66.5	86.2	154.1	11.6	41.4	53.0
1998						

See footnotes at end of table.

continued--

Appendix table 1--Per capita consumption of major food commodities, 1970-97 1/--continued

1/ Forecast for 1998 shown for meat and eggs.

2/ Includes veal, lamb, and mutton.

3/ Includes turkey.

4/ Computed from unrounded data.

5/ Includes half and half, light cream, and heavy cream.

6/ Includes eggnog.

7/ Includes Neufchatel.

8/ Excludes full-skim American and cottage, pot, and baker's cheese.

9/ Includes lower fat and nonfat ice cream, sherbet, mellorine, frozen yogurt beginning 1981 and other nonstandardized frozen dairy products.

10/ Includes specialty fats used mainly in confectionery products and nondairy creamers.

11/ Excludes wine grapes.

12/ Consumption of most items at the processing level. Excludes quantities used in alcoholic beverages and fuel.

13/ Milled basis.

14/ Includes corn flour, meal, hominy, grits, and starch.

15/ Includes rye flour and barley products.

16/ Exlcudes sugar in imported blends and mixtures.

17/ Includes high-fructose corn syrup (HFCS), glucose, and dextrose.

18/ Includes sorgo, maple, and sugarcane syrup, edible molasses, edible refiner's syrup, and honey.

19/ Caloric sweetners used in carbonated soft drinks are included in "Caloric sweeteners."

Appendix table 2--U.S. food supply: Nutrients and other food components per capita per day, 1970-94 1/

Year	Food energy	Carbo-hydrate	Protein	Fat			
				Total fat	Satu-rated fat	Monoun-saturated fat	Polyun-saturated fat
	Kilo-calories	Grams					
1970	3,300	386	95	154	54	63	26
1971	3,300	387	96	154	55	63	26
1972	3,300	386	95	155	54	63	27
1973	3,200	390	94	150	52	61	27
1974	3,200	383	94	151	52	62	27
1975	3,200	385	93	146	50	59	27
1976	3,300	399	97	152	51	60	29
1977	3,300	398	96	149	51	59	28
1978	3,200	392	95	150	51	59	29
1979	3,300	400	96	151	51	60	30
1980	3,300	406	96	153	52	60	30
1981	3,300	394	96	153	51	61	30
1982	3,300	396	96	152	51	60	30
1983	3,300	400	97	157	53	62	31
1984	3,400	404	98	155	53	62	29
1985	3,500	420	101	163	55	65	32
1986	3,500	425	102	162	54	65	32
1987	3,500	436	103	160	53	64	32
1988	3,600	443	105	161	53	64	33
1989	3,500	445	104	156	51	63	32
1990	3,600	458	105	156	51	63	32
1991	3,600	464	107	155	50	63	32
1992	3,700	473	108	158	52	64	32
1993	3,700	482	108	161	52	66	32
1994	3,800	491	110	159	52	65	31

See footnotes at end of table.

continued--

Appendix table 2--U.S. food supply: Nutrients and other food components per capita per day, 1970-94 1/--continued

Year	Choles-terol	Vitamins: Vitamin A	Caro-tenes	Vitamin E	Vitamin C	Thia-min	Ribo-flavin
	Milligrams	Micrograms retinol equivalents		Milligrams alpha-TE	-------- Milligrams---------		
1970	470	1,500	510	13.7	107.0	2.0	2.3
1971	470	1,510	520	13.5	108.0	2.0	2.3
1972	460	1,530	550	13.9	108.0	2.0	2.3
1973	440	1,520	580	14.4	106.0	2.0	2.3
1974	440	1,560	600	14.2	108.0	2.1	2.3
1975	430	1,550	620	14.4	112.0	2.2	2.3
1976	430	1,580	620	14.7	113.0	2.3	2.5
1977	430	1,530	580	14.2	112.0	2.3	2.4
1978	430	1,510	580	14.5	108.0	2.2	2.4
1979	430	1,530	610	14.6	109.0	2.3	2.4
1980	430	1,520	600	14.6	112.0	2.3	2.4
1981	430	1,510	600	14.7	109.0	2.3	2.4
1982	420	1,510	620	15.0	110.0	2.3	2.4
1983	430	1,500	600	15.4	115.0	2.3	2.4
1984	430	1,530	640	14.9	112.0	2.3	2.5
1985	430	1,520	630	16.2	114.0	2.4	2.5
1986	420	1,500	610	16.3	118.0	2.4	2.5
1987	420	1,530	640	16.4	115.0	2.5	2.5
1988	420	1,470	610	16.9	116.0	2.5	2.5
1989	410	1,500	640	16.5	115.0	2.6	2.5
1990	400	1,530	670	16.8	111.0	2.6	2.6
1991	400	1,500	640	17.0	115.0	2.6	2.5
1992	410	1,540	670	17.1	117.0	2.7	2.6
1993	410	1,530	670	17.6	122.0	2.7	2.6
1994	410	1,520	660	16.9	124.0	2.7	2.6

