CENTER FOR NUTRITION POLICY AND PROMOTION

Family Economics and Nutrition Review

Research Articles

Research Briefs

Research Summaries

Regular Items

UNITED STATES DEPARTMENT OF AGRICULTURE
Volume 12, Number 1
1999

Dan Glickman, Secretary
U.S. Department of Agriculture

Shirley R. Watkins, Under Secretary
Food, Nutrition, and Consumer Services

Rajen Anand, Executive Director
Center for Nutrition Policy and Promotion

Carol S. Kramer-LeBlanc, Deputy Executive Director
Center for Nutrition Policy and Promotion

P. Peter Basiotis, Director
Nutrition Policy and Analysis Staff

Center for Nutrition Policy and Promotion

Family Economics and Nutrition Review

Family Economics and Nutrition Review is written and published each quarter by the Center for Nutrition Policy and Promotion, U.S. Department of Agriculture, Washington, DC.

The Secretary of Agriculture has determined that publication of this periodical is necessary in the transaction of the public business required by law of the Department.

 Family Economics and Nutrition Review is indexed in the following databases: AGRICOLA, Ageline, Economic Literature Index, ERIC, Family Studies, PAIS, and Sociological Abstracts.

Family Economics and Nutrition Review is for sale by the Superintendent of Documents. Subscription price is $12.00 per year ($15.00 for foreign addresses). Send subscription orders and change of address to Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954. (See subscription form on p. 75.)

Original manuscripts are accepted for publication. (See "guidelines for authors" on back inside cover.) Suggestions or comments concerning this publication should be addressed to Julia M. Dinkins, Editor, *Family Economics and Nutrition Review*, Center for Nutrition Policy and Promotion, USDA,1120 20th St. NW, Suite 200 North Lobby, Washington, DC 20036. Phone (202) 606-4876.

The *Family Economics and Nutrition Review* is now available on the Internet (http://www.usda.gov/cnpp) (see p. 73).

Research Articles

Research Briefs

Research Summaries

Regular Items

Volume 12, Number 1
1999

Nutrition and Dairy Industry Benefits Associated With Promoting Lowfat Milk: Evidence From the 1989 CSFII

David L. Pelletier[1]
Anne Kendall[1]
Laura Kettel Khan[1,3]
Alan Mathios[2]

The dairy industry spends about $225 million each year promoting its products, but historically, it has resisted explicit promotion of lowfat milk. This study examines the potential nutritional and industry benefits associated with greater use of lowfat milk by the U.S. population. The 1989 Continuing Survey of Food Intakes by Individuals (CSFII) was used to examine the association between types of milk, intake of lipids and calcium, and quantity of milk consumed. Results show that compared with whole milk drinkers, lowfat milk drinkers obtain less fat, saturated fat, and cholesterol from milk. However, lowfat milk drinkers are more likely than their counterparts to exceed the recommended levels of fat and saturated fat from all food sources. Lowfat milk drinkers consumed one-third to one-half more milk on the recalled day than whole-milk drinkers consumed. These results are consistent with other evidence that the dairy industry may derive economic benefits from promoting lowfat milk; the nutritional benefits are less clear. Additional study is warranted in this area: the effects of milk type on milk intake and dietary substitutions. Nutrition education should continue to promote specific dietary changes within the context of the total diet.

For the past few decades, public-private partnerships have emerged as an important element of nutrition and public health strategies *(14,17)*. Similarly, the Institute of Medicine has recommended the negotiation of such partnerships as an important part of national, State, and local efforts to improve the diets of the U.S. population *(14)*. Voluntary partnerships are particularly attractive as a means for implementing national nutrition policy because of the size of the food industry, the intensity of its marketing strategies, and the limited degree to which government regulation and promotion can be applied in this sector. The 5 A Day for Better Health Campaign is one example of such a partnership *(9)*.

Unlike the 5 A Day Campaign that aligns nutrition objectives and industry objectives (i.e., both seek to promote greater consumption of fruits and vegetables), a perceived conflict exists between dairy industry objectives and nutrition objectives as they relate to dietary fat. Dairy foods (as a class) are relatively high in total and saturated fats, and they contribute a large share of these nutrients (as well as calcium) in the American diet. For instance, analysis of a national sample revealed that whole milk, natural and

[1]Division of Nutritional Sciences, Cornell University
[2]Department of Policy Analysis and Management, Cornell University.
[3] Current affiliation: Division of Nutrition and Physical Activity, Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, GA.

processed cheese, and lowfat milk (all types combined) contribute 33 percent of the saturated fats and 21 percent of total fats in the diets of 2- to 5-year-old children *(15)*. The same study estimated that the average intakes of fat and saturated fats by these children could be reduced to 30 percent and 10 percent of calories, respectively (corresponding to the upper levels as recommended for individuals), if lower fat versions of these three product categories were adopted. Such estimates make dairy products an attractive target for nutrition education and behavior change programs, especially in light of the apparent simplicity of changing to lower fat versions of milk. Recent work by the Center for Science in the Public Interest confirms that it may be feasible to induce a substantial population-level shift toward 1-percent milk and skim milk through intensive community-based promotions *(2)*.

At the time of the report on *Improving America's Diet and Health (14)*, the Committee on Dietary Guidelines Implementation of the Food and Nutrition Board believed that the dairy industry had inadequately promoted lowfat versions of dairy products, citing concerns about product image, price incentives, and labeling definitions. Since then, a number of changes have occurred at the national level to reduce those concerns and create incentives for the industry to promote lowfat milk. These changes include marked reductions in the U.S. Department of Agriculture's (USDA) support prices for dairy producers, corresponding declines in government-held surpluses of butter and cheese, more export opportunities, intense competition in the beverage industry for low-calorie products, and redefinition of ''lowfat'' milk by the Food and Drug Administration (FDA) *(11)*. The familiar ''moustache'' advertisements for milk and related promotional materials *(7)* are indicators of this shift in marketing strategy at the national level.

Despite this encouraging trend in industry advertising at the national level, much more needs to be done at State and local levels where the majority of funds for dairy promotion are spent and where more intensive, innovative promotional work can occur. The industry currently issues a mandatory assessment (''check-off'') against producers, representing 15 cents per 100 pounds of milk, one-third of which supports national promotional efforts; two-thirds supports State and local efforts. In 1993 this assessment generated about $75 million for use at the national level and $150 million for use at State and local levels. Most of these funds continue to be used for generic promotion programs, rather than lowfat promotion, despite evidence of diminishing returns in some markets *(13)* and differential effects on the sale of whole, lowfat, and skim milk *(12)*.

This paper presents some findings on (1) the quantitative contribution of dairy products to the nutrient intakes of children and adults, with a special emphasis on fluid milk; and (2) the relationship between types of milk (whole vs. lowfat) and amount of milk consumed. The first of these results is needed to estimate the magnitude of the effect (on nutrient intake) that might be expected from lowfat milk promotion efforts. The second of these results is of great interest to the dairy industry, because of the industry's concern that promoting lowfat milk might decrease product sales. These analyses, together with interviews with members of dairy promotion boards, were undertaken at the request of the New York State Department of Health to identify opportunities for partnering with the industry to promote lowfat milk. The results are described at greater length elsewhere *(11)*.

Methods

This study uses data from the 1989 Continuing Survey of Food Intakes by Individuals (CSFII), a multistaged, stratified probability sample that is representative of the 48 contiguous States. The sample consisted of 4,876 respondents. Sample sizes for African Americans and Hispanics were too small for most age categories to provide separate analyses, hence results are presented for all groups combined. Race, age, income, education, and region are controlled for in multiple regression analyses. Sample weights were used in all analyses to make inferences to the general population of the 48 contiguous States.

Dietary data were collected using a 24-hour recall conducted in person by a trained interviewer. Two additional days of dietary data were collected by a food-record method, with no probing for portion sizes and methods of preparation. The two methods yielded significant differences in the estimate of the amount of milk consumed each day: data from the dietary records collected on the second and third days suggested lower intakes. The 24-hour recall data are used here; we believe the recall data more accurately represent actual consumption.

The CSFII data set contains codes for 422 dairy items, grouped for this analysis into an overall dairy category and seven subgroups: Milk, yogurt, milk drinks, ice cream, ice milk, frozen yogurt, and cheese. People who reported using more than one dairy product or type of milk on the recalled day are included in all applicable categories for the purpose of estimating the percentage of people

Table 1. Sample sizes and percent reporting[1] various types of milk, 1989 CSFII

Age and gender	Total n	Percent reporting					
		Any dairy	Any milk	Whole	2-percent	1-percent	Skim
Males							
1-5	324	93.2	81.6	34.1	37.6	–[2]	–
6-11	299	91.9	82.6	47.6	37.6	–	–
12-15	114	95.7	81.3	27.0	42.7	–	–
16-18	120	75.6	68.7	24.8	34.3	–	–
19-24	146	80.7	51.7	27.5	17.4	–	–
25-44	600	74.1	56.3	21.3	23.9	3.1	8.0
45-64	328	73.9	53.2	22.1	18.2	3.6	9.3
65+	336	77.1	62.1	24.5	19.4	6.1	12.1
Females							
1-5	325	94.8	84.9	46.8	35.6	–	–
6-11	290	86.6	71.9	31.4	27.5	–	–
12-15	102	87.1	60.0	27.8	30.6	–	–
16-18	122	80.8	61.5	27.9	26.6	–	–
19-24	160	82.2	54.1	29.6	20.0	–	–
25-44	759	77.1	59.5	19.8	23.2	4.4	12.1
45-64	429	70.0	58.3	22.7	21.9	2.3	11.4
65+	422	85.6	71.6	25.9	27.6	5.7	12.4

[1]Sample sizes refer to the number of observations in the data set; ''percent reporting'' cells reflect sample weights.
[2]Cells are blank when the sum of the 1-percent and skim columns is less than 20 cases.

consuming a product. People not reporting the type of milk consumed were excluded from the analysis. Our paper focuses on fluid milk because of the interest in promoting lowfat versions of this product, which includes milk consumed as a beverage or as an easily recalled ingredient in some dishes (e.g., with breakfast cereal) but generally does not include milk used in more complex dishes (e.g., casseroles).

We used descriptive statistics to examine the percentage of respondents using any dairy product on the recalled day: Any type of milk; and whole, 2-percent, 1-percent, and skim milk. Because these categories are not mutually exclusive and many respondents can report more than one category on a given day or in a 3-day period, the samples overlap. Thus such ''cross-drinkers'' are found in 12 percent of the adult female sample and 11 percent of the adult male sample, based on a subanalysis of the 3-day dietary data for each person. Cross-drinkers are included in some descriptive statistics (table 1) but are excluded from the regressions, which require that individuals be assigned to only one category of milk. Descriptive statistics are provided on the contribution of these dairy product categories to total fat, saturated fat, cholesterol, and calcium intake on the recalled day. The dietary data are compared with the recommended levels of total fat (no more than 30 percent of calories), saturated fat (no more than 10 percent of calories), and cholesterol (no more than 300 milligrams) based on the Dietary Guidelines for Americans *(16)* and compared with the recommended levels of calcium based on the 1989 Recommended Dietary Allowances *(8)*.

We use multiple regression to estimate the statistical effect of type of milk on milk intake while controlling for potential socioeconomic confounders. This analysis was conducted among 25- to 44-year-old adults for whom total sample sizes are greatest and the samples reporting

Whole milk and 2-percent milk are the more common forms consumed at all ages....

1-percent and skim milk are sufficient to support these analyses. Separate regressions were conducted to contrast whole milk with 2-percent, with 1-percent and skim combined, and with all lowfat versions combined (2-percent, 1-percent, and skim). The 1-percent and skim-milk drinkers were combined because of small sample sizes; they were analyzed only when at least 20 cases were in a given age/gender group to reduce the influence of random error on parameter estimates. Regression analyses were conducted with only those respondents who reported consuming any type of milk on the recalled day. Hence the results presented here refer to the portion of the population that consumes milk. All statistics were calculated with SAS (version 6), and proportional sample weights were used.

Results

About 70 to 96 percent of the sample reportedly consumed some type of dairy product on the recalled day (table 1). A somewhat lower percentage, 52 to 85 percent, reportedly consumed some type of fluid milk. Among milk drinkers, roughly half reportedly consumed whole milk, and most of the others reported drinking 2-percent milk. Whole milk and 2-percent milk are the more common forms consumed at all ages and are consumed by roughly similar proportions of the sample at each age. About 11 to 18 percent of respondents in the three oldest age categories (25 to 44, 45 to 64, and 65+) reported consuming 1-percent or skim milk on the recalled day, with skim milk being more common than 1-percent milk.

Whole milk provides 9 to 10 grams of total fat and about 6 grams of saturated fat for males and 6 to 9 grams of total fat and 4 to 6 grams of saturated fat for females (table 2). This represents about 10 to 12 percent of total daily fat intake and 15 to 22 percent of saturated fat intake in most age/gender groups. (Results are not shown.) As expected, the quantity of fat and saturated fat provided by milk decreases considerably from whole milk to skim milk for all age/gender groups. Milk as a total category provides roughly half of the fat and saturated fat that comes from all dairy foods combined. (Results are not shown.)

The difference in fat and saturated fat intake across the four types of milk suggests that fat intake might be reduced if whole-milk drinkers switched to lower fat versions and did not start other dietary substitutions. Actually, the use of lower fat milks seems to be associated with considerable substitution, as shown in the ''Pct>30%'' and ''Pct>10%'' rows—the percentage of persons whose total fat and saturated fat intake (from all sources) was greater than recommended levels on the recalled day. Compared with the consistent gradient across the types of milk noted earlier, no consistent gradient is obvious in the percentage of respondents meeting the recommendations for fat and saturated fat. For instance, in five of the six age/gender groups, 2-percent milk drinkers exceed the recommendations for total fat and saturated fat by a higher percentage, compared with whole-milk drinkers. The same is true for the saturated fat recommendation. One-percent and skim-milk drinkers have values similar to or less than those for whole-milk drinkers in many age/gender groups.

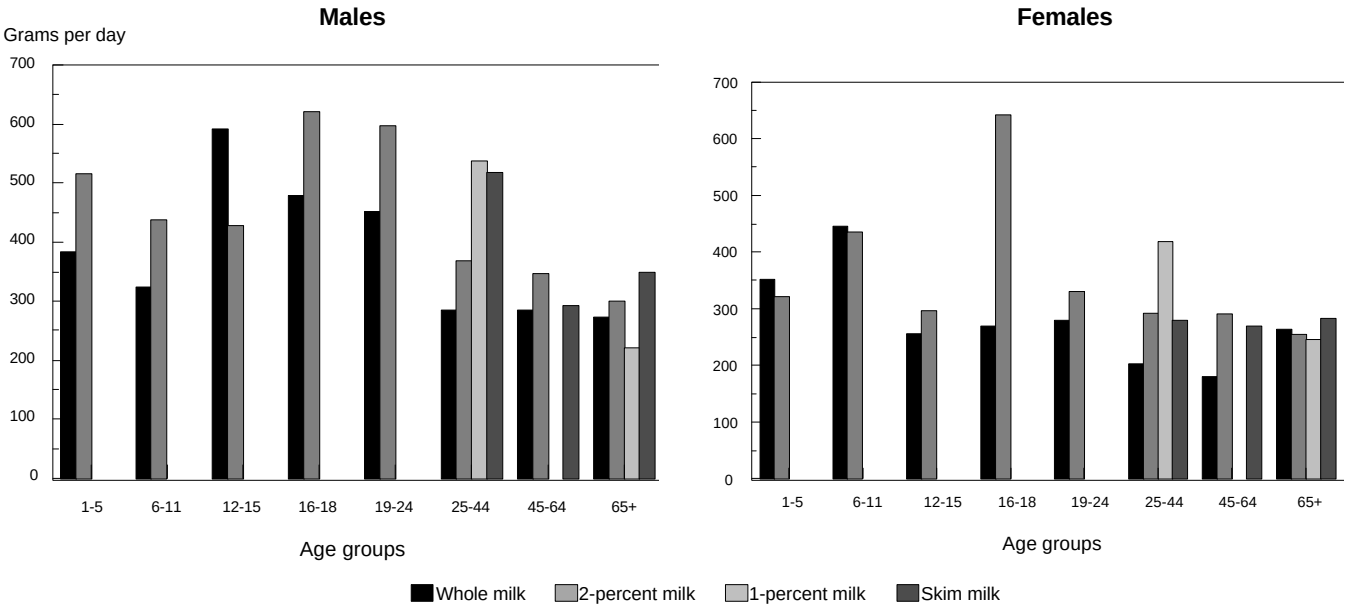
The results for cholesterol follow a pattern similar to those for fat and saturated fat, with stepwise gradients in the quantity of cholesterol derived from milk, across the four types of milk and

Table 2. Nutrient intake, by milk type, 1989 CSFII

Age and grams	Milk type consumed by males				Milk type consumed by females			
	Whole	2-percent	1-percent	Skim	Whole	2-percent	1-percent	Skim
Total fat								
25-44								
Grams	9.6	7.1	5.7	0.9	6.8	5.6	4.4	0.5
Pct>30% kcals[1]	73	66	87	55	63	65	76	70
45-64								
Grams	9.6	6.7	–[2]	0.5	6.1	9.7	–	0.5
Pct>30% kcals[1]	51	73	–	85	72	76	–	68
65+								
Grams	9.2	5.8	2.3	0.6	8.8	5.0	2.5	0.5
Pct>30% kcals[1]	71	85	73	63	67	81	58	65
Saturated fat								
25-44								
Grams	6.0	4.4	3.6	0.6	4.2	3.5	2.8	0.3
Pct>10% kcals[1]	67	75	80	87	65	70	84	79
45-64								
Grams	6.0	4.2	–	0.3	3.8	5.6	–	0.3
Pct>10% kcals[1]	49	79	–	80	73	72	–	55
65+								
Grams	5.7	3.6	1.4	0.4	5.5	3.0	1.6	0.3
Pct>10% kcals[1]	76	82	67	62	58	81	57	71
Cholesterol								
25-44								
Grams	39	28	22	9	28	22	17	5
Pct>300 mg[1]	29	32	25	57	31	30	31	37
45-64								
Grams	39	26	–	5	25	22	–	5
Pct>300 mg[1]	14	11	–	6	16	12	–	6
65+								
Grams	37	22	9	6	36	19	10	5
Pct>300 mg[1]	31	19	20	33	27	43	15	27
Calcium								
25-44								
Grams	342	450	663	642	243	356	516	315
Pct<2/3 RDA[1]	34	41	52	39	37	47	48	38
45-64								
Grams	343	422	–	363	217	354	–	332
Pct<2/3 RDA[1]	36	40	–	40	32	40	–	43
65+								
Grams	328	365	270	427	315	310	300	349
Pct<2/3 RDA[1]	56	49	18	44	49	34	52	38

[1]Percentage of respondents whose intake of nutrients from *all* food sources on the recall day did not meet the recommended level.
[2]Cells are blank when the sum of 1-percent and skim columns is less than 20 cases.

Milk intake, by milk type, 1989 CSFII



a less consistent gradient for percentage of persons exceeding the recommendation based on all foods consumed on the recalled day. The results for calcium show no consistent gradient across the types of milk consumed and age/gender groups, although there is a tendency toward higher calcium intakes among 1-percent and skim-milk drinkers, compared with whole-milk drinkers.

Is there a relationship between the type and amount of milk consumed? For all males except the 12 to 15 age groups, 2-percent milk drinkers report higher milk consumption on the recalled day than whole-milk drinkers reported (figure).[1] Among 25- to 44-year-old men, milk consumption is greatest among 1-percent drinkers and second highest among skim-milk drinkers. There is no consistent relationship between milk type and quantity consumed for men 45 to 64 years or 65 years and older. Likewise, for females, there is no consistent relationship across the age groups, although the 25- to 44-year-olds who consumed lower fat versions of milk have consumed more grams of milk, compared with whole-milk drinkers.

Analysis of the characteristics of different milk drinkers revealed that lower fat milk is differentially consumed by older age groups, Whites (versus non-Whites), those with higher incomes, those living in the Northeastern United States, and those with more years of education (data not shown). For this reason, we used multiple regressions to examine the statistical effect of milk type on milk volume after controlling for these potential confounding factors (table 3). The milk-type variable is positive and statistically significant for each of the three contrasts, for males as well as females.

The size of the difference between whole-milk drinkers and various lower fat milk drinkers is substantial (table 4). Compared with their intake of whole milk, males' intake of other types of milk is higher: 2-percent milk, 18 percent higher; 1-percent and skim milk, 102 percent higher; and 2-percent, 1-percent, and skim milk combined is 55 percent higher. The corresponding intake values for females are 58 percent, 75 percent, and 62 percent, respectively. In all cases, adjusting for socioeconomic differences across milk types leads to an *increase* in the effect estimates, rather than a decrease.

[1]The 1-percent and skim-milk categories are omitted when the sample size is less than 20 for any given age group.

Table 3. Multiple regression equations testing the effect of milk type on milk volume while controlling for potential confounders (25- to 44-year-olds), 1989 CSFII

	Whole vs. lowfat[1]		Whole vs. 2-percent		Whole vs. 1-percent and skim	
Gender and characteristics	B	P-value	B	P-value	B	P-value
Males						
Age (years)	-14.00	0.0001	-11.35	0.0001	-10.33	0.002
Income ($ x 1,000)	-0.12	0.08	-0.89	0.14	-0.28	0.003
Education (years)	-1.13	0.48	-0.51	0.68	0.66	0.78
Race (White vs. other)	108.94	0.02	73.33	0.04	89.11	0.10
Region (Northeast vs. other)	2.36	0.95	-202.24	0.0001	95.34	0.02
Milk type[2]	170.16	0.0001	54.90	0.04	314.42	0.0001
Females						
Age	-3.00	0.05	-1.19	0.39	-3.25	0.12
Income	-0.66	0.08	-1.64	0.0001	0.05	0.92
Education	-0.60	0.63	-0.99	0.34	-1.56	0.41
Race	4.32	0.87	-22.75	0.28	-9.50	0.79
Region	-23.08	0.30	25.58	0.20	-61.88	0.04
Milk type[2]	139.63	0.0001	129.63	0.0001	167.12	0.0001

[1]Lowfat refers to 2-percent, 1-percent, and skim milk combined.
[2]Values indicate the difference (in grams) in consumption between whole-milk drinkers (reference group) and the lowfat categories. Positive values indicate greater consumption in lowfat categories.

Discussion

This paper provides empirical results that may help nutrition, public health, and dairy promotion board representatives evaluate the potential benefits of explicitly promoting lowfat milk. For nutrition and public health practitioners, it is important to know the contribution that milk consumption makes to total daily intake of key nutrients (fat, saturated fat, cholesterol, and calcium), the extent to which lowfat milk consumption affects that contribution, and the extent to which use of lower fat milks is associated with lower total fat and saturated fat intakes. For dairy promotion boards, it is important to know what effect, if any, promotion of lowfat milk may have on total milk sales.

This paper reveals that, for most adult age/gender groups, whole milk provides about 6 to 10 grams of total dietary fat and 4 to 6 grams of saturated fats, compared with less than 1 gram of total fat or saturated fat for skim-milk drinkers. This represents roughly 10 to 12 percent of total fat and 15 to 22 percent of saturated fat in the daily diet. These figures suggest that we might expect a substantial reduction in daily fat and saturated fat intake if whole-milk drinkers switched to skim milk, used the same quantity of milk each day, and made no other dietary substitutions. This paper provides evidence, however, that use of lower fat milks is associated with substantially higher volumes of intake among 25- to 44-year-olds (55 to 62 percent for all lowfat versions combined), representing a type of dietary substitution. This volume effect may offset some of the fat-related benefits of switching to lower fat milk but represents a positive finding with respect to calcium and other nutrients in milk. We also found that, compared with whole-milk drinkers, lowfat milk drinkers are as likely or even more likely to exceed the recommendations for dietary fat when all food sources are considered. Results suggest that dietary substitutions may negate some or all of

Table 4. Estimates of the effect of milk type on milk volume for 25- to 44-year-olds (adjusted consumption derived from regressions), 1989 CSFII

Gender and milk type	Observed consumption		Adjusted consumption	
	Grams consumed	Percent increase over whole milk	Grams consumed	Percent increase over whole milk
Males				
Whole	308	–[2]	308	–
Lowfat[1]	411	33	478	55
2-percent	371	21	363	18
1-percent and skim	506	64	622	102
Females				
Whole	223	–	224	–
Lowfat	303	36	363	62
2-percent	299	34	353	58
1-percent and skim	310	39	390	75

[1]Lowfat refers to 2-percent, 1-percent, and skim milk combined.
[2]Reference group.

...the use of lower fat versions of milk is associated with greater intakes.

the nutritional benefits of consuming lowfat milk.

We believe it is of interest that the percentage of fat, saturated fat, and cholesterol derived from cheese is similar to that provided by whole milk—among the 25 to 30 percent who report using cheese on the recalled day *(11)*. Moreover, the percentage of these nutrients derived from pizza, among the 5 to 10 percent reporting pizza on the recalled day, is 3 to 5 times greater than the contribution from whole milk for those older than 20 years *(11)*. However, cheese was reported by only about half as many people as those reporting milk; pizza was reported by an even smaller number of people. The results nonetheless indicate the potential for substitutions to negate or overcompensate for the positive effects of lowfat milk consumption on total fat and saturated fat intake, even when the substitutions take place within the dairy category. U.S. milk supply data (macro level) provide further evidence of product substitutions; the sustained shift toward 2-percent milk since the mid-1970's has been accompanied by a 50-percent increase in cheese use *(6)*, in part reflecting the growth in fast-food and prepared-food sectors.

One of the most provocative findings from this study, from the perspective of forming partnerships with dairy promotion boards, is this: the use of lower fat versions of milk is associated with greater intakes. This occurred in all age groups for males (except 12- to 15-year-olds) and in five of the seven age groups for females. Findings from the multiple

regressions suggest that among 25- to 44-year-olds (for whom sample sizes are adequate) this relationship is not due to confounding by socioeconomic factors: the magnitude of the statistical effect is *greater* after adjusting for potential confounders. The New York State Dietary Survey that used a food frequency instrument supports our findings *(10,11)*. Similar results also are evident in 18- to 24-year-old women in the 1989-91 CSFII *(4)*, women aged 18 and over in the 1990-91 CSFII *(3)*, and in the community-based campaign by the Center for Science in the Public Interest (CSPI) *(2)*. Significantly, the CSPI found that total milk sales rose by 15 percent in the month after the campaign and 25 percent 1 year later. Together, these results provide consistent evidence that an economic incentive may exist for the dairy industry to promote lowfat milk.

Several methodological limitations are relevant in making inferences about the potential effects of switching to lowfat milk on milk volume and on total daily intake. First, data in this study are cross-sectional and may reflect self-selection effects. That is, those now using lower fat milk may differ in many ways from those using whole milk, including the other dairy and nondairy components of their diets. And these traits may have preceded their switch to lowfat milk. Although the methods used here control for some of the potential confounding factors, they do not control for all potential confounding factors, and they do not address the possibility of reverse causality (i.e., that those with high fat intakes and/or high milk intakes may have switched to lowfat milk, rather than the switch in the type of milk causing an increase in milk intake). Longitudinal and experimental designs would provide more convincing evidence of the net effects of switching to lower fat milk and associated substitutions.

Second, although dietary substitutions are a widely recognized class of behaviors *(18)*, our approach for estimating substitutions relies upon examination of group-level data (table 2), rather than multiple regression. We used group-level data because of the inherent limitations of 24-hour recalls as estimates of habitual intake and substitutions. Using the 24-hour recalls in multiple regression analyses to investigate substitutions would likely lead to a large overestimate of the degree of substitution in the habitual diet. For example, most people are unlikely to consume milk, cheese, yogurt, cottage cheese, and ice cream all in 1 day, but all of these foods may be part of their habitual diet. Using group averages overcomes this problem but generates results that refer to group tendencies—not individual behavior.

