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Potential Effects of Fat-Controlled, Low-Cholesterol Diet on U.S. Food Consumption

By Corinne Le Bovit and Hazen Gale

If the entire U.S. population were to select one food pattern among those that meet the American Heart Association recommendations for a fat-controlled, low-cholesterol diet, calorie intake would decline about 13 percent compared with present consumption. The cost would be about a tenth higher, however, since beef, poultry, fish, and fruits and vegetables would partly replace lower priced foods such as pork, eggs, fats, and sugars. The farm value of the foods would be about the same as for current food consumption patterns. The total amount of agricultural resources required would change little but there would be shifts within the farm sector.

Key words: Food consumption; fat; fatty acids; cholesterol; diet; food economics; agricultural resources; food costs.

The influence of diet on the risk of coronary heart disease has been the subject of a long-simmering debate. And even for those who accept diet as an important causal factor, there is a range of opinions as to what changes should be recommended and for whom. The American Heart Association and other medical groups represented by the Inter-Society Commission for Heart Disease Resources (8)¹ urge that the public starting with the young, should markedly lower intake of cholesterol and saturated fats, and increase intake of polyunsaturated vegetable oils. They fear that otherwise many people will die or be injured unnecessarily while we wait for further evidence. On the other hand, some researchers believe that current evidence is inconclusive, and that any drastic dietary changes now would interfere with the orderly progress of research and perhaps jeopardize the success of more appropriate public health measures when and if such are clearly indicated by scientific evidence (3, 6, 10). Some scientists believe that many Americans should make some reduction in total fat intake and some substitution of polyunsaturated for saturated fat. One factor on which there is general agreement is that ideal body weight should be maintained throughout life.

This paper does not attempt to judge the merits of any of the arguments or make any recommendations. It only considers the possible effects on food consumption in the United States if consumers adopted one particular diet pattern incorporating all of the American Heart

Association (AHA) proposals. Other diet patterns which meet the AHA recommendations are of course feasible. Each would have somewhat different effects on food consumption and each could be analyzed in the same way.

The paper discusses some recent and prospective changes in consumption that may be health related. The potential impacts of dietary changes on consumer food budgets and on use of agricultural resources are considered briefly.

Recommendations of the Commission (8) include the following diet modifications for the general public:

- (1) Reduce calorie intake to a point where it maintains body weight.
- (2) Limit total fat ingestion to less than 35 percent of calories, considerably less than recent levels of 43 percent (12).
- (3) Decrease the proportion of saturated fat to less than 10 percent and increase that of polyunsaturated fatty acids to not more than 10 percent.
- (4) Reduce cholesterol intake to less than 300 milligrams per day, a sharp reduction from about 400 which is common in current diets.

Although high cholesterol content of foods is generally associated with high saturated-fat content, the relationship is not uniform. For example, seafoods such as lobster and shrimp are not high in saturated fat, but they are high in cholesterol.

Other researchers have suggested that carbohydrates should be composed of more starch and less sugar than at present. In terms of foods, the Commission states that

¹ Italic numbers in parentheses refer to items in the References, p. 57.

this pattern can be achieved by altering habits along the following lines (8):

- (1) Use lean cuts of beef, lamb, pork, and veal, cooked to dispose of saturated fat and eaten in moderate portions.
- (2) Use lean meat of poultry and fish.
- (3) Use fat-modified (reduced saturated-fat and cholesterol content) processed meat products (frankfurters, sausage, salami, etc.).
- (4) Use organ meats (e.g., liver) and shellfish in moderation since they are higher in cholesterol than muscle of red meat, chicken, and fish.
- (5) Avoid fat cuts of meat, addition of saturated fat in cooking meat, large meat portions, and processed meats high in saturated fat.
- (6) Use low-fat and fat-modified dairy products.
- (7) Avoid high-saturated-fat dairy products.
- (8) Use fat-modified baked goods (pies, cookies, cakes, sweet rolls, doughnuts, crullers).
- (9) Avoid baked goods high in saturated fat and cholesterol.
- (10) Use salad and cooking oils, new soft margarines, and shortenings low in saturated fat.
- (11) Avoid butter, margarine and shortenings high in saturated fat.
- (12) Avoid candies high in saturated fat.
- (13) Avoid egg yolk, bacon, lard, suet.
- (14) Use grains, fruits, vegetables, legumes.

