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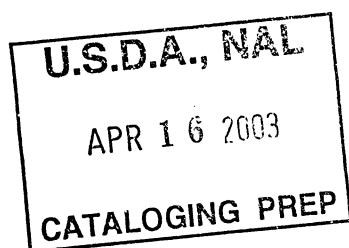
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Food Demand and Consumption Behavior
Selected Research Topics

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IMPACT OF NUTRITION ON FOOD DEMAND AND CONSUMPTION AND VICE VERSA

Lillian Emmons*

INTRODUCTION

Many forces shape food demand and food consumption behavior. What people eat is affected not only by what scientists know, or by what nutritionists and doctors tell them, or even by what they themselves understand. According to Winikoff of Rockefeller Foundation, "it 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 availability and palatability. Nutrition, then, is the end result of pushes and pulls in many directions, a response to the multiple forces creating the 'national nutrition environment'"(U.S. Senate, 1977).

The supply of foods and nutrients in the marketplace is the result of decisions made by many different people -- producers, processors, marketers, advertisers, economists, politicians, and many more. Rarely are those who make the decisions sensitized to the nutritional consequences of their actions. The balancing of budgets has been more important in our profit-oriented system than the balancing of diets (Berg).

Nutritionists have long wanted to help decision-makers at each point in the food chain so that the nutritional impact of their decisions on consumers can be foreseen. We have not been too successful up to now for each profession and occupation erects its own language barrier. Nevertheless, I believe that those who speak about "elasticities" can understand those who talk about "Recommended Dietary Allowances," and vice versa. This workshop provides an excellent opportunity for us to try.

The marketplace has become increasingly complex. Today's supermarket has over 10,000 items: some are the traditional foods of the past; an increasing number are processed, enriched, fortified or fabricated. Some foods cannot be recognized from the list of ingredients on the label. Consumers are becoming more dependent on nutritional value decisions that are made for them, not by them (Breeling).

From the array of available foods, shoppers choose items that satisfy their hunger; i.e., meet their caloric needs, and that satisfy

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their appetite; i.e., meet the needs their environment has taught them are important (American Dietetic Association). Although we take pride in the abundance in our marketplace, it is clear from USDA's Food Consumption Surveys in 1955 and 1965 that an increasing number of families are choosing foods that result in poor diets (15% of the families had poor diets in 1955; 21% in 1965). While poor diets are more common among low income families, they are not limited to the poor. Factors other than income are of marked importance in food selection (USDA, 1969).

Numerous programs and activities are working to improve, change or regulate food consumption patterns and the nutritional status of the population, or segments of it. These include direct intervention programs (food stamps and other feeding programs); a multitude of nutrition education programs (from physicians to first graders, from the affluent to the poor); food advertising; the efforts of consumer groups and food faddists. Of great importance are the labeling of foods, development of new foods, food safety regulations, food fortification programs, nutrition surveys, training of professionals, nutrition research programs, and certain aspects of health care programs.

In the end we are all concerned about the American diet and the degree to which it meets the nutritional needs of all population segments. Nutritionists have established Recommended Dietary Allowances; i.e., nutrient standards, to assess the nutritional quality of diets. The way in which Recommended Dietary Allowances are used in this evaluation and the ways they are used in the enrichment, fortification and fabrication of foods and in nutrition labeling deserves careful attention. It is through the intended and unintended uses of the Allowances that nutritionists have had major impact on the food supply and, therefore, on consumption.

A second area where nutritionists have felt primary responsibility is nutrition education. However, they are finding themselves outflanked and outfunded by others with different points of view. A look at the changing American diet helps to indicate who the consumer is listening to.

Several large scale studies, some in the past, some ongoing, provide data on food consumption and nutrient intakes. In addition, the various food assistance programs have been evaluated to see how they affect food demand and the nutritional status of recipients. It is important to discuss the methods used for obtaining and evaluating dietary data if we are to understand the usefulness of the data in describing food consumption and dietary status.

A look into each of these areas and some discussion of the interplay of nutrition on food demand and consumption behavior and, vice

versa, of food demand and consumption behavior on nutrition, illuminates problems we confront in providing people with all the nutrients they need and accurately assessing the adequacy of their diets.

RECOMMENDED DIETARY ALLOWANCES AND THEIR USES

Description

Recommended Dietary Allowances (RDA) are the levels of intake of some essential nutrients determined by the Food and Nutrition Board of the National Research Council to be adequate to meet known nutritional needs of practically all healthy persons (Food and Nutrition Board).

Ideally the allowance is developed by: (1) determining the average requirement of a healthy and representative segment of each age group for the nutrient under consideration; (2) assessing statistically the variability among the individuals within the group; and (3) calculating from this the amount by which the average requirement must be increased to meet the needs of nearly all healthy individuals.

For many nutrients it is difficult to determine what the requirements are. Requirements differ among individuals, and from time to time for a given individual. They differ with age, sex, body size, physiological state, and genetic makeup. Some are further influenced by how active a person is and by the environment in which he lives. For some nutrients the requirements for man must be estimated from animal studies or from trials on very few subjects.

It is necessary to recognize these problems in order to understand why recommendations for nutrient allowances may differ from country to country and why the allowances for some nutrients exceed the presumed requirement by a much greater proportion than those for others.

For those nutrients whose requirements are known, recommended allowances are obtained by increasing the average requirement by twice the standard deviation. With a statistically normal distribution for the requirements of individuals, 97.5 percent of the population should have requirements below this amount.

There are 45 essential nutrients. Recommended Dietary Allowances have been established for 17 of them:

protein	vitamin B ₁₂
vitamin A	folacin
vitamin D	calcium
vitamin E	phosphorus
vitamin C	iodine
thiamin	iron
riboflavin	magnesium
vitamin B ₆	zinc
niacin	

Recommended Dietary Allowances have not been established for the other 28 essential nutrients for there is insufficient data on requirements to do so at the present time:

linoleic acid (a polyunsaturated fatty acid)	
8 essential amino acids (10 for children)	
sources of energy (fat, carbohydrate, protein)	
vitamin K	manganese
pantothenic acid	cobalt
choline	copper
biotin	selenium
sodium	molybdenum
potassium	nickel
chloride	tin
fluoride	vanadium
chromium	silicon

The Food and Nutrition Board feels it is appropriate to use the RDA for:

1. Planning and procuring food supplies for population groups.
2. Interpretation of food consumption data in relation to nutritional status.
3. Establishing policies for health and welfare programs.
4. Nutrition education.
5. Product development, nutrition labeling, and regulation of nutritional quality.

The RDA serve as helpful standards for good nutrition in that people consuming diets that provide the RDA are likely to get sufficient amounts of all essential nutrients if the RDA are from as varied a selection of foods as is practicable (Food and Nutrition Board). If a large proportion of the foods in a diet are processed or fabricated, one cannot assume that all 45 essential nutrients will be obtained even with a varied selection of food. Here are the effects of food labeling, enrichment, fortification and fabrication become important.

Labeling

To obtain the nutrients used in food labeling, the RDA table was reduced to the U.S. Recommended Dietary Allowances; i.e., the U.S. RDA. In most cases, the highest amounts of protein, vitamins and minerals recommended for any group in the RDA table were chosen for the U.S. RDA. Since men have the highest requirements for nutrients, most of the levels chosen were those for men. However, adult women need more iron than men so their value was chosen (Committee on Food Protection). Although there are actually four U.S. RDA tables for different groups, that for adults and children over 4 years is used for general labeling purposes.

U.S. RDA are based on the 1968 tables of the Food and Nutrition Board. When these were revised in 1974, the Food and Nutrition Board decided that the former recommendations for such nutrients as protein, vitamin B₁₂, vitamin C and vitamin E had really been higher than new evidence supported. The amount of vitamin C was cut about 25 percent. Vitamin E was trimmed even more.

