CENTER FOR NUTRITION POLICY AND PROMOTION

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Center for Nutrition Policy and Promotion
Mission Statement

To improve the health of Americans by developing and promoting dietary guidance that links scientific research to the nutrition needs of consumers.

CENTER FOR NUTRITION POLICY AND PROMOTION

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Front and Center

The Center for Nutrition Policy and Promotion continues to link nutrition science to the nutrition needs of consumers. This issue of *Family Economics and Nutrition Review* provides the science on the associations between nutrient intakes and dietary status of several segments of the U.S. population: dietary supplement users and nonusers in the food stamp population, adolescents, and preschool-aged children. Understanding the associations among supplement use, nutrient densities, and diet quality among subgroups within a population informs policy. A long-term portrait of the intakes among U.S. adolescents leads to recommendations regarding the intake of grains, vegetables, fruits, legumes, lean meats, dairy products, dietary fat, physical activity levels, and effective nutrition education. A comparison among household types in which preschool-aged children reside highlights the continuing need to address issues of food security, energy (kcal) consumption, and sedentary activities that may place children at higher risks of being overweight or obese.

In addition to *Family Economics and Nutrition Review*, the Center uses a series of bulletins to inform consumers of the connection between dietary guidance and nutritional well-being. In its latest issue of the bulletin *Putting the Guidelines into Practice*, the Center suggests ways that consumers can "Get moving . . . For the health and fun of it!" This bulletin helps consumers understand the benefits of physical activity, how much is needed, and how to incorporate it into a busy lifestyle.

With its online dietary assessment tool—the Interactive Healthy Eating Index (IHEI)—the Center provides an opportunity for consumers to input their daily food intakes and then receive a quick summary measure of the quality of their diets. With USDA's release of the Interactive Physical Activity Tool (IPAT) this past December, the Center combined two important aspects of healthful living: appropriate dietary intake and physical activity. An enhancement to the IHEI, the IPAT allows users to input their daily activities and receive a physical activity score in terms of current recommendations. In combination, the IHEI and the IPAT allow users to receive prompt, accurate, and up-to-date information on diet quality and physical activity status.

From the research of *Family Economics and Nutrition Review* to the information of the consumer bulletins to the interactive feedback of the complementary Web-based IHEI and IPAT, the Center's mission remains focused on helping consumers link dietary guidance to lifelong dietary behaviors that can enhance their well-being.

Eric J. Hentges, PhD
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Nutrient Intakes Among Dietary Supplement Users and Nonusers in the Food Stamp Population

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This study characterized the nutrient intakes of participants in the Food Stamp Program (FSP) who used nutrient supplements, compared with those who did not, and examined the variation in these relationships across different socio-demographic subgroups. Dietary intakes from food sources for eight key nutrients were examined from the 1994-96 Continuing Survey of Food Intakes by Individuals. Two measures of overall diet quality were also included in the analysis. Findings revealed that supplement use in FSP participants was positively associated with nutrient densities for iron, calcium, fiber, folate, vitamin A, and vitamin C and with overall diet quality. However, the direction and magnitude of this association varied across age, gender, and ethnic groups for iron, saturated fat, fiber, vitamin A, and one measure of overall diet quality (Z-score). Thus, results show that supplement use is not uniformly associated with more healthful diets among FSP participants.

The U.S. marketplace for dietary supplements is large and changing rapidly. National surveys indicate that dietary supplements are used by roughly 50 percent of the U.S. population (Balluz, Kieszak, Philen, & Mulinare, 2000; Slesinsky, Subar, & Kahle, 1995). Industry sources suggest that sales of all forms of supplements combined—including nutrients, herbals, sports products, and meal supplements—rose from $8.6 billion in 1994 to $16 billion in 2000 (Heasman & Mellentin, 2001). During that same period, sales of nutrient supplements, specifically, rose from $3.9 billion to $6.1 billion. This rise in consumption of dietary supplements is only the beginning of a much larger "functional foods revolution" built upon the development and marketing of a wide variety of supplements, genetically engineered foods, fortified foods, and conventional foods with compositional properties that are perceived or marketed as having links to improved health, performance, or well-being (Heasman & Mellentin, 2001). The U.S. market for functional foods is estimated to rise from about $20 billion in 2000 to $50 billion by 2010 (Government Accounting Office [GAO], 2000).

The rapid rise and high prevalence of supplement use in the United States stand in marked contrast to the views and positions of professional and scientific nutrition communities. Organizations such as the American Dietetic Association (ADA) (Hunt, 1996), the Dietary Guidelines for Americans Advisory Committee (U.S. Department of Agriculture [USDA] & U.S. Department of Health and Human Services [DHHS], 2000), and the Food and Nutrition Board of the Institute of Medicine (IOM, 1994) have maintained that most individuals can and should obtain all necessary nutrients in adequate amounts from a varied diet and that supplements are needed only in special circumstances. The position of the ADA regarding supplementation is that

> the best nutritional strategy for promoting optimal health and reducing the risk of chronic disease is to obtain adequate nutrients from a wide variety of foods. Vitamin and mineral supplementation is appropriate when well-accepted, peer-reviewed, scientific evidence shows safety and effectiveness. (Hunt, 1996, p. 73)

Notwithstanding the views of the ADA, the Food and Drug Administration (FDA), and other professional and scientific bodies, Congress created the Dietary Supplement Health and Education Act in 1994 that has little or no requirement for manufacturers to demonstrate the safety and efficacy of dietary supplements and is more permissive than conventional foods regarding the claims that marketers can make about the benefits of these products. In a recent report, the GAO (2000) concluded that the

> FDA's efforts and federal laws provide limited assurances of the safety of functional foods and dietary supplements [and] . . . we also found that agencies' efforts and federal laws concerning health-related claims on product labels and in advertising provide limited assistance to consumers in making informed choices and do little to protect them against misleading and inaccurate claims. (pp. 4-5)

While nutrient supplements taken in moderation do not raise the same safety concerns as do herbals and other dietary supplements, they do raise two other issues. One is their low efficacy in individuals and populations that do not suffer from nutrient deficiencies (USDA, 1999). In such cases, the exaggerated marketing claims regarding their benefits may mislead some consumers. While most studies show that supplement use is more common among Whites, women, those with higher levels of education, and those with higher incomes (USDA, 1999; Koplan, Annest, Layde, & Rubin, 1986; Lyle, Mares-Perlman, Klein, Klein, & Greger, 1998; Pelletier & Kendall, 1997), usage is not restricted to those groups. For instance, analysis of the 1994-95 Continuing Survey of Food Intakes by Individuals (CSFII) reveals that supplements were used by 49 percent of higher income individuals (greater than 130 percent of the poverty line) and 36 percent of lower income individuals (USDA, 1999).

The second issue related to nutrient supplements is whether they are used as true supplements for an already healthful diet or as a substitute for such a diet. This is important because of the wide range of health-promoting substances contained in whole foods, compared with supplements, which still are far from being understood fully. Most studies have shown that supplement users, compared with nonusers, tend to have higher vitamin and mineral intakes from food (Koplan et al., 1986; Looker, Sempos, Johnson, & Yetley, 1998; Lyle et al., 1995), suggesting a *supplementing* effect rather than a *substitutive* effect. Those studies have, however, assumed that such a finding applies equally to all consumers. The one study that examined potential heterogeneity in that relationship revealed that supplement use is associated with more healthful food intakes in some population groups but also is associated with less healthful food intakes in other groups defined by sociodemographic or attitudinal characteristics (Pelletier & Kendall, 1997).

The present study was initiated within the context of a rapidly expanding dietary supplement industry, a permissive set of laws and regulations, continued uncertainty regarding safety and efficacy, and questions concerning the positive or negative relationships between supplement use and the quality of food intake. The specific motivation for the study was the proposal considered by Congress on numerous occasions in the last decade to permit the use of food stamps to purchase nutrient supplements. This proposal was included in a House bill leading up to the welfare reform effort in 1996 (H.R.104-236) and more recently in a Senate bill (S.1731) leading up to the 2002 Farm bill. The proposal has yet to be incorporated into legislation on these and other occasions.

An expert committee of the Life Sciences Research Office (LSRO, 1998) and the USDA (1999) raised a number of concerns regarding this proposal, including evidence that nutrient intakes of FSP participants are similar to those of the general population, that most FSP participants can and do purchase supplements with income other than food stamps, and that administrative complications associated with the proposed change are considerable. In addition, the LSRO report noted a lack of research-based information concerning the relationship between supplement use and dietary intake among FSP participants.

This study examined the associations between supplement use and nutrient intakes from food among FSP participants, as well as the extent to which these associations are uniform across all sociodemographic subgroups of the FSP population.

Methods

Data and Sample

The data used in this study were derived from the 1994-96 CSFII. The CSFII, a national survey of dietary intake conducted by the USDA, is weighted to reflect a nationally representative sample of noninstitutionalized persons living in the United States (Tippett, Enns, & Moshfegh, 1999). The present study examined the first recalled day for the 16,103 respondents who provided at least 1 day of dietary data. The focus of this research was on nutrient intake exclusively from food sources. As defined by the 1994-96 CSFII, food intake does not include vitamins, minerals, or other supplements. Thus, the nutrient intakes analyzed here reflect these caveats.

Only 9,468 records were used in this analysis. The respondents excluded from the analysis were less than 18 years old; other than Hispanic, Black, or White; and had missing records or erroneous data. For the final sample, 886 were FSP participants and 8,582 were FSP nonparticipants.

Variables and Transformations

Much of the methodology used in this study followed very closely the methods of an earlier study by Pelletier and Kendall (1997). The dietary data used in this analysis were based on a single 24-hour recall for each participant. To account for differences in total energy intake, we used the 1-day dietary recall nutrient data for the eight key nutrients (total fat, saturated fat, iron, calcium, fiber, folate, vitamin A, and vitamin C), which were expressed in proportion to total kilocalories consumed and are referred to here as nutrient densities. Such nutrient indices are more indicative of overall diet quality and make comparison among records easier. Because of the assumption that data are normally distributed, which is implicit in many standard statistical tests such as the *t* and F tests as used in the present analysis, various transformations were used to ensure that individual nutrient data represented a normal distribution. A square root was used to transform fiber and vitamin C intakes while a natural log transformation was applied to folate, calcium, iron, and vitamin A. Because total fat and saturated fat data were normally distributed, they were not transformed.

In addition to the eight individual nutrient density variables, we included two additional variables in the regression to test the overall quality of each respondent's diet. An average diet score (index) was calculated from the Z-score values of the eight key nutrients. This average Z-score reflects the quality of the diet with respect to these key nutrients and, as such, may provide different information than any single nutrient considered alone. By using the full dataset of 9,468 individuals that included FSP participants and nonparticipants, we were able to calculate average intake values that were representative of the entire U.S. population. Subsequently, intake values of smaller subgroups could be compared with those of the whole population. The sign of the Z-score was reversed for total and saturated fat, prior to summing across all nutrients, to maintain consistency in the interpretation of this index.

Another computed variable used to measure overall diet quality was the Healthy Eating Index (HEI). The HEI was developed by the USDA's Center for Nutrition Policy and Promotion to assess and monitor the dietary status of Americans in accordance with the Food Guide Pyramid and the Dietary Guidelines for Americans (Variyam, Blaylock, Smallwood, & Basiotis, 1998). Each of the 10 components of the HEI has a maximum score of 10 and a minimum score of 0. High component scores indicate intakes close to recommended ranges or amounts; low component scores, less compliance. The present analysis used the five Food Guide Pyramid components of the HEI, which reflect how well each person incorporated the desirable number of servings from each of the five food groups on the recalled day. These five components were averaged together to achieve a mean value for each person. It is important to note that unlike the Z-score index, the HEI was not adjusted for energy intake or the quantity of food intake on the day of the recall.

Sociodemographic variables consisted of age, gender, education, employment status, and ethnicity. Ethnicity was coded as non-Hispanic Whites ("Whites"), non-Hispanic Blacks ("Blacks"), and anyone reporting Hispanic origin ("Hispanic"). The reference (omitted) groups in the regression analyses were 50 years and older (age), female (gender), less than high school (education), unemployed (employment status), and White (ethnicity).