See footnotes at end of table.

continued--

Appendix table 2--U.S. food supply: Nutrients and other food components per capita per day, 1970-94 1/--continued

Year	Vitamins-continued				Minerals						
	Niacin	Vitamin B6	Folate	Vitamin B12	Calcium	Phosphorus	Magnesium	Iron	Zinc	Copper	Potassium
	--Milligrams--		--Micrograms--		-----------------------Milligrams-----------------------						
1970	22	2.0	279	9.5	890	1,460	320	15.4	12.2	1.6	3,510
1971	22	2.0	280	9.5	890	1,470	320	15.6	12.3	1.6	3,500
1972	22	2.0	279	9.4	890	1,470	330	15.6	12.2	1.6	3,490
1973	22	1.9	284	8.9	880	1,440	330	15.8	11.8	1.6	3,460
1974	23	2.0	276	9.2	850	1,430	320	18.1	12.0	1.6	3,410
1975	24	1.9	298	8.8	840	1,430	320	19.8	11.8	1.7	3,440
1976	26	2.0	303	9.1	890	1,480	330	23.8	12.3	1.7	3,530
1977	25	2.0	302	9.0	880	1,470	320	23.3	12.2	1.7	3,460
1978	25	1.9	291	8.7	880	1,460	320	23.0	12.0	1.6	3,410
1979	25	2.0	299	8.5	890	1,480	330	16.1	11.9	1.7	3,480
1980	25	2.0	292	8.4	870	1,460	320	16.0	11.8	1.7	3,440
1981	26	2.0	292	8.5	860	1,460	320	16.2	11.9	1.7	3,400
1982	25	2.0	298	8.2	870	1,460	330	16.4	11.9	1.7	3,430
1983	26	2.0	301	8.4	890	1,490	330	17.4	12.1	1.7	3,490
1984	26	2.0	295	8.5	900	1,500	330	18.4	12.1	1.7	3,500
1985	27	2.1	310	8.5	920	1,540	350	19.1	12.5	1.8	3,590
1986	27	2.1	313	8.4	930	1,570	350	19.2	12.6	1.8	3,650
1987	27	2.1	304	8.5	930	1,580	350	19.3	12.5	1.8	3,590
1988	28	2.1	316	8.3	930	1,600	360	19.8	12.7	1.8	3,630
1989	28	2.2	308	8.2	920	1,600	360	19.8	12.6	1.8	3,630
1990	28	2.2	311	8.2	940	1,620	370	20.2	12.7	1.8	3,650
1991	28	2.2	321	8.2	940	1,630	380	20.5	12.8	1.9	3,690
1992	29	2.3	326	8.3	950	1,660	380	20.8	13.0	1.9	3,750
1993	29	2.3	329	8.0	950	1,650	380	20.9	13.0	1.9	3,750
1994	29	2.3	331	8.1	960	1,680	380	21.2	13.2	1.9	3,780

1/ Data are based on ERS estimates of per capita quantities of food available for consumption from Putnam, Judith J., and Jane E. Allshouse, "Food Consumption, Prices, and Expenditures, 1970-94, ' SB-928, ERS, USDA, Apr. 1996, on imputed consumption data for foods no longer reported by ERS, and on estimates from USDA's Center for Nutrition Policy and Promotion (CNPP) of quantities of produce from home gardens. Historical data for this table are available from CNPP's Shirley Gerrior, (202) 606-4839, or Lisa Bente, (202) 208-2447.