The Food and Drug Administration decided that, since the U.S. RDA were reference standards, they would for the present let the older values stand to avoid delays in instituting nutrition labeling and provide extra margins of protection (National Nutrition Consortium).

U.S. RDA for Adults and Children over 4 Years

Nutrients Which Must Be On The Label

Protein	65 g
Vitamin A	5,000 IU
Vitamin C	60 mg
Thiamin	1.5 mg
Riboflavin	1.7 mg
Niacin	20 mg
Calcium	1.0 g
Iron	18 mg

Nutrients Which May Be On The Label

Vitamin D	400 IU
Vitamin E	30 IU
Vitamin B ₆	2.0 mg
Folacin	0.4 mg
Vitamin B ₁₂	6 mcg
Phosphorus	1.0 g
Iodine	150 mcg
Magnesium	400 mg
Zinc	15 mg
Copper	2 mg
Biotin	0.3 mg
Pantothenic acid	10 mg

The U.S. RDA of 65 grams of protein is used for this table.

However, a U.S. RDA of 45 grams is used in labeling for foods providing high quality protein, such as milk, meat and eggs.

Because eight nutrients must appear on the label, the impression is given that these eight nutrients are more important than the other twelve that may appear on the label, or the other 25 nutrients that are essential but not included in labeling.

The public's impression of nutritional value in foods is further misled by the unevenness of labeling. Foods must be labeled if they have been fortified or fabricated, or if a nutritional claim is made for them. Other foods may be labeled voluntarily.

Only half the foods, in terms of dollars spent on food in grocery stores, would be labeled even if the labeling program were fully implemented by industry (Leverton). Some foods of particular nutritional importance are not labeled on the food item itself or above the display area in most supermarkets. These foods include the perishables--fresh fruits, vegetables, meat, fish, poultry, etc.

Consumers who read labels, and 26 to 29 percent of them do (Klinger), can easily get the impression that the labeled foods with high percentages of the RDA are the most important in overall nutritional value and head for the aisles with breakfast cereals, fortified snacks, etc. This worries nutritionists such as Hegsted: "How are we going to tell the consumer that many of those apparently superior products simply are not worth the money?"

On the other hand, Ogden Johnson, former Director, Office of Nutrition and Consumer Sciences in the Food and Drug Administration, believes that with labeling "those who want to bring about change in the marketplace can do so by calling attention to the specific nutritional qualities--or lack of them--in the products available to consumers".

Enrichment, Fortification and Fabrication

Many foods are enriched, after processing, to restore nutrients to pre-processing levels; however, not all of the nutrients destroyed in processing are replaced by enrichment. In refining whole wheat flour to white flour, for example, more than half of 14 vitamins and minerals is lost (USDA, 1963). White bread is enriched with only four nutrients: thiamin, riboflavin, niacin and iron. The amounts of nutrients lost in the processing of different foods may be small but these amounts, if not added back by enrichment, result in a considerable loss of nutrients in some diets.

Fortification, i.e., adding nutrients to levels above those in natural foods, can give a false sense of nutritional security. The

tendency, because of the labeling requirements for nutrients, is to fortify foods first with the nutrients that must be on the label and, secondly, with the nutrients that may be on the label. The food looks very nutritious if it has high percentages of the U.S. RDA. This gives inordinate weight to the nutrients that appear on labels while forgetting the other essential nutrients in the diet.

Dr. Virgil O. Wodicka, Director of the FDA Bureau of Nutrition, is emphatic in stating FDA's intention to take whatever steps are necessary to see that the addition of pure nutrients to foods is kept on a sound scientific basis and is not used as "a form of marketing one-upmanship" (Johnson). FDA's concern about nutrient gamesmanship is commendable but equal attention needs to be given to the under-supply or absence of essential nutrients not required on labels.

The discussion over which foods to fortify, with what nutrients, and to what levels, will surely continue. There are dangers if people choose diets with many fortified foods. The repercussions from too much vitamin A or vitamin D or iron are well known. Of newer interest, is the danger of too much vitamin C. It had been thought that all water soluble vitamins were absorbed as needed by the body with the excess simply spilled off. New research has shown, however, that taking 250 mg. of vitamin C a day for three months can raise a person's requirement for this nutrient. Then, if intake is reduced to the RDA (45 mg. for adults), symptoms of scurvy can occur (Rhead and Schrauzer). Ordinarily, symptoms of scurvy would not occur unless the level of vitamin C was 10 mg. or less (Food and Nutrition Board). This is a very serious effect of over-supplementation and one that may be more common as high levels of nutrients are added to more foods.

The increased number of fabricated foods raises new concerns. The Food and Nutrition Board and the American Medical Association Council on Food and Nutrition have recommended that an imitation or fabricated food should contain at least the variety and the amounts of important nutrients contained in the food it replaces (Editorial Staff, 1974). However, if the natural food contains less than 10 percent of the RDA of a nutrient, the fabricated food does not need to include that nutrient. As a result, fabricated foods may not contain the small amounts of many RDA and other essential nutrients that add up to an adequate dietary level in a varied diet.

Problems arise, too, in setting nutrient standards for frozen "heat and serve" convenience dinners. A special committee of the Food and Nutrition Board, National Research Council, determined the minimum amounts of 6 RDA nutrients that must be in the dinners and stated that 6 other nutrients will also be expected to be present when there is sufficient information to establish standards. In the meantime, the nutrient requirements for these meals are small (Grant).

Certainly fabricated foods will not be reliable replacements for traditional foods if they have added to them only the nutrients for which there are RDA.

Many now believe that a national policy needs to be developed to insure that fabricated foods are as nutritious as the traditional foods they replace. If that is not done, the day may soon come when large numbers of people have diets with all the calories and RDA nutrients they need, but less than the needed amounts of the other essential nutrients.

Some have proposed that basic foods be uniformly fortified or fabricated so they are nutritionally complete. Richard Gordon, President of the Institute for Urban Development, suggested that "each of the basic foods should be fortified with the nutrients selected to a level such that, if it were consumed as the sole source of an adequate caloric intake, it would supply complete daily nutrient needs" (Labuza).

This view presumes more knowledge of the requirements for each of the 45 essential nutrients than we currently have. It also presumes that people choose foods in a more predictable manner than they really do. There would be great problems of over and under supplementation depending on the foods people selected to eat.

Nevertheless, the different points of view show the pressures at work changing the nutrient supply in the marketplace. Even in 1970, fortification was responsible for the following amounts of nutrients in the food supply (Dymsza):

thiamin	40%	vitamin A	10%
iron	25%	vitamin C	10%
niacin	20%	vitamin B ₆	4%
riboflavin	15%	vitamin B ₁₂	2%

That was just the beginning.

NUTRITION EDUCATION

Basic nutrition information has been taught traditionally using the basic Four Food Groups:

- Dairy foods
- Meat, fish, poultry
- Fruits and vegetables
- Breads and cereals

Nutritionists believed that, if people learned about these food groups and the number of servings of each they should have each day, they would be able to make nutritionally wise selections in the marketplace and feed their families well. However, even with increased efforts at nutrition education, it is apparent from Food Consumption Surveys in 1955 and 1965 that the percent of families receiving adequate diets has decreased, not increased (USDA, 1969).