Nutrient supplement use was defined based on the response to this question: "How often, if at all, do you take any vitamin supplement in pill or liquid form?" Because of sample size considerations, we defined users as those reporting the use of any type of supplement "every day or almost every day" or "every so often," and we defined nonusers (the reference group) as those reporting "not at all."

Data Analysis

The relationships among dietary intake, supplement use, and sociodemographic characteristics in the population of FSP participants were examined by using multiple regressions.

. . . among FSP nonparticipants, supplement use was more common among Whites, women, persons 50 years and older, and those with a college degree or more.

Table 1. Supplement use based on the various sociodemographic characteristics of the U.S. population, CSFII 1994-96

Variable	Total sample (n = 9,468)	Non-food stamp recipients (n = 8,582)	Food stamp recipients (n = 886)
		Percent users[1]	
Ethnicity			
White	51	52	40
Black	37	39	32
Hispanic	41	43	29
Gender			
Female	55	57	41
Male	42	43	26
Age			
18-49 years	47	48	43
50 years and older	52	53	33
Education			
Less than high school	36	37	32
High school or some college	48	49	35
College degree or more	59	59	55
Employment status			
Unemployed	48	49	35
Employed	49	51	36

[1]Percentages are weighted. Some percentages may not total to 100 because of rounding.

- Main-effects models tested whether the (generally) positive association between supplement use and dietary intake could be accounted for by socio-demographic variables. Each nutrient and the two measures of overall dietary quality were used as a dependent variable in its own model, and the association of supplement use to the dependent variable was observed before and after adjusting for the set of sociodemographic variables (ethnicity, gender, age, education, and employment status).

- Interaction models tested whether the strength or direction of the association was uniform across ethnicity, gender, and age while controlling for education and employment status. This was accomplished by testing the significance of an entire block of interactions between supplement use and ethnicity, gender, and age after controlling for the above-mentioned variables. These analyses included models with only 2-way interaction terms and, in separate runs, models with both 2-way and 3-way interaction terms.

These statistical methods were designed to permit a valid test of the hypothesis that the strength or direction of the association between supplement use and nutrient density from food among FSP participants is uniform across groups defined by socio-demographic characteristics. In this study, such a test was obtained by comparing the proportion of variance explained by either the 2-way model versus the main-effects model, the full 3-way model versus the main-effects model, or the full 3-way model versus the 2-way model. Because the table of model coefficients is difficult to interpret in the presence of higher

Table 2. Nutrient densities from the food consumed by supplement users and nonusers participating in the Food Stamp Program

	User	Nonuser
	Adjusted means[1]	
Fat (% kcal)	33.3	33.6
Saturated fat (% kcal)	11.0	11.3
Iron (mg/1,000 kcal)[3**]	7.4	6.7
Calcium (mg/1,000 kcal)[3*]	335.8	302.4
Fiber (g/1,000 kcal)[2**]	8.1	7.0
Folate (mcg/1,000 kcal)[3*]	116.2	101.7
Vitamin A (RE/1,000 kcal)[3*]	328.8	271.1
Vitamin C (mg/1,000 kcal)[2*]	48.0	41.7
Z-score average[4**]	0.02	-0.15
HEI average[**]	5.7	5.2

[1]Models for calculating adjusted means consist of age, gender, ethnicity, education, and employment status, as well as a dummy variable to indicate supplement use.
[2]Square root transformation applied in regression; geometric means are shown for ease of interpretation.
[3]Natural log transformation applied in regression; geometric means are shown for ease of interpretation.
[4]Z-scores were based on the total sample (n = 9,468), including FSP participants and nonparticipants.
*$p < 0.05$.
**$p < 0.001$.
n = 309 users and 550 nonusers.

order interaction terms, graphs were used to present differences in the direction and magnitude of the association of supplement use with nutrient densities.

Although SUDAAN generates more accurate variance estimates for surveys with complex sample structures like the CSFII, SAS was used to analyze the data because they were better suited for estimating the statistical interactions involving supplement use.

Results

In the total CSFII sample[1] and among FSP nonparticipants, supplement use was more common among Whites, women, persons 50 years and older, and those with a college degree or more (table 1).

[1]Results for the total sample are shown for comparison.

Over half (51 to 59 percent) of those in each socioeconomic group used supplements. Similar patterns were found among FSP participants, except that supplement use was more common in the younger age group (18 to 49 years). FSP participants had consistently lower supplement use than did nonparticipants in each of the sociodemographic groups (40 to 55 percent vs. 52 to 59 percent). Employment status appeared to have little association with supplement use.

When age, gender, education, employment status, and ethnicity were controlled, results showed that supplement users had statistically higher vitamin and mineral densities from food than did nonusers (table 2). The density for each of these nutrients was roughly 10 to 20 percent higher in the diets of supplement users than in the diets of nonusers. Also, in this study, the two groups had very similar densities of fat and saturated fat, contrasting with the earlier study of the general CSFII sample (1989-91) that found significantly lower total fat and saturated fat density among supplement users (Pelletier & Kendall, 1997). Both measures of diet quality, the Z-score average and the HEI average, showed statistically more healthful diets among supplement users than among nonusers.

Regression coefficients for all the variables in the main-effects models (table 3) that were used to generate the adjusted means in table 2 demonstrated the more favorable nutrient profiles for supplement users. In addition, the results based on the main-effects models revealed patterns among various subgroups within the group of FSP participants:

- Males, compared with females, had significantly higher densities of total fat, lower densities of vitamin C, and lower Z-scores for overall diet quality.
- Individuals less than 18 to 49 years old, compared with those 50 years old and over, had significantly higher densities of saturated fat and lower densities of iron, fiber, folate, vitamins A and C, as well as lower Z-scores.
- Hispanics, compared with Whites, had higher densities of fiber, folate, and vitamin C and higher Z-scores; Blacks, compared with Whites, had significantly lower densities of calcium, folate, and vitamin A but higher densities of vitamin C.
- Employed individuals, rather than unemployed individuals, had significantly lower densities of iron and calcium and lower Z-scores.

Table 3. Regression coefficients of the main-effects model for Food Stamp Program participants

Variable	Total fat	Saturated fat	Iron	Calcium	Fiber	Folate	Vitamin A	Vitamin C	Diet score Z average	HEI average
Main Effects[1]										
Intercept	***0.3336	***0.1129	***-4.8460	***-0.8910	***2.9970	***-2.0116	***-0.8367	***0.2081	**0.1568	***4.8784
Supplement user	-0.0026	-0.0029	***0.0928	*0.1048	***0.1971	**0.1332	**0.1930	*0.0150	***0.1721	***0.4375
Male	**0.01876	0.0052	-0.0125	-0.0121	-0.0708	-0.0501	-0.0856	***-0.0264	**-0.1141	***0.5277
18-49 years	0.0078	*0.0070	***-0.1271	-0.0399	***-0.3877	***-0.2306	***-0.2797	**-0.0252	***-0.2631	0.0839
Hispanic	-0.0025	-0.0031	0.0529	-0.0315	***0.2490	*0.1309	0.1133	***0.0525	***0.1701	***0.6401
Black	-0.0037	-0.0041	0.0244	***-0.2360	-0.1040	*-0.0962	*-0.1718	**0.0205	-0.0780	0.0182
Employed	0.0055	-0.0009	**-0.0758	***-0.1331	0.0111	-0.0800	-0.1260	-0.0093	*-0.1041	-0.0180
High school/ some college	***-0.0231	**-0.0090	0.0417	**-0.1059	-0.0133	-0.0019	-0.0630	0.0054	0.0404	0.1654
College or more	*-0.0267	-0.0089	0.0152	0.0775	0.0869	0.0856	0.0315	**0.0463	*0.1805	*0.6052
R^2	.0242	.0217	.0505	.0844	.0839	.0657	.0512	.0779	.1051	.0556

[1]Main effects are shown in relation to the reference (omitted) group within each variable: Female (Gender), 50 years and older (Age), White (Ethnicity), Unemployed (Employment status), and Less than high school (Education).
*p < 0.05, ** p < 0.01, ***p < 0.001.
n = 859.

Table 4. Test of uniformity in the association between supplement use and nutrient intakes among Food Stamp Program participants: 2-way and 3-way interaction models[1]

Variable	Total fat	Saturated fat	Iron	Calcium	Fiber	Folate	Vitamin A	Vitamin C	Diet score Z average	HEI average
R^2 for main-effects model	.0242	.0217	.0505	.0844	.0839	.0657	.0512	.0779	.1051	.0556
R^2 for 2-way model	.0273	.0293	.0779	.0935	.1004[2]	.0771	.0698	.0837	.1136	.0681
R^2 for 3-way model	.0371	.0430[4]	.0882[3,4]	.0946	.1020	.0836	.0780[3]	.0866	.1237[4]	.0701

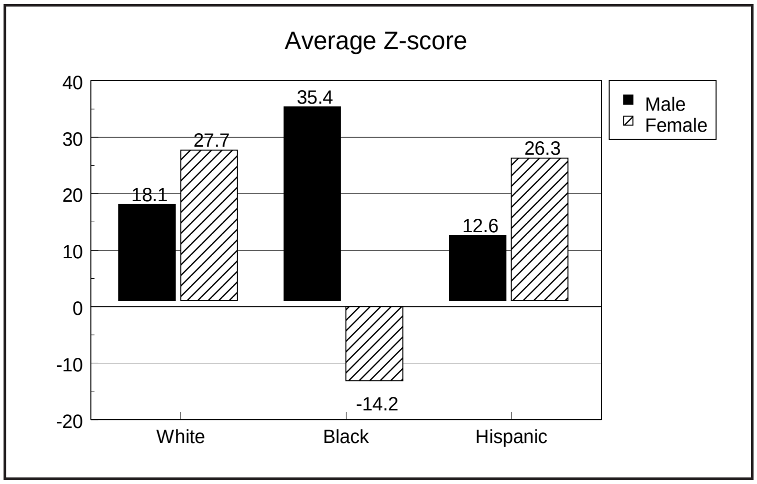
[1]Two-way models involved interaction terms between supplement use and ethnicity, age, or gender; 3-way models involved interaction terms between supplement use and any two of these variables.
[2]Two-way versus main-effects model; R^2 difference significant at p = .084 (fiber).
[3]Three-way versus main-effects model; R^2 difference significant at p = .005 (iron) and p = .0458 (vitamin A).
[4]Three-way versus 2-day interaction model; R^2 difference significant at p = .0375 (saturated fat), p = .0959 (iron), and p = .0890 (Z average).
n = 859.

- High school graduates tended to have more healthful diets as suggested by lower fat densities and higher composite diet scores than did non-high school graduates, but the patterns of means and statistical significance were not consistent across all nutrients.

Overall, these results suggest a complex and varying set of relationships existing between socio-demographic characteristics and nutrient densities from food, even before interaction terms were added to the models.

To test for the uniformity of the association between supplement use and nutrient density from food across major population groups, we sequentially added interaction terms involving the "user" variable to the main-effects model (table 4). Two-way interactions were first added, then blocks of 2-way and 3-way interactions were added in sequence. The statistical test of significance was based on the F statistic for the R^2 improvement, as each block of interaction terms was added to the model. Overall, the test of uniformity in the association between supplement use and nutrient density was rejected for four of the eight individual nutrients (saturated fat, iron, fiber, and vitamin A) and for one

Figure 1. Percent difference in average Z-score between supplement users and nonusers among Food Stamp Program participants, by ethnic and gender groups (adjusted for employment status and education)



Among older Whites and older Hispanics, supplement use was associated with more healthful nutrient profiles for iron, vitamin A, saturated fat, and the composite Z-score. However, this pattern was not evident among older Blacks where little or no association existed between supplement use and mean nutrient densities.

of the composite diet scores (Z-score). Saturated fat, iron, vitamin A, and the Z-score had significant 3-way interactions; whereas, only fiber had a significant 2-way interaction. The test of uniformity in the relationship between supplement use and nutrient density could not be rejected for total fat, calcium, folate, vitamin C, or the HEI average. Overall, these results suggest that, with respect to certain nutrients and one of the composite diet scores, the strength or direction of the association between supplement use and nutrient density was not uniform across all subgroups within the sample of FSP participants.