Appendix table 3--U.S. food supply: Nutrients contributed from major food groups per capita per day, 1970 and 1994 1/

Food group	Food energy		Carbohydrates		Protein	
	Kilo-calories	% of total	Grams	% of total	Grams	% of total
Meat, poultry, and fish						
1970	650	19.8	*	0.1	38	40.3
1994	540	14.3	*	0.1	43	39.3
Dairy products 2/						
1970	350	10.6	25	6.4	20	21.2
1994	350	9.3	23	4.7	21	19.3
Eggs						
1970	60	2.0	1	0.1	5	5.7
1994	50	1.3	*	0.1	4	3.8
Fats and oils 3/						
1970	580	17.8	*	**	*	0.1
1994	740	19.5	*	**	*	0.1
Fruits						
1970	100	2.9	24	6.1	1	1.2
1994	130	3.4	31	6.4	1	1.3
Citrus fruits						
1970	30	0.9	7	1.8	1	0.5
1994	40	1.0	9	1.9	1	0.6
Noncitrus fruits						
1970	70	2.1	17	4.3	1	0.7
1994	90	2.4	22	4.5	1	0.8
Legumes, soy, and nuts						
1970	100	2.9	9	2.2	5	5.4
1994	110	2.9	10	2.0	7	6.0
Vegetables 4/						
1970	170	5.2	39	10.1	5	5.8
1994	180	4.7	40	8.2	5	5.3
White potatoes						
1970	90	2.8	21	5.4	2	2.5
1994	100	2.6	22	4.5	3	2.3
Dark green, deep yellow						
1970	10	0.4	3	0.8	*	0.4
1994	10	0.4	3	0.6	*	0.4
Other vegetables						
1970	70	2.1	15	3.9	3	3.0
1994	70	1.8	15	3.1	3	2.6
Grain products						
1970	640	19.6	134	34.7	18	19.1
1994	950	25.1	199	40.5	26	23.7
Sugars and sweeteners						
1970	590	18.1	152	39.4	*	*
1994	690	18.3	184	37.3	*	*
Miscellaneous 5/						
1970	40	0.9	4	0.9	1	1.2
1994	50	1.2	4	0.9	1	1.2

See footnotes at end of table.

continued--

Appendix table 3--U.S. food supply: Nutrients contributed from major food groups per capita per day, 1970 and 1994 1/--continued

Food group	Fat								Cholesterol	
	Total		Saturated		Monoun-saturated		Poly-unsaturated			
	Grams	% of total	Grams	% of total	Grams	% of total	Grams	% of total	Milli-grams	% of total
Meat, poultry, and fish										
1970	53	34.6	20	37.2	17	37.4	5	20.2	186	39.8
1994	39	24.5	14	26.4	24	25.7	5	14.9	181	43.8
Dairy products 2/										
1970	19	12.6	12	22.3	6	8.8	1	2.6	71	15.2
1994	20	12.3	12	23.6	6	8.6	1	2.1	67	16.1
Eggs										
1970	4	2.8	1	2.5	1	2.6	1	2.3	184	39.3
1994	3	2.1	1	2.0	2	2.0	1	1.5	142	34.4
Fats and oils 3/										
1970	66	42.7	18	32.7	37	45.0	17	62.9	27	5.7
1994	83	52.2	21	40.9	29	56.3	22	68.9	23	5.6
Fruits										
1970	1	0.4	*	0.2	*	0.3	*	0.5	0	0.0
1994	1	0.5	*	0.3	*	0.4	*	0.5	0	0.0
Citrus fruits										
1970	*	0.1	*	**	*	**	*	0.1	0	0.0
1994	*	0.1	*	**	*	**	*	0.1	0	0.0
Noncitrus fruits										
1970	1	0.3	*	0.2	*	0.3	*	0.4	0	0.0
1994	1	0.4	*	0.3	*	0.4	*	0.5	0	0.0
Legumes, soy, and nuts										
1970	5	3.4	1	1.9	3	3.7	2	5.9	0	0.0
1994	6	3.6	1	2.1	2	4.1	2	5.5	0	0.0
Vegetables 4/										
1970	1	0.5	*	0.2	*	0.1	*	1.2	0	0.0
1994	1	0.5	*	0.3	*	0.1	*	1.0	0	0.0
White potatoes										
1970	*	0.1	*	0.1	*	0.0	*	0.2	0	0.0
1994	*	0.1	*	0.1	*	0.0	*	0.2	0	0.0
Dark green, deep yellow										
1970	*	*	*	**	*	*	*	0.1	0	0.0
1994	*	0.1	*	**	*	*	*	0.1	0	0.0
Other vegetables										
1970	1	0.3	*	0.2	*	0.1	*	0.9	0	0.0
1994	1	0.3	*	0.2	*	0.1	*	0.7	0	0.0
Grain products										
1970	2	1.5	*	0.7	1	0.5	1	3.6	*	**
1994	4	2.2	1	1.1	*	1.0	1	4.5	*	**
Sugars and sweeteners										
1970	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1994	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Miscellaneous 5/										
1970	3	1.7	1	2.5	1	1.5	*	0.9	0	0.0
1994	4	2.3	2	3.4	1	1.9	*	1.1	0	0.0