More and more foods do not fit into the Four Food Groups. Processed foods, when enriched, do not have the same nutrient content as the pre-processed foods. Fortified and fabricated foods do not fit into the Basic Four Food Groups because of their pattern of selected nutrients. New groupings are needed, such as:

- | | |
|-----------|--|
| Example 1 | Natural foods
Enriched
Fortified
Fabricated
Empty calorie (no nutrients, just calories) |
| Example 2 | Traditional foods
Substitute or reformulated foods
Meal replacements
Snack foods (Ahlstrom) |

It is clear that people do not buy food just because it is good for them. They buy food that satisfies their caloric needs and appeals to their senses. Foods beckon because of their buttery flavor, crispness, color, smoothness, ease of serving, gourmet status, etc. However, if people learn basic nutrition principles and good dietary practices, they do select foods for a better diet.

Much more money is spent by industry to advertise their products, than is spent by nutrition educators to teach good nutrition practices. For example, USDA's budget to extension, which is largely for nutrition education, was \$50,560,000 in 1975, while the advertising budget for General Foods alone was \$180,000,000 in 1973 (U.S. Senate, 1977).

In hearings before the Senate's Select Committee on Nutrition and Human Needs, Jean Mayer concluded that, "The more useless the food product, the greater the advertising" (U.S. Senate, 1973). This statement is supported by a recent study of Masover and Stamler of Northwestern University Medical School (U.S. Senate, 1977). They analyzed the food advertising on four Chicago television stations during the period August 4 to 10, 1975, and reported:

"A detailed look at this weekly food advertising time--restaurants excluded--found that the group of non-nutritive beverages was,

by far, the single most-advertised food group, capturing approximately two-fifths of the time, of which nearly one-third was for wine and beer. Sweets took up about 11 percent of the time; non-nutritive beverages plus sweets--all items low in nutrients and most of them high in calories--commanded an absolute majority of time. Add to these the oils, fats, margarines, baked goods, snack foods, and relishes, and the proportion of advertising going to low-nutrient, generally high-calorie foods was nearly 70 percent!"

The study found that only about 25 percent of the time was devoted to "nutritious groups" such as bread, cereal, pasta, meat, fish and seafood, dairy products, fruits and vegetables, soups and nut products.

Masover and Stamler also found "Of the restaurants advertised, nearly all were of the limited-menu, fast-food type specializing in foods high in saturated fats and cholesterol" (U.S. Senate, 1977). Another study found that total advertising for fast-food operations has increased 234 percent since 1971 to \$200 million annually (Community Nutrition Institute Weekly, 1977).

The consumer is under great pressure to buy certain foods and often has insufficient nutrition knowledge to withstand the pressures. Joan Gussow, chairperson of the Program in Nutrition at Teachers College, Columbia University, testified recently:

"No amount of information about the nutritive or non-nutritive qualities of foods advertised will compensate for the total imbalance in the nature of the foods advertised on TV. The nature of the foods advertised is largely highly processed foods, many of them snack foods, highly sugared, highly salted... We should have advertising of fruits and vegetables. They should be public service announcements selling people on those components of the diet which, in fact, they are not currently being sold on--dairy products, beans, rice, grains, and other forms of protein foods--and all these foods don't get sold because they do not have a high enough mark-up" (U.S. Senate, 1977).

Many agree with Mark Hegsted, "There is something wrong with a system that encourages people to waste their money" (U.S. Senate, 1977).

Since greater manipulation of the food supply is a certainty (Call) and greater control of sensory acceptability will make substitutes for traditional foods increasingly attractive, we will need to find sensible solutions. Either nutrition education will need to provide consumers with the information they need to select and consume foods for a balanced diet--or we may need to legislate careful control of the nutrient levels in food.

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THE AMERICAN DIET: YESTERDAY, TODAY AND TOMORROW

During the last thirty years our diet has become increasingly rich--rich in meat and rich in sugar and too high in salt. Between 1910 and 1970 the percent of total calories from carbohydrate has decreased, the percent from fat has increased and the percent from protein has remained about the same as shown in Figure 1 (U.S. Senate, 1977).

Today 42% of daily calories come from fat (Robinson). In the last seven years, meat has provided the largest increase in fat, followed by salad and cooking oils and then by shortening. Specifically, the consumption of beef and veal, chicken and turkey has increased, while that of pork, lamb and mutton has remained steady (Figures 2 and 3) (USDA, 1975).

Between 1940 and 1973 milk consumption decreased 43% mostly because the consumption of whole milk fell 20% and that of cream and butter 35%. However, during the same period the consumption of low-fat milk increased 571% and that of cheese increased 55% (Pearson). Fewer shell eggs are eaten now but the use of processed eggs has remained steady (Figure 3). This shows the concern about saturated fat in whole milk, cream and butter, and cholesterol in eggs.

In the early 1900's almost 40 percent of our caloric intake came from fruits, vegetables and grain products. Today, only a little more than 20 percent of our calories comes from these sources. With decreased dependence on fruits, vegetables and cereals has come an 80% decrease in natural fiber (Burkitt and Painter).

In recent years, however, vegetable consumption has risen slightly (Figure 4) with most of the increase in processed vegetables (Figure 5) (USDA, 1975). Citrus fruit consumption has risen, too, (Figure 6) but that of noncitrus fruit has decreased (Figure 7) (USDA, 1975).

Of particular concern today is the high intake of sugar. We now consume, on the average, 100 pounds of sugar a year and, therefore, obtain about 14% of our calories from sugar (Robinson). Sugar does not bring with it any nutrients, just calories.

With 14% of our calories from sugar and 14% from salad and cooking oils, shortening and lard, 28% of our calories are from nutrient-deficient sources. The remaining 72% of our calories must bring with them the recommended amounts of all 45 essential nutrients. This is why the nutrient density of our food supply assumes great importance.

The changing percentages of carbohydrate from starch and sugar are shown in Figure 8 (U.S. Senate, 1977). Most of the starch is from grain products in the form of bread and other baker products (Figure 9) (U.S. Senate, 1977).

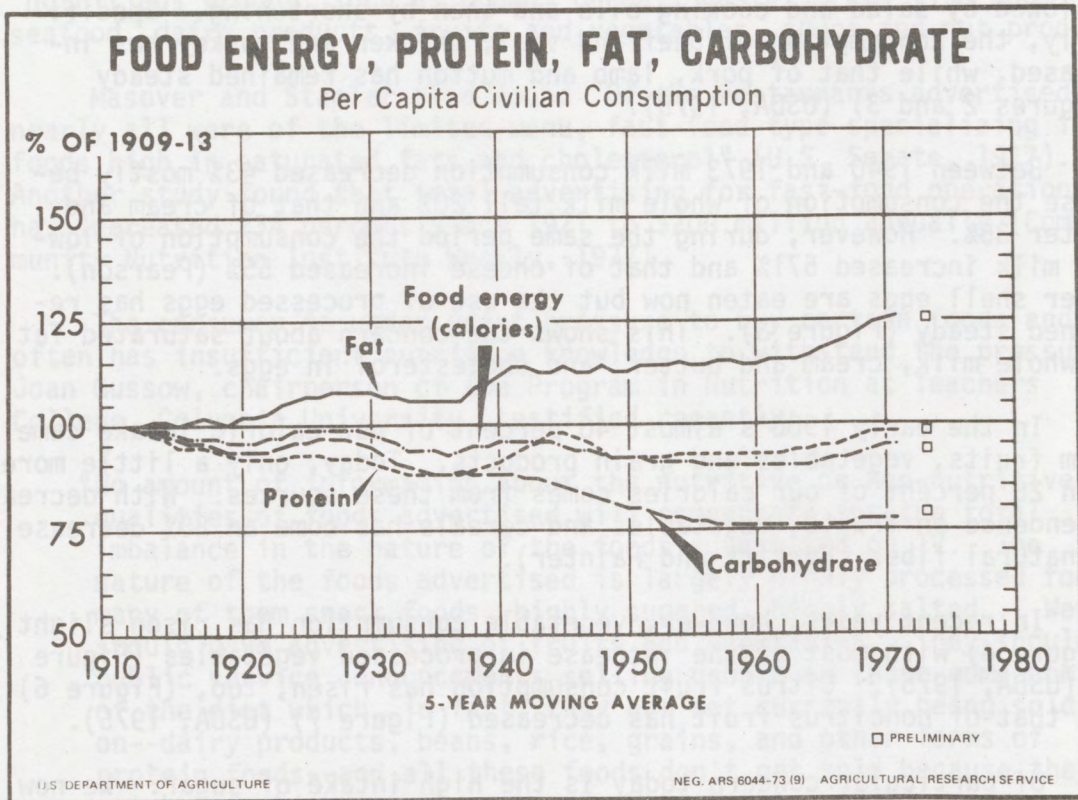


Figure 1. Food energy, protein, fat and carbohydrate consumption per person.