Based on the equations from the above analyses, we generated a series of predicted means to facilitate interpretation of the interactions. These predicted means revealed the magnitude and direction of the difference in nutrient density among supplement users versus nonusers across major FSP subgroups. These differences are summarized in figures 1 and 2. These figures display the mean difference in nutrient densities for supplement users versus nonusers in each sociodemographic group, expressed as a percentage of the mean for nonusers in that group. This was done to aid the interpretation of the regression coefficients and to further standardize the comparison across nutrients.

Figure 1 reveals that the basis for the 3-way interaction involving ethnicity, gender, and supplement use is that nutrient densities for Black females do not show the same pattern as in the other groups. As shown here for the Average Z-score, five of the ethnicity x gender groups had positive Difference scores, indicating that in each of these groups, supplement use was associated with more healthful nutrient density profiles. By contrast, Black females had a negative Difference score, indicating that supplement use in that group was associated with a less healthful nutrient profile. The patterns for iron, vitamin A, and saturated fat densities were similar (data not shown).

Figure 2. Percent difference in mean nutrient intakes between supplement users and nonusers among Food Stamp Program participants, by ethnic and gender groups (adjusted for employment status and education)

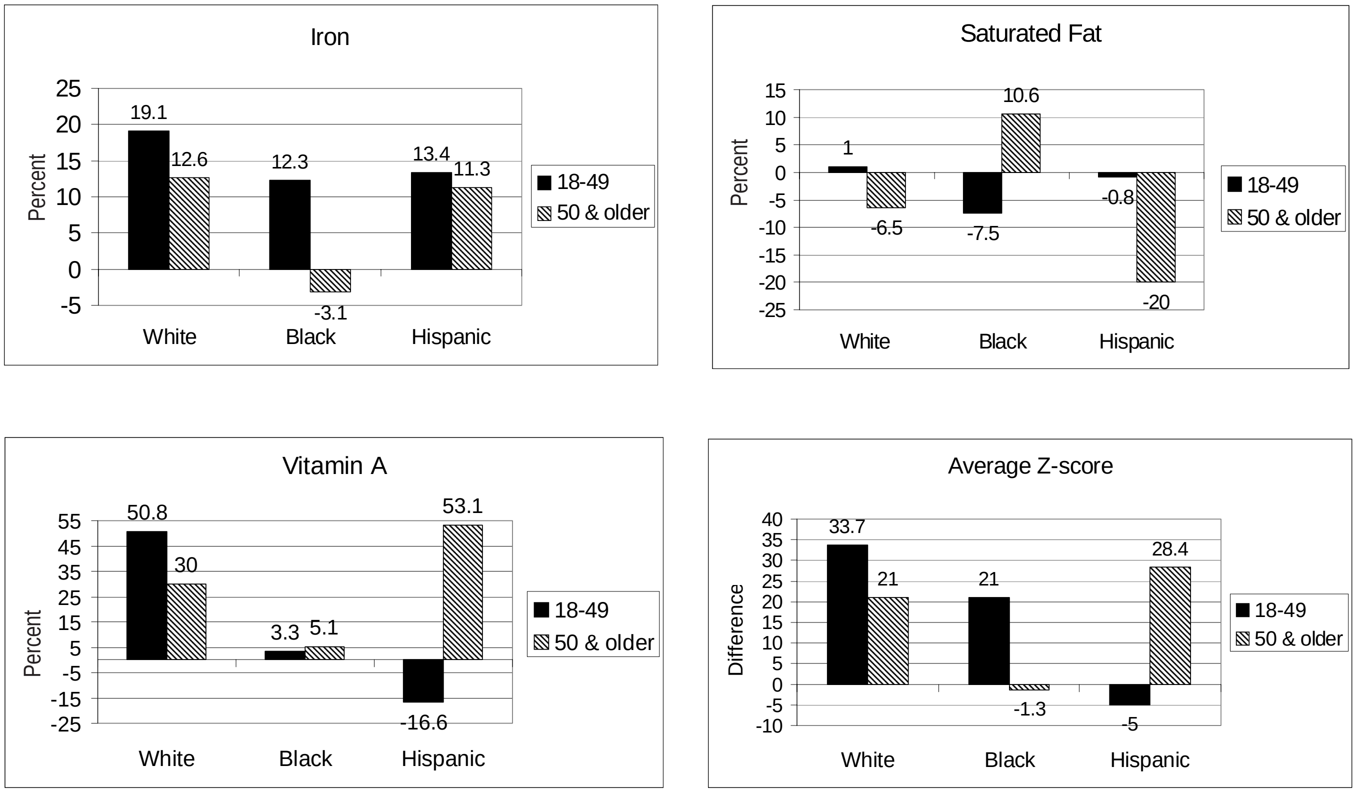


Figure 2 illustrates the basis for the 3-way interaction involving ethnicity, age, and supplement use. In this case, the relationships were more complex than those shown in figure 1. Among older Whites and older Hispanics, supplement use was associated with more healthful nutrient profiles for iron, vitamin A, saturated fat, and the composite Z-score. However, this pattern was not evident among older Blacks where little or no association existed between supplement use and mean nutrient densities.

Among younger Whites and younger Blacks, supplement use was associated with a more healthful composite Z-score (33.7 and 21.0 difference, respectively); among younger Hispanics, there was little or no association (-5 difference). However, in this case, the composite Z-score obscured significant variation with respect to individual nutrients. Thus, the positive Z-score difference for younger Blacks was a result of supplement users, compared with nonusers, having higher iron densities and lower saturated fat densities. Among younger Whites, the positive Z-score difference was a result of supplement users, compared with nonusers, having higher iron and vitamin A densities. Among younger Hispanics, the near-zero (-5) Z-score difference was a result of supplement users, compared with nonusers, having higher iron density but lower vitamin A.

While the above analyses pertaining to the 3-way interactions were sufficient to reject the hypothesis of uniformity in the association between supplement use and nutrient density from food, they were not adequate for exploring the social or behavioral basis for the differences observed. Further insight might be gained by testing more complete models, including higher level interactions with education, geographic location of residence, and other variables.

Discussion

There are two major findings from our research. First, among FSP participants, supplement use is positively associated with nutrient densities from food for iron, calcium, fiber, folate, vitamins A and C, and with two composite diet quality scores (average Z-score and average HEI). These associations remain statistically significant after accounting for age, gender, ethnicity, education, and employment status. In contrast to findings in the general population (Pelletier & Kendall, 1997), total fat and saturated fat densities are not significantly related to supplement use among FSP participants. Second, while these trends are evident for the FSP population as a whole, the interaction analysis reveals that the direction and strength of the association between supplement use and nutrient density vary significantly across age, gender, and ethnic groups for iron, saturated fat, fiber, vitamin A, and Z-score average. These findings are consistent with the results of parallel statistical analyses pertaining to the overall U.S. population (Pelletier & Kendall, 1997) and confirm the existence of significant heterogeneity in the relationship between supplement use and nutrient densities from food.

The present study has a number of strengths and limitations that should be considered when interpreting these findings. The strengths consist of the following:

- the analysis focused on the FSP participant population, which is precisely the population of interest in the policy proposals considered by Congress;
- the FSP sample was drawn from a nationally representative survey sample (CSFII) based on a standardized survey methodology;
- the analysis was restricted to nutrients of key public health concern in the United States; and
- the analysis formally explored statistical interactions, which few other studies on this subject have done.

The limitations of this study include use of the following:

- a cross-sectional survey rather than a longitudinal and/or experimental design;
- a single dietary recall for each subject, which is a poor measure of usual intake for individuals;
- small sample sizes in some of the cells used in the interaction analysis; and
- a dichotomous variable (yes/no) to measure supplement use, which does not fully capture the variation in usage related to type of supplement, frequency, regularity, and dosage.

In addition, the nutrient density indices in this study are appropriate for examining overall diet quality but are not intended to indicate dietary adequacy. The latter would require comparison with Dietary Reference Intakes or other external standards.

While it is important to acknowledge the above limitations, in statistical terms, the net effect of the problems related to dietary recall, sample size, and the dichotomous usage variable is to *reduce* the power of this study to find statistically significant associations and interactions between supplement use and nutrient density from food. Thus, while these considerations could have been invoked as possible explanations for *negative* findings (i.e., no statistically significant interactions), they cannot be invoked as an explanation for the *positive* findings reported here. To the contrary, the latter three methodological limitations imply that the true (unobservable) interactions may be larger in number and stronger in magnitude than those reported here.

Another methodological consideration is that the present analysis is focused on the mean nutrient densities of foods consumed by various subgroups. From a policy perspective, the greatest concern may be with those individuals at the lower end of the nutrient intake distributions rather than with those whose intakes are at the mean. Some insight into this issue might be gained in future studies by undertaking distributional analyses of the larger CSFII sample, which represents the general population. In addition, future studies should investigate whether interactions of the type noted here, in relation to nutrient density, may be due to variation in energy intake, physical activity, or other factors not measured here.

Finally, it is important to reiterate that the variations in nutrient density documented here, and in a previous study (Pelletier & Kendall, 1997), are important not only in relation to the particular nutrients studied but also because they are assumed to reflect systematic variations in patterns of food intake among supplement users and nonusers of different sociodemographic groups. This is a significant distinction, because chronic disease tends to be associated more closely with long-term patterns of food intake than with the intake of individual nutrients or supplements (National Research Council [NRC], 1989).

Policy Implications

This study highlights the pitfalls of assuming that statistical averages observed in the general population can be applied to all of its subgroups. This assumption is illustrated by one of the claims made commonly by representatives of the supplement industry (Council for Responsible Nutrition [CRN], 1998, 2002):

> In general, supplement users are healthy people who view supplements as just one of several approaches for improving health. There is no evidence that supplement users rely on supplements as a substitute for improving dietary habits. In fact, surveys show that supplement users tend to have somewhat better diets than [do] nonusers (Koplan, 1986; Looker, 1988; Hartz, 1988; Slesinsky, 1996). This suggests that consumers who use supplements are also paying more attention to their overall nutritional habits. Even so, these consumers have nutrient shortfalls in their diets, and supplements can help fill those gaps. (CRN, 2002, p. 14)

In contrast to these claims, a body of research now exists which suggests that in some U.S. sociodemographic groups, supplement use is associated with more healthful diets, and in some groups, supplement use is associated with less healthful diets. This pattern is found in the general U.S. population (Pelletier & Kendall, 1997) as well as among participants in the FSP (present study). In theory, however, these patterns may exist either because supplements are being used to substitute for healthful diets or because supplement users are a self-selected group. Although existing analyses of national survey data are not adequate for distinguishing between these two explanations, qualitative research with participants in the FSP reveals a common belief that supplements are intended to be a replacement or substitute for food (Kraak et al., 2002).

The accumulated evidence highlights a logical fallacy underlying one of the common arguments for permitting the use of food stamps to purchase nutrient supplements. The logical fallacy is that statistical averages observed from cross-sectional survey data from the general population apply equally to all subgroups within the population and, moreover, that such averages can be used to predict the response of the general population as well as a low-income population (e.g., FSP participants) to changes in policy. This present study adds to the broader body of evidence and rationales provided by an expert committee (LSRO, 1998) and a USDA report (1999), suggesting that any potential benefits of permitting the purchase of supplements with food stamps are outweighed by the risks, administrative complications, and uncertainties. The repeated failure of proposed legislation for changing FSP policy regarding nutrient supplements (e.g., H.R.104-236 and S.1731) suggests that policymakers may agree with this assessment.