Results of Diet Change

If the population were to follow the AHA dietary recommendations presented here, consumption patterns would differ from those reported in a 1965-66 household survey as follows (table 1):

- Thirteen percent fewer calories.
- Fifteen percent more pounds of food (because of substitution of lower for higher calorie foods).
- Slightly over 10 percent more beef, veal, and lamb.
- About 70 percent less pork.
- About 50 percent more poultry and fish.
- Almost no change in total meat, poultry, and fish.
- Almost no change in total dairy products (excluding butter).
- About 75 percent less eggs, margarine, and shortening.
- About 30 percent less butter.
- About 60 percent more salad and cooking oil.
- About 20 percent less total fats and oils.
- About 75 percent more fruits and vegetables.
- Half as much sugars.
- A little less grain products.

This consumption pattern would result in the ingestion of about 230 milligrams of cholesterol per day, which is within the AHA recommendation, compared

with the estimated 400 milligrams in the 1965-66 survey.² Sources of calories in food ingested are distributed as follows:

	AHA diet	1965-66 survey ¹
	Percent	Percent
Protein	17	14
Carbohydrate	53	46
Fat	30	40
Fatty acids:		
Saturated	10	15
Monounsaturated (oleic) ...	10	16
Polyunsaturated (linoleic) ...	7	5

¹ These estimates relate to food ingested and differ from other estimates based on food use including waste.

In addition to these changes, some major shifts might occur within the product groups, including the following:

Beef, veal, lamb—more lower grades, leaner beef, more veal, less lamb.

Dairy products—increase in nonfat solids, but much less fat solids.

Margarine, shortening—mostly products containing liquid oil.

Flour and cereal products—very little sweet baked goods, snack items, or presweetened cereals.

All of these foods are currently available in U.S. markets.

One change that may surprise some people is the larger decrease for margarine and shortening than for butter. This is a coincidence and the more significant aspect is the relatively low level for table fats.

Recent Consumption Trends

Such drastic changes in consumption as presented here are unlikely to occur soon for the general population, even if the entire medical profession agreed with the AHA. However, some recent trends in consumption indicate that some related changes are occurring. Some of these are simple time trends which may or may not be linked specifically to diet and health considerations. Other changes are related to economic variables such as price and income. Two sets of data show some of these changes: (1) The time series of national consumption and (2) the results of the 1955 and 1965 surveys. We look at the time series first.

² A factor inherent in the method of computation could modify the results. The proportions of food groups in the 1965-66 survey were based only on food consumed at home, so the changes in table 1 may overstate decreases in eggs and bacon, breakfast items which are more important in at-home food, and understate decreases in sugars which are less important in food at home (9).

Table 1.—Weekly per capita food consumption: Actual quantities, 1965-66, estimated quantities in AHA diet, and percent change

Foods	Per capita consumption HFSC, 1965-66	AHA diet	
		Estimated per capita consumption	Change from HFSC
	<i>Pounds</i>	<i>Pounds</i>	<i>Percent</i>
Beef, veal, lamb	1.817	2.062	13
Bacon, lard .....	.315	.037	-88
Other pork, including lunchmeat	1.141	.448	-61
Poultry .....	.879	1.335	52
Fish, shellfish .....	.323	.488	51
Dairy products, low fat	7.623	7.653	0
Dairy products, other .....	.342	.379	11
Eggs .....	.769	.214	-72
Butter .....	.122	.082	-33
Margarine, shortening .....	.365	.081	-78
Oils .....	.259	.420	62
Nuts .....	.131	.209	60
High-fat baked goods	1.117	.475	-57
Other grain products	2.752	3.164	15
Dry beans, peas .....	.157	.175	11
Potatoes	1.944	2.223	14
Other vegetables	3.928	6.860	75
Fruits	3.997	6.907	73
Sugars	1.347	.741	-45
Alcoholic beverages .....	.643	.630	- 2
Miscellaneous (cocoa, coffee, leavenings) .....	.294	.294	0

Source: Household Food Consumption Survey (14).