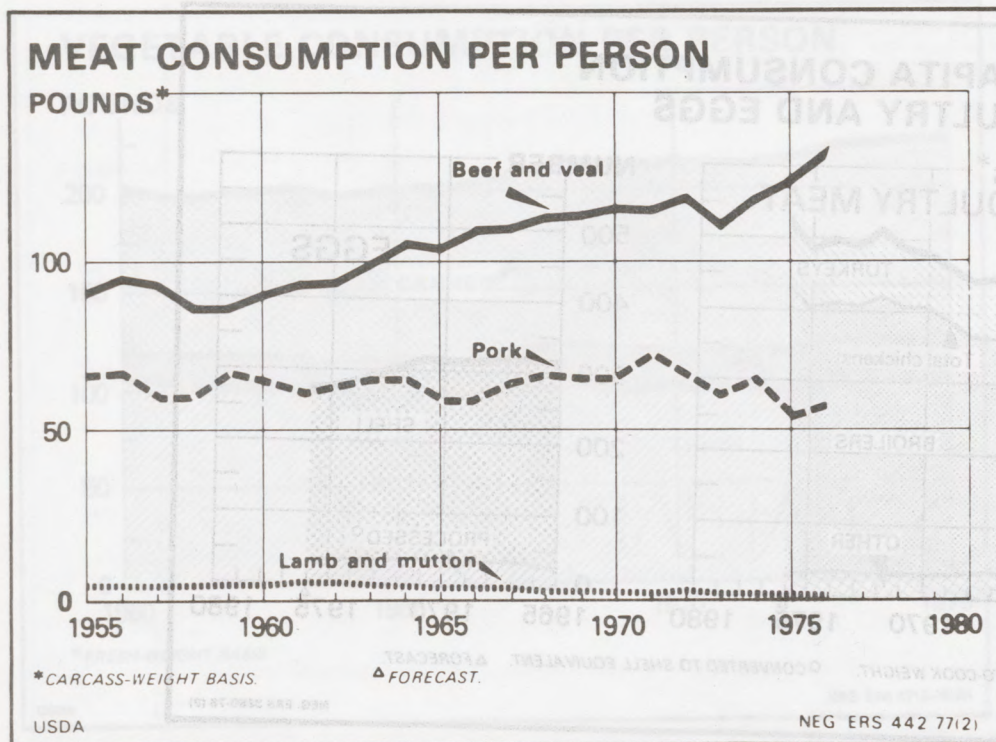


Figure 2. Meat consumption per person.

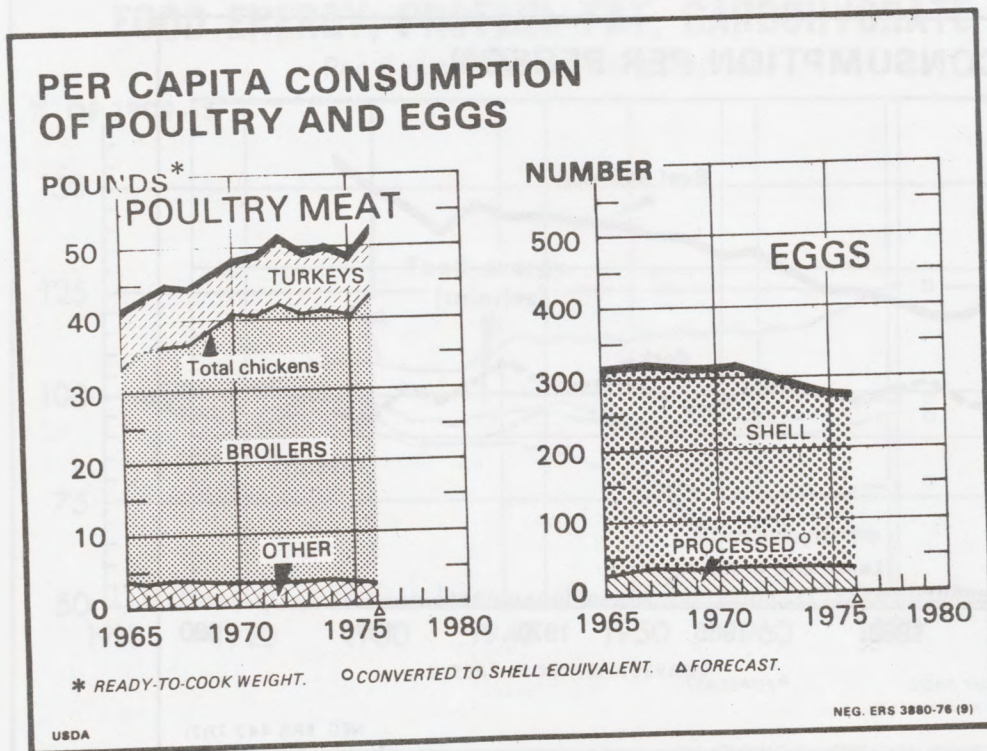


Figure 3. Poultry and egg consumption per person.

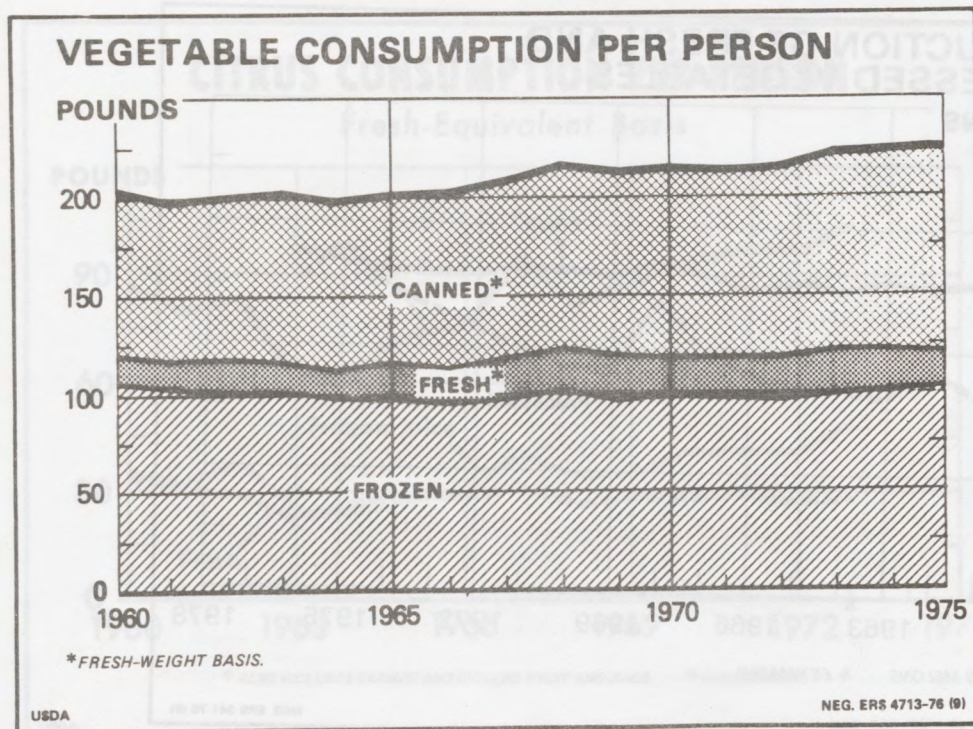


Figure 4. Vegetable consumption per person.