See footnotes at end of table continued--

Appendix table 3--U.S. food supply: Nutrients contributed from major food groups per capita per day, 1970 and 1994 1/--continued

Food group	Vitamins									
	Vitamin A		Carotene		Vitamin E		Vitamin C		Thiamin	
	Retinol equiv.	% of total	Retinol equiv.	% of total	Alpha TE	% of total	Milli-grams	% of total	Milli-grams	% of total
Meat, poultry, and fish										
1970	440	29.3	0	0.0	0.9	6.3	3	2.4	0.5	25.2
1994	325	21.4	0	0.0	0.8	4.8	3	2.0	0.5	18.7
Dairy products 2/										
1970	256	17.0	16	3.2	0.5	3.8	4	4.0	0.2	9.6
1994	264	17.4	15	2.3	0.5	2.8	3	2.7	0.2	6.2
Eggs										
1970	83	5.5	0	0.0	0.5	3.3	0	0.0	**	1.4
1994	64	4.2	0	0.0	0.4	2.1	0	0.0	**	0.8
Fats and oils 3/										
1970	196	13.0	18	3.5	8.7	63.6	0	0.0	0.0	0.0
1994	178	11.7	16	2.4	11.5	67.8	*	0.0	0.0	0.0
Fruits										
1970	46	3.1	46	9.1	0.5	4.0	42	39.2	**	4.7
1994	51	3.3	51	7.6	0.7	3.8	54	43.5	0.1	4.7
Citrus fruits										
1970	8	0.5	8	1.6	0.1	0.9	27	24.9	**	2.5
1994	9	0.6	9	1.3	0.2	1.0	34	27.8	0.1	2.3
Noncitrus fruits										
1970	38	2.6	38	7.6	0.4	3.1	15	14.3	**	2.2
1994	42	2.8	42	6.3	0.5	2.8	20	15.8	0.1	2.1
Legumes, soy, and nuts										
1970	*	**	*	0.1	0.8	5.9	*	0.1	0.1	5.4
1994	1	**	*	0.1	0.9	5.5	*	0.1	0.1	4.7
Vegetables 4/										
1970	406	27.0	406	80.1	1.1	8.1	53	49.9	0.2	12.6
1994	536	35.3	536	80.7	1.2	7.3	59	47.2	0.2	10.0
White potatoes										
1970	0	0.0	0	0.0	0.1	0.5	19	18.2	0.1	5.7
1994	0	0.0	0	0.0	0.1	1.1	20	15.8	0.1	4.9
Dark green, deep yellow										
1970	305	20.3	305	60.2	0.1	1.1	7	6.4	**	0.9
1994	431	28.4	431	64.9	0.2	0.4	12	9.4	**	0.8
Other vegetables										
1970	101	6.7	101	19.8	0.9	6.5	27	25.4	0.1	6.0
1994	105	6.9	105	15.8	0.9	5.7	27	22.0	0.1	4.3
Grain products										
1970	5	0.3	4	0.8	0.6	4.5	*	**	0.8	40.4
1994	10	0.7	9	1.4	0.9	5.1	*	**	1.5	54.5
Sugars and sweeteners										
1970	0	0.0	0	0.0	0.0	0.0	*	**	**	0.2
1994	0	0.0	0	0.0	0.0	0.0	*	**	**	0.2
Miscellaneous 5/										
1970	72	4.8	17	3.3	0.1	0.7	5	4.5	**	0.6
1994	93	6.1	38	5.7	0.1	0.9	6	4.5	**	0.7

See footnotes at end of table

continued--

Appendix table 3--U.S. food supply: Nutrients contributed from major food groups per capita per day, 1970 and 1994 1/--continued