In the last 20 years, there have been pronounced trends toward consumption of lower fat dairy products and substitution of vegetable oils for animal fats (7). Some of these trends have accelerated in the past 5 years. These changes reflect in part economic motivation; but part of the change probably reflects a desire for fewer total calories for weight control, and perhaps some desire for medical reasons to avoid animal fats in favor of vegetable oils.

Fluid milk and cream—During the last 20 years, consumption of fresh fluid whole milk and cream has decreased while that of low-fat milks has increased. Moreover, these trends have accelerated within the last 5 years. The price of low-fat milks (skim, 1-percent, 2-percent, buttermilk) differs very little if at all from the price of fluid whole milk. Therefore, the choice of the

lower fat milk probably was not economically motivated. Such choices may be based on a desire for fewer calories or for less dairy fat. The lower fat products often require some adjustments of taste, so the change would have to be a purposeful one (table 2 and figure 1).

Frozen dairy products—Consumption of all frozen dairy products has increased, but the increase has occurred primarily in the low-fat products, particularly ice milk which was a very minor product before 1950. Since ice milk is slightly cheaper than ice cream, price might play some part in the trends but probably not a major one (table 2 and figure 1).

Table fats—There was only a small decrease in consumption of total table fats over the last 20 years, but margarine has been replacing butter at a steady rate

Table 2.—Per capita food consumption, 1950 and 1970, and annual changes, 1950-69 and 1965-69

Foods	Per capita consumption		Change per year (least-squares trends)	
	1950	1970	1950-69	1965-69
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Milk, fresh fluid:				
Whole	296.0	231.0	-3.0	-7.5
Low fat	33.6	58.3	.7	4.8
Cream	11.8	5.6	-.3	-.4
Frozen dairy products:				
Ice cream	17.2	17.9	(¹)	-.1
Ice milk	1.2	7.3	.3	.1
Sherbet .....	.7	1.6	(¹)	0
Total dairy products:				
Nonfat solids	43.6	40.9	-.1	-.2
Fat solids, excluding butter	20.7	16.4	-.2	-.4
Fats and oils:				
Butter	10.7	5.1	-.2	-.2
Margarine	6.1	11.0	.2	.2
Total table fat	16.8	16.1	(¹)	0
Lard	12.6	4.8	-.4	-.2
Shortening	11.0	17.9	.3	.6
Oils	8.6	17.4	.4	.6
Total:				
Animal	21.9	14.9	-.3	-.4
Vegetable	24.0	38.4	.6	3.4
Eggs	48.5	40.3	-.5	.1
Chicken	20.6	41.7	.9	1.3
Fish	11.8	11.3	(¹)	.1
Beef	50.1	83.7	1.5	2.1
Pork:				
Bacon, salt pork	19.4	18.3	-.1	.6
Other	45.0	42.5	-.2	1.3

¹ Less than 0.05 pound.

Source: Hiemstra (7).

(table 2 and figure 1). Both spreads are identical in calorie content so weight-control interest could not contribute to the trend. The lower cost of margarine probably has been the principal factor. On the other hand, the soft and the corn oil margarines, introduced fairly recently, are more expensive types of margarine, and are taking an increasing share of the margarine

market. Use of corn oil (the highest priced of the oils used in margarine manufacture) in margarine increased from less than 1 percent of the total prior to 1959 to about 10 percent since 1963. Safflower oil, which was not recorded as used in margarine manufacture prior to 1962, now makes up about 2 percent of the total oil used (15).