Third, this study refers to milk drinkers' consumption patterns of 1989, which may differ from today's consumption patterns. Moreover, according to these analyses about 40 percent of 25- to 44-year-olds reported no milk consumption on the recalled day, roughly similar to the 30 percent seen in the full 1989-91 CSFII based on 3 days of observation for each subject *(5)*. The factors associated with switching to lowfat milk and with the quantity of milk consumption may be quite different from the factors associated with the practice of consuming or not consuming milk habitually. Both sets of factors are of great interest—from an industry and a public health perspective—and are worthy of more detailed investigation using the more recent 1994-96 CSFII data. In particular, it would be instructive to apply econometric approaches to investigate these relationships and to address the limitations we noted *(1)*. This is relevant to note: the two-stage regression analysis of the 1989 CSFII data provided results similar to those reported here *(11)*.

Our study provides evidence that the explicit promotion of lowfat milk may produce economic benefits for the dairy industry. Ironically, the nutritional benefits of such promotion (with respect to meeting the dietary fat recommendations) are less convincing in this study, because of the possibility of dietary substitutions. Additional studies of these substitution effects and milk volume effects are warranted, as is continued educational emphasis on the importance of the total diet. Practitioners may want to use these encouraging findings to initiate or strengthen their dialog with dairy promotion boards at the State and local levels, where two-thirds of the dairy industry's promotion dollars are spent.

Acknowledgments

We thank the New York State Department of Health, Division of Nutrition, for suggesting this project and providing the funding.

References

1. Briscoe, J., Akin, J., and Guilkey, D. 1990. People are not passive acceptors of threats to health: Endogeneity and its consequences. *International Journal of Epidemiology* 19:147-153.

2. Center for Science in the Public Interest. 1997 (January). *1% or Less Yes. 1% or Less Update.* Center for Science in the Public Interest. Washington, DC.

3. Guthrie, J.F. 1996. Dietary patterns and personal characteristics of women consuming recommended amounts of calcium. *Family Economics and Nutrition Review* 9*(3)*:33-49.

4. Hampl, J.S. and Betts, N.M. 1995. Comparison of dietary intake and sources of fat in low- and high-fat diets of 18- to 24-year-olds. *Journal of the American Dietetic Association* 85:893-897.

5. Life Sciences Research Office. 1995. *Third Report on Nutrition Monitoring in the United States, Vol. 2.* Report prepared for the Interagency Board for Nutrition Monitoring and Related Research.

6. Milk Industry Foundation. *Milk Facts: 1994 Edition.* Washington, DC.

7. National Fluid Milk Processor Promotion Board. 1995. *Milk! What a Surprise! Surprising Facts About Milk Booklet*.

8. National Research Council, Subcommittee on the Tenth Edition of the RDAs, Food and Nutrition Board. 1989. *Recommended Dietary Allowances* (10^{th} ed.). National Academy Press, Washington, DC.

9. Neil, K. and Allensworth, D.D. 1994. A model to increase consumption of fruits and vegetables by implementing the Five-a-Day initiative. *Journal of School Health* 64*(4)*:150-155.

10. Ogden, C.L. 1994. *New York State Dietary Survey Dairy Food Analysis*. Report prepared for New York State Department of Health. Division of Nutritional Sciences, Cornell University, Ithaca, NY.

11. Pelletier, D.L., Kendall, A., and Mathios, A. 1996. *Lowfat Milk Promotion: Opportunities Created by A New Policy Environment*. Report Prepared for the New York State Department of Health. Division of Nutritional Sciences and Department of Consumer Economics and Housing, Cornell University, Ithaca, NY.

12. Reberte, C. and Kaiser, H.M. 1996. Impact of generic fluid milk advertising on whole, lowfat, and skim milk demand. *National Institute for Commodity Promotion Research and Evaluation* 96-01:1-7. Cornell University, Ithaca, NY.

13. Reberte, C., Kaiser, H.M., Lenz, J.E., and Forker, O. 1995. Generic advertising wearout: The case of the New York City Fluid Milk Campaign. *National Institute for Commodity Promotion Research and Evaluation* 95-02:1-9. Cornell University, Ithaca, NY.

14. Thomas, P.R. (Ed.). 1991. *Improving America's Diet and Health* (pp. 202-203). National Academy Press, Washington, DC.

15. Thompson, F.E. and Dennison, B.A. 1994. Dietary sources of fats and cholesterol in US children aged 2 through 5 years. *American Journal of Public Health* 84:799-806.

16. U.S. Department of Agriculture and U.S. Department of Health and Human Services. 1990. *Nutrition and Your Health: Dietary Guidelines for Americans* (3rd ed.). Home and Garden Bulletin No. 232.

17. U.S. Department of Health and Human Services, Public Health Service. 1991. *Healthy People 2000: National Health Promotion and Disease Prevention Objectives.*

18. Von Braun, J. and Puetz, D. 1993. *Data Needs for Food Policy in Developing Countries.* International Food Policy Research Institute, Washington, DC.

Folate Intake and Supplement Use in Women of Childbearing Age

Gail E. Gates
Oklahoma State University

Tawni W. Holmes
Oklahoma State University

Data from the 1994-95 Continuing Survey of Food Intakes by Individuals were analyzed to determine folate intake and supplement use by women of childbearing age (11 to 50 years old). We identified the primary food sources of folate and mean folate intake from two nonconsecutive 24-hour recalls and examined characteristics of supplement users of B vitamins. Top sources of folate were ready-to-eat cereals, citrus fruits and juices, grain mixtures, and yeast breads. Mean dietary folate was 215 ± 3 μg. On a daily basis, one of four women consumed supplements containing B vitamins. Thirty-two percent of women consumed at least 400 μg folates from food and/or daily supplements. Compared with nonusers, daily supplement users were more likely to be White, older, more educated, frequent exercisers, and have higher income. Results suggest that nutrition educators may be more successful encouraging women to consume additional servings of fortified-grain products rather than encouraging women to add folate-rich foods or supplements to their diet.

Neural tube defects are serious birth defects that can result in infant mortality or serious disability. Each year in the United States about 4,000 infants are born with neural tube defects such as spina bifida, which has the third highest lifetime cost of any birth defect *(11)*. Thus, there is continual need to identify modifiable risk factors that can prevent this defect. Adequate folic acid status is potentially an ideal modifiable risk factor, because folate coenzymes function metabolically in the synthesis of RNA, DNA, and protein in the developing fetus *(27,33,37)*.

To prevent neural tube defects, women need to achieve optimal folate status before pregnancy occurs, because the neural tube forms and closes during the first month of pregnancy. Increasing folate intake by diet and supplements before conception and in the first 6 weeks of pregnancy has been shown to protect against the occurrence of neural tube defects *(6,13,28,29)*.

Adequate folate intake is especially important for women with a history of a pregnancy with a neural tube defect. Recurrence rates for women with a previously affected pregnancy are about 10 to 15 times higher than those for the general population *(39)*. However, 95 percent of infants with neural tube defects are born to women without a family history of the defects *(4)*. Because about half of pregnancies are unplanned or mistimed *(20)*, adequate folate intake is important for all women who can become pregnant.

Women in their childbearing years consume less than the recent recommendations for folate: at least 400 µg per day of folic acid to reduce the risk of neural tube defects *(9,10)*. Data from the Third National Health and Nutrition Examination Survey (NHANES) and the 1989-91 Continuing Survey of Food Intakes by Individuals (CSFII) have shown that most women of childbearing age consumed about half the recommended amount of folates *(1,38)*. Subar et al. *(45)* found that 93 percent of women surveyed in the NHANES II consumed less than the recommendation. In the 1986 CSFII, less than 10 percent of women met the recommended 400 µg folate per day, and only about 30 percent of low-income women and 50 percent of higher income women met the 1989 Recommended Dietary Allowance (180 µg) *(30)* from food sources *(5)*.

This study examines folate intake—from food and supplement use—of a sample of households with women of childbearing age. Understanding the existing patterns of folate intake and characteristics of women who consume supplements will allow researchers and others to evaluate the potential effects associated with changes in diet or supplement use among women.

Subjects and Methods

We examined the foods consumed by 2,086 women of childbearing age (11 to 50 years old) who completed two 24-hour dietary recalls in the U.S. Department of Agriculture's (USDA) 1994-95 CSFII. The CSFII provides information on nutrient intakes and a number of demographic, socioeconomic, and personal characteristics. To identify participants, the survey incorporates a stratified, multistage sampling plan. Subjects are noninstitutionalized individuals grouped by gender, age, and income level. Details of the study design and recruitment of CSFII participants are described in detail elsewhere *(49)*.

Food Sources

USDA food codes classify foods into 11 major food groups: Milk and milk products; meat, poultry, and fish; eggs; legumes; nuts and seeds; grain products; fruits; vegetables; fats; sugars and sweets; and beverages. The USDA food codes also identify 59 subgroups within 8 of the major food groups. For example, vegetables are divided into 8 subgroups (white potatoes; dark-green vegetables; deep-yellow vegetables; tomatoes; lettuce; green beans; corn, green peas, and lima beans; and other vegetables). Eggs, legumes, and nuts and seeds do not contain subgroups.

To determine whether to use a major food group or subgroup for this analysis, we identified the five foods in each subgroup most frequently consumed by the women of childbearing age who were included in this study. The CSFII Survey Nutrient Data Base was used to determine the amount of folate in a serving of each identified food *(49)*. If the amount of folate in the foods in the subgroups was similar, we used only the major food group. For example, skim milk and whole milk contain about the same amount of folate (12 µg), so we reported all fluid milk as one group.

If the amount of folate in the subgroups was substantially different, we used each subgroup separately. For example, ready-to-eat cereals (44 µg) and rice (2 µg) were analyzed as separate grain subgroups. We selected 38 food groups and subgroups from 70 possible groups and subgroups. The total amount of folate in each of the selected groups was divided by the total folate intake from all foods *(45)*, and foods were ranked by percentage contribution to dietary folate intake (table 1). To determine the percentage of women who consumed each food, we grouped those who consumed any amount of the food and those who did not consume the food during the two 24-hour recalls.

Statistical Analysis

Using SPSS software *(42)*, we compared differences in mean dietary folate intake among women based on their descriptive characteristics. T-tests compared folate intake by ethnic origin, weight-loss diet, smoking status, and use of food stamps. Analysis of variance (ANOVA) with Scheffe range tests compared folate intake by race, pregnancy/lactation status, supplement use, household income (expressed as a percentage of the Federal poverty index), and exercise frequency. Pearson coefficients were used to correlate folate intake from food with mean grams of foods consumed, level of education, energy intake, and body mass index (BMI).

We described the characteristics of women who used supplements containing B vitamins (daily, every so often, and never) using ANOVA and Chi-square analyses. We used normalized 2-day sample weights *(49)*, and we reported means and standard error of the mean (SEM). Differences were considered statistically significant at the $p<0.01$ level—a more conservative level than standard practice—to compensate for the effects of the large sample size and complex design *(49)*.

Results

Food Sources

For 11- to 50-year-old women in this study, the major sources of folate were ready-to-eat cereals, citrus fruits and juices (predominately orange juice), grain mixtures such as pizza, and yeast breads (table 1). Ready-to-eat cereals contributed 20 percent of total folates to the women's diet; citrus fruits and juices, 8 percent; grain mixtures, 7 percent; and yeast breads, 6 percent. Some of the other top contributors of folate (e.g., milk, nonalcoholic beverages, and white potatoes) are not rich sources of this vitamin, but these foods were consumed by most women during the two nonconsecutive 24-hour dietary recalls (64 to 95 percent). Other foods that are naturally rich sources of folate (e.g., dark-green vegetables and liver) did not contribute as much folate to the diet, because few women consumed these foods.

The foods that correlated most strongly with folate intake were ready-to-eat cereals, citrus fruits and juices, fluid milk, and legumes, such as beans (re-fried and pinto). For example, women who consumed less than 120 µg folates ate almost no (0.4 g) ready-to-eat cereals; however, women who consumed at least 400 µg folates ate, on average, 46.8 g of ready-to-eat cereals per day. (Data are not shown.)

Folate Intake by Characteristics

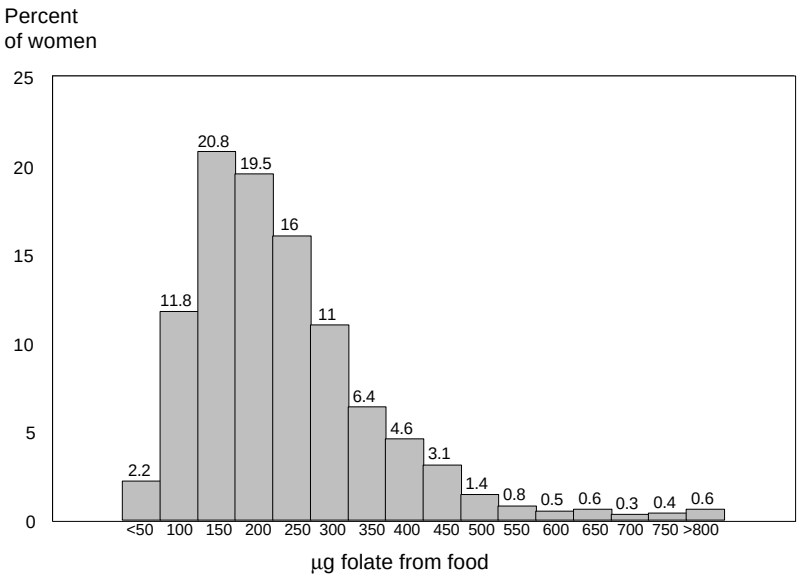
Overall, only 8 percent of the women of childbearing age consumed more than 400 µg folate per day (the new recommendation) (figure). Mean folate intake was 215±3 µg, and median intake was 189 µg. (Data are not shown.) About half (47 percent) of the women consumed less than the 1989 RDA of

Table 1. Sources of folate in the diets of U.S. women of childbearing age[1] and correlation between grams of food consumed and folate intake, 1994-95 CSFII

Food group[2]	Percent of total folate[3]	Percent of women who consumed food[4]	r
Ready-to-eat cereals	19.7	34.6	0.59***
Citrus fruits and juices	7.6	36.7	0.35***
Mixtures mainly grains	6.5	60.7	0.08***
Total yeast breads and rolls	6.2	82.4	0.11***
Mixtures mainly meat, poultry, fish	5.1	56.4	0.09***
Other vegetables (including brewer's yeast)	4.5	62.5	0.13***
Legumes	4.5	22.0	0.25***
Fluid milk	4.4	67.6	0.36***
Nonalcoholic beverages	4.1	95.2	0.09***
White potatoes	4.0	63.5	0.00
Lettuce	3.5	42.3	0.15***
Cake, cookies, pastries, pies	3.3	56.1	0.10***
Dark-green vegetables	3.1	16.7	0.17***
Other fruits, mixtures, juices	3.0	50.0	0.20***
Corn, lima beans, green peas	2.3	20.3	0.12***
Eggs	2.3	28.6	0.03
Crackers, popcorn, pretzels, corn chips	1.8	43.4	0.15***
Tomatoes	1.6	57.5	0.13***
Nuts, seeds	1.3	13.9	0.11***
Quick breads, pancakes, french toast	1.3	36.4	0.09***
Alcoholic beverages	0.9	13.8	0.06***
Beef	0.9	35.7	0.02
Cheese	0.8	52.4	0.09***
Green beans	0.8	13.1	0.04
Poultry	0.8	40.5	-0.05
Milk-based desserts	0.7	25.0	0.12***
Sugar	0.7	69.1	0.06***
Organ meats (e.g., liver)	0.5	0.8	0.11***
Deep-yellow vegetables	0.5	21.7	0.11***
Pasta	0.5	13.5	0.07***
Fish, shellfish	0.5	13.7	0.01
Yogurt	0.4	7.0	0.11***
Rice	0.4	19.5	0.05
Frankfurters, sausages, luncheon meat	0.3	40.6	-0.03
Fat	0.3	72.0	0.11***
Pork	0.2	23.6	-0.01
Lamb, veal, game	0.1	1.6	0.01
Dried fruits	0.0	2.2	0.14***

[1]Women 11 to 50 years old who completed two nonconsecutive 24-hour recalls; n=2,086.
[2]Food groups and subgroups that provided 99 percent of the sample's folate intake.
[3]The total amount of folate in each group was divided by the total folate intake from all foods consumed by all women during the two 24-hour recalls.
[4]Percentage of women who consumed any amount of the food during the two 24-hour recalls.
***Significant correlation between grams of food consumed and folate intake, $p \leq 0.001$.

Dietary folate intake (μg) of women[1] 11 to 50 years old, 1994-95 CSFII



[1]Women who completed two nonconsecutive 24-hour recalls.

The foods that correlated most strongly with folate intake were ready-to-eat cereals, citrus fruits and juices, fluid milk, and legumes, such as beans (refried and pinto).

180 μg folate per day from food sources. (Data are not shown.) Also, analysis of folate intake by the women's characteristics showed that Blacks had lower intakes than Whites had (table 2). Women who were breast-feeding consumed more folate from their diet than other women consumed. Results also revealed that subjects with higher incomes, those who did not receive food stamps, and nonsmokers consumed more folate than did their counterparts. Women's folate intake was not statistically different based on several characteristics: Ethnic origin, exercise frequency, BMI (not shown), and whether the women followed a weight-loss diet. However, further analysis showed that dietary folate was related positively to energy intake ($r=.42$, $p < 0.001$).

Supplement Use

Daily, about one-fourth (27 percent) of the women consumed a dietary supplement containing folate, and 15 percent occasionally consumed this supplement. Only 9 women reported consuming a separate folic acid supplement; all other supplement users took a multivitamin or B-complex vitamin. Women who took daily supplements containing B vitamins consumed significantly more folates from food than did women who occasionally or never consumed supplements (table 3). Of the 161 women who consumed at least 400 μg folates from food, 42 percent also took daily supplements. In all, 32 percent (n=661) of the total sample met the recommendation by diet and/or daily consumed supplements. (Data are not shown.)

Women who consumed supplements daily were significantly more likely to be older and more educated than were women who never took supplements.

Table 2. Differences in mean folate intake (μg), by demographic characteristics of women 11 to 50 years old,[1] 1994-95 CSFII

Characteristic	N	Mean ± SEM	P
Race			0.001
White	1601	219.6 ± 3.4[2]	
Black	284	188.5 ± 7.2[3]	
Other	201	214.9 ± 8.3[2,3]	
Origin			NS
Non-Hispanic	1851	213.1 ± 3.0	
Hispanic	235	228.8 ± 8.9	
Reproductive status			<0.001
Pregnant	47	249.0 ± 20.0[2]	
Lactating	33	337.8 ± 34.1[3]	
Not pregnant or lactating	2006	212.1 ± 2.9[2]	
Receiving food stamps			<0.001
Yes	269	182.1 ± 7.1[2]	
No	1817	219.8 ± 3.1[3]	
Income (% of poverty index)			<0.001
<130%	432	197.9 ± 6.2[2]	
130-350%	861	208.6 ± 4.2[2]	
>350%	793	231.0 ± 5.0[3]	
Smoking status			0.001
Smoker	749	201.8 ± 4.6[2]	
Nonsmoker	1337	222.3 ± 3.7[3]	
Following a weight-loss diet			NS
Yes	145	207.2 ± 10.8	
No	1941	215.5 ± 3.0	
Exercise frequency			NS
Daily	294	209.4 ± 7.5	
5-6 times a week	162	239.5 ± 11.6	
2-4 times a week	539	219.7 ± 5.3	
Once a week	194	223.0 ± 10.6	
1-3 times a month	153	203.3 ± 8.5	
Rarely	744	208.5 ± 4.9	

[1]Women 11 to 50 years old who completed two nonconsecutive 24-hour recalls; n=2,086.
[2,3]Values in the same column with different superscript numbers are significantly different, $p < 0.01$.
NS = not significant.

Those women who consumed supplements daily were also more likely to be White, be pregnant or lactating, have higher income, and be more frequent exercisers. However, they were less likely than women who never consumed supplements with folate to receive food stamps. Frequency of supplement use was not related significantly to women's energy intake, BMI, ethnic origin, smoking status, and weight-loss diet status.

Discussion

Three approaches to increasing folate intake in women are to increase their consumption of folate-rich foods, add folic acid to fortified grain products they consume, or encourage women to take supplements containing folic acid *(14,27,31,35,38)*. Our study provides results that address all three approaches.

Food Sources

In our study, we found that the foods which provided the most folate for women of childbearing age are similar to the major sources of folates reported in earlier national studies; however, the foods appear in a different order. Our results show that ready-to-eat cereals provide about 20 percent of the folate consumed by these women. The top 10 contributors of folate (when regrouped according to USDA food groups) for all adults in NHANES II were citrus fruit and juice, bread, cold cereals, legumes, green salad, fluid milk, eggs, alcoholic beverages, coffee and tea, and liver *(45)*. Top contributors of folate for women who participated in the 1987-88 Nationwide Food Consumption Survey were vegetables; ready-to-eat cereals; meat, fish, poultry; grains; other foods; desserts and snacks; orange juice; other beverages; milk; and fruit *(38)*. The Framingham Study showed that the top

Table 3. Frequency of intakes of vitamin B supplement, by demographic characteristics of women 11 to 50 years old, 1994-95 CSFII

	Frequency of supplement use			
	Daily (n=567)	Every so often (n=303)	Never (n=1216)	P
	Mean ± SEM	Mean ± SEM	Mean ± SEM	
Folate from food (μg)	240.1 ± 5.7[1]	212.1 ± 6.9[2]	203.9 ± 3.7[2]	<0.001
Age (years)	32.6 ± 0.4[1]	29.8 ± 0.6[2]	29.4 ± 0.3[2]	<0.001
Education (years)	13.8 ± 0.1[1]	13.6 ± 0.2[1]	12.8 ± 0.1[2]	<0.001
Energy (kcal)	1765 ± 26	1756 ± 34	1692 ± 18	NS
BMI (kg/m^2)	26.8 ± 0.6	25.7 ± 0.7	27.7 ± 0.5	NS
	N %	N %	N %	
Race				<0.001
White	475 83.8	237 78.2	889 73.0	
Black	51 9.0	37 12.2	197 16.2	
Other	41 7.2	29 9.6	131 10.8	
Origin				NS
Non-Hispanic	514 90.7	263 86.8	1074 88.2	
Hispanic	53 9.3	40 13.2	143 11.8	
Reproductive status				<0.001
Pregnant	38 6.7	2 0.7	7 0.6	
Lactating	22 3.9	2 0.7	10 0.8	
Not pregnant or lactating	507 89.4	299 98.7	1199 98.6	
Receiving food stamps				<0.001
Yes	52 9.2	24 7.9	193 15.9	
No	515 90.8	278 92.1	1024 84.1	
Income (% of poverty index)				<0.001
<130%	90 15.8	46 15.2	296 24.3	
131-350%	231 40.7	125 41.4	505 41.5	
>350%	247 43.5	131 43.4	415 34.1	
Smoking status				NS
Smoker	214 37.7	115 38.0	421 34.6	
Nonsmoker	353 62.3	188 62.0	796 65.4	
Following a weight-loss diet				NS
Yes	47 8.3	21 6.9	77 6.3	
No	519 91.1	282 93.1	1139 93.7	
Exercise frequency				<0.001
Daily	83 14.6	35 11.6	176 14.5	
5-6 times a week	42 7.4	27 8.9	92 7.6	
2-4 times a week	172 30.3	88 29.0	279 22.9	
Once a week	67 11.8	31 10.2	96 7.9	
1-3 times a month	32 5.6	36 11.9	85 7.0	
Rarely	171 30.2	86 28.4	488 40.1	

[1,2]Values in the same row with different superscripts are significantly different, $p < 0.01$.
NS = not significant.

…27 percent of women of childbearing age consumed supplements containing B vitamins daily; these women consumed more folate than did women who did not take supplements.

food sources of folates for elderly subjects were citrus fruit and juice, cold cereals, lettuce, dark-green vegetables, bread, other vegetables, grain mixtures, fruits, and milk *(47)*.

The richest food sources of folates in the U.S. food supply are liver, ready-to-eat cereals, legumes, and dark-green vegetables *(2,45)*. Few women in our study ate these folate-rich foods, the exception being ready-to-eat cereals. Other foods, such as orange juice, contain moderate amounts of folates but are major contributors to the diet because of the frequency and quantity with which they are consumed (2).

An important point to make is this: nutrient databases (including the USDA database used in this study) are believed to provide an inaccurate estimate of folate intake. The database values are thought to underestimate actual folate content, because of the limitations of traditional analytical methods used in generating the food composition data for folate *(18)*.

For women to receive all of the needed folate from food sources, they need to consume at least the minimum number of servings from each food group, as recommended by the Food Guide Pyramid *(17,48)*, and select good sources of folates within each food group *(5,23,33)*. For example, according to the 1989-91 CSFII, about one-third of women who consumed folate-rich, ready-to-eat cereals met the 400 µg folate recommendation; less than 5 percent of women who did not consume cereal met the recommendation *(38)*. Krebs-Smith et al. *(23)* found that less than 1 percent of women in the United States consumed the recommended number of servings from all food groups; only 27 percent consumed the recommended number of grain products.

Beginning in January 1998, enriched cereal-grain products in the United States were fortified to provide 140 µg per 100 g of product *(17)*. This amount of fortification is estimated to add about 100 µg folic acid per day to the average U.S. diet *(22,31,46)*. The Food and Drug Administration (FDA) allows breakfast cereals to be fortified with folic acid up to 400 µg per serving, but this is being monitored to determine how widespread this practice becomes *(16)*.

Several recent studies explored the potential benefits of fortifying grain products with folic acid. Folic acid from fortified foods was more effective in increasing the concentration of red blood cell folate than equivalent amounts of naturally occurring folate *(18)*. Pfeiffer et al. *(32)* provided evidence of effective absorption of folic acid that is added to grain foods in a light meal. Their conclusion: folic acid absorbed from fortified foods should improve the folate status of the population.

Two studies of the potential benefits of folic acid fortification *(34,46)* recently estimated that the level of fortification recently approved by the FDA would increase the percentage of the population who consume at least 400 g folate to about 50 percent. Daly et al. estimated that this level of fortification would decrease the incidence of neural tube defects by 50 percent *(14)*. However, because many women limit energy intake and grain consumption, the influence of fortification may be less in this high-risk group than in other groups.

Folate Intake by Characteristics

We found that women with higher energy intakes consume more folate; however, women who report following a weight-loss diet consume the same amount of folate as women who did not acknowledge following such a diet. This indicates that women on weight-reduction diets may select more foods that are good sources of folates. However, the significant correlation between energy and folate intake indicates that women who restrict their energy intake (even if they do not acknowledge following a weight-loss diet) are less likely than their counterparts to consume enough folate. Other researchers found that the chance of having an inadequate folate intake is greater for women with the following characteristics: Low socioeconomic status, poor eating habits, stringent dieting for weight loss, abuse of drugs or alcohol, and smoking cigarettes *(5,21,33,36)*. We also found that smokers consumed less folate than nonsmokers, and lower income women consumed significantly less folate than was the case for higher income women.

Supplement Use

In our study, we found that 27 percent of women of childbearing age consumed supplements containing B vitamins daily; these women consumed more folate than did women who did not take supplements. About 25 percent of the women in the 1992 and 1987 National Health Interview Surveys consumed supplements daily *(40,41,44)*. Similar to our study, the studies of other researchers show that most adults take one broad-spectrum vitamin/mineral supplement rather than a single nutrient *(7,25,43)*. The National Health Interview Surveys also found that daily supplement use was highest among Whites, those with higher incomes, and those with more than a high school education *(40,41,44)*. A study of the Dutch population found that age, social class, alternative food habits, smoking, and dieting were all related to the use of supplements *(15)*. However, we did not find significant relationships between dieting or energy intake and how often the women used supplements.