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Trends in Food and Nutrient Intakes by Adolescents in the United States

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Evaluations of dietary trends can show whether food habits are changing in recommended directions. Trends in intakes among adolescents age 12 to 19 years were examined by using data from the Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96, the CSFII 1989-91, and the Nationwide Food Consumption Survey 1977-78. Increases were seen in intakes of soft drinks, grain mixtures, crackers/popcorn/pretzels/corn chips, fried potatoes, noncitrus juices/nectars, lowfat milk, skim milk, cheese, candy, and fruit drinks/ades. Decreases in intake were observed in whole milk and total milk, yeast breads/rolls, green beans, corn/green peas/lima beans, beef, and pork. Lower percentages of calories from fat were partly due to increased carbohydrate intakes. Adolescents had increases in thiamin, niacin, vitamin B_6, and iron and decreases in vitamin B_{12}. Servings per day from the food groups of the Food Guide Pyramid were used to discuss diet quality in the most recent survey. For any given Pyramid group, less than one-half of the adolescents consumed the recommended number of servings, and their intakes of discretionary fat and added sugars were much higher than recommended. Diets of adolescents still need to change in directions indicated by the Dietary Guidelines for Americans, including increases in intakes of whole grains, fruits, dark-green and deep-yellow vegetables, legumes, nonfat or lowfat dairy products, and lean meats. Additionally, increases in physical activity should be encouraged, as well as decreases in fats and added sugars. Effective nutrition education efforts for adolescents should be supported at every level.

As part of the National Nutrition Monitoring and Related Research Program, each of the U.S. Department of Agriculture (USDA) food and nutrient intake surveys provides a snapshot of the food choices made at a given time by the population of the United States. Information about trends in food and nutrient intakes by adults age 20 years and over and by children age 6 to 11 years has been published (Enns, Goldman, & Cook, 1997; Enns, Mickle, & Goldman, 2002). This article focuses on trends in intakes by adolescents age 12 to 19 years.

To examine whether adolescents' food intakes have changed over time, we compared nationally representative estimates from the most recent USDA survey of dietary intakes with similar estimates from two previous USDA surveys. The three surveys were the Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96,[1] CSFII

[1]Although the most recent USDA dietary intake survey encompassed the year 1998 as well as 1994-96, data collection in 1998 only included children under 10 years of age. For that reason, we identify the survey in this article as the CSFII 1994-96. The sampling weights constructed for analysis of the CSFII 1994-96 data were used for the present analysis.

1989-91, and the Nationwide Food Consumption Survey (NFCS) 1977-78 (Tippett et al., 1995; USDA, 1983, 1999, 2000a). The estimates reported in this study are of food intakes, the percentages of individuals consuming foods, and nutrient intakes for girls and boys age 12 to 19 years during all three periods. In the discussion of diet quality in the most recent survey, we cite information on intakes stated in terms of Food Guide Pyramid servings (USDA, 2000b).

Design and Methods

The Three Surveys

The CSFII 1994-96 was the most recent source of information on adolescents' intakes in the evolving series of USDA food and nutrient intake surveys that also includes the two earlier surveys (Tippett, Enns, & Moshfegh, 2000). Differences among the three surveys in sampling and methodology are discussed briefly in the following paragraphs. More information on methods in the NFCS 1977-78 and the CSFII 1989-91 is available elsewhere (Tippett et al., 1995; USDA, 1983).

The target population covered all 50 States in 1994-96 versus the 48 conterminous States in 1977-78 and 1989-91. In 1989-91 and 1994-96, the low-income population was over-sampled. In 1977-78 and 1989-91, all adolescents in sample households were eligible for inclusion in the survey; in 1994-96, selected individuals within each household were eligible. The number of adolescents age 12 to 19 years and the all-individuals Day-1 response rate, respectively, for each survey are 5,890 and 56.9 percent (NFCS 1977-78), 1,627 and 57.6 percent (CSFII 1989-91), and 1,469 and 80.0 percent (CSFII 1994-96).

In 1977-78 and 1989-91, dietary data were collected on 3 consecutive days by using a 1-day dietary recall and a 2-day dietary record. In 1994-96, the number of days was reduced to two, partly to reduce respondent burden (Tippett & Cypel, 1998). Both days of CSFII 1994-96 dietary data were collected with 1-day dietary recalls; interviews were on nonconsecutive days, 3 to 10 days apart, to ensure that nutrient intakes on the 2 days would be statistically uncorrelated. Between the earlier surveys and the CSFII 1994-96, the 1-day recall was modified to include multiple passes through the list of all foods and beverages recalled by the respondent, with the goal of improving the completeness of the data collected (Tippett & Cypel, 1998).

The USDA Survey Nutrient Database was updated on an ongoing basis to incorporate additional nutrients and improved nutrient values as well as to reflect changes in foods on the market (Tippett & Cypel, 1998; Tippett et al., 1995; USDA, 1987, 1993).

Presentation of Estimates

Because the number of survey days and the method of data collection on Day 2 differed among the surveys, tables comparing food and nutrient intake estimates among the surveys are based on only Day-1 data collected from each individual. Using these data maximizes comparability among surveys. One-day data are appropriate for comparisons of group means. All estimates are weighted to be nationally representative.

Mean food intakes are presented "per individual," meaning intakes include those by both consumers and non-consumers of the food group. To calculate "per user" intakes of foods, researchers may divide the mean intake of a food group by the percentage of individuals using that food group, expressed as a decimal. Because only selected food subgroups are presented, subgroup intakes will not sum to the food group total.[2] Food mixtures were not broken down; mixed foods reported by respondents were grouped by their main ingredient.[3] One effect of this method of classifying food is the inflation of some food groups or subgroups (e.g., meat mixtures) and deflation of others (e.g., sugars and sweets) relative to the amounts they would contain if all ingredients were disaggregated.

Estimates based on a small number of observations or on highly variable data may tend to be less statistically reliable than estimates based on larger sample sizes or on less variable data. Standard errors may be used to calculate a measure of the relative variability of an estimate called the coefficient of variation, the ratio of the standard error to the estimate itself. Because the CSFII has a complex sample design, sampling weights and procedures for specialized standard error estimation were used in computing the estimates and standard errors (USDA, 2000a, documentation section 5). SAS version 8.2 (1999) and SUDAAN version 7.5.1 (Shah, Barnwell, & Bieler, 1997) were used for statistical calculations.

In the tables, we flagged estimates that are potentially less reliable because of factors such as small sample sizes or large coefficients of variation. The guidelines that were used for determining when a statistic may be less reliable involve the use of a variance inflation factor in the role of a broadly calculated design effect. Those guidelines have been described in detail elsewhere (USDA, 1999, appendix B). The

[2]Readers interested in subgroups not included here are directed to Tippett et al. (1995) and USDA (1983, 1999).

[3]See "Table Notes" in Tippett et al. (1995) and USDA (1983); see "Descriptions of Food Groups" in USDA (1999).

variance inflation factors used in this study were 1.19 (1977-78), 2.26 (1989-91), and 1.41 (1994-96).

Approximate *t* tests were performed to determine whether food and nutrient intakes and the percentages of individuals using foods were significantly higher or lower in 1977-78 versus 1989-91, 1989-91 versus 1994-96, and 1977-78 versus 1994-96. All told, some 460 pairs of estimates were compared. Because the analysis involved such a large number of comparisons, we used conservative criteria for significance. When significant differences are discussed in the text, they may be referred to either as "changes" (or values may be said to have risen/fallen or to be higher/lower in 1994-96 than in 1977-78) or as "trends."

The term "change" is used only if intakes (or percentages using) in 1977-78 and 1994-96 were different when p was less than 0.001. The term "trend" is used only if two criteria were met: (1) mean intakes (or percentages using) either rose or fell progressively from one survey to the next (e.g., intake X rose between 1977-78 and 1989-91, then rose again between 1989-91 and 1994-96), and (2) p was less than 0.05 for both comparisons. For each trend, the level of significance noted in the tables (< 0.05 or < 0.01) is the one that is true of both the 1977-78 versus 1989-91 *t* test and the 1989-91 versus 1994-96 *t* test. For example, if the 1977-78 versus 1989-91 *t* test was significant at p < 0.01 but the 1989-91 versus 1994-96 *t* test was significant at p < 0.05, the latter level is shown in the table.

Results and Discussion

Beverages

Since the late 1970s, the overall picture of beverage intakes by adolescents has changed considerably. The diets of both girls and boys age 12 to 19 had decreasing trends over time in both intakes of total fluid milk and the percentages of individuals using fluid milk (tables 1-4). Both girls' and boys' diets had increasing trends in intakes of soft drinks, and boys' diets also had a trend to a higher percentage of individuals using soft drinks. In 1977-78 adolescents drank at least one and one-half times as much fluid milk as any other beverage, but by 1994-96 they drank about twice as much soft drinks as milk. Adolescents' intake of noncitrus juices and nectars—such as apple juice, grape juice, and 100-percent fruit juice blends—tripled between 1977-78 and 1994-96, although in the latter survey, they still drank less noncitrus juices than soft drinks, milk, or fruit drinks and ades. Adolescents' intakes of fruit drinks and ades, which contain little or no fruit juice, doubled between 1977-78 and 1994-96.

The shift in beverage intakes is of nutritional concern. Guenther (1986) found negative associations between intake of soft drinks and intakes of milk, calcium, magnesium, riboflavin, vitamin A, and vitamin C. Harnack, Stang, and Story (1999), in an analysis of CSFII 1994 data, reported a positive association between consumption of nondiet soft drinks and energy intake. Wyshak (2000) found that high-school-age girls who drink carbonated beverages may have a higher risk of bone fractures than is the case for girls who do not drink carbonated beverages. In a 19-month-long prospective study, Ludwig, Peterson, and Gortmaker (2001) observed an association between consumption of sugar-sweetened drinks

Although the percentages of adolescents drinking skim milk more than doubled between 1977-78 and 1994-96, they still remained low (7 to 9 percent) . . . .

and childhood obesity. Because the studies by Guenther (1986), Harnack et al. (1999), Wyshak (2000), and Ludwig et al. (2001) were observational, it cannot be inferred that the relationships between soft drinks and the negative outcomes described were causal. Further research is needed in this area.

Foods

Overall, the intakes of grain products were about two-fifths higher in 1994-96 than in 1977-78 for girls and boys age 12 to 19 years (tables 1 and 2). In all three surveys, the subgroup "mixtures mainly grain"—grain-based mixtures such as pasta with sauce, rice dishes, and pizza—accounted for the largest share (by weight) of grain products eaten by adolescents. Teenage girls' and boys' diets had increasing trends for both intakes and percentages using grain mixtures (tables 3 and 4).

Increasing trends were observed in adolescents' intakes of grain-based snack foods from the group "crackers, popcorn, pretzels, and corn chips." Among boys, there were also trends toward lower intakes and percentages consuming yeast breads and rolls; the decline in girls' intakes and percentages using yeast breads and rolls could not be classified as a trend. Yeast breads and rolls are common components in sandwiches, and some sandwiches (especially fast-food items) are categorized under "mixtures mainly meat, poultry, fish." Intake estimates for yeast breads and rolls would be higher if the breads and rolls from those sandwiches were included here.