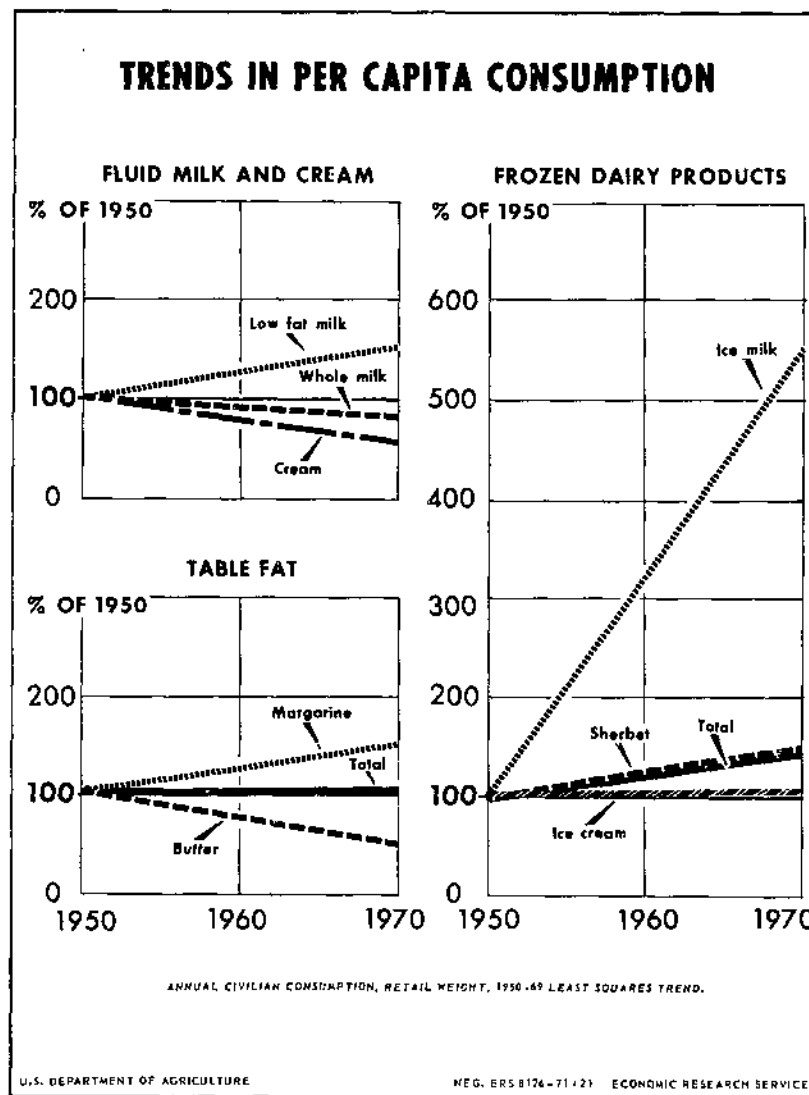


Figure 1

Both corn and safflower oils have been widely publicized for higher content of polyunsaturated fatty acids than other oils, and popularity of margarines containing these oils, despite their generally higher prices, is most likely related to a belief that they lessen the risk of heart disease. Some doctors have prescribed them. However, many people do not realize that hydrogenation often converts these oils to solid fats and in the process converts some polyunsaturated fatty acids to monounsaturated. The former tend to lower blood cholesterol; the latter have little or no effect. The polyunsaturated fatty acid content of corn or safflower oil is maximized when the oil is incorporated in the margarine in liquid form.

Other products—Decreasing lard consumption and increasing shortening and oil use may be related to

increases in products such as potato chips, french fries, doughnuts, and other fried foods, and to greater popularity of salads. The decline in egg and bacon consumption may be related as much to decreased interest in breakfast or a trend to small breakfasts as to dietary considerations. Increases for chicken and for beef may be related to changes in price and income relationships. However, it is also possible that some of these shifts could be related to the desire for less animal fat and cholesterol in the diet.

Comparison of data from the 1955 and 1965 food consumption surveys gives some indication of the income effects on food consumption. These surveys show a 1-percent increase in dietary fat over the 10-year period (13,14). However, this increase hides other changes for certain income groups. Families in the highest income

quintile did not increase their fat consumption at all (table 3). In addition, changes in fat sources used by these families differed from changes made by other families, indicating choices were made for dietary reasons rather than because of income or price shifts. Total table fat (butter and margarine) use declined about 10 percent for all families (somewhat more than in the time series data) but declined 17 percent for the top income quintile. However, the percentage of margarine in the total table fat increased for all income groups—but more for the highest income group (38 percent compared with 30 percent for all families) indicating a shift from butter to margarine for other than economic reasons.