Women in our study who took supplements daily consumed significantly more folate in their diets than did women who took supplements less often or never. The mean intake for all groups was, however, less than the recommended amount of folate. Women in the National Health Interview Survey who took supplements had diets that were significantly more healthful (lower in fat and higher in fiber, calcium, and vitamins A, C, and E) than non-users had *(40)*. Others reported similar findings *(3,7,24,26)*.

Supplemental folic acid in doses up to 1,000 µg per day is considered nontoxic to healthy adults *(8,18)*. Folic acid in supplements is about twice as available as naturally occurring folates because folic acid can be absorbed intact, while folates must be broken down before absorption *(19,37)*. The folic acid in supplements may be most beneficial to women who limit their dietary selection: such as women who avoid folate-rich foods or restrict their energy intake *(39)*. Providing supplementation to the target group is likely to cause the least harm to others *(35)*. Despite the effectiveness and safety of folic acid supplements, this approach probably will have only a small influence on decreasing the incidence of neural tube defects because most women are unlikely to take a supplement before they become pregnant *(14,27)*. A recent study in London found that only 3 percent of pregnant women had taken folic acid supplements before conception when it would have been most beneficial *(12)*.

Implications

Our study provides evidence, from a recent national survey, that can be used to help nutrition educators and policy-makers in addressing inadequate folate intake by women of childbearing age. Increasing folate intake by encouraging women to add foods that are naturally rich in folate is a challenge for nutrition educators. Perhaps, a more successful approach is to encourage women to substitute good sources of folate for low-folate choices (e.g., orange juice instead of apple juice) or consume an additional serving of fortified grain products rather than add a folate-rich food such as a dark-green vegetable that few women eat.

Encouraging all women of childbearing age to take supplements containing folic acid is another approach to improving folate status in this high-risk group. Our findings confirm the results of other studies on supplement use; women who take supplements are less likely to need additional folate than women who do not take supplements.

Future research should identify the best strategies to use when shaping nutrition interventions to increase women's intake of foods that are naturally rich or fortified with folates or to increase women's use of folic acid supplements. In addition to having information on the foods that are being consumed and the demographic characteristics that influence supplement use, we need to understand better the behaviors and environmental factors that shape food intake and supplement use. Then interventions and nutrition education programs can be designed that result in increased intake of folates.

Acknowledgment

This project was funded in part by the Oklahoma Agricultural Experiment Station project OKLO/2283.

References

1. Alaimo, K., McDowell, M.A., Briefel, R.R., Bischof, A.M., Caughman, C.R., Loria, C.M., and Johnson, C.L. 1994. Dietary intake of vitamins, minerals, and fiber of persons ages 2 months and over in the United States: Third National Health and Nutrition Examination Survey, Phase 1, 1988-91. *Advance Data* No. 258.

2. Bailey, L.B. 1992. Evaluation of a new Recommended Dietary Allowance for folate. *Journal of the American Dietetic Association* 92:463-471.

3. Bender, M.M., Levy, A.S., Schucker, R.E., and Yetley, E.A. 1992. Trends in the prevalence and magnitude of vitamin and mineral supplement usage and correlation with health status. *Journal of the American Dietetic Association* 92:1096-1101.

4. Bendich, A. 1991. Importance of vitamin status to pregnancy outcomes. In A. Bendich and C.E. Butterworth (Eds.), *Micronutrients in Health and in Disease Prevention* (pp. 235-262). Marcel Dekker Inc., New York, NY.

5. Block, G. and Abrams, B. 1993. Vitamin and mineral status of women of child-bearing potential. *Annals of the New York Academy of Sciences* 678:244-254.

6. Bower, C. and Stanley, F.J. 1989. Dietary folate as a risk factor for neural-tube defects: Evidence from a case-control study in Western Australia. *Medical Journal of Australia* 150:613-618.

7. Bowerman, S.J.A. and Harrill, I. 1983. Nutrient consumption of individuals taking or not taking nutrient supplements. *Journal of the American Dietetic Association* 83:298-305.

8. Butterworth, C.E. and Tamura, T. 1989. Folic acid safety and toxicity: A brief review. *American Journal of Clinical Nutrition* 50:353-358.

9. Centers for Disease Control. 1991. Use of folic acid for prevention of spina bifida and other neural tube defects, 1983-1991. *Morbidity and Mortality Weekly Report* 40:513-516.

10. Centers for Disease Control. 1992. Recommendations for the use of folic acid to reduce the number of cases of spina bifida and other neural tube defects. *Morbidity and Mortality Weekly Report* 41:1-7.

11. Centers for Disease Control. 1995. Economic costs of birth defects and cerebral palsy—United States, 1992. *Morbidity and Mortality Weekly Report* 44:37.

12. Clark, M.A. and Fisk, N.M. 1994. Minimal compliance with Department of Health recommendation for routine folate prophylaxis to prevent neural tube defects. *British Journal of Obstetrics and Gynecology* 101:709-710.

13. Czeizel, A.E. and Dudas I. 1992. Prevention of the first occurrence of neural tube defects by periconceptual vitamin supplementation. *New England Journal of Medicine* 327:1832-1835.

14. Daly, L.E., Kirke, P.N., Molloy, A., Weir, D.G., and Scott, J.M. 1995. Folate levels and neural tube defects. *Journal of the American Medical Association* 274:1698-1702.

15. Dorant, E., Van Der Brandt, P.A., Hamstra, A.M., Feenstra, M.H., Goldbohm, R.A., Hermus, R.J.J., and Sturmans, F. 1993. The use of vitamins, minerals and other dietary supplements in the Netherlands. *International Journal of Vitamin Nutrition Research* 63:4-10.

16. Food and Drug Administration. 1996. Food standards: Amendment of the standards of identity for enriched grain products to require addition of folic acid. *Federal Register* 61:8781-8797.

17. Food and Drug Administration. 1996. Food additives permitted for direct addition to food for human consumption; folic acid (folacin). *Federal Register* 61:8797-8807.

18. Food and Nutrition Board. 1998. *Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B_6, Folate, Vitamin B_{12}, Pantothenic Acid, Biotin, and Choline.* National Academy Press, Washington, DC.

19. Gregory, J.F. 1997. Bioavailability of folate. *European Journal of Clinical Nutrition* 51:S54-S59.

20. Grimes, D.A. 1986. Unplanned pregnancies in the US. *Obstetrics and Gynecology* 67:438-442.

21. Houghton, L.A., Green, T.J., Donovan, U.M., Gibson, R.S., Stephen, A.M., and O'Connor, D.L. 1997. Association between dietary fiber intake and the folate status of a group of female adolescents. *American Journal of Clinical Nutrition* 66:1414-1421.

22. Kelly, P., McPartlin, J., Goggins, M., Weir, D.G., and Scott, J.M. 1997. Unmetabolized folic acid in serum: Acute studies in subjects consuming fortified food and supplements. *American Journal of Clinical Nutrition* 65:1790-1795.

23. Krebs-Smith, S.M., Cleveland, L.E., Ballard-Barbash, R., Cook, D.A., and Kahle, L.L. 1997. Characterizing food intake patterns of American adults. *American Journal of Clinical Nutrition* 65:1264S-1268S.

24. Kurinij, N., Klebanoff, M.A., and Graudard, B.I. 1986. Dietary supplement and food intake in women of childbearing age. *Journal of the American Dietetic Association* 86:1536-1540.

25. Levy, A.S. and Schucker, R.E. 1987. Patterns of nutrient intake among dietary supplement users. *Journal of the American Dietetic Association* 87:754-760.

26. Looker, A., Sempos, C.T., Johnson, C., and Yetley, E.A. 1988. Vitamin-mineral supplement use: Association with dietary intake and iron status of adults. *Journal of the American Dietetic Association* 88:808-814.

27. McNulty, H. 1997. Folate requirements for health in women. *Proceedings of the Nutrition Society* 56:291-303.

28. Milunsky, A., Jick, H., Jick, S.S., Bruell, C.L., MacLaughlin, D.S., Rothman, K.J., and Willett, W. 1989. Multivitamin/folic acid supplementation in early pregnancy reduces the prevalence of neural tube defects. *Journal of the American Medical Association* 262:2847-2852.

29. MRC Vitamin Study Research Group. 1991. Prevention of neural tube defects: Results of the Medical Research Council Vitamin Study. *Lancet* 338:131-137.

30. National Academy of Sciences, National Research Council, Food and Nutrition Board. 1989. *Recommended Dietary Allowances* (10th ed.). National Academy Press, Washington, DC.

31. Oakley, G.P. 1997. Let's increase folic acid fortification and include vitamin B-12. *American Journal of Clinical Nutrition* 65:1889-1890.

32. Pfeiffer, C.M., Rogers, L.M., Bailey, L.B., and Gregory, J.F. 1997. Absorption of folate from fortified cereal-grain products and of supplemental folate consumed with or without food determined by using a dual-label stable-isotope protocol. *American Journal of Clinical Nutrition* 66:1388-1397.

33. Picciano, M.F., Green, T., and O'Connor, D.L. 1994. The folate status of women and health. *Nutrition Today* 29:20-29.

34. Romano, P.S., Waitzman, N.J., Scheffler, R.M., Pi, R.D. 1995. Folic acid fortification of grain: An economic analysis. *American Journal of Public Health* 85:667-673.

35. Rush, D. 1994. Periconceptual folate and neural tube defect. *American Journal of Clinical Nutrition* 59:511S-516S.

36. Sauberlich, H.E. 1995. Folate status of the U.S. population. In L.B. Bailey (Ed.), *Folate in Health and Disease* (pp. 171-194). Marcel Dekker Inc., New York, NY.

37. Sauberlich, H.E., Kretsch, M.J., Skala, J.H., Johnson, H.L., and Taylor, P.C. 1987. Folate requirement and metabolism in nonpregnant women. *American Journal of Clinical Nutrition* 46:1016-1028.

38. Schaller, D.R. and Olson, B.H. 1996. A food industry perspective on folic acid fortification. *Journal of Nutrition* 126:761S-764S.

39. Scott, J.M., Weir, D.G., and Kirke, P.N. 1995. Folate and neural tube defects. In L.B. Bailey (Ed.), *Folate in Health and Disease* (pp. 329-360). Marcel Dekker Inc., New York, NY.

40. Slesinski, M.J., Subar, A.F., and Kahle, L.L. 1996. Dietary intake of fat, fiber and other nutrients is related to the use of vitamin and mineral supplements in the United States: The 1992 National Health Interview Survey. *Journal of Nutrition* 126:3001-3008.

41. Slesinski, M.J., Subar, A.F., and Kahle, L.L. 1995. Trends in use of vitamin and mineral supplements in the United States. *Journal of the American Dietetic Association* 95:921-923.

42. *SPSS for Windows* (Version 7.5). 1997. SPSS, Inc., Chicago.

43. Stewart, M.L., McDonald, J.T., Levy, A.S., Schucker, R.E., and Henderson, D.P. 1985. Vitamin/mineral supplement use: A telephone survey of adults in the United States. *Journal of the American Dietetic Association* 85:1585-1590.

44. Subar, A.F. and Block, G. 1990. Use of vitamin and mineral supplements: Demographics and amounts of nutrients consumed. The 1987 Health Interview Survey. *American Journal of Epidemiology* 32:1091-1101.

45. Subar, A.F., Block, G., and James, L.D. 1989. Folate intake and food sources in the US population. *American Journal of Clinical Nutrition* 50:508-516.

46. Tucker, K.L., Mahnken, B., Wilson, P.W.F., Jacques, P., and Selhub, J. 1996. Folic acid fortification of the food supply: Potential benefits and risks for the elderly population. *Journal of the American Medical Association* 276:1879-1885.

47. Tucker, K.L., Selhub, J., Wilson, P.W.F., and Rosenberg, I.H. 1996. Dietary intake pattern relates to plasma folate and homocysteine concentrations in the Framingham Heart Study. *Journal of Nutrition* 126:3025-3031.

48. U.S. Department of Agriculture, Human Nutrition Information Service. 1992. *The Food Guide Pyramid*. Home and Garden Bulletin No. 252.

49. U.S. Department of Agriculture, Human Nutrition Information Service. 1995-96. *Continuing Survey of Food Intakes by Individuals: 1994-95*.

Trends in Availability of Foods and Nutrients: A Comparison Between the United States and Italy, 1961-92

Claire Zizza
University of North Carolina—Chapel Hill

Shirley Gerrior
Center for Nutrition Policy and Promotion

The Mediterranean diet is of interest for its health-promoting qualities. The purpose of this study is to better define this diet and to compare it with the U.S. diet. We examined U.S. and Italian food-balance sheet data for 1961-92. Per capita per year food estimates show less available whole milk and white potatoes in both countries, less eggs and red meat in the United States, and less grain in Italy. Italy had higher per capita estimates for grains, cheese, oils, vegetables, and noncitrus fruits, while the United States had higher estimates for dairy foods, citrus fruits, eggs, and sugars and sweeteners. Nutrient levels increased for both countries, except for lower carbohydrate levels in Italy. Vitamin A, thiamin, riboflavin, niacin, and iron levels were higher for the United States; vitamin C, calcium, phosphorus, and potassium levels were higher for Italy. The considerable changes in the diets of both countries in the past 30 years have implications for health, in particular, the incidence of coronary heart disease and other diseases with acknowledged nutritional etiology.

During the early 1960's, people living in the Mediterranean area had some of the highest life expectancies and lowest rates of coronary heart disease, certain cancers, and other chronic diseases in the world. Unable to attribute these favorable health statistics to educational level, financial status, or health care expenditures, nutrition researchers have focused on the diet in this area *(23)*. The role of the Mediterranean diet in the prevention of coronary heart disease was first described by Keys in the 1950's *(11)*. Keys showed that Italian men living in Naples in the early 1950's had diets in which fat contributed 20 percent to their total energy; whereas, a comparable American group had diets in which fat contributed 40 percent of their energy. He demonstrated that higher fat diets were associated with higher concentrations of serum cholesterol in men and consequently with a higher risk of atherosclerosis *(9)*. Keys and his coworkers initiated in the early 1950's the Seven Countries Study that lasted for more than 20 years. This landmark study confirmed his previous findings: dietary fat influences levels of human serum cholesterol that influence the risk of coronary heart disease *(10)*.

The desire to preserve traditional diets likely to foster good health prompted the World Health Organization (WHO), the Food and Agriculture Organization (FAO) Collaborating Center in Nutritional Epidemiology at Harvard School of Public Health, the WHO Regional Office for Europe, and Oldways Preservation & Exchange Trust to develop the Mediterranean Food Guide Pyramid (fig. 1) *(23)* . These organizations depicted the Mediterranean diet as a graphic similar to the Food Guide Pyramid released by the U.S. Department of Agriculture (fig. 2) *(20)*. The Mediterranean Food Guide Pyramid depicts a general sense of the relative proportions and frequency of servings of foods and food groups that constitute the Mediterranean diet *(23)*.

The term ''Mediterranean diet'' has been broadened to include primarily plant-based diets with olive oil as the major source of fat. At least 16 countries along the Mediterranean Sea in which this dietary pattern was possible are Egypt, Morocco, Syria, Tunisia, Turkey, Algeria, Greece, Albania, Israel, Spain, Italy, France, Croatia, Lebanon, Libya, and Malta *(23)*.

The purpose of this study is to better define the Mediterranean diet and to compare it with the American diet in terms of food use and nutrient contributions. We examined U.S. and Italian food-balance sheet data, the best available source of information to examine dietary trends over time. Thus, the data are often used for international comparisons *(11)*. We chose Italy to represent the Mediterranean area because food composition and edible portion data were available for this country.

Within and between country data on trends for foods, nutrients (food energy,

Figure 1. Mediterranean Diet Pyramid

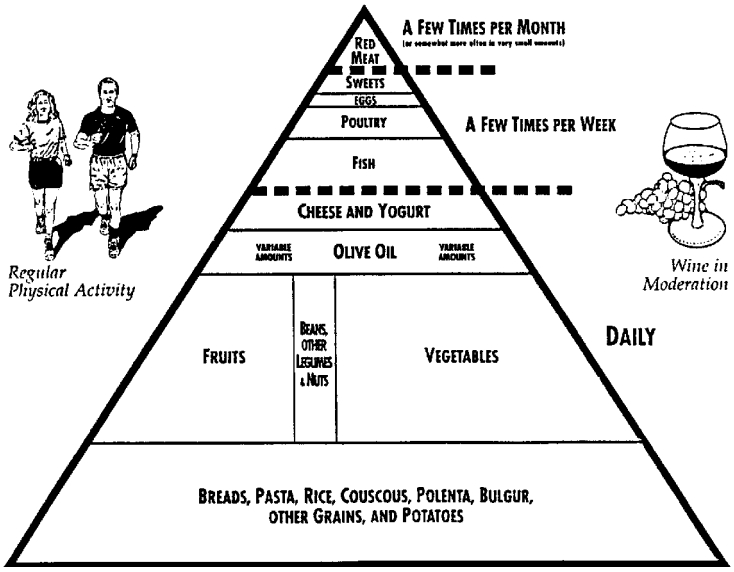
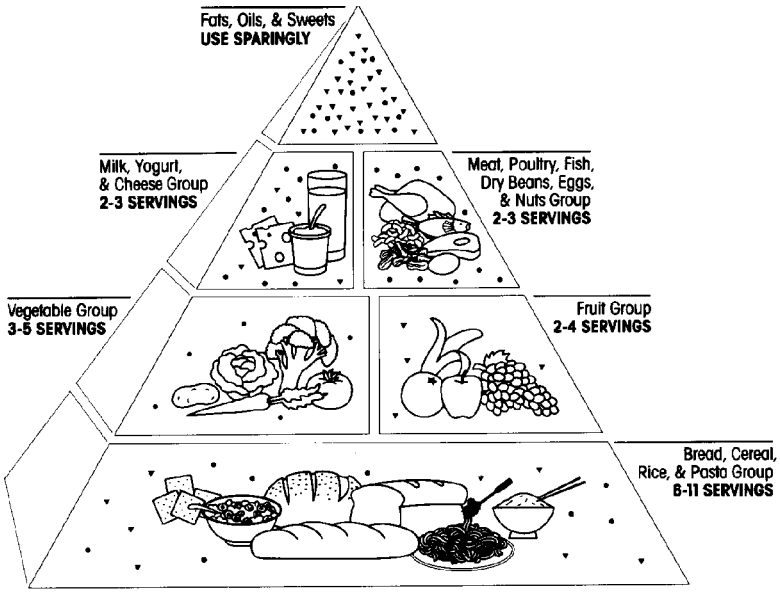


Figure 2. USDA Food Guide Pryamid



protein, carbohydrate, and fat; five vitamins, and four minerals) and sources of food nutrients were calculated and compared. Adequate vitamin A and vitamin C prevents night blindness and scurvy, respectively. Both are important antioxidants. Adequate thiamin prevents beriberi, and in addition to it, riboflavin and niacin are involved in energy metabolism. Calcium and phosphorus are important for their structural functions in bone. Iron is important in preventing iron-deficiency anemia, and potassium is also important in transportation across cell membranes and in the metabolism of energy.

In addition, we investigated whether the idealized Mediterranean diet still existed and the changes that may have occurred to this dietary pattern. By quantitatively examining the similarities and differences between the two countries' food supplies, we are able to discuss the feasibility of implementing in the United States the Mediterranean diet as a guidance model.

Methods

The nutrient content of the U.S. and the Italian food supply was calculated as similarly as possible for 1961-92.[1] Generally, both sets of data were estimated by multiplying the amount of each food consumed by the amount of food energy and other nutrients in the edible portion of food. The other nutrients were carbohydrate, protein, fat, vitamin A, ascorbic acid, thiamin, riboflavin, niacin, calcium, phosphorus, iron, and potassium. The data on U.S. food per capita were converted to kilograms for ease of comparison. Results for each nutrient for all the foods were totaled, and amounts per capita per day were generated. An interactive system[2] written in Foxpro, a relational database management program, was used to calculate each set of values of nutrients per capita per day. This system, maintained by the USDA's Center for Nutrition Policy and Promotion (CNPP), contains nutrient estimates from as far back as 1909. These estimates are updated on a continual basis to reflect the most up-to-date food composition.

Two databases for each country were needed to calculate nutrient per capita: one on food per capita and another on nutrient composition. The USDA's Economic Research Service (ERS) annually calculates U.S. food per capita values for most commodities. The U.S. Department of Commerce's National Marine Fisheries Service provides fish and shellfish values. The USDA's Agricultural Research Service (ARS) provides nutrient composition data. Italian food per capita values were obtained from FAO, and the nutrient database was based on the Italian National Nutrition Institute's (INN) *Tabelle di Composizione degli Alimenti*[3] *(2)*.

Food Database Development

Food-balance sheet data, also referred to as food supply, food availability, disappearance data, and consumption are accounts of food supplies that ''disappear'' into the national marketing system. The estimates of food are referred to as ''disappearance data'' because of the method by which they are derived. Supply tables are constructed from data on production, imports, and beginning-of-the-year inventories; whereas, utilization tables are from data on exports, year-end inventories, and nonfood uses. The amount of food from the utilization table is subtracted from the amount in the supply table.

The resulting food has ''disappeared'' and is assumed to be consumed by the population. Data on food composition and edible portions of food are then used to calculate the nutrients available in the food supplies. Dietary comparisons between countries are possible because these data are all derived in this manner. Differences between the U.S. and Italian food supplies are therefore ''real'' and not an artifact of different procedures. Despite the limitation that data on the food balance do not directly measure dietary intake, these data can be used to estimate the dietary patterns of the Mediterranean region in the early 1960's *(8)*. Roughly 400 primary commodity foods are included in the U.S. data set. A more detailed discussion of the methods for the estimates of U.S. nutrients per capita is presented elsewhere *(7)*.

FAO provided a spreadsheet of the amounts of about 300 foods used by the Italian population on a yearly basis from 1961 to 1992 *(4)*. In addition, FAO supplied estimates of the Italian population for those years. Food estimates used in this study were divided by the appropriate population estimates to yield values on a kilogram per capita per year basis. About 200 primary commodity foods are included in the Italian data set. A more detailed discussion of the methods for the Italian nutrient per capita is presented elsewhere *(24)*.

Refuse and Edible-Portion Factors

We used refuse factors from USDA's Nutrient Data Base for Standard Reference Release No. 10 *(18)* to calculate

[1]The year ranges are 1961-65, 1966-70, 1971-75, 1976-80, 1981-85, and 1986-92.

[2]The system was written by FU Associates, Ltd. (Arlington, VA).

[3]Food Composition Table.

the amount of edible food in the food supply. These factors were used to adjust food amounts so that inedible parts of foods (such as bones, rinds, and seeds) are not included. When a refuse factor for a food was not equal to zero, we multiplied the food amount by a value equal to one minus the refuse factor. Averages of refuse factors were calculated for some foods that were reported only as a single value for several food items.

Edible-portion factors for Italy were provided by the INN. If a food had an edible-portion factor with a value other than 100 percent, we multiplied the per capita amount of the food by its edible-portion factor. When FAO reported several foods as a total for a group of foods, such as whole freshwater fish, we calculated weighted averages of the edible-portion factors within the group. The method was based on the Italian reference diet as described by Turrini, Saba, and Lintas *(14)*. When FAO values of food per capita were grouped together by the authors, the relative amount of each food in the group was used to develop a composite edible-portion factor. When too little information existed to calculate weighted edible-portion factors, we calculated averages for foods reported as groups.

Refuse factors are different from inedible-portion factors, but usually edible-portion factors are the refuse values subtracted from 100 percent. Refuse factors for the United States and inedible-portion factors for Italy were used to make the procedures for both countries as similar as possible and to account for food amounts that typically are not available for human consumption.

Differences in the Food Per Capita Data Sets

A method to estimate production from home gardens has been developed for estimating the nutrient content of the U.S. food supply. This method incorporates household consumption data from USDA's Nationwide Food Consumption Surveys *(17)* and the percentage of households with vegetable gardens from the National Gardening Association's National Gardening Survey *(1)*. Data on vegetable consumption were derived for the years in which USDA's surveys were conducted and then interpolated for the years between surveys by using the percentage of households with gardens.

Vegetables produced in small family gardens are not included in the FAO's statistics on food. Estimates have shown that vegetables grown in family gardens in Italy comprise almost 20 percent of the total production of vegetables *(3)*. Thus, some nutrient per capita values could be underestimated because these sources of nutrients could not be included in estimating the nutrient content of the Italian food supply, particularly those values for nutrients such as vitamin A, ascorbic acid, and potassium that are concentrated in vegetables.

For both countries the nutrients provided by alcoholic beverages are excluded from the estimates of nutrients per capita. Vitamins and minerals added to the food supply through drinking water and supplements are also excluded in each set of estimates of nutrients per capita.

Nutrient Data Base Development

Sources of Data

Data on U.S. nutrient composition were obtained from the Primary Nutrient Data Set (PDS), which was developed by ARS's Nutrient Data Laboratory for the 1994 Continuing Survey of Food Intakes by Individuals *(19)*. In addition, food specialists in the Nutrient Data Laboratory developed nutrient profiles for unique items in the food supply. Nutrient data provided on a per 100 gram basis were converted to a per pound basis.

A nutrient database on a per kilogram basis was developed based on the Italian per capita food use estimates. Most of the nutrient values were taken from *Tabelle di Composizione degli Alimenti (2)*, maintained by the INN. Modifications and additions were also made to this nutrient database so that nutrient profiles corresponded to food data.

In some cases, nutrient information that corresponded to foods reported by FAO did not exist in the INN database. For these foods, we imputed nutrient values from either USDA's 1991 Primary Nutrient Data Set *(16)*, its 1976-1992 Agriculture Handbooks (AH-8) *(15)*, or its 1963 Agriculture Handbook *(22)*. The most recent source of USDA data was used in all cases.

Differences in the Nutrient Composition Data Sets

The values of nutrients per capita for the United States include estimated nutrient amounts added to the food supply through fortification and enrichment. The nutrient amounts from fortification and enrichment were based on data from surveys of industry conducted by the Bureau of Census for USDA *(5)* and on advice about flour

In both countries, the per capita per year amounts of most foods available for consumption increased.

enrichment from authorities in the milling and baking industries *(13)*. Estimated nutrients include iron, thiamin, riboflavin, and niacin added to flour and cereal products; vitamin A added to margarine, milk, and milk extenders; and vitamin C added to fruit juices and drinks, flavored beverages, dessert powders, milk extenders, and cereals. No comparable information was available for Italy.

Another difference between these two data sets is the adjustment of the data on nutrient composition to reflect technological and marketing innovations over time. In the United States, for example, changes in animal husbandry and closer fat-trimming practices by the meat industry have lowered the fat content of beef and pork since the late 1970's *(6)*. To account for these changes, nutrient values for beef and pork have been updated since the mid-1970's. Data were not available to determine if such changes existed in the Italian food supply; thus, we assumed that the nutrient composition of foods used for the Italian data set has not changed over time. The nutrient composition of most foods in the U.S. food supply did not change between 1961 and 1992. The major exceptions are the lower fat content of beef and pork, the varying fat content of poultry, and the higher vitamin A content of deep-yellow vegetables.