Food group	Vitamins									
	Riboflavin		Niacin		Vitamin B 6		Folate		Vitamin B 12	
	Milli-grams	% of total	Milli-grams	% of total	Milli-grams	% of total	Micro-grams	% of total	Micro-grams	% of total
Meat, poultry, and fish										
1970	0.5	21.8	9.7	44.5	0.8	38.9	29	10.5	7.1	74.8
1994	0.5	18.1	11.1	38.2	0.8	36.4	24	7.4	5.9	72.9
Dairy products 2/										
1970	0.8	36.4	0.5	2.1	0.2	11.7	26	9.4	1.8	19.0
1994	0.8	30.7	0.4	1.4	0.2	9.7	24	7.3	1.7	21.0
Eggs										
1970	0.2	9.6	**	0.2	0.1	3.0	20	7.3	0.4	4.5
1994	0.2	6.5	**	0.1	0.1	2.0	16	4.8	0.3	4.1
Fats and oils 3/										
1970	0.0	0.1	**	**	**	**	*	**	**	0.1
1994	**	0.1	**	**	**	**	*	0.1	**	0.1
Fruits										
1970	**	2.6	0.6	2.7	0.1	9.1	27	9.8	0.0	0.0
1994	0.1	3.0	0.7	2.4	0.2	11.0	41	12.4	0.0	0.0
Citrus fruits										
1970	**	0.7	0.2	0.7	**	1.6	19	6.9	0.0	0.0
1994	**	0.7	0.2	0.6	**	1.8	30	9.1	0.0	0.0
Noncitrus fruits										
1970	**	1.9	0.4	2.0	0.1	7.4	8	2.9	0.0	0.0
1994	0.1	2.3	0.5	1.7	0.2	9.2	11	3.3	0.0	0.0
Legumes, soy, and nuts										
1970	**	1.5	1.0	4.8	0.1	3.4	56	20.2	0.0	0.0
1994	**	1.7	1.2	4.0	0.1	3.8	67	20.1	0.0	0.0
Vegetables 4/										
1970	0.1	6.4	3.0	13.6	0.5	23.4	78	27.9	0.0	0.0
1994	0.1	6.1	3.2	11.1	0.6	22.5	79	24.0	0.0	0.0
White potatoes										
1970	**	1.4	1.6	7.4	0.3	12.9	14	4.9	0.0	0.0
1994	**	1.3	1.7	6.0	0.3	11.8	15	4.4	0.0	0.0
Dark green, deep yellow										
1970	**	1.0	0.2	0.8	**	2.2	8	2.9	0.0	0.0
1994	**	0.9	0.2	0.7	0.1	2.4	10	3.1	0.0	0.0
Other vegetables										
1970	0.1	4.1	1.2	5.5	0.2	8.4	56	20.1	0.0	0.0
1994	0.1	3.9	1.3	4.4	0.2	8.4	55	16.5	0.0	0.0
Grain products										
1970	0.4	19.3	6.0	27.8	0.2	9.3	36	12.9	0.2	1.6
1994	0.8	31.0	11.7	40.2	0.3	12.8	72	21.8	0.2	1.9
Sugars and sweeteners										
1970	**	1.2	**	**	**	0.3	*	**	0.0	0.0
1994	**	1.4	**	**	**	0.2	*	**	0.0	0.0
Miscellaneous 5/										
1970	**	1.1	1.0	4.4	**	0.9	6	2.0	0.0	0.0
1994	**	1.4	0.8	2.7	**	1.5	7	2.2	0.0	0.0

See footnotes at end of table

Appendix table 3--U.S. food supply: Nutrients contributed from major food groups per capita per day, 1970 and 1994 1/--continued