Cream consumption dropped 33 percent for all families, but 41 percent for the top income group. The proportion of milk fat in total milk solids (excluding butter) showed about the same rates of decrease for each income group. Changes in the lower income groups are very likely related to their increased use of nonfat dry milk, perhaps for economic reasons, but changes in the upper groups appear related to decreases in a number of higher fat milk products.

Egg consumption decreased 8 percent for all families but 20 percent for the top group.

Comparative Costs

Resistance to dietary changes of the magnitude indicated by the AHA recommendations may be great not only because of the time it takes people to change food habits, but also because the AHA diet is relatively

expensive. In terms of constant 1957-59 prices, the selected pattern presented here costs 9 percent more than the average household diet in 1965-66. The large increase in fruit and vegetable consumption is a major factor in this higher cost. These and many of the other foods with significantly greater quantities—beef, poultry and fish—are higher priced than those they replace—pork, eggs, fats, and sugars.

These changes represent an increase in the food consumption index of about a tenth even though total calories would be lower. If the income elasticity of food consumption is 0.20 to 0.25 (a 10-percent increase in per capita income increases the per capita food purchased by 2 to 2½ percent) and if we rely solely on income to achieve this higher level of consumption, per capita income would have to be about half again as high as the 1965-66 income. Even if this increase in income occurs, there would be no guarantee that the AHA recommended pattern would be attained for individual commodities. Considerable publicity, consumer education, and perhaps other measures would be necessary to get consumers to change their diet in a reasonable time.

The farm value for the AHA diet might average about the same as for the 1965-66 consumption pattern. However, producers of poultry, beef, and a number of fruits and vegetables would stand to benefit most from the diet change. In addition, the demand for fish would increase.

Since food products from animal sources and fruits and vegetables generally require more agricultural

Table 3.—Changes in per capita consumption of food and nutrients, U.S. households by income quintiles, spring 1955 to 1965

Food and nutrients	All households	Income quintiles				
		Lowest	Second lowest	Middle	Second highest	Highest
	Percent	Percent	Percent	Percent	Percent	Percent
Fats and oils	-6	-3	-6	-4	-5	-13
Table fats	-9	-5	-8	-3	-6	-17
Margarine ¹	+30	+30	+22	+12	+24	+38
Eggs	-8	+3	0	-2	-14	-20
Milk solids, total	-14	-4	-10	-16	-15	-13
Fat ²	-9	-9	-9	-6	-6	-6
Calories	+2	-1	+2	+3	0	+1
Protein	+3	+1	+5	+4	+2	+1
Fat	+1	-2	+2	+4	+3	0

¹ Change in proportion of margarine in table fats consumed.

² Change in proportion of fat in total milk solids consumed.

Sources: Household Food Consumption Surveys (13, 14).

resources than food from grains and oilseeds, changes suggested by the AHA diet might require slightly more agricultural resources to provide the Nation's food supply than the 1965-66 diet required. Production of poultry, beef and veal, some dairy products, and fruits and vegetables would expand, but production of eggs and fat pork would decline. While these shifts probably are feasible with present agricultural resources, major production adjustments would be required and food prices would probably average materially higher during a transition period. Some sectors would benefit greatly as the market encouraged expanded output, while other sectors would undergo an extended and difficult adjustment period as resources were transferred to other uses.

These estimated costs to consumers and returns to farmers are based on the assumption that all foods would be available at the same relative prices as in 1957-59. In practice, some prices might average higher, while others probably would decline. Some people contend that a substantial increase in production of some farm commodities would require higher prices on the average, because less efficient resources would be used to produce the added output. On the other hand, expanded production of other commodities may offer opportunities for increased productivity and associated cost reduction. One approach to projections of changes in relative prices and resource use to achieve changes in national average consumption patterns was developed by Christensen (2). He points out the numerous aspects to be considered to determine the effect of consumption changes on the agricultural sector.