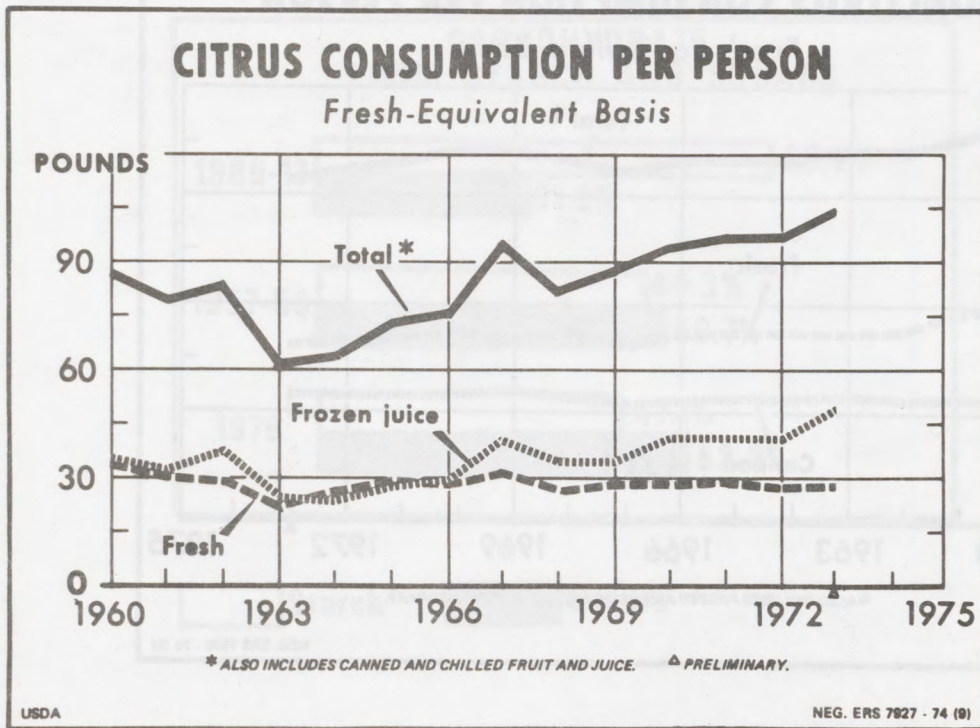


Figure 6. Citrus consumption per person.

Food Situation, CFE (Aug.) 295-9, January 1976. Preliminary data for 1976 unpublished. Agricultural Research Service, U.S. Department of Agriculture.

Figure 8. Percent of dietary carbohydrate from starch and other

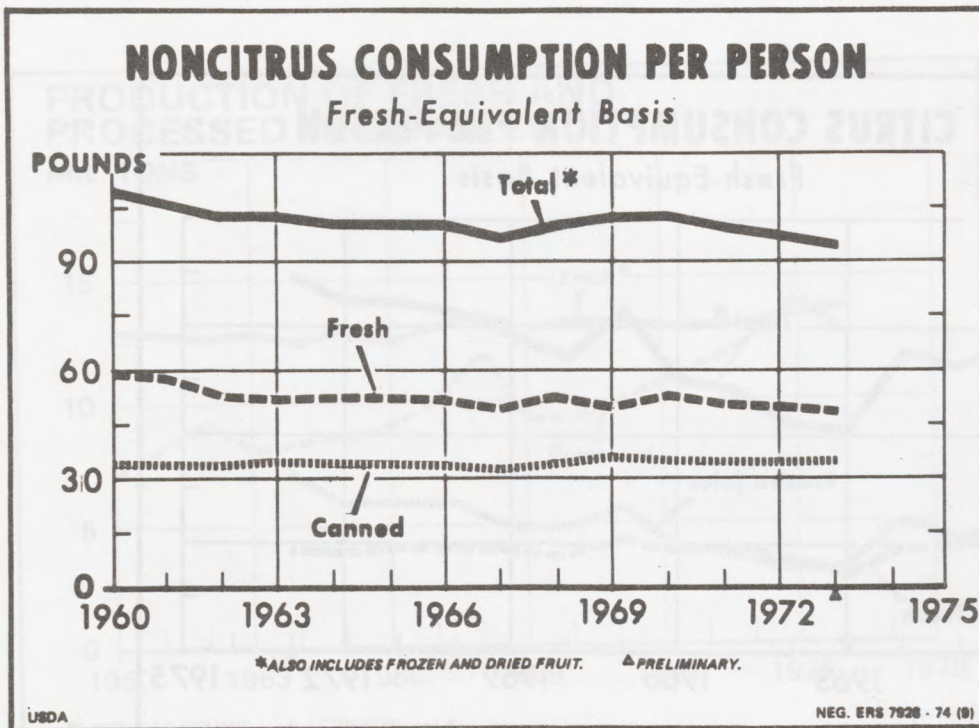
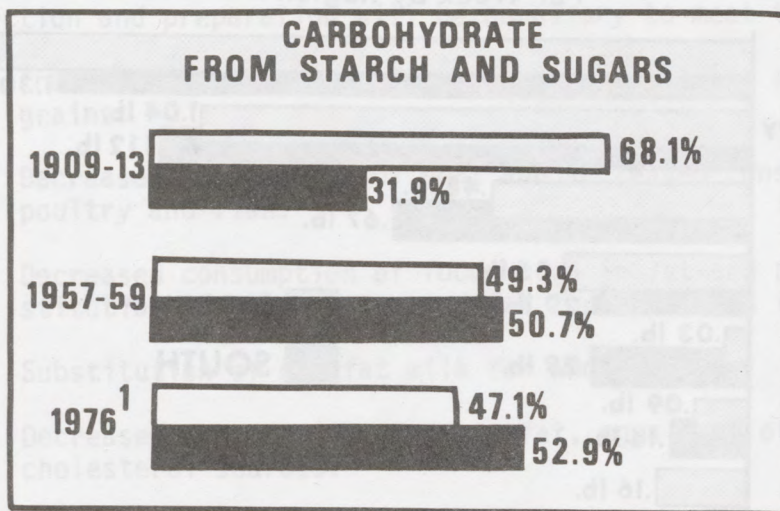


Figure 7. Noncitrus consumption per person.

As a result of all these changes, the source of calories in our diet is:

42% from fat: 16% saturated
26% poly- and monounsaturated
12% from protein
46% from carbohydrates: 22% complex carbohydrate
24% sugar

On the basis of hearings on the American diet, the Senate Select Committee on Nutrition and Human Needs formulated dietary goals (Figure 10).
GRAIN PRODUCTS USED PER PERSON
less saturated fat, more poly- and monounsaturated fat, and less complex carbohydrate; and the same amount of fat.