In 1994-96 only 35 percent of girls and 48 percent of boys consumed the number of servings of grain products recommended in the Food Guide Pyramid based on their caloric intake (USDA, 2000b). Despite Pyramid recommendations to choose "several servings a day" of whole-grain foods

Table 1. Trends and changes in adolescent[1] girls' mean intakes from selected food groups

Food group	Intake (grams) 1977-78	1989-91	1994-96	Change[2]	Trend[3]
Grain products	215	261	306	+91	**
Yeast breads and rolls	52	45	40	-12	
Ready-to-eat cereals	11	15	17	+6	
Cakes, cookies, pastries, pies	34	26	37		
Crackers, popcorn, pretzels, corn chips	5	8	15	+11	*
Mixtures mainly grain	59	100	132	+73	*
Vegetables	165	129	145		
White potatoes	61	56	61		
Fried white potatoes	18	31	31	+13	
Dark-green vegetables	6	5	9		
Deep-yellow vegetables	6	5[4]	4		
Tomatoes	16	17	18		
Green beans	8	5	4	-5	
Corn, green peas, lima beans	19	12	8	-11	
Fruits	129	133	157		
Citrus juices	53	68	67		
Apples	20	11	13		
Melons and berries	7	7	15		
Noncitrus juices and nectars	12	19	35	+23	
Milk and milk products	380	308	268	-112	
Fluid milk	303	239	189	-114	*
Whole milk	166	97	67	-99	*
Lowfat milk	53	115	91	+38	
Skim milk	13	16[3]	30	+17	
Milk desserts	25	20	29		
Cheese	9	15	14	+5	
Meat, poultry, and fish	186	152	158	-28	
Beef	46	19	21	-25	
Pork	16	11	5	-10	
Frankfurters, sausages, luncheon meats	17	15	15		
Chicken	21	20	19		
Fish and shellfish	10	6	6		
Mixtures mainly meat, poultry, fish	66	73	85		
Eggs	18	12	13		
Legumes	19	13	14		
Fats and oils	11	10	10		
Sugars and sweets	22	23	31		
Candy	5	6	12	+7	
Beverages	417	534	645	+228	**
Tea	89	87	92		
Fruit drinks and ades	72	87	134	+62	
Carbonated soft drinks	208	324	396	+188	*

[1]12 to 19 years.
[2]Change = mean intakes in 1977-78 and 1994-96 are significantly different at $p < 0.001$.
[3]Trend = mean intake rose or fell progressively from 1977-78 through 1989-91 to 1994-96.
[4]Estimate is based on small sample size or coefficient of variation ≥ 30 percent.
* = trend significant at $p < 0.05$.
** = trend significant at $p < 0.01$.

Table 2. Trends and changes in adolescent[1] boys' mean intakes from selected food groups

Food group	Intake (grams) 1977-78	1989-91	1994-96	Change[2]	Trend[3]
Grain products	297	351	406	+109	*
Yeast breads and rolls	77	65	54	-23	*
Ready-to-eat cereals	18	25	29	+10	
Cakes, cookies, pastries, pies	48	45	49		
Crackers, popcorn, pretzels, corn chips	6	9	19	+14	*
Mixtures mainly grain	78	121	175	+96	**
Vegetables	209	173	176		
White potatoes	86	78	86		
Fried white potatoes	27	35	44	+17	
Dark-green vegetables	8	9	6		
Deep-yellow vegetables	8	4	6		
Tomatoes	17	22	28	+11	
Green beans	12	6[4]	3[4]	-9	
Corn, green peas, lima beans	27	20	10	-17	
Fruits	143	157	174		
Citrus juices	60	84	94		
Apples	24	20	13	-11	
Melons and berries	7	6[4]	11[4]		
Noncitrus juices and nectars	9	12	29	+20	
Milk and milk products	571	461	409	-162	
Fluid milk	472	376	303	-169	*
Whole milk	257	145	100	-157	*
Lowfat milk	88	197	157	+69	
Skim milk	17	22[4]	40		
Milk desserts	34	32	29		
Cheese	11	13	19	+8	
Meat, poultry, and fish	257	221	250		
Beef	64	34	30	-34	
Pork	24	12	12	-12	
Frankfurters, sausages, luncheon meats	26	27	28		
Chicken	26	26	26		
Fish and shellfish	9	7	8		
Mixtures mainly meat, poultry, fish	94	103	135	+41	
Eggs	28	16	22		
Legumes	28	27	17		
Fats and oils	13	14	12		
Sugars and sweets	32	29	35		
Candy	5	8	13	+8	*
Beverages	467	639	994	+527	**
Tea	98	95	115		
Fruit drinks and ades	98	104	205	+107	
Carbonated soft drinks	220	424	608	+388	**

[1]12 to 19 years.
[2]Change = mean intakes in 1977-78 and 1994-96 are significantly different at $p < 0.001$.
[3]Trend = mean intake rose or fell progressively from 1977-78 through 1989-91 to 1994-96.
[4]Estimate is based on small sample size or coefficient of variation ≥ 30 percent.
* = trend significant at $p < 0.05$.
** = trend significant at $p < 0.01$.

(USDA, 1996), adolescents' intake of whole grains in 1994-96 was only about 1 serving per day.

Few trends were observed in adolescents' intakes of vegetables. It is important to remember that vegetables are frequently consumed as part of meat mixtures and grain mixtures. For adults in 1994, intakes of vegetables accounted for about 24 percent and 28 percent (by weight) of grain mixtures and meat mixtures, respectively (Enns et al., 1997). If vegetables account for a similar proportion of grain and meat mixtures for adolescents as for adults, then the observed higher intakes of grain mixtures would at least partially offset the lower intakes of vegetables. Further research is needed to clarify this issue. However, even when mixture ingredients are separated into their respective groups, 74 percent of adolescent girls and 67 percent of adolescent boys had diets that did not meet the Pyramid recommendations for servings of vegetables (USDA, 2000b). Despite Pyramid recommendations to eat both dark-green leafy vegetables and legumes "several times a week," adolescents ate no more than one-fifth of a serving from either category on any given day.

Adolescents' intakes of fried white potatoes were higher in 1994-96 than in 1977-78. The percentages of adolescents using tomatoes rose between 1977-78 and 1994-96, and the increase qualified as a trend among boys. Both girls and boys had lower intakes and lower percentages using the subgroups "green beans" and "corn, green peas, and lima beans" in 1994-96 than in 1977-78. The decrease in the percentage of boys using corn, green peas, and lima beans met the definition of a trend.

Aside from the observed changes in intakes of noncitrus juices and nectars, few changes occurred in fruit consumption. Between 1977-78 and 1994-96, the percentage using citrus juices and apples fell among girls and both intakes and percentages using apples fell among boys. In 1994-96 only 18 percent of girls and 14 percent of boys consumed the number of servings of fruit recommended in the Food Guide Pyramid based on their caloric intake (USDA, 2000b).

Among milk and milk products subgroups, adolescents' intakes of some high-fat items (e.g., whole milk) decreased and others (e.g., cheese) increased. Notably, milk intakes shifted away from whole milk.[4] Decreasing trends were seen both in adolescents' intakes of whole milk and in the percentages of adolescents using whole milk. Intakes of lower fat milks (2%, 1%, and skim) by adolescents surpassed those of whole milk in 1989-91. Although the percentages of adolescents drinking skim milk more than doubled between 1977-78 and 1994-96, they still remained low (7 to 9 percent), as did their intakes of skim milk (30 to 40 grams [g], or about 1 to 1-1/3 fluid ounces). None of the shifts in intakes of lower fat milks or percentages using them qualified as a trend.

On the other hand, increasing trends in the percentages of adolescents using cheese were seen. Although cheese intakes were higher in 1994-96 than in 1977-78, the increase did not qualify as a trend. Because cheese is a common

[4]Another shift occurred that can be seen by summing the milk subgroup intakes (whole, lowfat, and skim) in a given survey and dividing by the intake of total fluid milk. A greater proportion of total fluid milk was allocated to a specific fat level in later years than in 1977-78. The increase may indicate a greater awareness of the fat level of milk, because the ability to classify fluid milk as whole, lowfat, or skim depends on information provided by respondents. Milk whose fat level was not specified was included under total fluid milk but not in any of the subgroups.

Table 3. Trends and changes in percentages of adolescent[1] girls using items from selected food groups

Food group	Percentage using 1977-78	1989-91	1994-96	Change[2]	Trend[3]
Grain products	96	97	98[4]		
Yeast breads and rolls	75	65	61	-15	
Ready-to-eat cereals	29	28	30		
Cakes, cookies, pastries, pies	40	30	41		
Crackers, popcorn, pretzels, corn chips	16	20	31	+15	
Mixtures mainly grain	23	39	46	+23	*
Vegetables	83	72	79		
White potatoes	51	45	46		
Fried white potatoes	28	32	35		
Dark-green vegetables	5	6	7		
Deep-yellow vegetables	7	7	11		
Tomatoes	22	29	35	+13	
Green beans	10	7	4	-6	
Corn, green peas, lima beans	18	12	7	-11	
Fruits	50	44	46		
Citrus juices	25	21	18	-7	
Apples	13	7	8	-5	
Melons and berries	3	3	6		
Noncitrus juices and nectars	4	7	10	+6	
Milk and milk products	84	77	75	-9	
Fluid milk	72	60	50	-22	**
Whole milk	42	29	18	-24	**
Lowfat milk	13	27	24	+11	
Skim milk	4	4	9	+6	
Milk desserts	18	14	17		
Cheese	19	29	36	+17	*
Meat, poultry, and fish	92	81	80	-12	
Beef	33	18	22	-11	
Pork	21	14	11	-10	
Frankfurters, sausages, luncheon meats	27	27	25		
Chicken	17	17	19		
Fish and shellfish	9	6	6		
Mixtures mainly meat, poultry, fish	32	35	34		
Eggs	23	13	15	-8	
Legumes	11	9	11		
Fats and oils	53	48	46		
Sugars and sweets	47	44	46		
Candy	9	12	24	+15	
Beverages	73	78	87	+14	
Tea	21	18	19		
Fruit drinks and ades	19	21	27		
Carbonated soft drinks	46	58	62	+17	

[1]12 to 19 years.
[2]Change = percentages in 1977-78 and 1994-96 are significantly different at $p < 0.001$.
[3]Trend = percentage rose or fell progressively from 1977-78 through 1989-91 to 1994-96.
[4]Estimate is based on small sample size or coefficient of variation ≥ 30 percent.
* = trend significant at $p < 0.05$.
** = trend significant at $p < 0.01$.

Table 4. Trends and changes in percentages of adolescent[1] boys using items from selected food groups

Food group	Percentage using 1977-78	1989-91	1994-96	Change[2]	Trend[3]
Grain products	98	97	98[4]		
Yeast breads and rolls	81	71	63	-19	*
Ready-to-eat cereals	37	35	33		
Cakes, cookies, pastries, pies	45	39	41		
Crackers, popcorn, pretzels, corn chips	15	20	27	+12	
Mixtures mainly grain	25	37	46	+21	*
Vegetables	87	81	78	-9	
White potatoes	58	50	50	-9	
Fried white potatoes	34	37	39		
Dark-green vegetables	6	6	4		
Deep-yellow vegetables	8	8	8		
Tomatoes	23	32	43	+20	**
Green beans	12	6	3	-9	
Corn, green peas, lima beans	23	14	7	-15	**
Fruits	50	44	45		
Citrus juices	26	24	22		
Apples	13	10	8	-5	
Melons and berries	3	3	4		
Noncitrus juices and nectars	3	4	8	+5	
Milk and milk products	90	87	81	-9	
Fluid milk	82	72	60	-22	**
Whole milk	50	31	23	-27	**
Lowfat milk	16	39	31	+15	
Skim milk	3	5	7	+4	
Milk desserts	20	16	14	-7	
Cheese	19	27	37	+18	**
Meat, poultry, and fish	96	90	87	-9	
Beef	37	26	24	-13	
Pork	27	14	16	-11	
Frankfurters, sausages, luncheon meats	32	35	32		
Chicken	16	18	18		
Fish and shellfish	7	5	5		
Mixtures mainly meat, poultry, fish	37	36	38		
Eggs	28	15	17	-11	
Legumes	12	11	11		
Fats and oils	54	52	43	+11	
Sugars and sweets	53	41	47		
Candy	8	14	21	+13	**
Beverages	72	78	87	+16	
Tea	21	14	16		
Fruit drinks and ades	20	18	28	+8	
Carbonated soft drinks	43	59	69	+26	*

[1]12 to 19 years.
[2]Change = percentages in 1977-78 and 1994-96 are significantly different at $p < 0.001$.
[3]Trend = percentage rose or fell progressively from 1977-78 through 1989-91 to 1994-96.
[4]Estimate is based on small sample size or coefficient of variation ≥ 30 percent.
* = trend significant at $p < 0.05$.
** = trend significant at $p < 0.01$.

component in both grain and meat mixtures, estimates for cheese would be even higher if the cheese that was an ingredient in these mixtures were included here. In 1994-96 only 12 percent of girls and 30 percent of boys consumed the number of servings of dairy products recommended in the Food Guide Pyramid based on their age (USDA, 2000b).