Implications for the Future

As long as the relatively sedentary way of life continues in this country, through dependence on labor-saving devices and on mechanized transportation instead of walking, obesity will continue to plague much of the population despite a desire to control it whether for cosmetic or health reasons. Weight control is the one factor in heart disease prevention on which the medical profession agrees. Therefore, whatever the outcome of the heart-diet controversy, a decrease in total calorie intake will be a goal for many people. Cutting down on fats which contain about 9 calories per gram has a greater impact on total calories than cutting protein or carbohydrate at 4 calories per gram. Therefore, the trend toward lower fat foods is likely to continue. But whether a higher ratio of polyunsaturated to total fats and less cholesterol are consumed will depend on the publicity given the AHA diet and on whether opposition to it continues.

It appears that people will rather readily make substitutions which do not have much impact on eating

patterns. Examples of these are shifts from butter to margarine, from more to less saturated fat margarines, and from whole to skim milk, as well as increases in use of beef, poultry, and lean cuts of pork, and decreases in use of fat pork. Whether changes having a greater impact on food habits would be adopted is questionable. The AHA emphasis on consumption of more fish, less sugar, and more fruits and vegetables may not be heeded by large masses of people. Recent reports of mercury contamination of fish could provide an added impediment to increasing fish consumption.

Some additional changes might occur more readily if the food industry were to modify more products as it has margarine, fluid milk, and frozen dairy desserts. Other products that might be modified to contain less fat or different kinds of fat are frankfurters and lunch meats, cheeses, and baked goods. At present, anyone on an AHA diet may not eat any lunch meats and must bake at home from basic ingredients if he wants cake, pie, or cookies. It is possible technically (but it may not be economical) to produce commercial baked goods, frankfurters, and lunch meats containing less fat or different fats. Lower fat cheese has been produced but it apparently has not gained wide acceptance. Beef, pork, and other meats could be produced with a lower or modified fat content by changing feeding and breeding practices. On the other hand, two segments of the food industry are likely to face more difficult adjustment problems. It may take the dairy industry some time to adjust to a demand for a higher level of nonfat solids but less fat, if indeed it could. Perhaps the most promising answer to the butterfat question is found in current research toward breeding cows that will give milk with lower butterfat or modified fat.

A similar adjustment problem exists for eggs. Egg whites are acceptable in the AHA diet but yolks are not. At present several companies are manufacturing a dried product containing the white along with substitute materials in place of most of the yolk.

Appendix: Method of Calculating AHA Diet

As an example of a diet that might meet the AHA recommendations from currently available foods, the diet pattern selected for use in this article was one chosen by a group of about 50 men in the Twin Cities phase of the Diet-Heart Study (1). These men had been given dietary instruction aimed at reducing their intake of saturated fat and cholesterol. Their wives shopped in their usual food markets and followed customary home-cooking procedures. Table 4 presents the calculations step by step.

Column 1.—The percentage of calories from each food group from the diet of men in the Twin Cities (diet

Table 4.—Worksheet: Computation of AHA fat-controlled, low-cholesterol diet per capita and comparison with per capita consumption, 1 week, 1965-66