Food group	Minerals							
	Calcium		Phosphorus		Magnesium		Iron	
	Milli-grams	% of total	Milli-grams	% of total	Milli-grams	% of total	Milli-grams	% of total
Meat, poultry, and fish								
1970	28	3.1	400	27.3	44	13.5	3.6	23.3
1994	32	3.3	415	24.8	49	12.8	3.4	16.3
Dairy products 2/								
1970	670	75.2	529	36.1	66	20.4	0.4	2.4
1994	698	72.8	550	32.8	63	16.4	0.4	2.1
Eggs								
1970	21	2.4	77	5.3	4	1.3	0.6	4.0
1994	16	1.7	60	3.6	3	0.9	0.5	2.3
Fats and oils 3/								
1970	2	0.2	2	0.1	*	**	**	0.1
1994	1	0.2	1	0.1	*	**	**	0.1
Fruits								
1970	22	2.5	24	1.7	20	6.0	0.5	3.2
1994	26	2.7	32	1.9	25	6.6	0.6	2.8
Citrus fruits								
1970	11	1.3	9	0.6	7	2.0	0.1	0.6
1994	12	1.3	13	0.8	9	2.2	0.1	0.5
Noncitrus fruits								
1970	11	1.2	15	1.0	13	4.0	0.4	2.5
1994	14	1.4	19	1.1	17	4.4	0.5	2.3
Legumes, soy, and nuts								
1970	34	3.8	77	5.3	40	12.3	1.4	9.4
1994	43	4.4	100	5.9	50	13.2	1.8	8.3
Vegetables 4/								
1970	58	6.5	119	8.1	54	16.7	2.2	14.3
1994	58	6.4	123	7.3	54	14.1	2.3	11.0
White potatoes								
1970	8	0.9	47	3.2	21	6.4	0.8	5.0
1994	9	0.9	47	2.8	20	5.3	0.9	4.0
Dark green, deep yellow								
1970	9	1.0	9	0.6	5	1.4	0.2	1.3
1994	9	1.0	11	0.7	5	1.4	0.2	1.0
Other vegetables								
1970	41	4.6	63	4.3	29	9.0	1.2	8.1
1994	43	4.5	65	3.9	29	7.5	1.2	6.0
Grain products								
1970	32	3.5	199	13.6	58	17.8	5.6	36.6
1994	47	4.9	350	20.8	98	25.5	10.7	50.5
Sugars and sweeteners								
1970	6	0.7	5	0.4	3	0.8	0.2	1.3
1994	8	0.8	6	0.3	3	0.9	0.2	1.1
Miscellaneous 5/								
1970	19	2.2	33	2.3	36	11.1	0.9	5.5
1994	28	2.9	42	2.5	37	9.6	1.2	5.7

See footnotes at end of table

continued--

Appendix table 3--U.S. food supply: Nutrients contributed from major food groups per capita per day, 1970 and 1994 1/--continued

Food group	Vitamins					
	Zinc		Copper		Potassium	
	Milli-grams	% of total	Milli-grams	% of total	Milli-grams	% of total
Meat, poultry, and fish						
1970	5.6	47.6	0.3	19.3	606	17.3
1994	5.5	41.5	0.3	14.0	633	16.7
Dairy products 2/						
1970	2.3	18.6	0.1	3.4	774	22.0
1994	2.5	18.9	0.1	2.8	702	18.5
Eggs						
1970	0.5	3.9	**	0.4	52	1.5
1994	0.4	2.8	**	0.3	41	1.1
Fats and oils 3/						
1970	**	0.1	**	0.1	2	0.1
1994	**	0.1	**	0.1	2	**
Fruits						
1970	0.1	1.3	0.1	6.9	327	9.3
1994	0.1	1.4	0.1	7.2	438	11.6
Citrus fruits						
1970	**	0.3	**	1.9	116	3.3
1994	**	0.4	**	2.0	153	4.0
Noncitrus fruits						
1970	0.1	1.0	0.1	5.1	212	6.0
1994	0.1	1.1	0.1	5.2	285	7.5
Legumes, soy, and nuts						
1970	0.7	6.0	0.3	16.2	271	7.7
1994	0.8	6.3	0.4	20.1	349	9.2
Vegetables 4/						
1970	1.0	7.6	0.4	24.0	972	27.7
1994	1.0	7.2	0.4	19.8	1,003	26.5
White potatoes						
1970	0.4	3.1	0.2	12.6	508	14.5
1994	0.4	2.9	0.2	9.5	501	13.2
Dark green, deep yellow						
1970	0.1	0.5	**	1.5	64	1.8
1994	0.1	0.6	**	1.2	77	2.0
Other vegetables						
1970	0.5	3.9	0.2	9.9	400	11.4
1994	0.5	3.7	0.2	9.1	425	11.2
Grain products						
1970	1.5	12.1	0.3	16.9	217	6.2
1994	2.4	18.4	0.4	23.3	365	9.7
Sugars and sweeteners						
1970	0.1	0.5	0.1	4.3	19	0.5
1994	0.1	0.5	0.1	4.2	22	0.6
Miscellaneous 5/						
1970	0.3	2.4	0.1	8.6	274	7.8
1994	0.4	3.0	0.2	8.4	231	6.1

* = Less than 1.0 but more than 0. ** = Less than 0.05 but more than 0.
1/ Percentages for food groups are based on aggregate nutrient data from appendix table 2.
2/ Excludes butter. 3/ Includes butter. 4/ Total may not add due to rounding.
5/ Coffee, tea, spices, chocolate liquor equivalent of cocoa beans, and fortification not assigned to a pa
Source: USDA/Center for Nutrition Policy and Promotion (CNPP).

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[Alphabetization is word-by-word (e.g., Tea consumption precedes Teacher education.]

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