The percentages of both girls and boys using foods from the meat, poultry, and fish group were lower in 1994-96 than in 1977-78. Both intakes and percentages of individuals using beef and pork separately (i.e., not as part of a mixture) fell. In all three surveys, intakes of "mixtures mainly meat, poultry, fish"—such as beef stew, hamburgers, chicken pot pie, and tuna salad—accounted for the largest share of intakes of total meat, poultry, and fish. Percentages of adolescents consuming eggs were lower in 1994-96 than in 1977-78.

In 1994-96 only 22 percent of girls and 44 percent of boys consumed the number of servings of meat and meat alternates recommended in the Food Guide Pyramid based on their caloric needs (USDA, 2000b). Cooked dry beans (other than soybeans) and peas, which may be tabulated under either the vegetable group or the meat group, were tabulated under the meat group for that analysis; otherwise, the percentages consuming the recommended number of servings from the meat group would have been even lower.

For both girls and boys, intakes and percentages using candy increased between 1977-78 and 1994-96. However, the increases qualified as trends only for the adolescent boys. Fats, oils, and sugars are common ingredients in foods; thus, the estimates of intakes and percentages using fats, oils, and sugars would be higher if the amounts that were ingredients in other foods were included here.

In 1994-96, intakes of discretionary fat and added sugars[5]—items from the tip of the Pyramid—were much higher than recommended (USDA, 2000b). Among adolescents, discretionary fat intake accounted for about 25 percent of calories for girls and 26 percent for boys. In a diet that meets all other Pyramid recommendations, discretionary fat intake would be expected to be closer to 15 percent of calories (USDA, 1996). In 1994-96, adolescent girls consumed 23 teaspoons of added sugars per day in a diet providing around 1,800 calories; adolescent boys consumed 34 teaspoons of added sugars per day in a diet providing around 2,700 calories. The Pyramid suggests that Americans try to limit their added sugars to 6 teaspoons a day if they eat about 1,600 calories, 12 teaspoons at 2,200 calories, or 18 teaspoons at 2,800 calories (USDA, 1996).

Energy Out of Balance

Over roughly the same period covered by the present analysis, the percentages of 12- to 19-year-old boys in the United States who were overweight[6] rose from 4.5 percent in 1976-80 to 11.3 percent in 1988-94; among adolescent girls, the increase was from 5.4 to 9.7 percent (U.S. Department of Health and Human Services [DHHS], 2001). The increasing prevalence of overweight is of concern for many reasons, including the increasing incidence and prevalence of Type II diabetes mellitus among overweight and obese adolescents (American Diabetes Association, 2000). Overweight in adolescence is also associated with high blood lipids,

Table 5. Trends and changes in adolescent[1] girls' and boys' mean intakes of food energy and selected nutrients and mean percentages of calories from protein, fat, and carbohydrate

Food group	Intake 1977-78	Intake 1989-91	Intake 1994-96	Change[2]	Trend[3]
Girls	n=2,993	n=837	n=732		
Energy (kcal)	1,797	1,748	1,910		
Protein (g)	70.6	66.0	65.3	-5.3	
Fat (g)	80.0	67.4	69.3	-10.7	
Carbohydrate (g)	202.0	223.5	261.9	+59.9	**
Protein (% kcal)	16.0	15.4	14.0	-2.0	
Fat (% kcal)	39.3	33.8	32.2	-7.2	*
Carbohydrate (% kcal)	45.4	51.7	55.0	+9.6	**
Vitamin A (IU)	4,410	4,554	4,817		
Vitamin C (mg)	78	90	95		
Thiamin (mg)	1.23	1.39	1.44	+0.21	
Riboflavin (mg)	1.72	1.72	1.75		
Niacin (mg)	16.7	18.1	19.0	+2.3	
Vitamin B_6 (mg)	1.37	1.42	1.53	+0.16	
Vitamin B_{12} (μg)	5.34	3.66	3.80	-1.54	
Calcium (mg)	784	797	771		
Phosphorus (mg)	1,127	1,123	1,108		
Magnesium (mg)	213	216	223		
Iron (mg)	10.3	11.9	13.8	+3.5	**
Boys	n=2,897	n=790	n=737		
Energy (kcal)	2,523	2,459	2,766	+243	
Protein (g)	99.8	93.1	97.5		
Fat (g)	113.7	96.8	102.8	-10.8	
Carbohydrate (g)	279.0	310.9	366.1	+87.0	**
Protein (% kcal)	16.1	15.6	14.4	-1.7	
Fat (% kcal)	39.9	34.7	33.1	-6.8	**
Carbohydrate (% kcal)	44.6	50.8	53.2	+8.5	**
Vitamin A (IU)	6,018	5,893	6,361		
Vitamin C (mg)	97	114	119		
Thiamin (mg)	1.76	1.99	2.13	+0.36	
Riboflavin (mg)	2.51	2.49	2.58		
Niacin (mg)	23.3	25.0	27.8	+4.4	*
Vitamin B_6 (mg)	1.92	2.01	2.21	+0.29	
Vitamin B_{12} (μg)	7.50	5.89	5.85	-1.65	
Calcium (mg)	1,145	1,145	1,145		
Phosphorus (mg)	1,608	1,598	1,633		
Magnesium (mg)	301	299	311		
Iron (mg)	14.5	17.8	19.8	+5.3	*

[1]12 to 19 years.
[2]Change = mean intakes (or percentages) in 1977-78 and 1994-96 are significantly different at $p < 0.001$.
[3]Trend = mean intake (or percentage) rose or fell progressively from 1977-78 through 1989-91 to 1994-96.
* = trend significant at $p < 0.05$.
** = trend significant at $p < 0.01$.

[5]For definitions of discretionary fat and added sugars, see appendix D in Pyramid Servings table set 1 (USDA, 2000b).

[6]Overweight is defined as body mass index (BMI) at or above the sex- and age-specific 95th percentile BMI cutoff points reported in the revised *CDC Growth Charts: United States* (Kuczmarski et al., 2000).

hypertension, an increased likelihood of overweight in adulthood, and various other problems (DHHS, 2001).

In the face of increasing overweight, one would expect to see either increasing energy intake or decreasing energy expenditure or both. In the present analysis, no significant trends or changes were seen in energy intakes between 1977-78 and 1994-96 (table 5). Adolescent boys' energy intake was over 200 kcal higher in 1994-96 than in 1977-78 (2,766 kcal vs. 2,523 kcal). Girls' energy intake was 1,910 kcal in 1994-96 and 1,797 kcal in 1977-78, but no significant difference was found.

Findings of underreporting in surveys, which are often but not always higher among overweight respondents, might lead one to speculate that the lack of a trend in energy intake could be due to increased underreporting over time as a function of increased obesity. On the other hand, methodological improvements in the Agricultural Research Service's 24-hour recall have addressed several issues that are considered important in obtaining complete intake data (see "Design and Methods").

Using CSFII data, Krebs-Smith et al. (2000) identified low-energy reporters by first estimating basal metabolic rate (BMR)[7] based on self-reported body weight, gender, and age and then comparing the BMR estimates with a cutoff level.[8] They found that the percentage of adults who were low-energy reporters was lower in 1994-96 (15 percent) than in 1989-91 (25 percent).

They also found less underreporting among adolescents than among adults. Only 9.5 percent of adolescents age 12 to 19 in 1994-96 were found to be low-energy reporters (S.M. Krebs-Smith, personal communication, March 8, 2002). Livingstone and Robson (2000) have stated that determining whether an adolescent's energy intake is implausibly low should take into account detailed information on the adolescent's activity level; however, such information is not available from the three surveys in the present analysis.

For girls, carbohydrate intake was about 60 g per day higher in 1994-96 than in 1977-78; for boys, the intake was 87 g higher.

Inactivity is probably a strong factor in the increased prevalence of overweight in the United States (DHHS, 2001; Weinsier, Hunter, Heini, Goran, & Sell, 1998). In 1996 the Surgeon General concluded that nearly half of American youths 12 through 21 years of age are not vigorously active on a regular basis, that about one-tenth of them are not active at all, and that physical activity declines during adolescence (DHHS, 1996).

The Dietary Guidelines for Americans recommend that adolescents engage in at least 60 minutes of moderate physical activity on most days of the week, preferably daily (USDA & DHHS, 2000). One strategy suggested by the Dietary Guidelines to help teens increase their activity is to limit television watching. On any given day in 1994-96, 32 percent of girls and 34 percent of boys age 12 to 19 watched 4 or more hours of television or videos, 29 percent of girls and 34 percent of boys watched 2 to 3 hours, and 39 percent of girls and 33 percent of boys watched 1 hour or less (unpublished data).

Energy-Providing Nutrients (Macronutrients)

Trends toward higher carbohydrate intakes were evident among both adolescent girls and boys. For girls, carbohydrate intake was about 60 g per

[7]BMR was estimated by using the formula developed by Schofield (1985).

[8]Eighty percent of BMR was the cutoff level used. That level was proposed by Goldberg et al. (1991) as the lower limit of plausible energy intake for a single individual with 2 days of intake data and 99.7 percent confidence limits.

day higher in 1994-96 than in 1977-78; for boys, the intake was 87 g higher. For both girls and boys, protein and fat intakes were lower in 1994-96 than in 1977-78, although the p value criterion for a trend was not met.

These shifts in adolescents' macronutrient intakes between 1977-78 and 1994-96 were reflected in trends toward a lower proportion of food-energy intake from fat and a higher proportion from carbohydrate. Adolescents' percentage of calories from protein was also lower in 1994-96 than in 1977-78, but the trend definition was not met. The proportion of energy from fat in adolescents' diets in 1994-96 (33 percent for girls and 32 percent for boys) was still higher than what is recommended by the Dietary Guidelines for Americans: 30 percent of calories or less (USDA & DHHS, 2000). At 11 percent of calories for girls and 12 percent of calories for boys (unpublished data), saturated fat intakes still exceeded the recommendation of less than 10 percent of calories.

Although the shifts in the proportion of energy intake from fat and carbohydrate appear to have brought the macronutrient proportions in the average diet nearer to the recommended levels, a closer examination is less encouraging. The observed decrease in the percentage of calories from fat is more due to the increase in calories from carbohydrate than to the decrease in fat intake. Fat intake decreased by almost 100 kcal for both girls and boys, but carbohydrate intake increased by about 240 kcal for girls and almost 350 kcal for boys, based on estimates in table 5 that were multiplied by Merrill and Watt's (1973) general conversion factors of 9 kcal/g for fat and 4 kcal/g for carbohydrate.

Vitamins, Minerals, and Other Dietary Components

Increasing trends were observed in iron intakes for both adolescent girls and boys (table 5). Boys' diets had an increasing trend in niacin intake, and girls' diets had a higher intake that did not meet the trend criteria. Additionally, thiamin and vitamin B_6 intakes for adolescents were higher, and vitamin B_{12} intakes were lower.

Mean dietary fiber intakes in 1994-96 were 13 g for girls and 17 g for boys (unpublished data). The Institute of Medicine (2002) has set the adequate intake of total fiber (which equals dietary fiber plus a minor amount of functional fibers) at 26 g/day for girls 9 to 18 years, 31 g/day for boys 9 to 13 years, and 38 g/day for boys 14 to 18 years. Observed increases in carbohydrate intakes were paralleled neither by significant increases in dietary fiber intakes nor by increases in overall intakes of fiber-rich foods.

Summary and Recommendations

The pattern of results seen for adolescents echos many of the findings for adults and children (Enns, Goldman, & Cook, 1997; Enns, Mickle, & Goldman, 2002). Adolescents' food intakes changed in various ways during the last quarter of the 20th century. Adolescents' diets exhibited trends not only toward large increases in intakes of soft drinks but also toward decreases in intakes of total fluid milk that were driven by decreases in whole milk. Some other shifts were to higher intakes of grain products (especially grain mixtures), crackers/popcorn/pretzels/corn chips, fried potatoes, noncitrus juices/nectars, lowfat milk, skim milk, cheese, candy, and fruit drinks/ades. Other shifts were to lower intakes of yeast breads/rolls, green beans, corn/green peas/lima beans, beef, and pork.