Results

Major Contributors Affecting the Availability of Food

In both countries, the per capita per year amounts of most foods available for consumption increased (table 1). Notable exceptions included less whole milk and white potatoes in both countries, less eggs and red meat in the United States, and less grains in Italy. Over the years, use of whole milk dropped by 61 percent in the United States and 28 percent in Italy. Initially, milk use in the United States was almost double its use in Italy. Later, with the large drop in the use of milk in the United States, both countries had similar use. Cow's milk was the predominant type of milk in both countries. In Italy, however, milk from other animals, such as goat, ewe, and buffalo was more common, particularly in cheesemaking. Generally, the use of white potatoes in both countries was similar and decreased by 11 percent in the United States and 14 percent in Italy. While the use of eggs in the United States surpassed that of Italy over the series, their use in the United States dropped by 23 percent between 1961-65 and 1986-92.

Italian per capita values for grain products, cheese, tomatoes, noncitrus fruits, other vegetables, and oils were all higher than U.S. values. For most of the years, the use of Italian grains was double that of the United States. However, a decline in the use of grains in Italy in 1986-92 resulted in Italian use being less than double but still substantially higher than U.S. use. Cheese use in both countries doubled between 1961-65 and 1986-92. However, cheese use was initially greater in Italy; thus, the Italian increase was considerably larger, causing the difference between the two countries to become greater.

The use of vegetables and fruits was substantially higher in Italy than it was in the United States. For example, Italians' use of tomatoes doubled, then tripled, that of the Americans' use, and the use of ''other vegetables''[4] in Italy

[4]Artichokes, asparagus, green beans, cabbage, cucumbers, eggplants, lettuces, garlic, mushroom, and cauliflower were counted in this group.

Table 1. Foods per capita per year in the U.S. and Italian food supplies[1]

Food group	1961-65		1966-70		1971-75		1976-80		1981-85		1986-92	
	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy
	Kilograms											
Dairy	151.7	74.9	144.1	71.2	138.0	87.2	134.7	95.4	128.5	102.8	128.4	85.1
Whole milk	116.4	61.6	104.6	54.2	89.8	66.2	73.1	66.4	59.4	70.7	45.0	48.0
Lowfat milk	13.3	4.2	18.4	5.3	27.4	7.5	40.0	13.5	45.4	13.3	56.5	15.3
Cheese	6.3	8.2	7.0	10.0	8.4	11.2	9.7	12.6	11.2	15.3	12.7	17.0
Eggs	18.5	8.3	18.3	8.8	17.0	10.0	15.8	10.3	15.2	10.3	14.2	10.7
Fats and oils	22.5	18.1	24.5	21.9	25.4	25.4	26.6	27.0	28.5	28.7	30.2	31.7
Fats	16.7	3.9	17.2	4.2	16.6	5.3	16.6	6.5	17.8	7.1	18.2	7.8
Oils	5.8	14.2	7.3	17.7	8.8	20.1	9.9	20.5	10.7	21.6	12.0	23.9
Meat, poultry, and fish	88.5	33.2	97.9	43.3	99.2	51.1	101.1	57.4	101.3	63.6	103.9	69.7
Red meat	64.8	21.8	70.1	28.9	69.5	34.2	68.5	37.9	65.2	41.9	60.6	45.7
Poultry	17.4	5.1	21.0	7.5	22.3	10.1	24.8	12.3	28.3	13.2	34.7	13.6
Fish	6.3	6.3	6.8	6.9	7.4	6.8	7.8	7.2	7.9	8.4	8.6	10.4
Grains	66.1	131.6	65.6	132.8	64.4	134.5	67.5	132.5	70.7	117.7	84.4	116.3
Sugars and sweeteners	51.1	23.9	54.0	26.5	55.8	29.9	57.5	30.1	56.2	28.2	61.1	26.5
Fruits	74.7	95.9	77.1	110.7	82.4	106.9	86.6	98.5	90.1	104.4	95.6	111.2
Citrus	22.9	13.6	27.0	22.2	32.5	27.0	33.6	27.7	32.4	28.4	31.3	29.1
Noncitrus	51.8	82.3	50.1	88.5	50.0	79.9	53.0	70.8	57.7	76.0	64.3	82.1
Vegetables	124.3	157.1	110.6	176.0	124.8	168.7	126.0	168.6	125.5	180.2	126.2	189.4
White potatoes	40.7	41.7	38.3	38.8	36.6	33.7	36.2	33.4	35.7	32.6	36.4	35.8
Tomatoes	16.7	35.0	16.4	43.9	20.3	39.9	20.5	41.0	20.4	53.4	20.5	60.6
Dark-green/deep-yellow vegetables	11.1	12.8	10.7	14.9	10.9	15.7	10.8	14.8	11.8	15.0	12.1	16.2
Other vegetables	55.7	69.5	55.9	80.5	56.9	81.6	58.5	81.6	57.6	81.3	57.2	78.9

[1]Values are the average for each year range.

was greater throughout the entire series and increased by 14 percent. Among the vegetables in this group, artichokes, cucumbers, eggplants, and cauliflower were consumed in much larger quantities in Italy than in the United States; the use of sweet corn, however, was common in the United States but negligible in Italy. In 1961-65, the use of dark-green and deep-yellow vegetables was similar in the two countries and increased. By 1986-92, Italian use of these vegetables was 34 percent higher than their use in the United States.

Originally, Italian use of noncitrus fruit was almost 60 percent greater than its use in the United States; by 1986-92 this difference was reduced to 28 percent. Additional analysis showed that the most common noncitrus fruits in both countries are apples, bananas, peaches, pears, grapes, strawberries, plums, cherries, cantaloupes, and watermelons. While figs and persimmons were more common in Italy, pineapples were more common in the United States.

The use of red meat, poultry, lowfat milk, citrus fruit, fats, and sugars and sweeteners was greater in the United States than in Italy. While the use of red meat in the United States was always greater than that in Italy, the pattern of use between the two countries differed. In Italy, the use of red meat more than doubled (21.8 to 45.7 kilograms per capita per year) over the period; in the United States, the use of red meat increased through the 1960's and then from 1966-70 to 1986-92, its use decreased by 14 percent. Also, the use of edible offals from animals such as cows, pigs, horses, and chickens in Italy was appreciable; in the United States the use of offals was negligible (data not shown). The use of fish in the two countries was the same initially, but by 1986-92, it was 21 percent higher in Italy than in the United States.

The use of dairy foods and citrus fruits for all years was higher in the United States than in Italy. The use of lowfat milk in the United States rose considerably, with use in 1986-92 almost four times its use in Italy. Although the use of citrus fruit was higher in the United States, a marked increase in its use by Italians narrowed the difference between the two countries—from 68 percent in 1961-65 to 8 percent in 1986-92.

The use of oil in Italy was 2 to 2½ times greater than its use in the United States; this difference narrowed in later years, however. When we examined the oil food group in more detail, we found that olive oil was the predominant oil in Italy in the earlier years (data not shown). In 1961-65 the amount of olive oil used per capita per year exceeded that of all other types of oils, including oil from maize, palm kernel, rapeseed, sesame, soybean, and sunflower. By 1986-92, however, the sum of these other oils was greater than the amount of olive oil in the Italian food supply. Use of oils, particularly soybean oil, in the United States has practically doubled.

Initially, the use of fats (butter, margarine, shortening, and lard) by the United States was more than four times that of Italian use. Because of the subsequent increase in the use of fats in Italy, the United States was using no more than twice as much as Italy used. Throughout the series, the use of sweeteners in the United States was twice their use in Italy.

Macronutrients

In the United States and Italy, levels of food energy increased by 17 and 18 percent, respectively (table 2). Despite the similar percentage increases, the United States consistently had higher levels of food energy.

Even though food energy in both countries increased consistently over the years, the relative contributions from carbohydrate, protein, and dietary fat changed in Italy but remained rather stable in the United States. From 1961-65 to 1986-92, the contribution of dietary fat to total food energy increased from 28 to 37 percent in Italy and remained stable at about 40 percent in the United States (fig. 3). The contribution from carbohydrate decreased from 61 to 49 percent in Italy but increased slightly in the United States: from 48 to 50 percent. The protein contribution to total energy for both countries remained stable: 12 percent for the United States and 13 percent for Italy.

Trends for the actual macronutrient levels (amounts available in the food supply) were more dramatic than their relative contributions to energy indicate (table 2). The most pronounced trend was for dietary fat. Between 1961-65 and 1986-92, Italian fat levels increased by 70 percent, quite a difference from the increase in the U.S. fat levels: 13 percent. Although Italian fat levels increased so dramatically, the United States still had higher fat levels for all years. However, the difference between the two countries narrowed from 71 percent in 1961-65 to 14 percent in 1986-92.

There were several differences in fat sources between the two countries (fig. 4). Oils were the primary source of dietary fat in Italy throughout the

Table 2. Food energy and macronutrients, vitamins, and minerals per capita per day in the U.S. and Italian food supplies, selected year ranges

Food energy and macronutrients

Years	Food energy		Carbohydrate		Protein		Fat	
	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy
	Kcal		*Grams*		Grams		*Grams*	
1961-65	3124	2849	374	437	91	89	140	82
1966-70	3259	3073	382	452	94	98	151	97
1971-75	3283	3258	386	459	94	104	151	112
1976-80	3337	3315	399	454	96	108	151	119
1981-85	3405	3274	403	421	98	109	156	128
1986-92	3641	3372	449	416	105	113	158	139

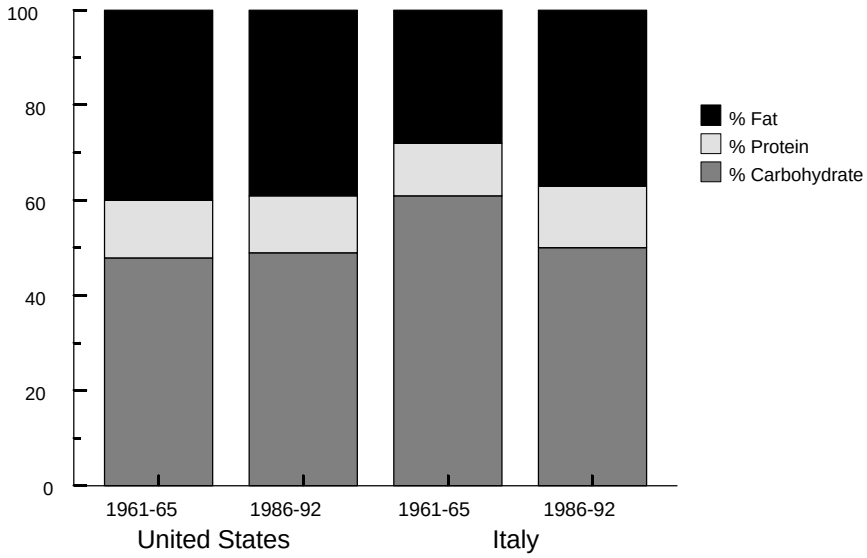
Vitamins

Years	Vitamin A		Vitamin C		Thiamin		Riboflavin		Niacin	
	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy
	mcg RE		*Milligrams*		*Milligrams*		*Milligrams*		*Milligrams*	
1961-65	1264	902	91	177	1.8	1.7	2.2	1.5	20	21
1966-70	1407	1071	98	210	1.9	1.9	2.2	1.6	21	23
1971-75	1536	1170	108	212	2.1	1.9	2.3	1.8	23	24
1976-80	1533	1223	111	212	2.3	2.0	2.4	1.9	25	25
1981-85	1513	1341	112	219	2.3	2.0	2.4	1.9	26	25
1986-92	1509	1414	115	225	2.6	2.0	2.5	1.9	28	26

Minerals

Years	Calcium		Phosphorus		Iron		Potassium	
	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy
	Milligrams		Milligrams		*Milligrams*		*Milligrams*	
1961-65	902	718	1428	1482	14.2	14.9	3472	3328
1966-70	886	792	1449	1595	14.8	16.1	3465	3657
1971-75	873	868	1447	1684	17.0	16.8	3462	3691
1976-80	881	925	1471	1742	20.4	17.0	3465	3716
1981-85	888	985	1491	1753	17.5	17.0	3480	3846
1986-92	936	963	1608	1780	20.0	17.3	3657	3949

Figure 3. Macronutrient sources of food energy in the U.S. and Italian food supplies, 1961-65 and 1986-92



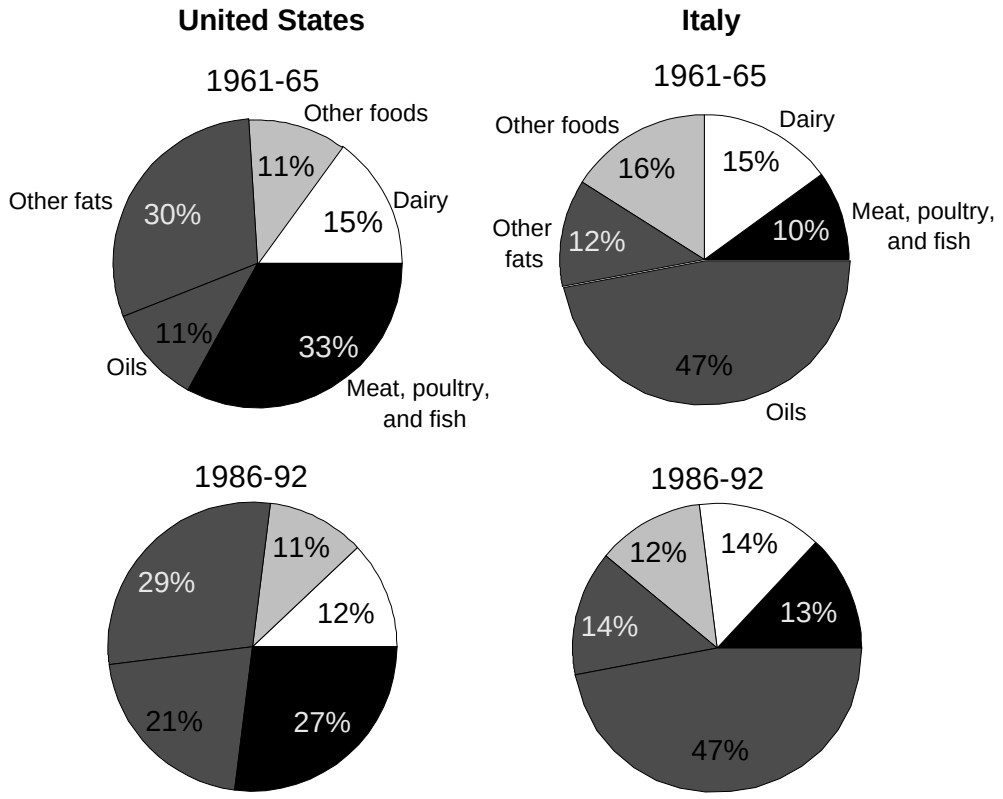
Although the use of citrus fruit was higher in the United States, a marked increase in its use by Italians narrowed the difference between the two countries---- from 68 percent in 1961-65 to 8 percent in 1986-92.

years; however, the types of oils shifted from olive oil to other oils. In the United States, while the contributions of dietary fat from oil increased, compared with use in Italy, margarine, shortening, and lard were used in greater quantities in the United States. Thus, U.S. oils contributed less than half the contributions from oils than was the case in Italy. Since the early 1970's, the use of red meat in the United States decreased. Despite the decreasing use of red meat by the United States since the early 1970's, the contribution of fat from the meat, poultry, and fish group between 1986-92 was twice that from this group in Italy.

The trends in carbohydrate levels were very different between the two countries. Initially, Italy had a higher carbohydrate level by 17 percent (437 vs. 374 grams per capita per day); however, by the end of the period, the carbohydrate levels in the United States increased and surpassed those for Italy by 8 percent (449 vs. 416 grams). Increased use of sugars and sweeteners in both countries and an increased use of grains in Italy were responsible for increased carbohydrate levels. By the late 1970's, carbohydrate levels began to drop in Italy because of decreased use of grains.

The relative contributions of carbohydrate from most foods remained fairly constant for both countries (fig. 5). During both periods, the grains group was the primary source of carbohydrate in Italy, contributing more than half of the carbohydrate levels. In the earlier period, the sugars and sweeteners group and the grains group each provided

Figure 4. Sources of fat in the U.S. and Italian food supplies, 1961-65 and 1986-92



37 percent of the carbohydrate in the United States (fig. 5). By 1986-92, the major source of carbohydrate in the United States was the grains group, followed by the sugars and sweeteners.

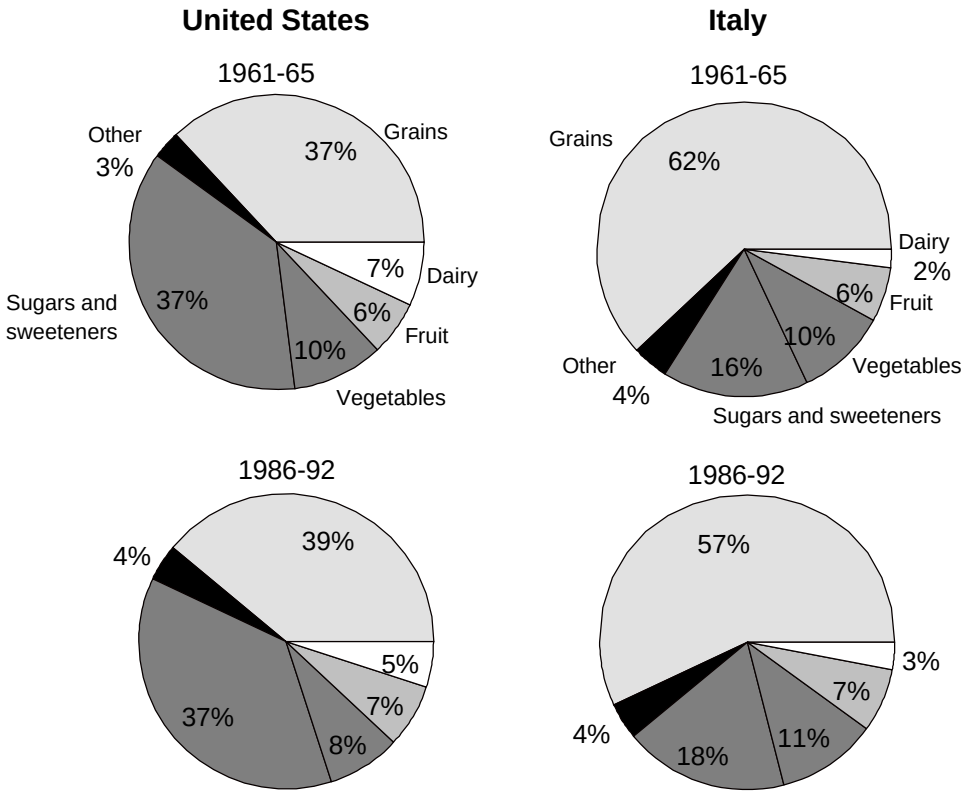
Protein levels, similar in the earlier years, increased for both countries, with a 15- and 27-percent increase, respectively, in the United States and Italy (table 2). In the United States, the red meat group was the leading source of protein, providing between 26 and 23 percent (data not shown). In Italy the grains group was the largest source of protein for the entire period even though grain contribution dropped 14 percent. In Italy the relative contribution from the red meat group increased during this period, while in both countries the protein contribution from poultry increased.

Vitamins

In both countries, vitamin levels have generally increased (table 2). The United States had higher levels for vitamin A, thiamin (particularly in later years), and riboflavin; whereas, Italy had much higher ascorbic acid levels. Niacin levels in both countries were initially similar; however, in the late 1970's, the niacin levels in the United States surpassed those in Italy.

Levels of total vitamin A, which includes both retinol and beta carotene, increased substantially (57 percent) in the Italian food supply, narrowing the U.S. lead: from a 40- to a 6-percent difference in the levels between the countries in 1961-65 and 1986-92, respectively. The meat group, particularly organ meats, and dark-green and deep-yellow vegetables were leading sources of vitamin A for both countries (fig. 6). From 1961-65 to 1986-92, the vitamin A contribution from the vegetable group was about two-fifths (45 percent) and that from the meat, poultry, and fish group increased from one-fifth to one-fourth in the Italian food supply. At the same time in the United States, vitamin A contributions from the vegetable group increased from about one-fifth to one-third (23 to 34 percent), and meat contributions dropped from one-third

Figure 5. Sources of carbohydrate in the U.S. and Italian food supplies, 1961-65 and 1986-92

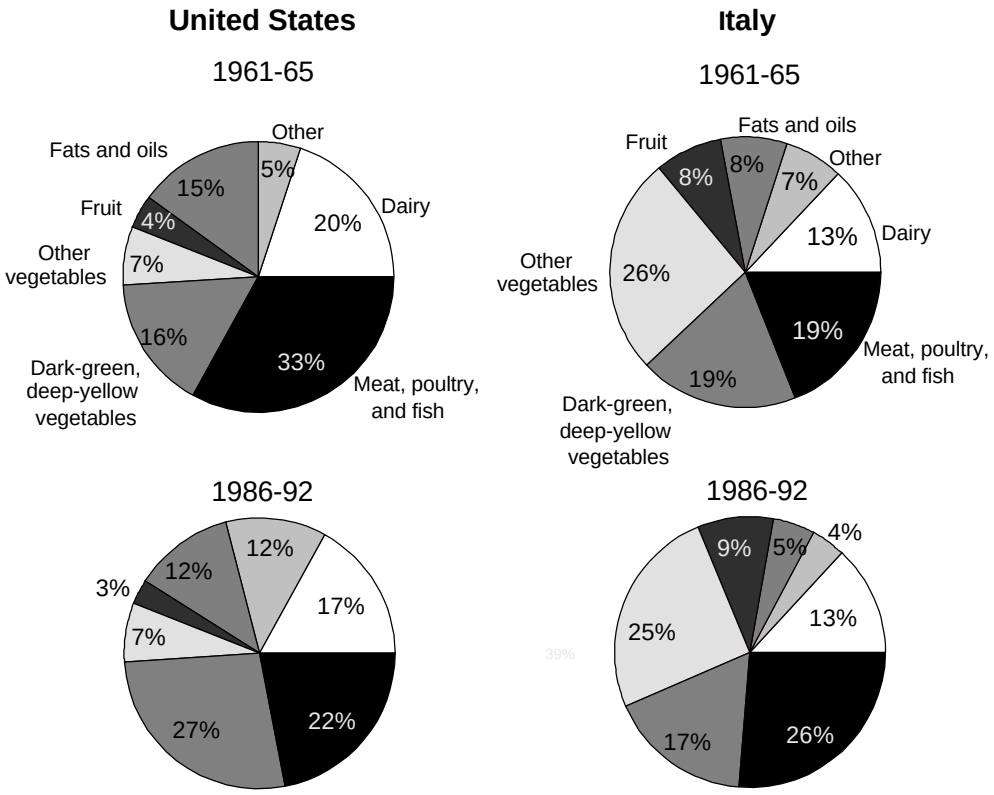


to about one-fifth (33 to 22 percent). The greater vitamin A contribution from the vegetable group in the United States was not from increased use but rather from the introduction in the mid-1960's of varieties of deep-yellow vegetables with more carotene than was true for earlier varieties. Another difference in contributions of vitamin A from the vegetable group was that in Italy, tomatoes (due to a sizable use over the years) were important contributors of vitamin A, unlike the trend in the United States. In the United States, because of the use of vitamin A-fortified margarine, the vitamin A contributions from fats and oils were appreciably higher, compared with contributions of vitamin A from fats and oils in Italy.

Throughout the series, ascorbic acid levels in Italy were almost double the levels in the United States. In both countries, ascorbic acid levels increased: from 91 to 115 mg in the United States and 177 to 225 mg in Italy. The relative contribution from the various food groups was rather stable over the years (data not shown). Contributions from fruits and vegetables comprised 90 percent or more of the levels of total ascorbic acid. In the later years of the series, fruit and vegetable contributions in the United States provided similar levels; in Italy, vegetables provided the majority of vitamin C.

Over the 30-year period, thiamin and riboflavin levels were higher in the United States than they were in Italy. In the United States, thiamin levels increased dramatically, by 44 percent; riboflavin levels increased by only 14 percent. Riboflavin levels in the United States rose from 2.2 to 2.5 mg (14-percent increase) per capita per day over the series; levels in Italy rose from 1.5 to 1.9 mg (27-percent increase). Also, niacin levels in the United States were higher than the levels in Italy were at the end of the series. Higher levels of these nutrients in the United States were, in part, due to an increase in the use of grains, but more substantially, these levels were due to Federal enrichment of grain products. With a

Figure 6. Sources of vitamin A in the U.S. and Italian food supplies, 1961-65 and 1986-92



decrease in the use of red meat in the United States, its contributions to these three vitamins dropped from 23 to 17 percent for thiamin, 17 to 14 percent for riboflavin, and 29 to 20 percent for niacin (data not shown). A reverse trend occurred in Italy: thiamin contributions from the red meat group more than doubled, primarily reflecting an increase in pork use. Also, Italian riboflavin contributions from the meat, poultry, and fish group increased from 10 to 16 percent. Reflecting the drop in grain use in Italy, contributions from this group for thiamin declined from 46 to 36 percent, for riboflavin from 21 to 15 percent, and for niacin from 37 to 27 percent (data not shown).

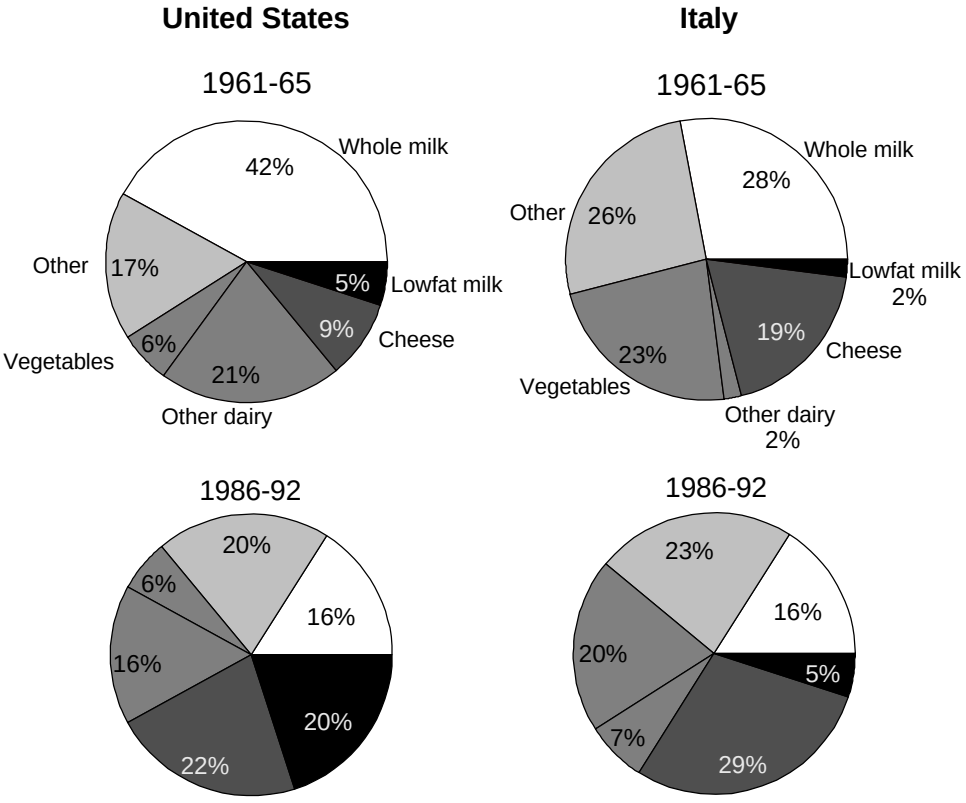
In both countries, the riboflavin contribution from the milk group declined because use dropped. The relative importance of the vegetable group to the supply of riboflavin was different between the two countries throughout the series: the Italian vegetable group provided about 20 percent of the riboflavin; whereas, the U.S. vegetable group provided about 7 percent.