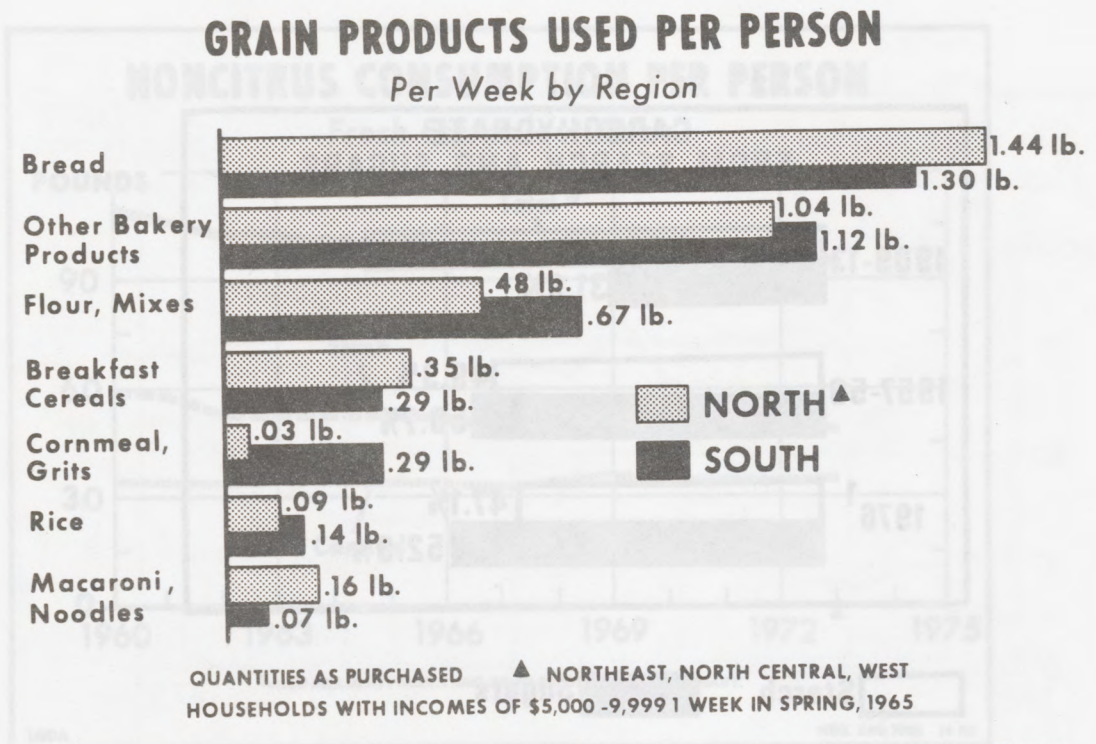
□ Starch ■ Sugars

1 Preliminary.

Source: Nutritional Review, National Food Situation, CFE (Adm.) 299-9, January 1975. Preliminary data for 1976 unpublished. Agricultural Research Service, U.S. Department of Agriculture.

Figure 8. Percent of dietary carbohydrate from starch and sugars.

Several levels of information help describe the food consumption and nutritional status of households and individuals. Data on fat



U.S. DEPARTMENT OF AGRICULTURE

NEG. ARS. 5944-69 (4) AGRICULTURAL RESEARCH SERVICE

Figure 9. Grain products used per person.

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 24% sugar

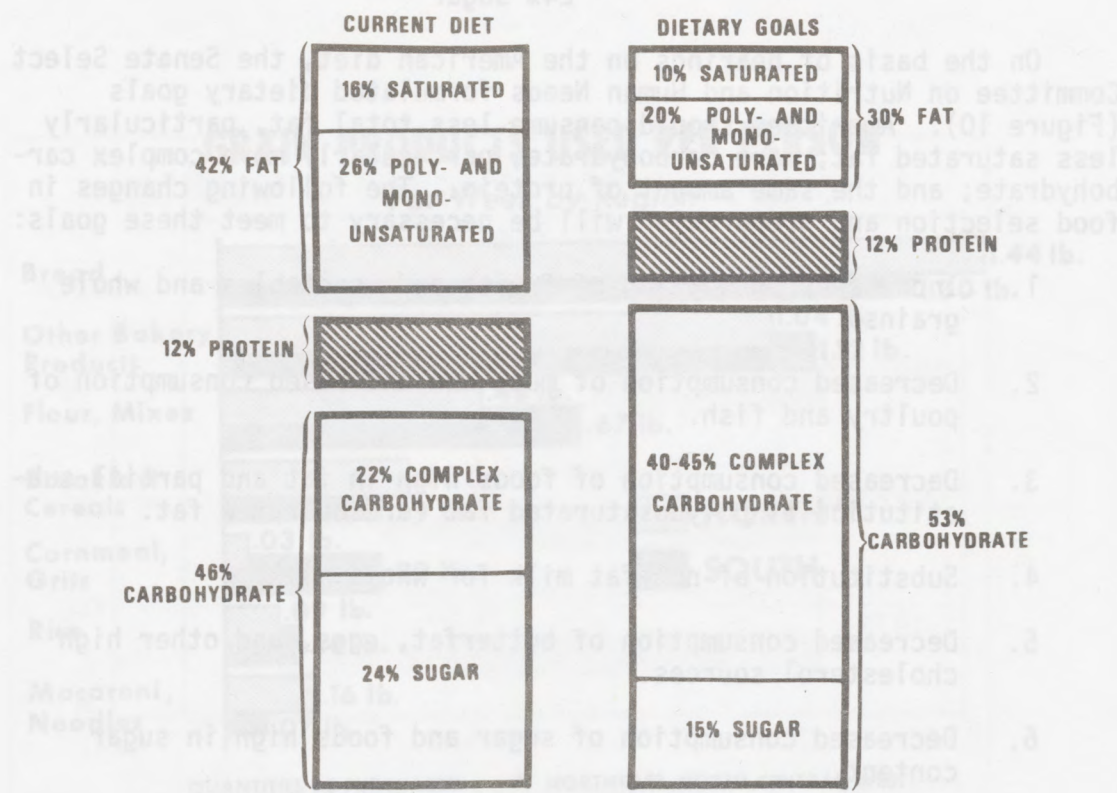
On the basis of hearings on the American diet, the Senate Select Committee on Nutrition and Human Needs formulated dietary goals (Figure 10). Americans should consume less total fat, particularly less saturated fat; more carbohydrate, particularly more complex carbohydrate; and the same amount of protein. The following changes in food selection and preparation will be necessary to meet these goals:

1. Increased consumption of fruits and vegetables and whole grains.
2. Decreased consumption of meat and increased consumption of poultry and fish.
3. Decreased consumption of foods high in fat and partial substitution of polyunsaturated fat for saturated fat.
4. Substitution of non-fat milk for whole milk.
5. Decreased consumption of butterfat, eggs, and other high cholesterol sources.
6. Decreased consumption of sugar and foods high in sugar content.
7. Decreased consumption of salt and foods high in salt content to approximately 3 grams a day (U.S. Senate, 1977).

These goals call for abrupt changes in our food selection and food consumption patterns. Yet, as the relationship of diet to disease becomes clearer, people may become interested in effecting these goals. Many have already decreased the levels of saturated fat and cholesterol in their diet. Such changes in purchasing patterns for health reasons are relatively new. They have changed the demand for some foods and may change the demand for many more. Careful monitoring will be needed to see how the marketplace responds and how nutrient levels in the diet change.

METHODOLOGY FOR OBTAINING DATA ON FOOD CONSUMPTION AND NUTRITIONAL INTAKE

Several levels of information help describe the food consumption and nutritional status of households and individuals. Data on the



Sources for current diet: "Changes in Nutrients in the U.S. Diet Caused by Alterations in Food Intake Patterns." B. Friend. Agricultural Research Service, U.S. Department of Agriculture, 1974. Proportions of saturated versus unsaturated fats based on unpublished Agricultural Research Service data.

Figure 10. Source of calories in current diet and in Dietary Goals proposed by U.S. Senate Committee on Nutrition and Human Needs.

financial resources of families and the proportion of their income spent on food comes largely from the Bureau of Labor Statistics.