Despite those shifts in intakes, most of the take-home messages about how to improve adolescents' diets remain the same:

- Eat more whole grains.
- Eat more vegetables, especially dark-green and deep-yellow vegetables.
- Eat more fruits—both citrus and noncitrus, with an emphasis on whole fruits rather than juices.
- Eat more legumes.
- Shift to lean meats and meat alternates.
- Drink more skim or 1% milk, or eat more lowfat dairy products, or include plenty of nondairy sources of calcium.
- Decrease the amount of fat used in cooking.

The amount of discretionary fat and added sugars in adolescents' diets is much higher than is recommended by the Food Guide Pyramid. Adolescents' diets would benefit overall from lowering intakes of "empty-calorie" foods and beverages that are high in fats and sugars but provide few other nutrients. In addition, when choosing among more nutrient-dense foods, adolescents would do well to shift toward items lower in fat and sugar.

Increases in intakes of foods high in fiber and complex carbohydrate—such as whole grains, vegetables, fruits other than fruit juices, and legumes—could lead to a diet lower in fat and added sugars and higher in fiber and complex carbohydrate. If such a change led to a lower overall energy intake, weight maintenance or loss would be made easier. Because widespread inactivity has been identified as a factor in the national epidemic of overweight, increased activity should be encouraged. In a recent *Call to Action*, the Surgeon General outlined key actions to address overweight and obesity (DHHS, 2001).

Educational efforts and interventions successfully change dietary behavior among adolescents, and factors leading to the effectiveness of nutrition education have been identified ("Adolescent Nutrition," 2002; Contento et al., 1995). Resources must be committed on every level—national, State, local, community, school, and family, as well as in the health care system—to help adolescents eat more healthfully and become more active.

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Food Security, Dietary Choices, and Television-Viewing Status of Preschool-Aged Children Living in Single-Parent or Two-Parent Households

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Over the past decades, the number of U.S. single-parent households has increased—particularly those headed by females (U.S. Census Bureau, 2001). In general, single-parent households have a lower household income than do other households and, consequently, tend to spend less money on food. As a result, single-parent households may be food insecure (Casey, Szeto, Lensing, Bogle, & Weber, 2001; Nord & Bickel, 2002).

In addition to changes in household structure over these decades, the prevalence of childhood overweight and obesity also increased (Ogden, Flegal, Carroll, & Johnson, 2002)—notably among low-income groups (Certain & Kahn, 2002)—and are a concern for several reasons, including their detrimental effects on children's quality of life and the potential increase in future health care costs. According to the National Health and Nutrition Examination Survey III (NHANES III), 7.2 percent of 2- to 5-year-old children were overweight between 1994 and 1998; according to Ogden and colleagues (2002), 10.4 percent were overweight. Also, sedentary lifestyle practices contribute to overweight among children (Crespo et al., 2001). Thus, we find that poor dietary intakes that do not comply with expert recommendations, combined with many hours of television viewing, are among the postulated reasons for the increase in the prevalence of childhood overweight and obesity in the United States (Robinson, 1999).

The objectives of this study were to compare food security and economic status of households headed by females only (single-parent) and households headed by both a male and female (two-parent) and to examine whether children ages 2 to 5 in these households had different patterns of dietary intakes and television- and videotape-viewing practices. The findings would show whether children living in female-headed households have dietary and other behavioral characteristics that may promote childhood obesity.

Methods

We used data from the USDA's 1994-96 Continuing Survey of Food Intakes by Individuals (1994-96 CSFII) and the 1998 Supplemental Children's Survey (1998 CSFII) (U.S. Department of Agriculture [USDA], 2000). Both surveys include nationally representative samples: the 1994-96 CSFII includes persons of all ages, and the 1998 CSFII includes children from birth to 9 years. In these two surveys, dietary intake data are collected on 2 nonconsecutive days, 3 to 10 days apart (Tippett & Cypel, 1998), via a interviewer-administered 24-hour recall that uses a multiple-pass technique to reduce underreporting. In the surveys, interviews for children under 6 years old are conducted with the adult household member (proxy) who is responsible for preparing the child's meals. Additionally, proxy interviews are conducted for respondents who cannot report for themselves because of physical or mental limitations. For our study, children were included if they were 2 to 5 years old and had complete food intake records on Day 1 of the survey. The children resided in single-parent, female-headed households or two-parent households headed by both a male and a female. The children (n = 190) who lived in male-headed households were excluded from this study because of the small sample size.

Children's mean food and nutrient intakes and television- and videotape-viewing behaviors were analyzed, as were household socioeconomic and demographic characteristics. Nutrients and food-group definitions in the analysis were the same as those in the 1994-96 CSFII (see box). Households that had enough of the kinds and quantities of foods they wanted to eat were considered "food secure"; households that either did not have enough food to eat or did not always have the kinds of foods they wanted to eat were considered "food insecure."

Money spent by households on groceries consisted of expenditures on store-bought foods plus prepared foods brought home from a grocery store's soup or salad bar or deli. Money spent on food away from home consisted of expenditures on prepared foods and beverages that were both bought and eaten away from home (e.g., food eaten at restaurants, fast-food places, work or school cafeterias, or foods and beverages from vending machines). Money spent per person per month for food was computed by dividing the total money spent for food by the household in a month by the total number of individuals in the household. No attempt was made to allocate money differently among adults and children within each household. *For this study, we discuss statistically significant ($p < 0.05$) differences only.*

The SUDAAN[1] software package was used to estimate percentages, means, and standard errors and to compare means of children living in households headed by a female with those living in households headed by both a male and female. The SAS[2] software package was used to estimate socioeconomic and demographic characteristics of the children living in these two households.

Definitions of Added Sugars and Food Groups

Added sugars includes sugars used as ingredients in processed or prepared foods, sugars eaten separately, and sugars added to foods at the table. Examples of foods and beverages containing added sugars are baked goods such as cakes, cookies, pastries and bread; dairy desserts; non-diet soft drinks; non-diet flavored drinks; and candies, jams, jellies, and syrups. Added sugars do not include sugars that are present naturally in foods, such as lactose in milk and fructose in fruits.

Whole milk includes whole fluid milk, low sodium whole milk, and reconstituted whole dry milk.

Lowfat and skim milk includes lowfat (1% and 2%) milk, skim or nonfat milk, lowfat or nonfat lactose-reduced fluid milk, and reconstituted lowfat and nonfat dry milk.

Frankfurters and sausages includes frankfurters, sausages; luncheon meats made from beef, pork, ham, veal, game, chicken, and turkey; and baby-food meat sticks.

Melons and berries includes cantaloupe, honeydew melon, watermelon, blueberries, blackberries, strawberries, raspberries, and cranberries.

Non-diet carbonated beverages and sweetened, fruit-flavored drinks includes all carbonated soft drinks except unsweetened and sugar-free types; all fruit drinks, fruit punches, fruit ades including those made from powdered mix and frozen concentrates and excludes low-calorie and low-sugar types. Excludes fruit juices.

Results and Discussion

Of the 5,594 children included in this study, 81 percent lived in two-parent households and 19 percent lived in female-headed households (table 1). About half (53 percent) of all African-American children lived in female-headed households. Children living in female-headed households were more likely to live in low-income (4 of 10 below 130 percent of poverty level) and urban (3 of 10) households, while children living in two-parent households were more likely to live in

[1]SUDAAN for Solaris, release 8.0.1, 2002, Research Triangle Park, NC.

[2]SAS, release 8.2, 1999-2001, Cary, NC.

Table 1. Socioeconomic and demographic characteristics of children 2 to 5 years, 1994-96, 98 CSFII

Characteristics	Percentage of children in total population[1]	Percentage of children living in female-headed households[2]
Gender		
Male	51.3	19.6
Female	48.7	18.7
Race/ethnicity		
Caucasian	61.8	10.3
African American	16.2	53.2
All Hispanics	16.3	20.2
Non-Hispanic, other races	5.7	15.2
Household income (% of poverty)		
Below 130%	31.4	44.5
131 to 350%	43.7	10.2
Above 350%	24.9	3.1
Urbanization		
Urban	32.2	30.0
Suburban	47.8	12.2
Rural	20.0	18.4
Region		
Northeast	19.2	20.3
Midwest	23.7	20.3
South	33.6	21.0
West	23.5	14.5

[1]n = 5,594.
[2]n = 999.

Children from female-headed households, compared with those in male- and female-headed households, consumed higher amounts of high-fat foods such as whole milk and frankfurters and sausages, ate lower amounts of relatively expensive fruits such as melons and berries, and drank more non-diet carbonated beverages and sweetened fruit-flavored drinks.

affluent suburban households. Compared with other regions, the Western region of the United States had the lowest percentage of children living in female-headed households, about 15 percent versus 20 percent.

The three indicators of food-security status were strikingly different between the two household types. While 74 percent of children in two-parent households had enough of the kinds of foods they wanted to eat, only 56 percent of children in female-headed households were food secure (table 2). Compared with children in two-parent households, children in female-headed households tended not to have the kinds of food they wanted to eat (37 percent vs. 24 percent) and not enough food to eat (7 percent vs. 2 percent). Female-headed households spent less money, per person, on monthly groceries, compared with two-parent households ($87 vs. $92). In addition, these households spent less money on foods purchased and eaten away from home, including food from fast-food places and restaurants ($17 per person vs. $26 per person). The amount of money spent on fast-food or carryout food brought into the house was not different ($14 per person for both household groups).

The children in female-headed households consumed more energy than did children in male- and female-headed households (1,642 kcal vs. 1,577 kcal) (table 3). Of these calories, higher amounts and proportions were from total fat and saturated fat. Whereas, children in female-headed households consumed 62 g of total fat (34 percent of calories) and 23 g of saturated fat (13 percent of calories), children in two-parent households consumed 56 g of total fat (32 percent of calories) and 21 g of saturated fat (12 percent of calories). Thus, our results showed that a smaller percentage of children in female-headed households met the recommendations of the Dietary Guidelines for total fat and saturated fat (USDA & DHHS, 2000).

Among the intake patterns that influenced differences in nutrient status were the following: Children from female-headed households, compared with those in male- and female-headed households, consumed higher amounts of high-fat foods such as whole milk and frankfurters and sausages, ate lower amounts of relatively expensive fruits such as melons and berries, and drank more non-diet carbonated beverages and sweetened fruit-flavored drinks.

For both household types, children's consumption of added sugars far exceeded the levels recommended in the Food Guide Pyramid (USDA, 1996). The Food Guide Pyramid's suggested levels of added sugars are 6, 12, and 18 teaspoons (24, 48, and 72 g) per 1,600, 2,200, and 2,800 calories of energy intakes per day. Because of the increase in the prevalence of childhood obesity, reducing intakes of foods and beverages that contain high amounts of added sugars and fat could help reduce intakes of empty, extra calories during childhood (Ludwig, Peterson, & Gortmaker, 2001). Soft drinks and fruit-flavored sugary drinks are the top sources of added sugars in the U.S. diet (Bowman, 1999).

Table 2. Food security status of and monthly expenditures by households with children 2 to 5 years, 1994-96, 98 CSFII

	Male- and female-headed household	Female-headed household
	Percent	
Having enough of the kinds of food they want to eat*	74	56
Having enough but not always the kinds of food they want to eat*	24	37
Sometimes or often not having enough to eat*	2	7
	Mean dollars per person per month	
Household groceries*	92	87
Food bought and eaten away from home*	26	17
Fast-food or carryout food brought into home	14	14

*Statistically different at $p < 0.05$.

Table 3. Mean energy, selected nutrients, food intake status, and hours of television- and videotape-viewing status of children 2 to 5 years, 1994-96, 98 CSFII

	Male- and female-headed household	Female-headed household
	Mean	
Energy (kcal)*	1,577	1,642
Total fat (g)*	56	62
Saturated fat (g)*	21	23
Carbohydrate (g)	218	218
Added sugars (g)	62	62
Protein (g)*	56	59
Percent of total fat calories*	32	34
Percent of saturated fat calories*	12	13
Percent of children having 30% or less energy from total fat[1]*	40	32
Percent of children having 10% or less energy from saturated fat[1]*	29	25
Whole milk (g)*	149	191
Lowfat and skim milk (g)*	188	114
Frankfurters and sausages (g)*	19	26
Melons and berries (g)*	14	7
Non-diet carbonated beverages and sweetened, fruit-flavored drinks (g)*	203	227
Number of hours of television/videotapes viewed*	2.5	3.0
Percent of children who viewed more than 2 hours of television/videotapes*	62	68

*Statistically different at $p < 0.05$.
[1]Recommendations of the USDA's *Food Guide Pyramid* (1996) and *Dietary Guidelines for Americans* (2000).