Minerals

From 1961-65 to 1986-92, the levels of calcium, phosphorus, iron, and potassium in the food supplies of both countries generally increased (table 2). Italian calcium levels surpassed those of the United States during the late 1970's. From 1961-65 to 1966-70, Italian potassium levels increased by 10 percent and quickly outpaced the rather stable U.S. levels. The primary source[5] of potassium in both food supplies was the vegetable group. The other sources of potassium differed in their importance between the two food supplies. Other major Italian food sources were grain products and fruits. Higher levels of potassium in Italy were mainly due to increased contributions from the meat, poultry, and fish group. Contributions from Italian dairy products remained stable at 9 percent but were minor compared with U.S. dairy product contributions, which provided about one-fifth of the total potassium throughout the years.

[5]Data on sources of potassium are not shown.

Figure 7. Sources of calcium in the U.S. and Italian food supplies, 1961-65 and 1986-92



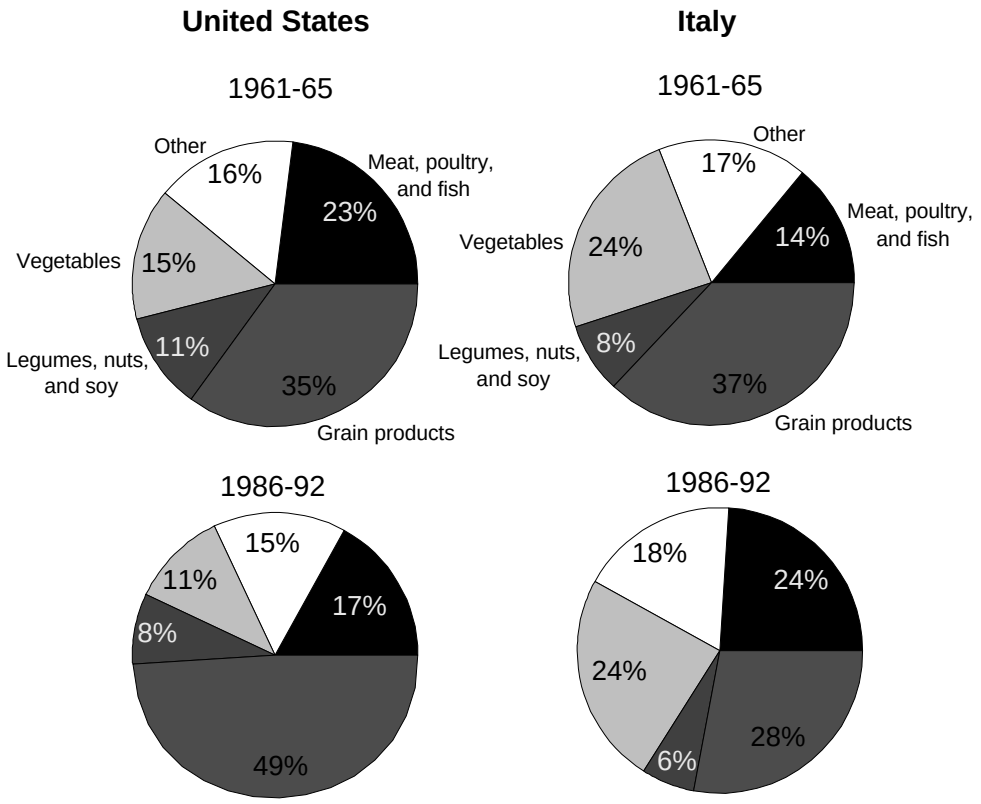
Iron levels were similar for both countries in the early years, but by the mid-1970's, U.S. levels were higher (20.4 vs. 17 mg). Italy had higher phosphorus levels for the entire period: 1,482 to 1,780 mg versus 1,428 to 1,608 mg for the United States.

Calcium levels in the Italian food supply increased by 34 percent, while U.S. levels fluctuated slightly but by 1986-92 were similar to the Italian level. Throughout the period, dairy products were the primary calcium source in both countries; however, over the years, dairy products provided 50 to 60 percent of the calcium in the Italian food supply and 74 to 77 percent of the calcium in the U.S. food supply (fig. 7). In both countries, the contributions from cheeses and lowfat milks increased; the contributions from whole milks decreased. In the United States, the contribution of cheeses to calcium levels more than doubled, lowfat milk quadrupled, and whole milks dropped by more than half.

In the United States, calcium contributions from the vegetable group were small (6 percent), compared with contributions from this group in the Italian food supply: around one-fifth (20 to 23 percent) of the total calcium in the Italian food supply, the result throughout the series of the ample use of many vegetables—particularly tomatoes and dried onions.

U.S. and Italian food sources of phosphorus differed (data not shown). In Italy, the primary source of phosphorus was the grain group; in the United States, the dairy group was the primary source. However, the share of phosphorus provided by grain products to the U.S. food supply increased, while the share in the Italian food supply dropped but continued to be the major source. The dairy group (especially cheese) became a more important source of phosphorus in the Italian food supply over the years, increasing from 18 to 22 percent. Also, the contributions from the meat, poultry, and fish group increased in the Italian food supply; in the United States, this group's contributions remained stable. Phosphorus contributions from vegetables

Figure 8. Sources of iron in the U.S. and Italian food supplies, 1961-65 and 1986-92



in the Italian food supply were about two times greater than those from vegetables in the U.S. food supply. The contributions from vegetables were relatively stable in both countries.

Per capita per day levels of iron in the two countries increased over the years; however, U.S. iron levels became noticeably higher in the mid-1970's because of enrichment and fortification practices. Grain products were the predominant source of iron for both countries (fig. 8). The relative contributions from grains decreased in the Italian food supply (37 to 28 percent), while those from the meat, poultry, and fish group (14 to 24 percent), particularly pork, increased. In the United States, the trend reversed—grains contributed more (35 to 49 percent) and meat, poultry, and fish less (23 to 49 percent). For Italy, the vegetable group remained a stable and important source of iron to the food supply (24 percent). In the United States, this group contributed a moderate but decreasing amount of iron (15 to 11 percent). In both countries, the legumes, nuts, and soy products provided modest amounts of iron throughout the series.

Conclusions

Discussion

Interest in the Mediterranean diet started with the work of Ancel Keys. In 1952, he and several colleagues undertook dietary and other coronary-risk studies in seven countries. After examining the results from these different countries, he was one of the first to link high-fat diets to higher concentrations of blood cholesterol and a subsequent increased risk of heart disease. To help individuals reduce their risks for coronary heart disease, he wrote a cookbook in which he summarized his findings and provided advice for a healthy lifestyle. Nestle *(11)* surmised that the Mediterranean diet of the 1960's was the prototype for current dietary guidance policy in the United States because the Dietary Guidelines for Americans *(21)* reflect the advice Keys outlined in his cookbook. This observation prompted us to compare the Mediterranean diet

to the U.S. diet in order to better quantify the characteristics of the Mediterranean diet.

Keys attributed the beneficial effects of the Mediterranean diet to the amount and type of fat consumed; however, in this study there were differences in the availability of other foods and nutrients. For example, vitamin C, calcium, phosphorus, and potassium levels were higher in Italy than in the United States. Thus it is difficult to ascertain if only one component, such as fat, is the only causative factor in the etiology of chronic diseases.

The successful implementation of dietary recommendations requires consumer access to affordable, health-promoting foods. From 1961-65 to 1986-92, substantial changes in the quantity and quality of foods in both countries resulted in different levels of nutrient availability. These different levels consequently caused the health-promoting attributes of these diets to be altered.

This study shows an increase in availability of fruits and grains in the United States and a shift to lower fat dairy and leaner meat products. However, along with these healthful trends, the U.S. food supply contains less dairy foods, more sugar and sweeteners, and more fat and oils in 1986-92 than in 1961-65. These trends resulted in higher levels of most vitamins and minerals; however, the 1986-92 levels of calcium (too low),[6] total fat (too high), and calories (too high) may be a concern in terms of dietary guidance. As with the United States, the Italian food supply diet had available for consumption more fruits and fats and oils in 1989-92 than in 1961-65. A healthful trend in Italy (not seen in the United States) was the increase in dairy products and vegetables available for consumption.

Trends that deviate from dietary guidance recommendation were the decreased use of grains and increased use of red meats and sugars and sweeteners in Italy. Determining the overall healthfulness of these two food supplies is difficult because the consumption of some foods came closer to dietary recommendations, and others deviated from dietary recommendations. Dietary quality is difficult to measure. The food supply of both countries must be able to provide healthful food choices.

For the U.S. population to consume a diet typical of the Mediterranean area in the 1960's, the availability of several food groups would need to change. When comparing the foods of Italy in 1961-65 to those in the United States in 1986-92, we found that Italy had less milk, cheese, eggs, fats, meat, chicken, fish, sugars, sweeteners, and citrus fruit available in 1961-65. Italy had more oils, grains, noncitrus fruit white potatoes, tomatoes, dark-green/deep-yellow and other vegetables available in 1961-65. As O'Brien *(12)* has noted, this would have significant implications for the agricultural sector in the United States. The current state of the U.S. food supply could not accommodate the estimated food needed for the U.S. population to adhere to a Mediterranean diet. However, whereas using the Mediterranean diet as a dietary guidance model in the United States might not be feasible at this time, the food industry has shown the capacity to adopt over time to changes in consumer demands and changing public policy.

Data Limitations

When food supply data are used to examine dietary patterns, concerns always arise regarding differences noted between food supply data and dietary intake data. Food supply data measure food and nutrient availability as national totals; whereas, dietary survey data (such as USDA's Continuing Survey of Food Intakes by Individuals) provide data on food and nutrient intakes reported by individuals and households. Both types of data have strengths and limitations that affect their ability to measure food consumption and their usefulness in dietary assessment. Estimates of the food supply reflect the amount of food available before it moves through marketing channels, not the amount actually consumed. Thus food supply data typically overestimate food and nutrient availability and are better indicators of trends in consumption over time rather than actual amounts ingested. On the other hand, the quality of the dietary or food intake survey depends on the accuracy and completeness of the individual's recall. Underreporting of the total diet or different food groups by respondents is common in these surveys, and actual food intakes may be underrepresented.

Another concern: fortification and enrichment estimates. USDA and Italian nutrient databases do not routinely identify levels of added nutrients. Fortification data in the U.S. food supply have not been updated since 1970, except for the percentage of flour enriched. Since 1970, enormous changes in fortification practices by the food industry have occurred, and both the range of fortified foods and the number of added nutrients expanded.

[6]Despite higher levels of calcium in 1986-92, these levels are below the calcium recommendations for many subgroups of the population.

An updated version of USDA's food composition database, designed to include nutrients added to foods commercially through enrichment and fortification, is needed to generate more accurate estimates of nutrients in the food supply. Based on personal communications with Italian authorities, we found that enrichment and fortification are not commonly practiced in Italy. Therefore, the higher U.S. levels for thiamin, riboflavin, and niacin are most likely real and not from a difference in methods.

The ability of estimates of the food supply to reflect accurately the contribution of fat from the meat group is another concern. The contribution of red meat in the U.S. food supply has been completely revised *(6)*, thus these estimates reflect more closely the trends in fat contributed by meat. The composition of red meat in Italy has also undergone a shift to more leaner types, and this is probably not reflected in the food composition values used for Italy. Thus the contribution of fat from meat is probably overestimated for Italy.

Because the Italian diet of the 1960's is no longer common, using it as a model is difficult. Many individuals would assume that the current Mediterranean diet is the model; as illustrated by this study, that assumption would be misleading. The effects on the health of those living in the Mediterranean area caused by changes in their diets require further research. The protective effect of the Mediterranean diet in terms of coronary heart disease may no longer exist, and perhaps the health of those currently living in the Mediterranean region would benefit by their returning to the diets of their grandparents.

References

1. Butterfield, B. 1996. Personal communication. National Gardening Survey. Burlington, Vermont.

2. Carnovale E. and Miuccio, F.C. 1989. *Tabelle di composizione degli alimenti*. Ministry of Agriculture and Forestry and National Institute of Nutrition, Rome.

3. Food and Agriculture Organization. 1993. *Statistical Series No. 12. FAO Yearbook Production*. Vol. 46. 1992. Rome.

4. Food and Agriculture Organization. 1994. Definition and classification of commodities (draft). Rome.

5. Friend, B. 1973. *Enrichment and Fortification of Foods, 1966-70.* U.S. Department of Agriculture, Agricultural Research Service. CFE (ADM). 282.

6. Gerrior, S. 1996. Estimating nutrient contributions from beef and pork in the U.S. food supply series. *Family Economics and Nutrition Review* 9*(4)*:38-43.

7. Gerrior, S. and Bente, L. 1997. *Nutrient Content of the U.S. Food Supply, 1909-94*. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. Home Economics Report No. 53.

8. Helsing, E. 1995. Traditional diets and disease patterns of the Mediterranean, circa 1960. *American Journal of Clinical Nutrition* 61(supp):1329S-1337S.

9. Keys, A., Fidanza, F., Scardi, V., Bergami, G., Keys, M., and Lorenzo, F. 1954. Studies on serum cholesterol and other characteristics on clinically healthy men in Naples. *Archives of Internal Medicine* 93:328-35.

10. Keys, A., Aravanis, C., Blackburn, H. et al. 1980. *Seven Countries: A Multivariate Analysis of Death and Coronary Heart Disease*. Harvard University Press, Cambridge, Massachusetts.

11. Nestle, M. 1995. Mediterranean diets: Historical and research overview. *American Journal of Clinical Nutrition* 61(supp):1313S-1320S.

12. O'Brien, P. 1995. Dietary shifts and implications for US agriculture. *American Journal of Clinical Nutrition* 61(supp):1390S-1396S.

13. Ranum, P. 1980. Notes on levels of nutrients to add under expanded wheat flour fortification/enrichment programs. *Cereal Chemistry* 57:70-72.

14. Turrini, A., Saba, A. and Lintas, C. 1991. Study of the Italian reference diet for monitoring food constituents and contaminants. *Nutrition Research* 11:861-873.

15. U.S. Department of Agriculture, Agricultural Research Service. 1976-1992. *Composition of Foods: Raw, Processed, Prepared.* Agriculture Handbook AH No. 8: AH-8-1 through AH-8-21, Washington, DC.

16. U.S. Department of Agriculture, Agricultural Research Service. 1991. Primary nutrient data set (PDS).

17. U.S. Department of Agriculture, Agricultural Research Service. 1994. *Food Consumption and Dietary Levels of Households in the United States, 1987-88.* Nationwide Food Consumption Survey, 1987-88, NFCS Report No. 87-H-1.

18. U.S. Department of Agriculture, Agricultural Research Service. 1996. *Revised Agricultural Handbook 8 Sections: U.S. Department of Agriculture Nutrient Data base for Standard Reference Release 10.*

19. U.S. Department of Agriculture, Agricultural Research Service. 1996. Primary Data Set. On 1994 Continuing Survey of Food Intakes by Individuals and 1994 Diet and Health Knowledge Survey.

20. U.S. Department of Agriculture, Human Nutrition Information Service. 1992. *The Food Guide Pyramid.* Home and Garden Bulletin No. 252.

21. U.S. Department of Agriculture and U.S. Department of Health and Human Services. 1995. *Nutrition and Your Health: Dietary Guidelines for Americans*. (4^{th} ed.). U.S. Department of Agriculture. Home and Garden Bulletin No. 232.

22. Watt, B.K. and Merrill, A.L. 1963. Composition of foods: Raw, processed, prepared. U.S. Department of Agriculture. Agriculture Handbook (AH) No. 8, 1-190.

23. Willett, W.C., Sacks, F., Trichopoulou, A., Drescher, G., Ferro-Luzzi, A., Helsing, E., and Trichopoulos, D. 1995. Mediterranean diet pyramid: A cultural model for healthy eating. *American Journal of Clinical Nutrition* 61(supp):1402S-1406S.

24. Zizza, C. 1997. The nutrient content of the Italian Food Supply 1961-92. *European Journal of Clinical Nutrition* 51:259-265.

Factors Associated With the Intake of Dietary Supplements

Rodolfo M. Nayga, Jr.
Texas A&M University

Debra B. Reed
Texas A&M University

Research on the relationship between diet and disease has increased interest in nutrition and in determining the nutrients and their levels that are related to adequate health *(7)*. The latest report on nutrition monitoring of the U.S. population classifies the dietary intake of iron and calcium as current public health issues *(4)*. This classification signifies an inadequate intake across many age, gender, and ethnic groups, and there is associated biochemical, clinical, or anthropometric evidence of adverse health conditions. Regarding intake, other minerals (e.g., magnesium, potassium, zinc, and copper) and vitamins (e.g., A, C, E, B_6, and B_{12}) are considered potential public health issues for which further study is required.

While no dietary supplement can replace a healthful diet, experts agree that providing the body with adequate nutrient intake is especially important in light of the increasing prevalence of degenerative diseases: for example, heart disease, cancer, and osteoporosis *(21)*. Because of increasing awareness and knowledge about the link between nutrition and health, as well as the rising costs of healthcare, many Americans are embracing self-medication with dietary supplements aimed at preventing diseases *(11)*. Evidence has been accumulating that a variety of dietary components may have a protective effect against cancer; therefore, many argue that supplements are necessary—because they extend beyond the prevention of deficiency diseases to the prevention of chronic diseases such as cancer *(14)*. For example, the possible protective effects against certain diseases of several nutrients, especially vitamins C and E and beta carotene, have been well publicized *(13)*.[1]

Consequently, public interest in dietary supplements has been intense. The Council for Responsible Nutrition reported a 19-percent increase in retail sales of supplements between 1987 and 1992 and estimated that about 40 to 50 percent of the U.S. population uses vitamin and mineral supplements *(18)*. According to the American Dietetic Association 1997 Nutrition Trends Survey, 35 percent of Americans believe vitamin supplements are necessary to ensure proper health, an increase from prior surveys (28 percent in 1995 and 27 percent in 1993 and 1991) *(2)*.

Despite the popularity and potential benefits of dietary supplements, few studies have examined the effect of sociodemographic, lifestyle, and attitudinal factors on the intake of dietary supplements. Using the 1992 National Health Interview Survey, researchers found that demographic and lifestyle

[1]Omenn et al.'s *(14)* study, combined with the ATBC Cancer Prevention Study *(1)* and the Physicians' Health Study *(6)*, however, brings to doubt the efficacy and safety of supplemental beta carotene or vitamin A in reducing the burdens of cancer or heart disease in certain populations.

characteristics and the diet of supplement users are typical factors associated with low risk of chronic disease *(18)*. Analyzing the National Health and Nutrition Examination Survey (NHANES) II data collected between 1976 and 1980, other researchers found that supplement use was more common among women, Whites, older persons, and those with more years of education and higher income *(10)*.

Stewart et al. *(19)* and Subar and Block *(20)* found that supplement use was most common in the western United States and among whites, women, older persons, those with higher incomes, those with higher education, and nonsmokers. Kolasa, Lackey, and Poehlman *(9)* found that special diet and attitudinal variables, such as an individual's willingness to make needed dietary changes, influence the intake of vitamin supplements. A review of research on the effects of exercise on vitamin status revealed that vitamin supplementation continues to be widely practiced by athletes in an effort to deal more readily with the rigors of training *(3)*.

Most of these studies have also disclosed the positive correlation between vitamin supplement intake and more healthful diets. These studies, however, used older data sets when dietary supplements were not as popular. Thus the findings may no longer represent current conditions. The intense scientific and popular interest in recent years in dietary supplements has increased the need for more current information on factors affecting individual supplement use. The objective of our study is to better understand the relationships between sociodemographics, lifestyle characteristics, and a number of attitudinal factors and the intake of dietary supplements.

Table 1. Description, means, and percentages of the variables used in the analysis

Name	Description	Mean/ percent
Dependent variable		
Suppl	1 if respondent is taking dietary supplement; 0 otherwise	0.49
Independent variables		
Income	Household income (thousand dollars)	33.59
Black	1 if respondent is Black; 0 otherwise	0.12
Other	1 if respondent is of some other race; 0 otherwise	0.05
Age	Age of respondent in years	48.48
City	1 if respondent resides in the city; 0 otherwise	0.32
Nonmetro	1 if respondent resides nonmetro area; 0 otherwise	0.26
Fstamp	1 if respondent is a food stamp recipient; 0 otherwise	0.08
Preglact	1 if respondent is pregnant or lactating; 0 otherwise	0.01
Male	1 if respondent is male; 0 otherwise	0.48
Unemployed	1 if respondent is unemployed; 0 otherwise	0.40
HHsize	Household size	2.66
Grade	Number of years of education	12.64
BMI	Body mass index	26.36
Health[1]	Respondent's perception of own health	2.52
Specdiet	1 if respondent is on special diet; 0 otherwise	0.18
Smoke	1 if respondent smokes; 0 otherwise	0.25
Know[2]	Degree of agreement with the statement that ''eating a variety of foods each day gives you all the vitamins and minerals you need''	3.06
Disease[2]	Degree of agreement with the statement that ''what you eat can make a big difference in your chance of getting a disease, like heart disease or cancer''	3.47
Belief[2]	Degree of agreement with the statement that ''the things I eat and drink now are healthy so there is no reason for me to make changes''	2.61
Exercise[3]	How often the respondent exercises	3.83
TVhours	Number of hours respondent watched TV or videotape yesterday	2.54

Note: Base group includes White, suburban, not a food stamp recipient, not pregnant or lactating, female, employed, not on a special diet, not smoking.
[1]Responses range from 1 to 5 where 1 = ''poor'' and 5 = ''excellent.''
[2]Responses range from 1 to 4 where 1 = ''strongly disagree'' and 4 = ''strongly agree.''
[3]Responses range from 1 to 6 where 1 = ''daily'' and 6 = ''rarely or never.''

Methods

We hypothesized that the likelihood of taking dietary supplements is a function of income, race, gender, urbanization, whether the individual is a food stamp recipient, whether the individual is pregnant or lactating, age, employment status, household size, education, body mass index (BMI), the individual's perception of own health, special diet status, whether the individual smokes, degree of exercise, number of television hours, a nutritional knowledge factor, a diet-disease variable, and a belief about diet factor. Therefore, our empirical model is specified as follows:

$$Suppl = f_i\ (income, Black, other, age, city, nonmetro, fstamp, preglact, male, unemployed, hhsize, grade, BMI, health, specdiet, smoke, know, disease, belief, exercise, tvhours).$$

The description of the variables and their means/percentages are exhibited in table 1. The significance level chosen for this analysis was 0.05.[2] The dependent variable is measured on a scale that is discrete and binary. Hence, a logit model, estimated through maximum likelihood, is used in the analysis.

Data

We used the 1994 Diet and Health Knowledge Survey (DHKS) from the U.S. Department of Agriculture. The target individuals in this survey were randomly selected from among eligible sample persons 20 years of age and older who had provided a complete Day 1 intake record in the 1994 Continuing Survey of Food Intakes by Individuals (CSFII). Data in this survey were collected by telephone interviews (in-person interviews for those without telephones). A total of 1,879 individuals participated in the DHKS survey. Because of some incomplete data, we used 1,525 observations in this analysis.

Results and Discussion

Food stamp recipients were less likely to take dietary supplements than those who were not food stamp recipients (table 2). This finding may have implications for any future plan to allow recipients to use food stamps to purchase dietary supplements. Results also indicate that those who were pregnant or lactating were more likely to take dietary supplements than those who were not pregnant or lactating. This result is particularly important; because, those who are pregnant or lactating are more in need of nutrients to sustain a healthy body and nourish a fetus or a baby.

As expected, males were less likely to take dietary supplements than were females, a finding that is consistent with those of Koplan et al. *(10)* and Slesinski, Subar, and Kahle *(18)*. Previous studies imply that men are typically less interested in diet and health issues than are women *(8,15)*. A study of Washington State residents revealed that females reported significantly more changes to healthful dietary practices than males reported *(15)*.

Household size was negatively related to the likelihood of taking dietary supplements. This finding suggests that larger households may not be able to afford supplements for all members.

Results generally suggest that those who are male, food stamp recipients... are less likely to take dietary supplements than others are.

[2]No degrading multicollinearity problems were detected based on the collinearity diagnostic tests conducted.

Education was positively related to the likelihood of taking dietary supplements, a result that is consistent with other research *(10,18)*.

Individuals with a higher BMI and those who believed their health was better were less likely than their counterparts to take dietary supplements. The reason for these results is not clear. However, it is possible that those with a higher BMI or those who believe that their health is better may think that they do not need dietary supplements; because, they perceive themselves to have adequate intakes of vitamins already. Although not directly comparable, this finding may be related to Pelletier and Kendall's *(16)* hypothesis that supplement users with unhealthful attitudes and beliefs may be using supplements to compensate for a diet and lifestyle that they perceive to be unhealthful. Their study suggested that this hypothesis may not apply equally to all age and ethnic groups.

Individuals who were on a special diet, however, were more likely than their counterparts to take dietary supplements; whereas, smokers were less likely than nonsmokers to take dietary supplements. The finding regarding the special diet is important: previous studies suggest that patients who are on a special diet (e.g., weight control) may not get enough vitamins in their food *(9)*. Our finding about dietary supplement usage among smokers and nonsmokers is consistent with prior expectations (because smokers are believed to be less interested in health) and is also consistent with those of Subar and Block *(20)*.

Those who agree with the statement that ''eating a variety of foods each day gives you all the vitamins and minerals you need'' were less likely to take dietary supplements. Although not directly comparable, this finding may be related to, and consistent with, research that indicates that users of dietary supplements have diets more consistent with current dietary guidelines *(18)*. Individuals who exercised less often than others were less likely to take dietary supplements, a finding that is consistent with that of Armstrong and Maresh *(3)* concerning the effects of dietary supplementation on exercise performance. In general, the results pertaining to gender and education were consistent with those of previous studies. Unlike the findings in previous studies, the results in the present study indicate that race, age, and income do not statistically affect the likelihood of taking dietary supplements.

Table 2. Parameter estimates of the model

Variable	Parameter	Standard error	Odds ratio
Intercept	1.850*	0.643	
Income	0.003	0.002	1.003
Black	0.165	0.180	1.179
Other	-0.343	0.256	0.709
Age	0.003	0.004	1.003
City	-0.136	0.133	0.873
Nonmetro	-0.102	0.137	0.903
Fstamp	-0.418*	0.200	0.658
Preglact	2.202*	1.067	9.040
Male	-0.551*	0.112	0.576
Unemployed	-0.066	0.141	0.935
HHsize	-0.149*	0.043	0.861
Grade	0.061*	0.022	1.063
BMI	-0.037*	0.010	0.963
Health	-0.117*	0.058	0.890
Specdiet	0.499*	0.148	1.647
Smoke	-0.324*	0.131	0.724
Know	-0.186*	0.064	0.830
Disease	0.031	0.072	1.031
Belief	0.035	0.063	1.036
Exercise	-0.118*	0.029	0.888
TVhours	-0.004	0.023	0.996
Sample size	1525		
McFadden R^2	0.08		
Correct prediction (%)	61.4		

*$p \leq 0.05$.

Concluding Remarks

The possible benefits and detrimental effects of dietary supplements to health promotion and disease prevention have been increasingly documented in scientific studies and the popular press *(5,12,14,17)*. Consequently, many supplements—that bridge the gap of marginal diets—are now available at retail stores *(7)*. Yet few studies have analyzed the influence of consumers' sociodemographic factors on the intake of dietary supplements. This study updates past work by using recent data to analyze the effect of not only sociodemographic factors but also lifestyle characteristics and attitudinal factors on the intake of dietary supplements.