While some families at all income levels have inadequate diets, a higher proportion of poor families have inadequate diets. For this reason, several food assistance programs are in operation which provide food either directly or indirectly through income expanding features. These programs affect food demand and the nutrient levels in the diets of recipients.

Evaluations of Food Assistance Programs

Food Stamp Program

This income expanding program now serves 17.6 million of the approximately 35 million people who, by income, would seem to be eligible for it (USDA News). Several studies have evaluated the nutritional impact of the program beginning with that of Reese and Adelson in Michigan and Pennsylvania in 1967 and most recently, the study done by Sylvia Lane in California. Households using food stamps consume more food than non-participating households. However, their choice of foods does not always improve their diet as much as it should. Lane found that food stamp participants received significantly more calories, protein, thiamin and riboflavin than non-participants, but both they and non-participants had diets with only half the recommended amounts of calcium, iron, vitamin A and vitamin C.

It appears that some nutrition education is needed along with food stamps. The Federal Extension Service established the Expanded Nutrition Education Program for that purpose. Unfortunately, it reaches only a small proportion of food stamp households.

National School Lunch and Breakfast Programs

The National School Lunch Program now serves 26.4 million and the School Breakfast Program serves 2.5 million of the 52 million children in the nation's schools (USDA News). Both programs have the effect of expanding the incomes of families whose children receive the meals. In a study by Emmons, Hayes and Call in New York State, both programs were shown to be markedly successful in raising the nutrient intake levels of children.

Special Supplemental Food Program for Women, Infants, and Children (WIC)

The program offers cash grants to make supplemental foods available to pregnant and lactating women, infants and children up to four

years of age. The system of delivery may include the distribution of supplemental foods at health clinics, the issuance of food vouchers redeemable at retail stores, or any other approved method a state health agency may select.

To be eligible pregnant and lactating women, infants and children must (1) live in an approved project area, (2) be eligible for medical treatment at reduced cost from a local agency serving the project area, and (3) be determined by competent medical personnel to be in need of supplemental food. The program now serves half a million of the 4.6 million women and children seemingly eligible for it.

A recent study on the coverage and effectiveness of the program was recently completed by the Urban Institute.

Title VII Nutrition Program for the Elderly

This program offers a noon meal supplying one-third of the day's nutritional requirements to people over age 60 and their spouses. The congregate meal sites are located in low income areas where many of the elderly may have difficulty procuring and preparing nutritious meals for themselves. The first year of a long term evaluation of this program is now being completed for the Administration on Aging (Personal communication).

While ongoing evaluations of the effectiveness and coverage of these food assistance programs is essential if we are to understand how they change the food consumption behavior of low income families, other studies that include people of all income levels are needed to understand overall food demand and consumption behavior.

Food Consumption Surveys

USDA's Food Consumption Surveys in 1936-37, 1942, 1948, 1955 and 1965-66 have provided basic information on food purchasing and consumption by different families. From this information, the nutrient content of the foods has been calculated and the diets of families rated good, fair or poor.

Two measures of food consumption were employed in the 1965-66 Food Consumption Survey: the kind and amount of food available to the household and the amount of that food used up during the 7-day reporting period; and the food eaten by each family member during one 24-hour period (Clark).

Data on the total amount of food eaten during the 7-day period was obtained using the list-recall method. In this method the

interviewer uses a schedule which includes a detailed list of foods and questions to help the homemaker remember foods eaten during the preceding week. Foods are recorded in common measures or retail units. There are advantages and disadvantages.

Advantages:

1. A single visit of the interviewer is enough to obtain necessary information.
2. A high cooperation rate can be expected.
3. The food consumption pattern is not seriously affected by intervention of the interviewer.
4. The cost of collecting data is moderate.

Disadvantages:

1. The degree of memory lapse and memory telescoping in reporting by the homemaker is unknown.
2. Consumption of individuals within the family is not measured.
3. Consumption of status foods may be overestimated.
4. Waste and losses are difficult to estimate.
5. Food eaten away from home is not recorded.

Information on the food intake of individual family members was obtained from individual food intake records kept for each family member for a 24-hour period. This kind of record is kept of all foods as they are eaten with an exact description of each food and the amount as measured or estimated in household measures or retail units. This method, too, has its advantages and limitations.

Advantages:

1. Accuracy is good because subjects do not depend on recall but record foods at the time they are eaten.
2. Eliminates problem of responses based on vague recalls of what and how much was eaten.
3. Interviewer intervention is decreased when subject does his own reporting.

Disadvantages:

1. Some food items may be omitted or inadequately described in the record.
2. Meals eaten away from home usually cannot be weighed or measured.
3. The necessity of keeping a record may alter the usual dietary pattern of the subject.
4. Respondent must be literate and cooperative. This introduces a sampling bias.
5. Recording may become increasingly careless as the recording period extends beyond one day.
6. Cost in money and time is comparatively high.

USDA found a considerable gap between the data on the household's food consumption for a week and the food recorded in the one-day records. It is difficult to estimate the amount of food that is wasted. No doubt more food ended up in the garbage than the homemaker remembered. In a study of garbage by Harrison, Rathje and Hughes in Tuscon, families were found to waste food equivalent to \$80 to \$100 a year.

The diets of households were rated according to their levels of seven nutrients: protein, calcium, iron, vitamin A, vitamin C, thiamin and riboflavin. A diet was good if it contained the RDA of all seven nutrients; poor if it did not furnish 2/3 of the RDA of any one nutrient; and fair if it fell inbetween. Vitamin A and vitamin C were the nutrients most often below allowances in households of all sizes.

Since the 1968 revision of the RDA was released after the 1965-66 data was analyzed, the 1963 RDA were used. If the 1968 RDA had been used, more households would have met the allowances for protein and vitamin C; fewer for iron, thiamin and riboflavin; and about the same for calcium and vitamin A. The 1974 revision of the RDA further complicates the comparison of diets in the different Food Consumption Surveys.

The 1977-78 Food Consumption Survey will include 15,000 households and some special subsamples. One subsample will have 5,000 families with elderly persons. Another subsample was to have included 5,000 low income families but it was dropped by the Ford Administration. Although some of these families will be included in the survey's 15,000 households, it will certainly be more difficult now to measure the effectiveness of food stamps, school lunch and other feeding programs in meeting the needs of low income families (Community Nutrition Institute Weekly, 1976).

In an effort to close the gap found in 1965 between information on the consumption of the household over seven days and that revealed by individual 24-hour records, USDA will use the food list recall as before and will ask for three days of data on each individual (two 24-hour food intake records and one 24-hour recall).

Data will also be gathered on food eaten outside the home. This is very important for one of each three food dollars is now spent on meals away from home (Labuza). The American Restaurant Association estimates that on in every two dollars will be spent outside the home in 1985.

Nutrition Surveys

The tools for complete nutritional assessment include: biochemical measurements of nutrients in body fluids and tissues; clinical examination, including assessment of growth; and the collection of data on dietary intake.

Ten-State Nutrition Survey

The Survey evaluated the nutritional status, not just the dietary intake, of a sample drawn from districts with the lowest average incomes (quartile) in each of ten states. Some middle and upper income families residing within these districts were also included. The sample contained 30,000 households.

The 24-hour recall was used to collect dietary data. Diets were analyzed for protein, iron, iodine, and vitamins A, C, thiamin and riboflavin, and calories and the relationship of nutrient levels in the diet to biochemical and physical measurements was studied (Editorial Staff, 1972).

While dietary inadequacies were more common and serious when incomes were low, it was clear in this survey that factors such as social, cultural and geographic characteristics, had a marked effect on nutrient intakes. Many people made poor food choices whatever their income level.