Foods	Food use in AHA diet						Used in 1965-66		Change in quantity (9)
	Ingested		Discarded		Total		Quantity (7)	Energy value (8)	
	Percent of total energy (1)	Energy value (2)	Fat from meats (3)	Other (4)	Energy value (5)	Quantity (6)			
	Percent	Calories	Calories	Calories	Calories	Pounds	Pounds	Calories	Percent
Beef, veal, lamb	8.3	1,249	703	345	2,297	2.062	1.817	2,046	13
Bacon, lard .....	.2	30	64	17	111	.037	.315	1,033	-88
Other pork, including lunchmeat	1.4	211	248	18	540	.448	1.141	1,455	-61
Poultry	2.4	361	178	95	634	1.335	.879	438	52
Fish, shellfish	1.5	226		40	266	.488	.323	186	51
Dairy products, low fat ..	10.2	1,535		271	1,806	7.653	7.623	2,471	0
Dairy products, other ...	2.6	391		69	460	.379	.342	415	11
Eggs .....	.8	120		21	141	.214	.769	506	-72
Butter	1.5	226		40	266	.082	.122	396	-33
Margarine, shortening ...	1.5	226		40	266	.081	.365	1,263	-78
Oils	10.6	1,595	282	563	1,314	.420	.259	811	62
Nuts					563	.209	.131	354	60
High-fat baked goods	4.7	707		125	832	.475	1.117	1,698	-57
Other grain products	29.8	4,485	1,121	280	4,597	3.164	2.752	3,999	15
Dry beans, peas					280	.175	.157	271	11
Potatoes					729	2.223	1.944	638	14
Other vegetables	15.4	2,318	409	1,173	6.860	3.928	708	75	
Fruits				1,554	6.907	3.997	899	73	
Sugars	7.1	1,069		189	1,258	.741	1.347	2,286	-45
Alcoholic beverages	1.0	150		26	176	.630	.643	185	-2
Miscellaneous (coffee, cocoa, leavenings)	1.0	150		26	176	.294	.294	176	0
Total	100.0	15,049	1,193	3,197	19,439	34.877	30.265	22,234	15

X of Diet-Heart Study) was subdivided into finer groups (bacon, other pork, other meat, poultry, rather than meat and poultry) from diets of men in the Coronary Prevention Evaluation Program (11). Diets of a sample of individuals in the United States in 1965 (12) showed a similar distribution of calorie sources for the total population and for men, except for dairy products and the meat, poultry, and fish group. To adjust the calorie sources derived from the two fat-controlled diet studies from one suitable for men to one for the total population, the percentage from dairy products was adjusted upward by a ratio derived from the individual diet study. Meat, poultry, and fish totals were adjusted downward to compensate.

Column 2.—Total calories required for weight maintenance of the 1965-66 average population were estimated to be 2,150 per capita per day or 15,050 per week. This total is a weighted average based on the calorie recommendations of the Food and Nutrition Board, National Research Council, for each age and sex (4) with weights developed from the age and sex distribution reported in the 1965-66 Household Food Consumption Survey (14). The number of calories per week contributed by each food was obtained by applying the percentages in the AHA diet to total calories. The 1965-66 survey data were used as a standard of comparison because the food items in the AHA diet could be matched with those in the survey.

Column 3.—All separable fat from meat and poultry would be trimmed off and discarded; all fat drippings would be discarded. Calories from such separable fat and drippings were estimated.

Column 4.—At present, food brought into the average U.S. household (14) and supplies available nationally at the retail level (5) both indicate a caloric content about 50 percent over the recommendations for ingestion. Some of this excess contributes to the production and maintenance of obesity, a national problem, and some represents food discarded before, during, and after preparation.

It has been assumed for this paper that people following AHA dietary recommendations would not consume any more calories than needed to maintain ideal weight, but that they would not change their normal waste patterns. Therefore, in addition to meat and poultry fat, they would further discard food equivalent to about 20 percent of the calories in starchy foods, and 15 percent of the calories in the rest of the available foods. This amount of waste would require food purchases substantially larger than the food ingested. We have estimated that total food use, including the discards, would be about 30 percent above the ingestion requirements.

Column 5.—Calories to be ingested and discarded were added together to get the total number of calories to be used. To match AHA classifications with survey food groupings, some groups such as oils and nuts, starchy foods, fruits and vegetables had to be broken down. For these allocations, the proportions found in the survey data were used.

Column 6.—Calories in each group (column 5) were divided by the calories per pound for comparable food used by households in 1965-66 (14). Where survey groups had to be combined to match AHA groups (as for lard and bacon), proportions reported in the survey data were used. The "high-fat baked goods" from AHA was matched with "bakery products other than bread." Similarly, the "other dairy products" group was matched with the cheese group from the survey. We arbitrarily matched low-fat dairy products in the AHA group with 2-percent milk.

Columns 7 and 8.—These were the quantities actually reported in the survey.

Column 9.—This shows the percentage change in quantity used if the population were to ingest food according to the pattern shown in column 1.

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