Results generally suggest that those who are male, food stamp recipients, not pregnant or lactating, in larger households, less educated, with higher BMI, with higher perception of their own health, not on special diet, smokers, and those who do not often exercise are less likely to take dietary supplements than others are. In addition, people who believe that eating a variety of foods each day gives all the vitamins and minerals they need are less likely than others to take dietary supplements. This study did not analyze actual nutrient intakes; thus, more work is needed to pinpoint definitively those individuals who are at most risk of consuming inadequate vitamins/minerals.

Based on the number of respondents in this study (49 percent) who took dietary supplements, we believe it is absolutely critical that researchers consider nutrients from supplements, along with dietary sources, when assessing individual intake and when monitoring the nutrient intake of the U.S. population. According to Slesinski, Subar, and Kahle *(18, p.5)*, ''failure to include nutrients from supplements may produce errors in nutrient estimates and misclassifications of persons with regard to their total intake.'' Dietary surveys (e.g., CSFII-DHKS) should also make sure that intakes from supplements are collected so that researchers can analyze not only intakes from foods consumed but also intakes from supplements taken. Admittedly, technical and methodological difficulties are inherent in collecting detailed information on supplement intake, not to mention the costs associated with such surveys in terms of respondent burden and survey costs. These problems must be addressed, however, if issues about the intake of dietary supplements ever can be definitively answered by researchers.

References

1. The Alpha-Tocopherol, Beta Carotene Cancer Prevention Study Group. 1994. The effect of vitamin E and beta carotene on the incidence of lung cancer and other cancers in male smokers. *New England Journal of Medicine* 330:1029-1035.

2. The American Dietetic Association 1997 Nutrition Trends Survey. 1997. The American Dietetic Association. Chicago, Illinois.

3. Armstrong, L. and Maresh, C. 1996. Vitamin and mineral supplements as nutritional aids to exercise performance and health. *Nutrition Reviews* 54*(4)*:s149-s158.

4. Federation of American Societies for Experimental Biology, Life Sciences Research Office. Prepared for the Interagency Board for Nutrition Monitoring and Related Research. 1995. *Third Report on Nutrition Monitoring in the United States: Executive Summary.* U.S. Government Printing Office, Washington, DC, 51 pp.

5. Greenwald, P. and Clifford, C. 1995. Dietary prevention. In P. Greenwald, B. Kramer, and D. Weed (Eds.), *Cancer Prevention and Control* (pp. 303-327). Marcel Dekker, New York.

6. Hennekens, C.H., Buring, J.E., Manson, J.E. et al. 1996. Lack of effect of long term supplementation with beta carotene on the incidence of malignant neoplasms and cardiovascular disease. *New England Journal of Medicine* 334:1145-1149.

7. Hunt, J.R. 1996. Position of the American Dietetic Association: Vitamin and mineral supplementation. *Journal of the American Dietetic Association* 96*(1)*:73-77.

8. Kim, I., Williamson, D.F., Byers, T., and Koplan, J.P. 1993. Vitamin and mineral supplement use and mortality in a US cohort. *American Journal of Public Health* 83:546-550.

9. Kolasa, K.M., Lackey, C., and Poehlman, G. 1996. When patients ask about vitamin-mineral supplements. *Patient Care* 30*(14)*:85-102.

10. Koplan, J.P., Annest, J.L., Layde, P.M., and Rubin, G.L. 1986. Nutrient intake and supplementation in the United States. *American Journal of Public Health* 76:287-289.

11. Krantz, M. 1997(May 12). The Self-Medication Generation. *Time* 149:72.

12. Michels, K.B. and Willett, W.C. 1994. Vitamins and cancer: A practical means of prevention? In V. DeVita, S. Hellman, and S. Rosenberg (Eds.), *Important Advances in Oncology (*pp. 85-114). J.B. Lippincott, Philadelphia.

13. National Research Council, Committee on Diet and Health. 1989. *Diet and Health: Implications for Reducing Chronic Disease Risk*. National Academy Press, Washington, DC.

14. Omenn, G., Goodman, G., Thornquist, M., Balmes, J., Cullen, M., Glass, A., Keogh, J., Meyskens, F., Valanis, B., Williams, J., Barnhart, S., and Hammar, S. 1996. Effects of a combination of beta carotene and vitamin A on lung cancer and cardiovascular disease. *New England Journal of Medicine* 334*(18)*:1150-1155.

15. Patterson, R.E., Kristal, A.R., and White, E. 1996. Do beliefs, knowledge, and perceived norms about diet and cancer predict dietary change? *American Journal of Public Health* 86*(10)*:1394-1400.

16. Pelletier, D.L. and Kendall, A. 1997. Supplement use may not be associated with better food intake in all population groups. *Family Economics and Nutrition Review* 10*(4)*:32-44.

17. Rucker, R.B. and Stites, T. 1994. New perspectives on function of vitamins. *Nutrition* 10:507-513.

18. Slesinski, M.J., Subar, A.F., and Kahle, L.L. 1995. Trends in use of vitamin and mineral supplements in the United States: The 1987 and 1992 National Health Interview Surveys. *Journal of the American Dietetic Association* 95*(8)*:921-923.

19. Stewart, M.L., McDonald, J.T., Ley, A.S., Schucker, R.E., and Henderson, D.P. 1985. Vitamin/mineral supplement use: A telephone survey of adults in the United States. *Journal of the American Dietetic Association* 85:1585-1590.

20. Subar, A.F. and Block, G. 1990. Use of vitamin and mineral supplements: Demographics and amounts of nutrients consumed: The 1987 Health Interview Survey. *American Journal of Epidemiology* 132:1091-1101.

21. Yates, A.A., Schlicker, S.A., and Suitor, C.W. 1998. Dietary Reference Intakes: The new basis for recommendations for calcium and related nutrients, B vitamins, and choline. *Journal of the American Dietetic Association* 98*(6)*:699-706.

Insight 7

The Diet Quality of Americans: Strong Link With Nutrition Knowledge

The following is a reprinted *Nutrition Insights*, a publication of the Center for Nutrition Policy and Promotion.

Mark Lino[1]
P. Peter Basiotis[1]
Rajen S. Anand[1]
Jayachandran N. Variyam[2]

The recently released report, *The Healthy Eating Index: 1994-96*, reveals that although Americans' overall diet quality has improved slightly in the last decade, it still needs much improvement. The Healthy Eating Index (HEI) is a summary measure of people's overall diet quality. It is computed on a regular basis by the U.S. Department of Agriculture's Center for Nutrition Policy and Promotion (CNPP). The most recent HEI is for 1996—the latest year for which national data are available. These data are from USDA's 1996 Continuing Survey of Food Intakes by Individuals, a nationally representative survey containing information on food consumption and nutrient intake. This *Nutrition Insight* presents the 1996 HEI for the U.S. population age 2 and over.

How the Healthy Eating Index Is Computed

The Healthy Eating Index consists of 10 components, each representing different contributions to a healthful diet: Components 1-5 measure the degree to which a person's diet conforms to the USDA's Food Guide Pyramid serving recommendations for the five major food groups: Grains (bread, cereal, rice, and pasta), vegetables, fruits, milk (milk, yogurt, and cheese), and meat (meat, poultry, fish, dry beans, eggs, and nuts). Component 6 measures total fat consumption as a percentage of total food energy (calorie) intake. Component 7 measures saturated fat consumption as a percentage of total food energy intake. Components 8 and 9 measure total cholesterol intake and total sodium intake, respectively. And component 10 measures the degree of variety in a person's diet.

Each component of the Index has a maximum score of 10 and a minimum score of zero. Intermediate scores are computed proportionately. High component scores indicate intakes close to recommended ranges or amounts; low component scores indicate less compliance with recommended ranges or amounts. The maximum combined score for the 10 components is 100. An HEI score above 80 implies a ''good'' diet, an HEI score between 51 and 80 implies a diet that ''needs improvement,'' and an HEI score less than 51 implies a ''poor'' diet.

Healthy Eating Index Scores

The 1996 average HEI score for the U.S. population is 64. The diet of most people (71 percent) is in the ''needs improvement'' range (fig. 1). Approximately 12 percent of the population have a good diet, and 17 percent have a poor diet. Most people meet the dietary recommendation for cholesterol on a given day; the average cholesterol score

[1]Center for Nutrition Policy and Promotion, U.S. Department of Agriculture.
[2]Economic Research Service, U.S. Department of

is 7.9 on a scale of zero to 10 (table). With an average score of 7.6, the variety score is the second best, indicating that people are heeding the message to eat a variety of foods.

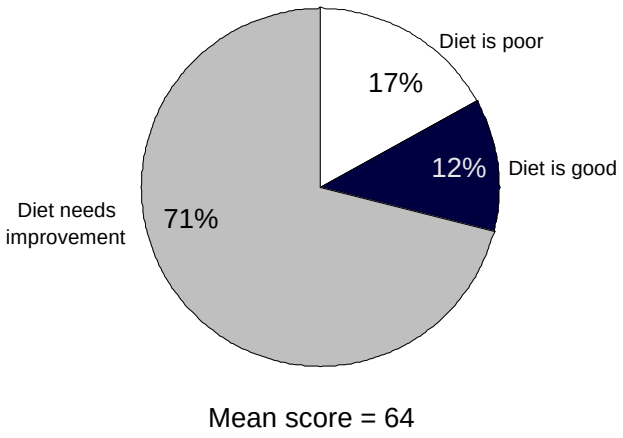
People score lowest on the fruits component of the HEI (3.8) and the milk component (5.4). Only 17 percent of people meet the dietary recommendation for fruits, and 26 percent meet the dietary recommendation for milk products on a given day. For the other HEI components, average scores are between 6 and 7 for the population. For all HEI components, with the exception of cholesterol and variety, fewer than 50 percent of people meet the dietary recommendations.

Healthy Eating Index Scores by Selected Characteristics

HEI scores vary by the demographic and socioeconomic characteristics of people. Females have an average HEI score two points higher than that of males (65 vs. 63). Children age 2 to 3 have the highest HEI score (73) among all age/gender groups, and as children age, their HEI score declines. By age 15 to 18, children's HEI scores average 60 (males) and 63 (females).

The HEI scores generally increase as level of education and level of income rise. People with household income 50 percent of the poverty threshold or below have an average HEI score of 61. By comparison, people with household income over three time the poverty threshold have an average HEI score of 65. Asian/Pacific Islander Americans have the highest average HEI score (68) among all racial groups, followed by Whites, with a score of 64, and African Americans, with a score of 59. By region, people who live in the Northeast have the highest HEI score (66), and those who live in the South have the lowest HEI score (61). An earlier report indicates that nutrition information can play a key role in improving dietary patterns and that it is partly responsible for these observed differences in HEI scores (box).

Figure 1. Healthy Eating Index rating and mean score, 1996



Healthy Eating Index components: Mean scores and percent meeting the dietary recommendations, 1996

	Component	Mean	Percent
1.	Grains	6.7	22
2.	Vegetables	6.3	32
3.	Fruits	3.8	17
4.	Milk	5.4	26
5.	Meat	6.4	26
6.	Total fat	6.9	38
7.	Saturated fat	6.4	40
8.	Cholesterol	7.9	72
9.	Sodium	6.3	35
10.	Variety	7.6	53

How Has the Healthy Eating Index Changed Over Time?

The HEI was first calculated for 1989. Since then, the diet of Americans has slightly, but significantly, improved. However, people's diets need further improvement. In 1989, the average HEI score for all people was 62, compared

Diet Quality and Nutrition Knowledge: A Strong Link

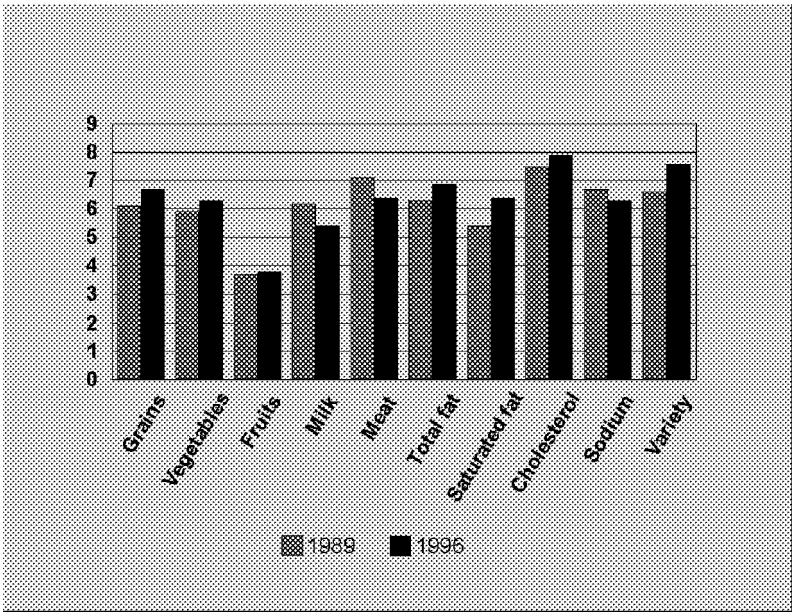
Women generally have a more healthful diet than men have. Older people generally have more healthful diets than do younger people. Those with more schooling generally have more healthful diets than those with less schooling have. Why? The report[1] *USDA's Healthy Eating Index and Nutrition Information*, published by USDA's Economic Research Service in collaboration with USDA's Center for Nutrition Policy and Promotion, finds that one reason for these dietary differences is that people with more healthful diets generally have a greater store of nutrition information and are more aware of the links between poor diet and certain diseases.

The report documents the influence on diet of socioeconomic characteristics, nutrition knowledge, and awareness of diet-disease relationships. For two individuals similar in most respects, the one scoring one point higher on a nutrition knowledge scale also scored four to five points higher on the Healthy Eating Index scale. Individuals with higher income or education tend to acquire more nutrition information and knowledge that, in turn, improves the quality of their diets. Informational differences also help explain the effects of gender, race, ethnicity, and income on diet quality. For example, women tend to have a higher stock of nutrition information than men have, and this is reflected in women's higher HEI scores.

These findings clearly illustrate the importance of nutrition education as a tool to help improve people's overall diets.

[1]Variyam, J.N., Blaylock, J., Smallwood, D. and Basiotis, P.P. April 1998. USDA's Healthy Eating Index and Nutrition Information. Food and Rural Economics Division, Economic Research Service, and Center for Nutrition Policy and Promotion, USDA. Technical Bulletin No. 1866. Available at http://www.econ.ag.gov/epubs/pdf/tb1866/.

Figure 2. Healthy Eating Index: Mean component scores, 1989 vs. 1996



with 64 in 1996. Between 1989 and 1996, the Federal Government introduced nutrition education initiatives, such as the Food Guide Pyramid and the Nutrition Labeling and Education Act, which may have contributed to this improvement. Scores increased for all HEI components from 1989 to 1996, except for milk, meat, and sodium (fig. 2). Scores improved the most for the saturated fat and variety components of the Index.

Summary

Most people have a diet that needs improvement. Americans especially need to improve their fruit and milk products consumption. Certain segments of the population (African Americans, teenagers, and people with low household income) tend to have lower quality diets. Nutrition educators can use these results in providing guidance and better targeting of nutrition programs to specific audiences.

Note: For additional results and more details on the Healthy Eating Index and how it is computed, the reader should see Bowman, S.A., Lino, M., Gerrior, S.A., Basiotis, P.P. 1998. *The Healthy Eating Index: 1994-96.* U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. CNPP-5. Available at *http://www.usda.gov/cnpp*.

Facts About Childhood Obesity and Overweightness

The following is a reprinted Fact Sheet distributed at the Symposium on Childhood Obesity: Causes and Prevention that was sponsored by the Center for Nutrition Policy and Promotion, October 27, 1998.

Overweight and obesity are important nutrition-related conditions in the United States. Some believe obesity is reaching epidemic proportions, particularly in the adult population. Many health professionals agree it is a chronic disease and associate it with other chronic conditions, including coronary heart disease, type II diabetes mellitus, hypertension, dyslipidemia, gallbladder disease, respiratory disease, some types of cancer, gout, and arthritis *(1)*. Because most methods for achieving weight loss are unsuccessful over time *(2)*, prevention continues to be the most viable option for controlling overweight.

The magnitude of obesity and overweightness is far-reaching—

- *About one in five children in the United States is now overweight (3).*
- *Overweight during childhood and adolescence is associated with overweight during adulthood (4).*
- *Parental obesity more than doubles the risk of adult obesity among both obese and non-obese children under 10 years of age (5).*
- *Over $68 billion are spent each year on direct health care related to obesity, representing 6 percent of total U.S. health care expenditures (6).*

The problem has grown over time—

- *The number of overweight children 6 to 17 years of age has doubled within three decades (3,8,9).*
- *The prevalence of overweight has increased from 7.6 to 10.9 percent for children age 6 to 11 years and from 5.7 to 10.8 percent for adolescents age 12 to 19 years between 1976-80 and 1988-91 (3,7).*

Diet plays a key role, but there is more to the problem—

- *Children with overweight parents had lower levels of physical activity and diets that were higher in fat and lower in carbohydrate (10,11,12).*
- *A review of the literature suggests that overweight among preschool children, as well as older children, may be associated less with increased energy intake and more with low physical activity (13).*

There is a relation to income, education, and ethnicity—

- *Poor White adolescents were about 2.6 times as likely to be overweight as those in middle- or high-income families, and adolescents with near-poor family income had an intermediate prevalence (14).*
- *There is little evidence for a pattern in the relationship between overweight prevalence and education of the family reference person. A pattern of decreasing overweight prevalence with increasing education of the family reference person is found only among non-Hispanic White male children and adolescents (8).*

- *Overweight and obesity rates among children and adolescents were highest for Mexican American males age 6 to 11 (17 percent), African American females age 6 to 19 (16 percent), and adolescents age 12 to 19 from low-income households (16 percent) (15).*

Reversing the trend in overweight will require changes in individual behavior, elimination of societal barriers, and better assessment tools—

- *Behaviors that have contributed to the increase in overweight prevalence for adults may be transmitted within the family setting and affect the weight status of children (8).*
- *Fewer than half of school children received daily physical education, with games and competitive sports being the mainstays of existing programs (16).*
- *For physical education programs to contribute to the public health goal of lifelong activity, they should include activities of moderate intensity and should not focus exclusively on team-oriented sports activities (17).*
- *Body Mass Index (BMI) is not as reliable a measure of fatness for children, especially across different ages and degrees of maturity, as it is for adults who have attained their peak height (8).*

The increased prevalence of overweight in children in the United States should be viewed in the context of similar increases occurring in other age groups in the United States and in many other societies around the world *(8)*.

References

1. Pi-Sunyer, F.X. 1993. Medical hazards of obesity. *Ann. Intern. Med.* 119:655-660.

2. NIH Technology Assessment Conference Panel. 1993. Methods for voluntary weight loss and control. *Ann. Intern. Med.* 119:764-770.

3. Troiano, R.P. et al. 1995. Overweight prevalence and trends for children and adolescents. The NHANES Surveys, 1963-1991. *Arch. Pediatr. Adolesc. Med.* 149:1085-1091.

4. Guo, S.S. et al. 1994. The predictive value of childhood body mass index values for overweight at age 35 years. *Am. J. Clin. Nutr.* 59:810-819.

5. Whitaker, R.C. 1997. Predicting obesity in young adulthood from childhood and parental obesity. *N. Engl. J. Med.* 337:869-873.

6. Wolf, A.M. 1998. What is the economic case for treating obesity? *Obesity Research* 6:2S-7S.

7. Kuczmarski, R.J. et al. 1994. Increasing prevalence of overweight among U.S. adults: The NHANES Surveys, 1960 to 1991. *Journal of the American Medical Association* 272:205-211.

8. Troiano, R.P. and Flegal, K.M. 1998 (March Suppl.). Overweight children and adolescents: Description, epidemiology, and demographics. *Pediatrics* 101*(3)*:497-504.

9. National Institute of Diabetes and Digestive and Kidney Diseases. 1996 (July 1). *Statistics Related to Overweight and Obesity*. NIH Publication 96-4158. National Institutes of Health, Rockville, MD.

10. Eck, L.H., Klesges, R.D. et al. 1992. Children at familial risk for obesity: An examination of dietary intake, physical activity and weight status. *International Journal on Obesity* 16:71-78.

11. Vara, L. and Agras, W.S. 1989. Caloric intake and activity levels are related in young children. *International Journal on Obesity* 13:613-617.

12. Klesges, R.D., Eck, L.H. et al. 1990. The effects of obesity, social interactions, and the physical environment on physical activity in preschool children. *Health Psychology* 9:435-449.

13. Schlicker, S.A. et al. 1994. The weight and fitness status of United States children. *Nutrition Reviews* 52:11-17.

14. National Center for Health Statistics. 1998. *Health, United States 1998 with Socioeconomic Status an Health Chart Book*. DHHS Publication No. (PHS) 98-1232. Hyattsville, MD.

15. Public Health Service. 1998. *Healthy People 2010: National Health Promotion an Disease Prevention Objectives*. DHHS Publication draft for comment.

16. Public Health Service. 1990. *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*. Publication PHS 90-50212. U.S. Department of Health and Human Services.

17. Sallis, J.F. and McKenzie, T.L. 1991. Physical education's role in public health. *Res. Q. Exercise Sport* 62:124-137 [Medline].

Earnings of Husbands and Wives in Dual-Earner Families

How important is a wife's earnings? To what extent is a wife in a dual-earner family the primary earner? Between 1970 and 1993, dual-earner couples rose from 39 to 61 percent of all married couples. Data also showed that married women's participation in the labor force increased substantially, moving from 35 percent in 1966 to 61 percent in 1994. During the same period, the participation rate for married women with children less than 3 years old was even more dramatic, rising from 21 to 60 percent. Thus these trends show that dual-earner couples are replacing the traditional married-couple model of a ''breadwinner'' husband and a ''homemaker'' wife. This research has implications regarding the wife's earnings and the role she assumes in decision-making about family finances and career choices. It is believed that at least in some families, the greater the wife's relative earnings, the more control she is likely to have over family financial decisions.

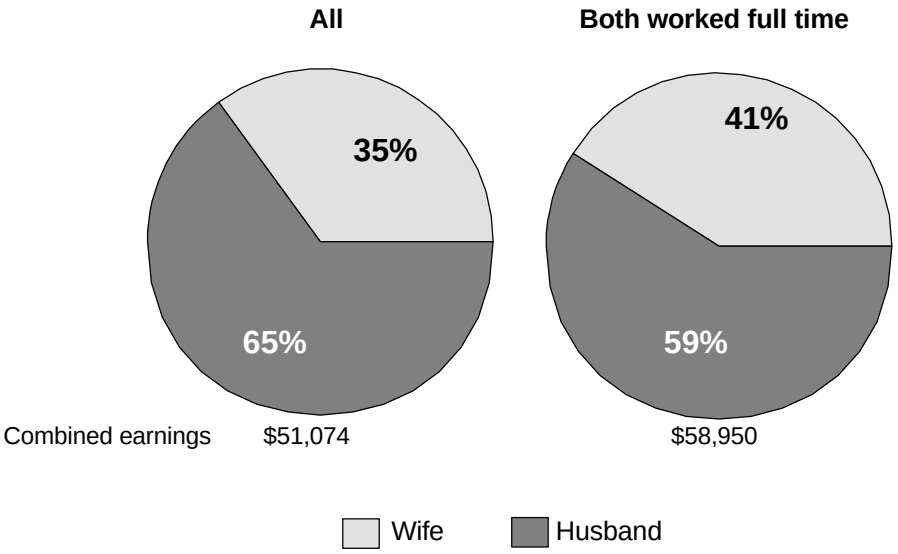
This report examines husbands' and wives' relative labor-market earnings to provide insight on the status of women in dual-earner families. Three types of wages were compared: Hourly, annual, and median weekly ''career.'' In this study, husbands and wives were placed in 1 of 42 ''career'' categories, including such occupations as engineers, secretaries, and construction trades. Then the husband and wife were each assigned the median weekly earnings figure that corresponded to their occupation based on the Bureau of Labor Statistics' periodical *Employment and Earnings* (January 1993). This report on dual-earner couples also examines whether ''positive assortative mating'' is related to the education of dual-earner couples, as well as to their earnings and wages. Assortative mating refers to the belief that husbands and wives do not randomly pair together but rather tend to follow a process referred to as ''positive assortative mating''–that is, more highly educated, higher wage men tend to pair with more highly educated, higher wage women; while less educated, lower wage men tend to pair with less educated, lower wage women.

The sample, drawn from the March 1993 Annual Demographic File of the Current Population Survey (CPS), consisted of matched pairs of husbands and wives and was weighted to reflect the population. The 21.9 million dual-earner couples were ages 25 to 64, and both spouses were wage or salary workers who had positive earnings in 1992. Husbands and wives with farm or self-employment income were not included. Also, the sample was restricted to those with computed hourly wages of $100 or less because of the topcoding in the CPS.

Marital Sorting, Educational Attainment, and Wages

''Positive assortative mating'' is related to dual-earners' education and combined 1992 wage and salary earnings from all jobs worked. About 50 percent of husbands in dual-earner couples had the same level of education as the wives. Furthermore, in 78 percent of all dual-earner couples, the husband had the same or more education than the wife had, probably reflecting both gender differences in educational attainment and social custom. In contrast, nearly 30 percent of husbands and wives in dual-earner couples had individual

Distribution of combined mean annual earnings of dual-earner couples, March 1993



wages in the same quintile. In about two-thirds (64 percent) of dual-earner couples, the husband's wage was in the same or higher quintile as the wife's wage. Also, findings showed that assortative mating had a clear influence on the combined earnings among dual-earner couples. For both the husband and wife with wages in the lowest quintile, the combined average earning was $17,936 per year. For dual-earner couples—both with wages in the highest quintile—the average combined earning was $97,324 per year.

Relative Wages and Earnings of Husbands and Wives

Higher percentages of wives in dual-earner couples earned more than their husbands based on median weekly career wages, followed by hourly wages and annual wages. Comparisons of *median weekly career* wages showed that, overall, 33 percent of the wives in dual-earner couples earned more than their husbands. Sixty-three percent earned more than their husbands when the husbands' career wage was in the first quintile; 29 and 6 percent earned more than their husbands when the husbands' wage was in the third and fifth quintile, respectively. The wives' weekly ''career'' wages were $415, $440, and $529, and the husbands' weekly ''career'' wages were $322, $505, and $756 for the first, third, and fifth quintiles, respectively. Data constraints, however, explain partially some wage differences. The husband's wage was topcoded; whereas, the wife's wage was not.

Overall, 25 percent of the wives had higher average *hourly* wages than their husbands had in 1992. However, as husbands' average hourly wages increased, wives' average hourly wages were less likely to outpace that of husbands'. Fifty-seven percent of the wives earned more than the husbands whose wages were in the first quintile, compared with 21 percent whose husbands' hourly wages were in the third quintile, and 7 percent for those wives whose husbands had hourly wages in the fifth quintile. The wives' mean hourly wages were $8.09, $10.36, and $13.45, and the husbands' mean hourly wages were $6.06, $13.67, and $28.14 for the first, third, and fifth quintiles, respectively.

One-fifth (20 percent) of the wives in dual-earner couples had an annual earning that exceeded that of their husbands. Among these dual-earner couples, over half (55 percent) of the wives earned more than the husbands when the husbands' income was in the first quintile. When the husbands' income was in the third and fifth quintiles, the percentage of wives earning more than the husbands dropped: 14 and 2 percent, respectively. For the first, third, and fifth quintiles, respectively, the wives' mean annual earnings were $14,469, $18,141, and $21,732; the husbands' mean annual earnings were $10,085, $29,492, and $62,810.

Results also showed that for all dual-earner couples, wives' average annual earnings were a little more than one-third of combined earnings; for dual-earner couples where both spouses worked full time and year round, wives' earnings made up about two-fifths of the annual combined earnings (figure). On average, a wife whose husband's annual earnings were in the fifth quintile contributed 26 percent to combined earnings. In contrast, a wife whose husband's annual earnings were in the first quintile contributed 59 percent to combined earnings.