Health and Nutrition Examination Survey (HANES)

The intent of HANES is "the establishment of a continuing National Nutrition Surveillance System ... (for) continuous monitoring of the health effects and prevalence of specified diseases, the examinations are intended to obtain baseline data on certain nutritional, physical, psychological, and physiological measurements. A sample of 30,000 was

selected through the use of a nationwide probability sample of the civilian, noninstitutionalized population between one and 74 years.

The 24-hour recalls were studied to reveal:

1. The nutritional value of reported food intakes of different subgroups.
2. The contribution of selected foods and food groups to nutritional intakes.
3. Frequency with which different foods and food groups were eaten.
4. Other factors related to dietary practices, such as numbers of meals or snacks consumed, places where food was eaten, and the use of vitamin-mineral supplements and table salt (Public Health Service).

The Ten-State Nutrition Survey, HANES, and the previously mentioned Title VII evaluation have all used the 24-hour recall to obtain dietary information. In this method, subjects are asked to recall the kinds and quantities of food eaten during the preceding day or the preceding 24 hours. The interviewer may use a structured or unstructured questionnaire and measuring aids, or the subject may write down the information without aids. There are advantages and limitations to this method.

Advantages:

1. It is an easy, rapid method, therefore economical.
2. It is used frequently so data from other studies are available for comparison.

Disadvantages:

1. Usual intake may be difficult to identify because of variability in day-to-day patterns of eating.
2. Poor recall by some subjects, especially of quantities.
3. Interviewer must be trained to probe, but avoid introducing bias.

Youland reported that in HANES, "The 24-hour diet recall served our purposes well in terms of time, cooperation by sample persons, administration by interviewers, and apparent ability of subjects to recall. Of the 20,749 persons examined, diet records were obtained on all but 71" (Youland and Engle).

Early studies on which reliance on the 24-hour recall is based have been reviewed by Becker, Indik and Beeuwkes in 1960, Young in 1960 and 1965 and Marr in 1971. Unfortunately, many of these studies had small numbers of subjects because tabulation and analysis of data were tedious and time consuming in the '40's and '50's. Modern statistical sampling techniques were generally not employed; instead, available subjects were used. Many studies were done with home economics students or other students, housewives or people in institutions (Young, et.al.).

While early studies were hampered because they did not have modern statistical methods and computers, today's studies have difficulties with the high cost of locating statistically drawn samples and obtaining dietary information on a new array of complex foods.

There is a real need to measure the errors involved in the use of 24-hour recalls and compare this method with others in different population groups. Although some small studies have been done on selected populations, more comprehensive work is needed for a method that is relied upon so heavily.

Evaluation of the Adequacy of Diets

Several large studies; the Food Consumption Surveys, the Ten-State Nutrition Survey, and the current evaluation of the Title VII Nutrition Program for the Elderly have used calories and seven nutrients to assess the adequacy of diets. These nutrients are:

protein	vitamin A
vitamin C	calcium
thiamin	iron
riboflavin	

RDA have been established for all seven of these key or indicator nutrients. Some of them are commonly found low in inadequate diets in this country so they are of particular interest (iron, calcium, vitamin A and vitamin C).

Basic to the use of some key nutrients to assess overall dietary adequacy is the assumption that, if one has a diet providing recommended amounts of these seven nutrients, one will also obtain all the other 38 essential nutrients in the amounts needed. There are two problems here.

Choice of Indicator Nutrients

The seven key nutrients usually chosen may not be the best indicators of overall nutritional adequacy. In a large scale analysis

of the correlation of each nutrient with every other essential nutrient in different foods, Pennington found seven nutrients which most clearly indicated the presence of the other essential nutrients. They differ from the seven usually used in dietary assessments.

<u>Pennington's Indicator Nutrients</u>	<u>Indicator Nutrients Usually Used</u>
folacin	protein
vitamin B ₆	vitamin C
pantothenic acid	thiamin
magnesium	riboflavin
vitamin A	vitamin A
calcium	calcium
iron	iron

Three nutrients are the same in both sets; four are different.

Pennington explains that vitamin C is not a good indicator itself; instead, its presence is assured if a diet has sufficient folacin and vitamin A. Similarly, thiamin is not a good indicator; instead, its presence is assured if a diet has sufficient levels of vitamin B₆, thiamin and iron.

It appears that the indicators used in dietary assessments need some review or we may be classifying diets wrongly as good, fair or poor.

Changing Nutrient Supply in the Marketplace

The enrichment, fortification, fabrication and labeling programs emphasize primarily the eight nutrients that must be on a label and, secondarily, the other twelve that may be on a label. There is the tendency to enhance foods with attractively high percentages of these nutrients and to forget about the other essential nutrients.

As more enriched, fortified and fabricated foods replace traditional foods in the diet, it becomes increasingly easy to obtain the nutrients required in labeling, and increasingly difficult to obtain the other essential nutrients normally present in natural foods.

It is possible that the nutrient supply at the marketplace has already changed so much-particularly in markets that carry few perishables-that eating as varied a selection of foods as is economically feasible can no longer assure getting all of the essential nutrients.

Nutrient data now available for different foods is being compiled by the Consumer and Food Economics Institute of USDA into a Nutrient

Data Bank (Rizek and Butrum). This computerized system for the storage and retrieval of analytical data on foods will make it possible to analyze diets directly for all essential nutrients for which there is sufficient data.

Since the food supply is undergoing highly significant changes, the time has come when it might be preferable to analyze diets for each essential nutrient for which there is sufficient data, rather than depending on key nutrients to indicate overall nutritional adequacy.

IN CONCLUSION

It is a time of change in the food supply, its nutrient content, and in the degree to which it meets the nutritional needs of the American people. As traditional foods are replaced by more and more processed foods, the nutrient content of the new foods becomes critical. Enrichment, fortification, fabrication and labeling programs overemphasize the nutrients that must or may be on labels, and neglect the other nutrients that are just as essential in the diet. We need to be cognizant of the changes these programs bring and monitor their impact on consumption.

There is much concern about the American diet for, during the past 70 years, it has become increasingly rich in fat and sugar. With 28 percent of dietary calories coming from nutrient-deficient sugar, oils, fats and shortening, the remaining 72 percent of the calories in the diet must bring with them sufficient quantities of all 45 nutrients which are essential in the diet. The nutrient density of the food supply has assumed great importance.

It is not easy for consumers to choose the foods they need for an adequate diet. They are bombarded with information but often get conflicting messages from nutritionists and the food industry. While nutritionists might be criticized for being too traditionalist in their teaching--the Four Food Groups are not as relevant as they used to be--others can be criticized for being more interested in balancing budgets and making a profit than in balancing diets.

Our problems indicate the need (1) to identify and measure the factors that determine food demand, (2) to review and improve the ways in which we gather information on consumption, and (3) to restudy our methods for evaluating nutritional adequacy. More ongoing measurements of consumption will be needed if we are to keep up with the impact of our changing food supplies and pressures in the marketplace on the diets of people in all population segments.

Thousands of people, both professional and nonprofessional, make decisions that affect our national nutrition environment. Many of

them feel so far removed from the ultimate consumer that they do not see the relationship of their actions to the diets of consumers. Yet all those who control facets of agriculture, taxes, exports and imports, processing, marketing, advertising, food assistance programs, nutrition education programs, etc. have a part in determining what people can eat and what they do eat.

Nutritionists are coming to see their role as one of helping to illuminate the nutritional issues in all these decisions. In this way, nutritional consequences of decisions can be foreseen and, if needed, alternate solutions proposed.

We who share a common concern about the food supply and food demand and consumer behavior need to work together, developing a common language, and mutual understanding of each other's unique contributions.

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