Source: Winkler, A.E., 1998, Earnings of husbands and wives in dual-earner families, *Monthly Labor Review* 121*(4)*:42-48.

Retirement Prospects of Baby Boomers

The baby-boom generation consists of about 78 million persons who were born from 1946 to 1964 inclusive. This generation represented 29 percent of the 1997 U.S. population, and when it reaches old age, our retirement system and health care institutions could be strained. The Bureau of the Census estimates that there will be twice as many persons age 65 or older in 2030 as there are today: 69 million (20 percent of the population) versus 34 million (13 percent of the population). Likewise, the Bureau's population projection, from its middle series, shows 18 million persons age 85 or older in 2050 (4½ percent of the U.S. population); now, there are less than 4 million persons in that age group (1½ percent of the U.S. population).

Generalizations about all baby boomers cannot be made: the baby-boomer generation is diverse, and this diversity will continue when this generation reaches retirement age. In addition, all projections about the economic status of baby boomers in retirement are subject to much uncertainty. All models that are used to produce projections are sensitive to various assumptions. However, researchers can identify specific subgroups of baby boomers that are likely to do better or worse than baby boomers in general. This article summarizes results from several studies concerning the financial prospects of baby boomers in their elderly years. Reports by the following government agencies, organizations, and authors are discussed.

- Congressional Budget Office (CBO), 1993
- Easterlin, Schaeffer, and Macunovich, 1993
- American Association of Retired Persons (AARP), 1994
- Bernheim, 1993
- Kotlikoff and Auerbach, 1994

Studies

Congressional Budget Office, 1993

The CBO study compared the actual income and wealth of baby boomers with that of their parents' generation at the same age and discussed the prospects for the economic well-being of the baby boomers in retirement. Incomes of baby boomers in 1989 were compared with incomes of their parents' generation at the same age in 1959. Using the 1960 Decennial Census and the March 1990 Current Population Survey, the CBO found that baby boomers in retirement generally should be better off than their parents, but some subgroups might not be.

The study examined income change for several socioeconomic subgroups of baby boomers and their parents—classifications by marital status of the householder, number of children in the household, education of the householder, and relative income level. Except for households where the householder did not have a high school education, all subgroups had increases in median income (constant dollars) from 1959 to 1989. The net worth of baby boomers (ages 25 to 34 and 35 to 44) and that of their parents' generation at the same age were also examined. The CBO used data from the 1962 Survey of Financial Characteristics of Consumers and the 1989 Survey of Consumer Finances. The study revealed that during the period, median constant dollar wealth rose for all households, married-head households, and unmarried- head households in both age groups.

The CBO report discussed factors that would be important when looking at the prospects for the economic well-being of baby boomers in retirement. For example, real wages should rise during the next 20 to 40 years, but the rate of growth will be less than that of the 1950's and 1960's. The Social Security retirement age will rise to age 67, and the Social Security earnings test has been made more liberal: factors that might influence people to retire later. Social Security and private pensions are likely to remain important sources of retirement income for baby boomers.

The CBO study concluded that baby boomers with low educational attainment, those who are not married, and those who are not homeowners are more likely than other boomers to have less retirement income than their parents' generation. At-risk groups include younger baby boomers with less than a high school education and younger baby boomers who are single and have children. General sources of risk for baby boomers in retirement are uncertain medical expenses, the size of educational expenses for their children, and uncertainty about average life expectancy when they reach retirement.

Radner prepared estimates of income that are similar to those in the CBO report but also included data in 1994 constant dollars. The oldest baby boomers, ages 45 to 49 in 1994, had median income that was 66 percent above the median for their parents' generation in 1964. The percentage increases for the other baby-boomer cohorts were 54 percent for those ages 40 to 44, 59 percent for those ages 35 to 39, and 51 percent

for those ages 30 to 34. These results were consistent with those reported by the CBO.

Easterlin, Schaeffer, and Macunovich, 1993

The Easterlin, Schaeffer, and Macunovich study, using data from the CPS, compared the actual incomes of baby boomers with the incomes of persons 25 years older—assumed to be in their parents' generation. The researchers used four baby-boomer birth cohorts: 1946-50, 1951-55, 1956-60, and 1961-65. (Those born in 1965 are not considered baby boomers.) This study found that the baby boomers were better off than their parents and other cohorts at the same age, but the gap may be narrowing over time.

Baby boomers' median income was about two-thirds higher than it was for their parents' generation at the same age. The difference was slightly higher for the oldest cohort and slightly lower for the youngest cohort. Easterlin, Schaeffer, and Macunovich's study concluded that the income of the baby boomers in retirement probably will be higher than that of their parents' in retirement. This conclusion is based primarily on the fact that life-cycle income patterns up to the observed ages of the baby boomers are not very different from those of earlier cohorts.

Savings rates for baby boomers were found to be similar to those of cohorts that preceded them in recent decades. Home ownership rates generally are similar for baby boomers and their parents' generation. Median net worth for the early baby boomers was more than double the median for their parents' generation. In general, wealth and income improved by about the same percentage for baby boomers, compared with their parents. The Easterlin, Schaeffer, and Macunovich study concluded that, based on both income and wealth, (1) baby boomers are doing considerably better than their parents' cohort did at similar ages; (2) it is likely that the difference will continue for the retirement of baby boomers; and (3) low-income younger baby boomers, who may fall behind corresponding persons in their parents' generation, are particularly at risk.

Radner updated the Easterlin, Schaeffer, and Macunovich's income comparisons by using estimates for 1970 through 1995, with observations every 5 years. Radner's results showed that the income of all four baby-boom cohorts[1] exceeded the income of their parents' generation. The youngest of the baby-boom cohorts had the smallest increase in income. Poverty rates were also compared. There was a tendency for the poverty rate to fall as each cohort aged.

American Association of Retired Persons, 1994

The American Association of Retired Persons (AARP) used the Pension and Retirement Income Simulation Model to estimate and project the income of old baby boomers in 2030 when they will be 66 to 84 years old. The AARP study presented four conclusions:

1. Within the baby-boom generation, an economic underclass—composed mainly of blacks, single women, and those with little education—will remain in that status in retirement.

2. The retirement incomes of younger baby boomers are more sensitive to differences in the future of the economy than are the retirement incomes of older baby boomers, mainly because the younger group has a greater percentage of its working life remaining.

3. Subgroups of the baby-boom generation with low incomes now are likely to do relatively poorly in retirement.

4. Because of general uncertainty, all baby boomers face some risk of inadequate income in retirement.

AARP projects that most baby boomers will be retired in 2030 and will have a real median income 70 percent higher than that of the corresponding age group in 1990. This increase will be caused by the assumed growth in real wages, the increase in women's labor force participation that will produce higher retirement income, and more people receiving pension income. In 2030, about 12 percent of female baby boomers and 2½ percent of male baby boomers are projected to be poor or near poor; over one-third of never-married, divorced, or separated women will be poor or near poor (compared with about 5 percent of men in those categories); and about 75 percent of baby boomers will receive Social Security benefits and pension income and asset income in 2030. Social Security benefits are projected to account for over half of the retirement income of 56 percent of baby boomers (about the same as the percentage in 1990).

Bernheim, 1993

Using estimates of the adequacy of the saving of baby boomers based on their saving behavior thus far, the Bernheim study examined the wealth baby boomers

[1] 1946-50, 1951-55, 1956-60, 1961-65.

would need to maintain adequate consumption in retirement, relative to preretirement consumption. It then compared an estimate of the saving rate of baby boomers thus far with the estimated rate needed. The author used data from the Current Population Survey and the Survey of Consumer Finances and made two assumptions: home equity would not be used to finance consumption in retirement, and savings would be used only for consumption in retirement and not for other purposes.

Findings showed that baby boomers generally are saving too little to maintain preretirement consumption. Bernheim constructed a life-cycle simulation model that provided estimates of the amount of savings needed to sustain consumption in retirement at a level consistent with preretirement consumption. The baby-boomer saving rate was only 34 percent of the required rate when home equity was excluded, but the saving rate was 84 percent of the required rate when home equity was included as a source of consumption in retirement. Bernheim's data are for wealth at a particular time, not for saving (that is, change in wealth). Also, he did not take inheritances into account.

Kotlikoff and Auerbach, 1994

Kotlikoff and Auerbach made projections of mean income and consumption at age 65 for three birth-year cohorts—1946, 1955, and 1964. Using data from the Survey of Income and Program Participation, the Consumer Expenditure Survey (CES), and the CPS, the authors found that baby boomers are poorly prepared financially for retirement because of inadequate saving. The oldest baby boomers at age 65 are projected to have consumption that is higher than the cohort's consumption in 1992 and higher than the consumption of 65-year-olds in 1992 if medical transfers are included in consumption, assuming there is no policy change. If medical transfers are excluded, the oldest baby boomers will have lower consumption in 2011 than in 1992 but will still have higher consumption than 65-year-olds had in 1992. The youngest baby boomers are projected to have slightly lower consumption at age 65 than today's 65-year-olds when consumption excludes medical transfers, lower consumption than that of the other baby-boomer cohorts at each age, and higher consumption at age 65, compared with their current consumption.

Kotlikoff and Auerbach also projected the percentage of each baby-boomer cohort that will have lower consumption than the median consumption of 65-year-olds in 1992. Assuming no policy changes and excluding medical transfers, the projections show that 40 percent of the oldest baby boomers, 42 percent of the middle baby boomers, and 50 percent of the youngest baby boomers will have consumption at age 65 that is less than the median consumption of those age 65 in 1992. This study concluded that the three age cohorts (1946, 1955, and 1964) will just be able to maintain their standard of living when they reach age 65—if there are no changes in policy. At each age, the 1964 cohort is projected to have a lower standard of living than the 1946 cohort at each age.

Conclusions

The consensus of these studies of the baby-boom generation points to the following: until now, baby boomers have had a higher economic status than their parents' generation did at the same ages. The baby boomers also have a higher economic status than preceding cohorts. When the baby-boom generation becomes elderly in the 21st century, its members probably will have a higher economic status than their parents' generation has and still have at those ages. However, compared with their parents' generation, some subgroups of the baby-boom generation do not have higher economic status. Baby boomers need to increase their saving in the coming years, and they may need to retire at later ages to maintain in their retirement years their preretirement standard of living.

Projections should be used with caution if they are used for policy purposes. No reliable projection of the overall status of the baby-boom generation in retirement is possible: factors such as the performance of the economy in the future, the saving behavior and the retirement behavior of baby boomers, asset values, and changes in policy and programs are uncertain. Also, two aspects of the measurement of economic status are problematic. First, putting a value on medical transfers is difficult, and such transfers often are not included in estimates of baby boomers' economic status. Second, in their elderly years, baby boomers are likely to hold substantial equity in their homes, which perhaps should be counted as part of their standard of living.

Source: Radner, D.B., 1998, The Retirement Prospects of the Baby Boom Generation, *Social Security Bulletin* 61*(1)*:3-18.

Clinical Guidelines: Identification, Evaluation, and Treatment of Overweight and Obesity in Adults

Overweight[1] and obesity are the second leading cause of preventable death in the United States today. Roughly 97 million American adults 20 years old or older are overweight or obese—55 percent of the adult population. This condition raises substantially adults' risk of morbidity from a number of diseases.

In May 1995, the National Heart, Lung, and Blood Institute's Obesity Education Initiative, in cooperation with the National Institute of Diabetes and Digestive and Kidney Diseases, convened an Expert Panel. Its purpose was to evaluate published information and to determine the most appropriate treatment strategies that would constitute evidence-based clinical guidelines on overweight and obesity for health professionals. The panel's guidelines were based on a systematic review of the scientific literature found in MEDLINE (January 1980 to September 1997).

The Expert Panel abstracted 236 randomized controlled trial (RCT) articles and compiled the data into individual evidence tables. The data were used as the basis for many of the recommendations contained in the guidelines. This Research Summary is based on the ''Executive Summary'' section of the panel's report.

[1]Overweight is defined as a body mass index (BMI) of 25 to 29.9; whereas, obesity is defined as a BMI of $\geq$30.

Summary of Evidence-Based Recommendations

Advantages of Weight Loss

Weight loss decreases the likelihood of developing certain diseases and conditions. The panel's recommendations on the following conditions emphasize the advantages of weight loss.

1. Blood Pressure

Strong and consistent evidence showed that weight loss produced by lifestyle modifications reduces blood pressure levels in both overweight hypertensive and nonhypertensive patients. Recommendation: *Weight loss is recommended to lower elevated blood pressure in overweight and obese persons with high blood pressure.*

2. Serum/Plasma Lipids

Lifestyle trials provided strong evidence that weight loss produced by lifestyle changes in overweight people is accompanied by reductions in serum triglycerides and by increases in HDL-cholesterol. Also, weight loss usually produces some decreases in serum total cholesterol and LDL-cholesterol. Recommendation: *Weight loss is recommended to lower elevated levels of total cholesterol, LDL-cholesterol, and triglycerides, and to raise low levels of HDL-cholesterol in overweight and obese persons with dyslipidemia.*

3. Blood Glucose

Strong evidence showed that weight loss produced by lifestyle change reduces blood glucose levels in overweight and obese persons without diabetes, and weight loss reduces blood glucose levels and HbA_{1c} in some people with type 2 diabetes. Recommendation: *Weight loss is recommended to lower elevated blood glucose levels in overweight and obese persons with type 2 diabetes.*

Measurement of Degree of Overweight and Obesity

Although there are no RCT's that reviewed measurements of overweight and obesity, the Expert Panel found that this segment of patient care warranted further consideration and that this guidance was valuable. Therefore, nonrandomized studies and clinical experience were the basis of the following recommendations.

1. BMI to Assess Overweight and Obesity

Methods exist to assess body fat, but no trial data exist to show that one measure of fatness is better than another for following overweight and obese patients during treatment. The measurement of BMI is a more practical approach in a clinical setting. Studies have shown that BMI provides an acceptable approximation of total body fat for most patients. Recommendation: *Practitioners should use the BMI to assess overweight and obesity. Body weight alone can be used to follow weight loss and to determine efficacy of therapy.*

2. BMI to Estimate Relative Risk

BMI is the favored measure of excess weight to use in epidemiological studies to estimate relative risk of disease. BMI is a simple, rapid, and inexpensive calculation that correlates both with morbidity and mortality. Recommendation: *The BMI should be used to classify overweight and obesity and to estimate relative risk of disease compared to normal weight.*

3. Assessing Abdominal Fat

The panel considered measures of waist circumference, waist-to-hip ratio, and magnetic resonance imaging (MRI) and computed tomography to assess abdominal fat content. Epidemiological studies show that waist circumference is a better marker of abdominal fat content

than waist-to-hip ratio. Also, computed tomography and MRI are expensive and not readily available for routine clinical use. Recommendation: *The waist circumference should be used to assess abdominal fat content.*

4. Sex-Specific Measurements
A high waist circumference is associated with an increased risk for type 2 diabetes, dyslipidemia, hypertension, and cardiovascular disease. Sex-specific cutoffs for waist circumference can be used to identify increased risk associated with abdominal fat in adults who have a BMI of 25 to 34.9. Recommendation: *For adult patients with a BMI of 25 to 34.9 kg/m^2, sex-specific waist circumference cutoffs should be used in conjunction with BMI to identify increased disease risks.*

Goals of Weight Loss

The general goals of weight loss and management are reducing body weight, maintaining a lower body weight over the long-term, and preventing further weight gain.

1. Initial Goal of Weight Loss From Baseline
Overweight and obese patients in well-designed programs can attain a weight loss of as much as 10 percent of baseline weight. An average of 8 percent of baseline weight was lost in diet trials, which included people who did not lose weight. Recommendation: *The initial goal of weight loss therapy should be to reduce body weight by about 10 percent from baseline. With success, further weight loss can be attempted if indicated through further assessment.*

2. Amount of Weight Loss
Weight loss at the rate of 1 to 2 pounds per week commonly occurs for up to 6 months. This represents a calorie deficit of 500 to 1,000 calories per day. Recommendation: *Weight loss should be about 1 to 2 lb/week for a period of 6 months, with the subsequent strategy based on the amount of weight loss.*

How to Achieve Weight Loss

Recommendations emphasized the potential effectiveness of weight control using multiple interventions and strategies.

1. Dietary Therapy
Articles dealing with the effectiveness of diets on weight loss included low-calorie diets (LCD's), very low-calorie diets (VLCD's), vegetarian diets, dietary guidelines of the American Heart Association, the National Cholesterol Education Program's Step I diet with caloric restrictions, and other lowfat regimens with varying combinations of macronutrients. These RCT's indicated that with a low-calorie diet, a person can lose, on average, 8 percent of initial body weight over 3 to 12 months, with an associated decrease in abdominal fat. Recommendations: *(A) LCD's are recommended for weight loss in overweight and obese persons. (B) Reducing fat as part of an LCD is a practical way to reduce calories. (C) Reducing dietary fat alone without reducing calories is not sufficient for weight loss. However, reducing dietary fat, along with reducing dietary carbohydrates, can facilitate caloric reduction. (D) A diet that is individually planned to help create a deficit of 500 to 1,000 kcal/day should be an integral part of any program aimed at achieving a weight loss of 1 to 2 lb/week.*

2. Physical Activity
Physical activity alone in obese adults produces modest weight loss. In addition, physical activity in overweight and obese adults increases cardiorespiratory fitness—independent of weight loss. Recommendations: *(A) Physical activity is recommended as part of a comprehensive weight loss therapy and weight control program because it: (1) modestly contributes to weight loss in overweight and obese adults, (2) may decrease abdominal fat, (3) increases cardiorespiratory fitness, and (4) may help with maintenance of weight loss. (B) Physical activity should be an integral part of weight loss therapy and weight maintenance. Initially, moderate levels of physical activity for 30 to 45 minutes, 3 to 5 days a week, should be encouraged. All adults should set a long-term goal to accumulate at least 30 minutes or more of moderate-intensity physical activity on most, and preferably all, days of the week.*

The effects of a combination of a reduced-calorie diet with increased physical activity on body weight were included in the guidelines. Evidence shows that the combination of a reduced-calorie diet and increased physical activity yields greater weight loss than diet or physical activity alone. Recommendation: *The combination of a reduced calorie diet and increased physical activity is recommended since it produces weight loss that may also result in decreases in abdominal fat and increases in cardiorespiratory fitness.*

3. Behavior Therapy
Behavioral strategies to reinforce changes in diet and physical activity in obese adults produce weight loss in the range of 10 percent over 4 months to 1 year. Without continued behavioral intervention, long-term follow-up of patients undergoing behavior therapy shows a return to baseline weight for most subjects. Also, patient motivation is a key component for success in any weight-loss program. Recommendations: *(A) Behavior therapy is a useful adjunct when incorporated into treatment for*

weight loss and weight maintenance. (B) Practitioners need to assess the patient's motivation to enter weight loss therapy: assess the readiness of the patient to implement the plan and then take appropriate steps to motivate the patient for treatment.

4. Summary of Lifestyle Therapy
The panel made the following recommendation concerning combined interventions: *Weight loss and weight maintenance therapy should employ the combination of LCD's, increased physical activity, and behavior therapy.*

5. Pharmacotherapy
Pharmacotherapy articles provided strong evidence that pharmacological therapy results in weight loss in obese adults when it is used for 6 months to 1 year. Recommendation: *Weight loss drugs approved by the FDA may be used as part of a comprehensive weight loss program, including dietary therapy and physical activity for patients with a BMI of ≥30 with no concomitant obesity-related risk factors or diseases, and for patients with a BMI of ≥27 with concomitant obesity-related risk factors or diseases. Weight loss drugs should never be used without concomitant lifestyle modifications. Continual assessment of drug therapy for efficacy and safety is necessary. If the drug is efficacious in helping the patient to lose and/or maintain weight loss and there are no serious adverse effects, it can be continued. If not, it should be discontinued.*

6. Weight Loss Surgery
Some RCT's examined the effect of surgical procedures on weight loss. These trials also provided evidence that lifelong medical surveillance after surgery is necessary. Recommendation: *Weight loss surgery is an option for carefully selected patients with clinically severe obesity (BMI ≥40 or ≥35 with comorbid conditions) when less invasive methods of weight loss have failed and the patient is at high risk for obesity-associated morbidity or mortality.*

Goals for Weight Loss Maintenance

Upon completion of clinical therapy, people who lose weight frequently regain it. Hence successful weight loss depends on continuing a maintenance program on a long-term basis. The reviewed RCT's suggest that after 6 months of weight loss treatment, maintaining weight loss is important. Recommendations: *(A) After successful weight loss, the likelihood of weight loss maintenance is enhanced by a program consisting of dietary therapy, physical activity, and behavior therapy which should be continued indefinitely. Drug therapy can also be used. However, drug safety and efficacy beyond 1 year of total treatment have not been established. (B) A weight maintenance program should be a priority after the initial 6 months of weight loss therapy. (C) The literature suggests that weight loss and weight maintenance therapies that provide a greater frequency of contacts between the patient and the practitioner and are provided over the long term should be utilized whenever possible. This can lead to more successful weight loss and weight maintenance.*

Special Treatment Groups

1. Smokers
Fear of weight gain upon cessation of smoking is an obstacle for many patients. Recommendations: *(A) All smokers, regardless of their weight status, should quit smoking. (B) Prevention of weight gain should be encouraged and if weight gain does occur, it should be treated through dietary therapy, physical activity, and behavior therapy, maintaining the primary emphasis on the importance of abstinence from smoking.*

2. Older Adults
Restrictions on overall food intake due to dieting could cause inadequate intake of protein or essential vitamins or minerals in the elderly. Also, involuntary weight loss indicative of occult disease could be mistaken for success in voluntary weight reduction. Proper nutritional counseling and regular body weight monitoring in older persons for whom weight reduction is indicated should be provided. Recommendation: *A clinical decision to forgo obesity treatment in older adults should be guided by an evaluation of the potential benefits of weight reduction for day-to-day functioning and reduction of the risk of future cardiovascular events, as well as the patient's motivation for weight reduction. Care must be taken to ensure that any weight reduction program minimizes the likelihood of adverse effects on bone health or other aspects of nutritional status.*

3. Diverse Patient Populations
Standard approaches to obesity treatment should be tailored to the needs of various patients or patient groups. Recommendation: *The possibility that a standard approach to weight loss will work differently in diverse patient populations must be considered when setting expectations about treatment outcomes.*

Source: National Institutes of Health, National Heart, Lung, and Blood Institute, 1998, *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report.*

Federal Statistics: Eating and Exercise

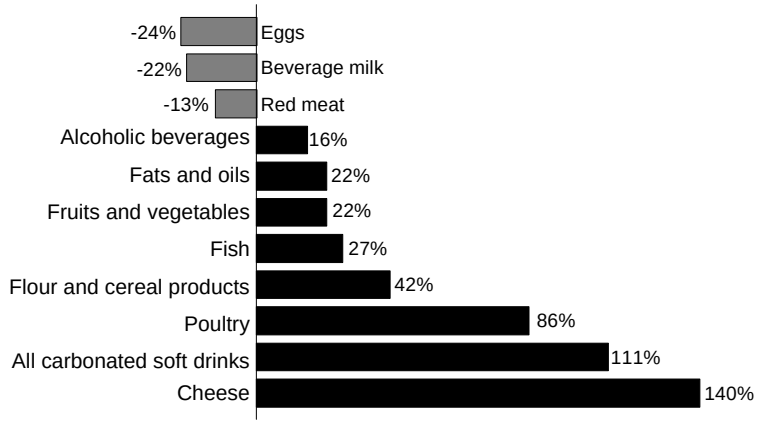
Eating and Exercise

According to the most recent *Dietary Guidelines for Americans*, healthful diets enable people to work productively and feel their best. Healthful diets also can help to reduce the risk of chronic diseases. To obtain a healthful diet, people should choose one with most of the calories from grain products, vegetables, fruits, lowfat milk products, lean meats, fish, poultry, and dry beans. Fewer calories should be chosen from fats and sweets. Physical activity also fosters a healthful diet. A sedentary lifestyle is not healthful. How are Americans doing with regards to diet and exercise?

Americans eating more fruits and vegetables:

Per capita consumption of foods by people has changed over the 1975-95 period. Consumption of fruits and vegetables increased 22 percent. Poultry consumption rose 86 percent. However, consumption of fats and oils grew by 22 percent. Consumption of carbonated soft drinks increased over 100 percent.

Changes in per capita consumption of selected foods, 1970-95

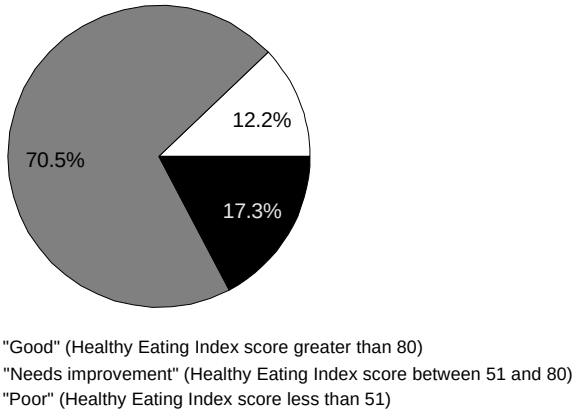


Source: U.S. Department of Agriculture, Economic Research Service, 1997, Food Consumption, Prices, and Expenditures, 1970-95/SB939.

Most people, however, have a diet that is poor or needs improvement:

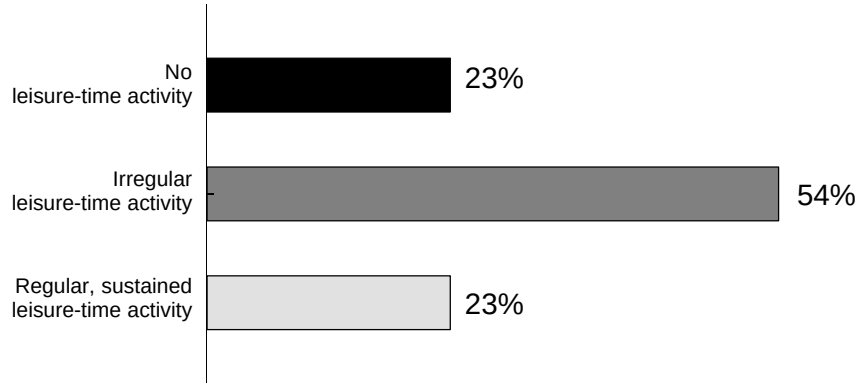
Although people are eating more fruits and vegetables, many have diets that still fall short of the dietary recommendations. The Healthy Eating Index, a summary measure of people's overall diet quality, shows that 88 percent of Americans in 1996 had a diet that was classified as poor or needs improvement.

Diet quality of U.S. population as measured by Healthy Eating Index, 1996



Source: Bowman, S.A., Lino, M., Gerrior, S.A., Basiotis, P.P. 1998. The Healthy Eating Index: 1995-96. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. CNPP-5.

Adults participating in physical activity during leisure time, 1995

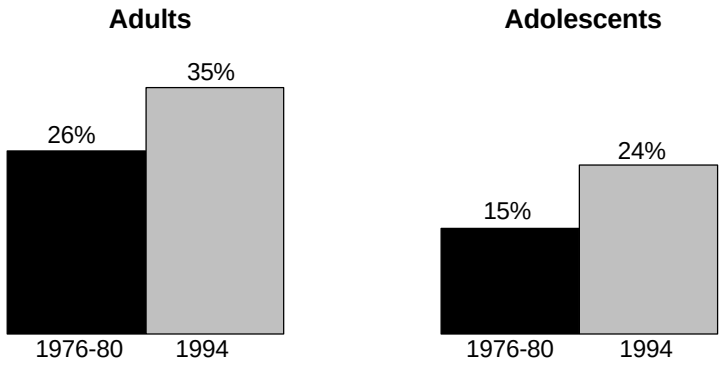


Source: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. 1998. Physical activity and fitness objective status. Unpublished table.

Physical activity is also low among Americans:

Many Americans do not get enough exercise. In 1995, only 23 percent of adults reported participating in regular, sustained activity during leisure time. Such activity is considered to be any type or intensity of activity that occurs 5 times or more per week and 30 minutes or more per occasion. Another 23 percent of adults reported participating in no activity at all.

Prevalence of being overweight among adults and adolescents, 1976-80 versus 1994



Source: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. 1998. Physical activity and fitness objective status. Unpublished table.

As a result, the prevalence of being overweight has grown:

More adults were overweight in 1994 than during the 1976-80 period. For all adults, 35 percent were overweight in 1994, compared with 26 percent in 1976-80. The prevalence of being overweight also increased among adolescents over this time.

Research and Evaluation Activities in USDA

From the Food, Nutrition, and Consumer Services' Center for Nutrition Policy and Promotion

The Center for Nutrition Policy and Promotion (CNPP) has several new and ongoing projects of interest to the nutrition and family economics community. Most publications listed below are available from CNPP by writing to USDA-CNPP, 1120 20th Street, NW, Suite 200 North, Washington, DC 20036; by calling CNPP at 202-418-0243; or by reaching CNPP at *www.usda.gov/cnpp*.

Expenditures on Children by Families, 1998

Each year since 1960, USDA has published a report that provides estimates of annual expenditures on children from birth through age 17. USDA estimates are used to set State child support guidelines and payments for foster care. This latest report, which is based on data from the 1990-92 Consumer Expenditure Survey, presents the 1998 figures for husband-wife and single-parent families. The Consumer Price Index is used to update the estimates.

For husband-wife families, child-rearing expenses are provided for three income groups; for single-parent families, expenses are provided for two income groups. Estimates are also provided for husband-wife families in urban areas in the West, Northeast, South, and Midwest; rural areas throughout the United States; and the United States overall to adjust, in part, for differences in prices and expenditure patterns. For single-parent families, estimates are provided for the overall United States only. Expenditures on children are provided for the major budgetary components: Housing, food, transportation, clothing, health care, child care and education, and miscellaneous goods and services.

For the overall United States, annual child-rearing expenses are between $8,240 and $9,340 for a child in a two-child, married-couple family in the middle-income group. Housing and food account for the largest percentage of total child-rearing expenses. Expenditures are lower for younger children and higher for older children.

Healthy Eating Index

To report on how well the American diet conforms to healthful eating patterns, CNPP publishes the Healthy Eating Index (HEI), which provides a measure of overall diet quality. The Index, based on different aspects of a healthful diet, examines 10 dietary components: The degree to which a person's diet conforms to recommended servings of USDA's Food Guide Pyramid for the food groups (grains, vegetables, fruits, milk products, and meat/meat alternates), total fat consumption, saturated fat consumption, cholesterol intake, sodium intake, and variety in the diet.

CNPP used the 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) to calculate the latest HEI and to produce in-depth analysis of the HEI for three groups: African Americans,[1] children,[2] and American Indians.[3] These analyses showed that among African Americans, most have a diet that needs improvement or have a diet that is poor; only 5 percent have a good diet. Also, the quality of the diet for African Americans is lower than the quality of the diet for other racial groups. African Americans, however, are not alone in needing to improve their diets. Most children also have a diet that needs improvement or is poor. As children get older, the quality of their diet declines, and children score particularly low for fruit and milk consumption. Among American Indians, less than 50 percent meet the dietary recommendations for 8 of the 10 components of the HEI.

Thrifty Food Plan

The Thrifty Food Plan (TFP) serves as a national standard for a nutritious diet that is at practically the lowest possible cost. Used as the basis for food stamp allotments, the Plan specifies the types and quantities of foods that people in 12 age-gender groups could consume to have a nutritious diet at a minimal cost. The last revision of the TFP market basket was in 1983.

CNPP is revising the TFP market basket to account for the most current knowledge of nutritional needs. This revision of the TFP is the first one to incorporate

[1] Report Card on the Diet Quality of African Americans, *Nutrition Insights*, Number 6.
[2] Report Card on the Diet Quality of Children, *Nutrition Insights*, Number 9.
[3] The Diet Quality of American Indians: Evidence From the Continuing Survey of Food Intakes by Individuals, *Nutrition Insights*, Number 12.

the serving recommendations of the *Food Guide Pyramid*. Data used are from the 1989-91 CSFII and various national price data bases. The cost of the revised TFP was set so that it did not exceed the average real cost of the TFP for 1989-91. This cost was used to ascertain whether, and how, a household could have a nutritious diet.

CNPP is also developing menus and recipes based on this new market basket. These menus and recipes represent low-cost and nutritious meals that food stamp recipients can follow to make the best use of their food dollars.

Food Guide Pyramid for Young Children

To help improve the diets of young children 2 to 6 years old, USDA has developed the *Food Guide Pyramid for Young Children*. USDA developed this ''new'' Pyramid to simplify educational messages and to focus on young children's food preferences and nutritional requirements. Released on March 25, 1999, the *Food Guide Pyramid for Young Children* is an adaptation of the original *Food Guide Pyramid* that was released in 1992.

Young children have unique food patterns and needs, compared with older children and adults. For example, more of their servings of the meat group come from ground beef and luncheon meats, and fewer servings come from fish. Young children are more likely than adults to eat ready-to-eat cereals. Also, compared with older children and adults, young children are less likely to eat lettuce salads and more likely to eat cooked green beans. Young children are also more likely to drink fruit juice than to eat whole fruit. Many young children are not eating healthful diets, and nutritionists know that early food experiences are crucial to food preferences and patterns throughout life.

The graphic and messages in the *Food Guide Pyramid for Young Children* have been made easier to understand and more appropriate for this young audience, their parents, and their caregivers. The graphic shows foods that are eaten commonly by young children, drawn in a realistic style, and shown in single-serving sizes when possible. In several cases, the new graphic depicts foods that children need to eat more often. The names of the food groups have been shortened to simplify them, and the number of recommended servings is a single number rather than a range.

The *Food Guide Pyramid for Young Children* has a key message: eating a variety of foods is healthful. The Pyramid is surrounded by illustrations of children engaged in active pursuits to show the importance of physical activity.

The *Food Guide Pyramid for Young Children* is based on actual food consumption patterns of young children. CNPP analyzed the diets of young children and adapted existing food-guidance recommendations to meet children's specific needs. The development of the *Food Guide Pyramid for Young Children*, as well as supporting educational material, was a direct result of this research.

CNPP staff examined young children's food choices and typical portion sizes that were reported for them in national food consumption surveys. The staff then determined that the nutrients in these foods, if eaten in amounts recommended by the original *Food Guide Pyramid*, would meet children's nutritional needs. The Pyramid was used as the basis for a new graphic because Pyramid food groups and numbers of servings resulted in a nutritionally adequate diet for young children.

The booklet ''Tips for Using the Food Guide Pyramid for Young Children 2 to 6 Years Old'' is based on the needs for food and nutrition information identified by parents and caregivers of young children. Educational messages and prototype materials for the *Food Guide Pyramid for Young Children* were tested with parents and caregivers in two rounds of focus groups that were held in several geographic regions of the United States. The information that was gathered from participants in the focus groups helped USDA to determine the messages to include in the materials and the types of materials to develop.

The booklet contains information and advice for parents and caregivers, including the following:

- Tips for encouraging healthful eating
- Basic information about the *Food Guide Pyramid*
- Information on ''child-size'' servings
- List of foods in each group to encourage young children to eat a variety of different foods
- Suggested activities that parents can use to involve their young children in meal preparation
- Ideas about snacks
- Ideas about meal planning
- Chart to track foods eaten over several days
- ''Hands-on'' food activity for home or child care centers

Dietary Guidelines for Americans

The *Dietary Guidelines for Americans*, first released in 1980 and revised in 1985, 1990, and 1995, are published jointly by the U.S. Departments of Agriculture (USDA) and Health and Human Services (DHHS). The Dietary Guidelines provide the basis for Federal nutrition policy and nutrition education activities. Nutrition and health professionals promote these Guidelines to focus Americans' attention on what constitutes a healthful diet. The Dietary Guidelines bulletin advises healthy Americans, ages 2 years and over, about food choices that promote health and prevent disease. The bulletin is based on the recommendations of a Dietary Guidelines Advisory Committee (DGAC)—a panel of nationally recognized nutrition and health experts.

In 1998, USDA and DHHS appointed a DGAC to review the 1995 Guidelines and to recommend changes that reflect new scientific evidence on diet and health relationships and new information on the usefulness of the earlier editions to professionals and the public. The committee held its first public meeting in September 1998, its second, March 1999.

The committee expects to hold two additional public meetings in 1999 and continues to receive written comments from the public about the Guidelines. Transcripts of the committee's meetings are available at the following Web site: *www.ars.usda.gov/dgac*. By the end of 1999, the committee will issue its recommendations in a report to the Secretaries of USDA and DHHS. The two Departments will then review the DGAC report and in the year 2000, release jointly the fifth edition of the Dietary Guidelines.

Dietary Guidance Working Group

The Dietary Guidance Working Group was established on January 2, 1986, under the Subcommittee for Human Nutrition of the Research and Education Committee, Secretary's Policy and Coordination Council. The Working Group was formed to help agencies meet the objectives of legislation related to dietary guidance and USDA's food and nutrition policy. Eight USDA agencies are represented; DHHS has a liaison member. Title III of the National Nutrition Monitoring and Related Research Act of 1990 calls for the Secretaries of USDA and DHHS to publish the *Dietary Guidelines for Americans* at least every 5 years and for the Secretaries to review and approve dietary guidance for the general population before the Guidelines are released. The purpose of all of these actions is to ensure that Federal dietary guidance is consistent with the *Dietary Guidelines for Americans* or is based on new medical or scientific knowledge determined to be valid by the Secretaries.

The Working Group reviewed nine draft publications produced by the two Departments in fiscal year 1998. The following are some of the special topics the Working Group discussed at monthly meetings:

- Standards of the new Body Mass Index for children and adolescents that were developed by the National Center for Health Statistics
- A presentation on the development of ''yourSELF''—Team Nutrition materials for adolescents that included a viewing of accompanying videos
- A report on the project ''Girl Power and You'' that is being developed for 11- to 14-year-old urban African American girls.

USDA's Food Guide: Updating the Research Base

The *Food Guide Pyramid* graphic illustrates what constitutes a healthful diet and conveys the importance of balance, moderation, and consumption of a variety of foods. The research base for USDA's food-guidance system provides the scientific underpinning of USDA's food-guidance information for consumers. The research also provides documentation that recommended patterns of food selection continue to meet the Guide's established nutritional objectives. Food group composites, based on survey data on food consumption, are developed to update the research base. Food consumption data show the relative frequency of the selection of specific foods within a food group (e.g., vegetables) or subgroup (e.g., dark-green leafy). Nutrient profiles are then developed for each food group composite from the most current data on food composition available at the time. *Food Guide Pyramid* patterns at 1,600 calories, 2,200 calories, and 2,800 calories are then created by using the revised composites to determine whether recommendations of the *Food Guide Pyramid* continue to meet established nutritional objectives, such as the Recommended Dietary Allowances (RDA).

Data on food composition and food consumption are being used to update the research base for the Food Guide. The data are from the 1994-96 CSFII. Nutrient profiles will be developed based on the weighted consumption of foods within each food group and subgroup, 1996 nutrient data, and the higher levels of folates in grain products that became effective in January 1988. The most recent update of the research base used data on food consumption from the 1989-91 CSFII for children ages 2 through 6 to develop the new

Food Guide Pyramid for Young Children. Also, data from the 1989-91 CSFII for all individuals were used to update the research base for the original *Food Guide Pyramid*, first developed using USDA's 1977-78 Nationwide Food Consumption Survey.

Symposium on Childhood Obesity: Causes and Prevention

CNPP sponsored a full-day symposium on childhood obesity that featured some of the Nation's leading authorities in the area. Some presentations focused on the relationship of diet and physical inactivity to childhood obesity, the health risk to children because of obesity, the factors influencing children's food intake, and the prevention of obesity in school-age children and adolescents. Other presentations centered on reducing childhood obesity and the role of government programs (such as child nutrition), choosing a policy strategy regarding childhood obesity, increasing physical activity among children, and the Federal perspective on childhood obesity and governmental intervention. Dan Glickman, Secretary of Agriculture; Shirley Watkins, Under Secretary of Food, Nutrition, and Consumer Services; and David Satcher, Surgeon General, also spoke about causes and prevention of childhood obesity. Proceedings were published and are available to the public.

Journal Abstracts

The following abstracts are reprinted verbatim as they appear in the cited source.

Van Hook, J., Glick, J.E., and Bean, F.D. 1999. Public assistance receipt among immigrants and natives: How the unit of analysis affects research findings. *Demography* 36*(1)*:111-120.

Differences between immigrant and native households in rates of welfare receipt depend on nativity differences in individual-level rates of receipt, in household size, in mean number of recipients in receiving households, and in household nativity composition. We present algebraic derivations of these relationships and use data from the 1990 and 1991 panels of the Survey of Income and Program Participation to examine empirically the extent to which levels of welfare receipt for immigrants and natives are sensitive to the use of household-, family-, or individual-level units of analysis of presentation. The findings show that nativity differences are statistically significant only at the level of larger units. The results also indicate that if immigrants and natives had identical living arrangements, immigrants' household-level receipt of Supplemental Security Income would significantly exceed natives' receipt even more than it actually does, but the nativity difference in receipt of Aid to Families with Dependent Children (AFDC) would reverse directions. Moreover, the level of AFDC receipt of immigrant households falls significantly below that of native households when native-born children living in households headed by immigrants are treated as if they were foreign born.

Roberts, J.A. 1998. Compulsive buying among college students: An investigation of its antedecents [*sic*], consequences, and implications for public policy. *The Journal of Consumer Affairs* 32*(2)*:295-319.

This study is an investigation of the incidence, antecedents, consequences, and public policy implications of compulsive buying among college students, a segment of the 44 million Americans born between 1965 and 1976, known as the Baby Bust generation. Previous research involving a broader range of adult consumers resulted in estimates of one to six percent classified as compulsive buyers. Using Faber and O'Guinn's (1992) clinical screener for compulsive buying, six percent of the college students sampled were classified as compulsive buyers, thus indicating the need for better understanding of compulsive buying behavior in this segment of the Baby Bust generation. Various contributing factors, including familial, psychological, sociological, and demographic influences, are detailed. Of particular interest is the relationship between credit card use and compulsive buying. Implications for consumer policy are discussed, and suggestions for research are offered.

Coleman, M., Ganong, L.H., Killian, T., and McDaniel, A.K. 1999. Child support obligations: Attitudes and rationale. *Journal of Family Issues* 20*(1)*:46-68.

The attitudes of 160 men and 264 women randomly selected from five nonurban midwestern communities were examined to (a) determine how much child support a nonresidential father is perceived to be obligated to pay; (b) assess how perceived obligations vary by gender or participant, legal custody arrangement, changes in parents' marital status, and father's financial status; and (c) explore the rationale used in making judgments about child support obligations. A vignette technique was used. Most participants (78%) indicated a child support amount that was less than state guidelines. Participants thought child support amounts should be reduced when mothers remarried and when fathers' financial status changed. Perceptions of child support obligations held by men and women did not differ, and custody arrangements were not related to attitudes about child support. Qualitative analyses of rationale underlying attitudes suggested that notions of fairness guided respondents' reasoning.

Brown, R.B., Xu, X., and Toth, Jr., J.F. 1998. Lifestyle options and economic strategies: Subsistence activities in the Mississippi Delta. *Rural Sociology* 63*(4)*:599-623.

''Subsistence'' and ''informal economy'' are contrasted in their utility as sociological concepts and their ability to explain a variety of activities in two rural Mississippi Delta communities. Literature on subsistence stresses that the desired outcome of participation is not an increase in income but the social rewards of participation itself. Two underlying dimensions of participation in these activities are documented through the literature and through a

confirmatory factor analysis of empirical data: life-style choice and economic strategy. These were constructed into indexes and examined individually and in combination as dependent variables using regressors at the community, household, and individual levels. Community ties were weakly associated with participation in such activities. Whites and those with higher incomes participated more in lifestyle choice oriented activities. Participation in general was statistically related to households needing less weekly income and being of larger size. Potential connections with persistent rural poverty are discussed.

Yeung, W.J. and Hofferth, S.L. 1998. Family adaptations to income and job loss in the U.S. *Journal of Family and Economic Issues* 19*(3)*:255-283.

Using data from the Panel Study of Income Dynamics, this study examines the extent to which families experience major economic setbacks and how they respond. Families that experience a substantial loss of income or work hours are more likely to cut back on expenditures, receive public assistance, experience divorce or separation, and move. No evidence that partners are able to compensate for a major income loss by increasing their work hours was found. Initial conditions, such as income and assets, the unemployment rate of the area, and race, affect how a family adapts. Families with fewer resources and those who live in areas of high unemployment are more likely to rely on public assistance, and they are less likely to move, increase the work hours of the female head of household, or cut food expenditures.

Glanz, K., Basil, M., Maibach, E., Goldberg, J., and Snyder, D. 1998. Why Americans eat what they do: Taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *Journal of the American Dietetic Association* 98*(10)*:1118-1126.

Knowing why people choose to eat what they do can help dietetics professionals optimize the effectiveness of nutrition messages. The authors of this study used 2 self-administered questionnaires to gather data from a national sample of nearly 3,000 adults. They found that taste is the most influential factor driving the decision of what to eat, followed by cost. Respondents fell into particular health lifestyle clusters, and membership in these clusters predicted the importance of nutrition and weight control on food choices. Demographic differences and health lifestyles were predictors of the consumption of fruits and vegetables, fast foods, cheese, and breakfast cereal, the 4 main outcome measures. These results suggest that nutrition messages should stress taste and value to be most effective.

Ferrucci, L., Izmirlian, G., Leveille, S., Phillips, C.L., Corti, M-C., Brock, D.B., and Guralnik, J.M. 1999. Smoking, physical activity, and active life expectancy. *American Journal of Epidemiology* 149*(7)*:645-653.

The effect of smoking and physical activity on active and disabled life expectancy was estimated using data from the Established Populations for Epidemiologic Studies of the Elderly (EPESE). Population-based samples of persons aged $\geq$65 years from the East Boston, Massachusetts, New Haven, Connecticut, and Iowa sites of the EPESE were assessed at baseline between 1981 and 1983 and followed for mortality and disability over six annual follow-ups. A total of 8,604 persons without disability at baseline were classified as ''ever'' or ''never'' smoker and doing ''low,'' ''moderate,'' or ''high'' level physical activity. Active and disabled life expectancies were estimated using a Markov chain model. Compared with smokers, men and women nonsmokers survived 1.6-3.9 and 1.6-3.6 years longer, respectively, depending on level of physical activity. When smokers were disabled and close to death, most nonsmokers were still nondisabled. Physical activity, from low to moderate to high, was significantly associated with more years of life expectancy in both smokers (9.5, 10.5, 12.9 years in men and 11.1, 12.6, 15.3 years in women at age 65) and nonsmokers (11.0, 14.4, 16.2 years in men and 12.7, 16.2, 18.4 years in women at age 65). Higher physical activity was associated with fewer years of disability prior to death. These findings provide strong and explicit evidence that refraining from smoking and doing regular physical activity predict a long and healthy life.

Official USDA Food Plans: Cost of Food at Home at Four Levels, U.S. Average, June 1999[1]

AGE-GENDER GROUPS	WEEKLY COST				MONTHLY COST			
	Thrifty plan	Low-cost plan	Moderate-cost plan	Liberal plan	Thrifty plan	Low-cost plan	Moderate-cost plan	Liberal plan
INDIVIDUALS[2]								
CHILD:								
1-2 years	$15.40	$19.10	$22.30	$27.20	$66.70	$82.80	$96.60	$117.90
3-5 years	16.70	20.80	25.70	30.90	72.40	90.10	111.40	133.90
6-8 years	20.70	27.70	34.40	40.00	89.70	120.00	149.10	173.30
9-11 years	24.50	31.40	40.00	46.40	106.20	136.10	173.30	201.10
MALE:								
12-14 years	25.30	35.40	43.80	51.50	109.60	153.40	189.80	223.10
15-19 years	26.10	36.30	45.30	52.30	113.10	157.30	196.30	226.60
20-50 years	28.00	36.10	45.00	54.50	121.30	156.40	195.00	236.10
51 years and over	25.30	34.40	42.40	50.90	109.60	149.10	183.70	220.50
FEMALE:								
12-19 years	25.30	30.50	36.90	44.60	109.60	132.20	159.90	193.30
20-50 years	25.20	31.50	38.40	49.20	109.20	136.50	166.40	213.20
51 years and over	24.80	30.70	38.10	45.60	107.50	133.00	165.10	197.60
FAMILIES:								
FAMILY of 2[3]:								
20-50 years	58.50	74.40	91.70	114.10	253.60	322.20	397.50	494.20
51 years and over	55.10	71.60	88.60	106.20	238.80	310.30	383.70	459.90
FAMILY OF 4:								
Couple, 20-50 years and children—								
1-2 and 3-5 years	85.30	107.50	131.40	161.80	369.60	465.80	569.40	701.10
6-8 and 9-11 years	98.40	126.70	157.80	190.10	426.40	549.00	683.80	823.70

[1]Basis is that all meals and snacks are purchased at stores and prepared at home. For specific foods and quantities of foods in the Low-Cost, Moderate-Cost, and Liberal Plans, see *Family Economics Review*, No. 2 (1983); for specific foods and quantities of foods in the Thrifty Food Plan, see *Family Economics Review*, No. 1 (1984). The food plans are based on 1977-78 Nationwide Food Consumption Survey data updated to current dollars using the Consumer Price Index for specific food items.

[2]The costs given are for individuals in 4-person families. For individuals in other size families, the following adjustments are suggested: 1-person—add 20 percent; 2-person—add 10 percent; 3-person—add 5 percent; 5- or 6-person—subtract 5 percent; 7- (or more) person—subtract 10 percent.

[3]Ten percent added for family size adjustment.

Official USDA Alaska and Hawaii Thrifty Food Plans: Cost of Food at Home (1st half 1999)[1]

AGE-GENDER GROUPS	ALASKA		HAWAII	
	Weekly Cost	Monthly Cost	Weekly Cost	Monthly Cost
INDIVIDUALS[2]				
Child, 6-8 years	$25.40	$110.10	$32.00	$138.70
Child, 9-11 years	29.90	129.60	38.30	166.00
Male, 20-50 years	33.30	144.30	41.90	181.60
Female, 20-50 years	30.50	132.20	38.50	166.80
FAMILY OF 2[3]				
20-50 years	70.20	304.20	88.40	383.20
FAMILY OF 4				
Couple, 20-50 years and children, 6-8 and 9-11 years	119.10	516.20	150.70	653.10

[1]Basis is that all meals and snacks are purchased at stores and prepared at home. For specific foods and quantities of foods in the Thrifty Food Plan, see *Family Economics Review*, No. 1 (1984). The food plans are based on 1977-78 Nationwide Food Consumption Survey data adjusted for Alaska and Hawaii and updated to current dollars using the Consumer Price Index for specific food items for the Anchorage, Alaska, and Honolulu, Hawaii, areas.
[2]The costs given are for individuals in 4-person families. For individuals in other size families, the following adjustments are suggested: 1-person—add 20 percent; 2-person—add 10 percent; 3-person—add 5 percent; 5- or 6-person—subtract 5 percent; 7- (or more) person— subtract 10 percent.
[3]Ten percent added for family size adjustment.

Consumer Prices

Average percent change for major budgetary components

GROUP	Annual average percent change from December of previous year to December: 1990	1995	1998	Percent change 12 months ending with March 1999
All Items	6.1	2.5	1.6	1.7
Food	5.3	2.1	2.3	2.3
Food at home	5.8	2.0	2.1	2.0
Food away from home	4.5	2.2	2.5	2.7
Housing	4.5	3.0	2.3	2.3
Apparel	5.1	0.1	-0.7	-1.6
Transportation	10.4	1.5	-1.7	-0.6
Medical care	9.6	3.9	3.4	3.5
Recreation	NA	2.8	1.2	0.8
Education and communication	NA	4.0	0.7	0.9
Other goods and services	7.6	4.3	8.8	9.0

Price per pound for selected food items

Food	Price per pound unless otherwise noted (as of December in each year) 1990	1995	1998	March 1999
Flour, white, all purpose	$.24	$ .24	$ .28	$ .29
Rice, white, long grain, uncooked	.49	.55	.54	.54
Spaghetti and macaroni	.85	.88	.88	.88
Bread, white	.70	.84	.87	.88
Beef, ground, uncooked	1.63	1.40	1.39	1.40
Pork chops, center cut, bone-in	3.32	3.29	3.03	3.11
Chicken, fresh, whole	.86	.94	1.06	1.06
Tuna, light, chunk	2.11	2.00	2.22	2.04
Eggs, Grade A, large, per dozen	1.00	1.16	1.09	1.00
Milk, fresh, lowfat, per gallon	NA	2.31	2.76	2.88
Butter, salted, grade AA, stick	1.92	1.73	3.18	2.74
Apples, red delicious	.77	.83	.85	.85
Bananas	.43	.45	.51	.51
Oranges, navel	.56	.64	.61	.87
Potatoes, white	.32	.38	.38	.38
Lettuce, iceberg	.58	.61	.64	.77
Tomatoes, field grown	.86	1.51	1.80	1.40
Broccoli	NA	.76	.97	.99
Carrots, short trimmed and topped	.43	.53	.54	.58
Onions, dry yellow	NA	.41	NA	NA
Orange juice, frozen concentrate per 16 oz.	2.02	1.57	1.68	1.74
Sugar, white, 33-80 oz. pkg.	.40	.39	.41	.42
Margarine, stick	.87	.79	NA	NA
Peanut butter, creamy	2.09	1.78	1.79	1.82
Coffee, 100% ground roast	2.94	3.51	3.45	3.48

NA = Data not available.
Selected items from CPI Detailed Reports, Bureau of Labor Statistics, various issues. Price changes are for all urban consumers. Food prices are U.S. city average.

Guidelines for Authors

Family Economics and Nutrition Review is a peer-reviewed quarterly journal published by the Center for Nutrition Policy and Promotion; Food, Nutrition, and Consumer Services; U.S. Department of Agriculture.

- All manuscripts must follow the guidelines of *Publication Manual of the American Psychological Association*, 4th Edition.
- The manuscript text for **feature articles**, including references, abstract (less than 150 words), tables, and figures, is limited to 30 pages. Include a separate title page with author's full name, title, affiliation, full address, and telephone number.
- The manuscript text for **research briefs**, including references, tables, and figures, is limited to 10 pages. No abstract is required.
- Include tables or figures only if they are necessary to understand or clarify the paper. No more than six figures and/or tables will be published with an article, and no more than three will be published with a research brief.
- Manuscripts may not be submitted elsewhere while under consideration by the journal.
- All authors and coauthors must sign a release acknowledging that contents of the journal are in the public domain.
- Upon acceptance of articles, authors must send the revised manuscript on computer disk, along with two hard (paper) copies. WordPerfect is the preferred word-processing program.
- Please send four copies to the editor:

  Julia M. Dinkins, PhD
  Family Economics and Nutrition Review
  USDA, Center for Nutrition Policy and Promotion
  1120 20th Street NW, Suite 200 North Lobby
  Washington, DC 20036-3406
  (202) 606-4876

Family Economics and Nutrition Review

Editorial Board