Differences were also seen in television- and videotape-viewing behaviors between the two household groups. The children living in female, single-parent households watched more hours of television and videotapes, compared with children living in two-parent households (3.0 hours vs. 2.5 hours each day). Additionally, a higher percent of children in female-headed households (68 percent vs. 62 percent) watched more than a total of 2 hours per day. These findings are important because television viewing has been associated with weight status in children (Dennison, Erb, & Jenkins, 2002; Eisenmann, Bartes, & Wang, 2002; Robinson, 1999; Saelens et al., 2002).

Conclusions

Nutrition education for children continues to be necessary, especially for children living in female-headed households. In particular, our study demonstrated that children in these households had higher energy and fat intakes and watched more hours of television and videotapes per day than did children living in two-parent households, thus placing themselves at a higher risk for overweight or obesity. Efforts should be made to encourage lowfat food choices, especially in the dairy and meat groups. In addition, we observed that all children, regardless of the household type, consumed a lot of added sugars and drank a large amount of fruit-flavored drinks and non-diet carbonated beverages. Encouraging children to drink water or 100-percent juice, instead of sweetened, fruit-flavored beverages, would help reduce intakes of empty calories.

Nutrition for caregivers also may be beneficial because children's dietary behaviors are patterned after their family's behaviors (Dennison et al., 2001; Fitzgibbon, Stolley, Dyer, Van Horn, & Kaufer-Christoffel, 2002; Eisenmann et al., 2002). Adults who prepare young children's food should choose lean cuts of meat and adopt lowfat food preparation techniques such as removing skin from chicken, trimming fat from meat, and encouraging children to drink lowfat milk. These practices would help reduce consumption of both total and saturated fats. Interventions should also aim at reducing time spent viewing television or videotapes. Encouraging children to increase their physical activity may help prevent or reduce obesity. Therefore, early interventions with both children and their caregivers are important for preventing obesity later in life.

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Expenditures on Children by Families, 2002

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This article presents the 2002 estimates of expenditures on children by husband-wife and single-parent families. Data and methods used in calculating annual child-rearing expenses are described. Estimates are provided by budgetary component, age of the child, family income, and region of residence. For the overall United States, estimates of child-rearing expenses ranged between $9,230 and $10,300 for a child in a two-child, husband-wife family in the middle-income group.

Child rearing is a costly endeavor. Since 1960 the U.S. Department of Agriculture (USDA) has provided annual estimates of family expenditures on children from their birth through age 17. USDA's annual child-rearing expense estimates are used in four major ways:

- ***To determine State child support guidelines.*** The economic well-being of millions of children is affected by child support. Under the Family Support Act of 1988, States are required to have numeric child support guidelines and to consider the economic costs of raising a child when establishing these guidelines.

- ***To determine State foster care payments.*** Many States use the estimates to determine how much to reimburse people with foster care children. In 1999 about 581,000 children were in foster care (U.S. Department of Health and Human Services, 2001).

- ***To appraise damages arising from personal injury or wrongful death cases.*** For example, if a person with children is hurt on a job such that he or she cannot work, the courts use the child-rearing expense figures to determine compensation for the family.

- ***To educate anyone who is considering when or whether to have children.*** Knowing how much it costs to raise a child until that child reaches the age of maturity may encourage teens to wait until adulthood and be more prepared financially to have children.

USDA Method for Estimating Expenditures on Children by Families[1]

USDA provides annual estimates of expenditures on children from their birth through age 17. These expenditures on children, by husband-wife and single-parent families, are estimated for the major budgetary components: housing, food, transportation, clothing, health care, child care/education, and miscellaneous goods and services (see box).

[1]*Expenditures on Children by Families, 2002* provides a more detailed description of the data and methods. To obtain a copy, go to http://www.cnpp.usda.gov, or you may contact USDA, Center for Nutrition Policy and Promotion, 3101 Park Center Drive, Room 1034, Alexandria, VA 22302 (telephone: 703-305-7600).

The most recently calculated child-rearing expenses are based on 1990-92 Consumer Expenditure Survey (CE) data, which are updated to 2002 dollars by using the Consumer Price Index (CPI). The CE, administered by the Bureau of Labor Statistics, U.S. Department of Labor, is the only Federal survey of household expenditures collected nationwide. It contains information on sociodemographic characteristics, income, and expenditures of a nationally representative sample of households. The sample used to determine child-rearing expenses consisted of 12,850 husband-wife and 3,395 single-parent households, weighted to reflect the U.S. population of interest.

In determining child-rearing expenses, USDA examines the intrahousehold distribution of expenditures by using data for each budgetary component. In the CE, the data on these budgetary components are child-specific (clothing, child care, and education) and household-specific (housing, food, transportation, health care, and miscellaneous goods and services). Multivariate analysis, used to estimate household- and child-specific expenditures, controlled for income level, family size, age of the child, and region of residence (when appropriate) so that expenses could be determined for families with these varying characteristics.

Estimates of child-rearing expenses are provided for three income levels, which were determined by dividing the sample of husband-wife families in the overall United States into equal thirds. For each income level, the estimates are for the younger child in families with two children. These younger children were grouped in one of six age categories: 0-2, 3-5, 6-8, 9-11, 12-14, or 15-17. Households with two children were selected as the standard because this was the average household size in 1990-92. The focus is on the younger child because the older child may be over age 17.

Child-rearing estimates provided by the USDA are based on CE interviews of households with and without specific expenses. For some families, expenditures may be higher or lower than the mean estimates, depending on whether or not they incur a particular expense. Calculation of child care and education expenditures are examples, because about 50 percent of husband-wife families in the study spent no money on these goods and services. Also, the estimates cover only out-of-pocket expenditures on children made by the parents and not by others, such as grandparents or friends.

Categories of Household Expenditures

Housing expenses: shelter (mortgage interest, property taxes, or rent; maintenance and repairs; and insurance), utilities (gas, electricity, fuel, telephone, and water), and house furnishings and equipment (furniture, floor coverings, and major and small appliances). For homeowners, housing expenses do not include mortgage principal payments; in the data set used, such payments are considered to be part of savings.

Food expenses: food and nonalcoholic beverages purchased at grocery, convenience, and specialty stores, including purchases with food stamps; dining at restaurants; and household expenditures on school meals.

Transportation expenses: the net outlay on the purchase of new and used vehicles, vehicle finance charges, gasoline and motor oil, maintenance and repairs, insurance, and public transportation.

Clothing expenses: children’s apparel such as diapers, shirts, pants, dresses, and suits; footwear; and clothing services such as dry cleaning, alterations and repair, and storage.

Health care expenses: medical and dental services not covered by insurance, prescription drugs and medical supplies not covered by insurance, and health insurance premiums not paid by the employer or other organizations.

Child care and education expenses: daycare tuition and supplies; babysitting; and elementary and high school tuition, books, and supplies.

Miscellaneous expenses: personal care items, entertainment, and reading materials.

After estimating the various overall household and child-specific expenditures, USDA allocated these total amounts among family members (i.e., in a married-couple, two-child family, the total amounts were allocated to the husband, wife, older child, and younger child). Because the expenditures for clothing, child care, and education are child-specific—and apply only to children—allocations of these expenses were made by dividing them equally among the children. The CE does not collect child-specific expenditures on food and health care. Thus, to apportion these budgetary components to a child based on his or her age, USDA used data from other Federal studies, which show the shares of the household budget spent on children's food and health care.

Unlike food and health care, no authoritative source exists for allocating among family members the amount the household spends on housing, transportation, and other miscellaneous goods and services. The marginal cost and the per capita methods are two common approaches used to allocate these expenses.

The marginal cost method measures expenditures on children as the difference in expenses between couples with children and equivalent childless couples. Various equivalency measures, yielding very different estimates of expenditures on children, have been proposed, but no standard measure has been accepted by economists. Also, the marginal cost approach assumes that the difference in total expenditures between couples with and without children can be attributed solely to the presence of children in a family. This assumption is questionable, especially because couples without children often buy homes larger than they need in anticipation of having children. Comparing the expenditures of these couples to those of similar couples with children could lead to underestimating how much is spent on meeting the lifetime needs—and wants—of children.

For these reasons, USDA uses the per capita method to allocate expenses on housing, transportation, and miscellaneous goods and services in equal proportions among household members. Although the per capita method has its limitations, they are considered less severe than those of the marginal cost approach.

Because transportation expenses resulting from work activities are not directly related to the cost of raising a child, these expenses were excluded when determining children's transportation expenses.

Expenditures on Children by Husband-Wife Families

Child-Rearing Expenses and Household Income Are Positively Associated

In 2002, estimated average expenses on children increased as income level rose (fig. 1). Depending on the age of the child, the annual expenses ranged from $6,620 to $7,670 for families in the lowest income group, from $9,230 to $10,300 for families in the middle-income group, and from $13,750 to $14,950 for families in the highest income group. The before-tax income in 2002 for the lowest income group was less than $39,700, between $39,700 and $66,900 for the middle-income group, and more than $66,900 for the highest income group.

On average, households in the lowest income group spent 28 percent of their before-tax income per year on a child; those in the middle-income group, 18 percent; and those in the highest group, 14 percent. The range in these

On average, households in the lowest income group spent 28 percent of their before-tax income per year on a child; those in the middle-income group, 18 percent; and those in the highest group, 14 percent.

percentages would be narrower if after-tax income were considered, because a greater percentage of income in higher income households goes toward taxes.

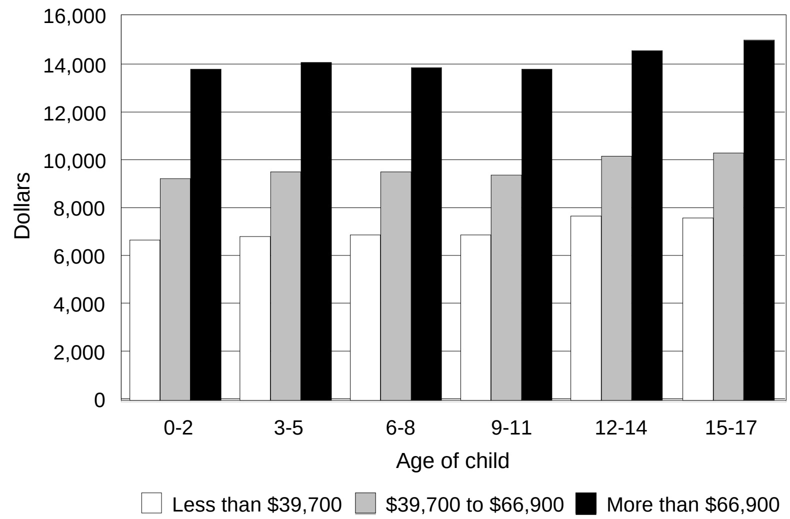
On average, the amount spent on children by families in the highest income group was about twice the amount spent by families in the lowest income group. This amount varied by budgetary component. In general, expenses on a child for goods and services considered to be necessities (e.g., food and clothing) did not vary as much as those considered to be discretionary (e.g., miscellaneous expenses) among households in the three income groups.

Housing Is the Largest Expense on a Child

Housing accounted for the largest share of total child-rearing expenses. (Figure 2 demonstrates this for middle-income families.) Based on expenses incurred among all age groups, housing accounted for 33 percent of child-rearing expenses for a child in the lowest income group, 34 percent in the middle-income group, and 37 percent in the highest income group. Food, the second largest average expense on a child for families regardless of income level, accounted for 20 percent of child-rearing expenses in the lowest income group, 17 percent in the middle-income group, and 15 percent in the highest income group. Transportation was the third largest child-rearing expense across income levels, averaging 13 to 14 percent.

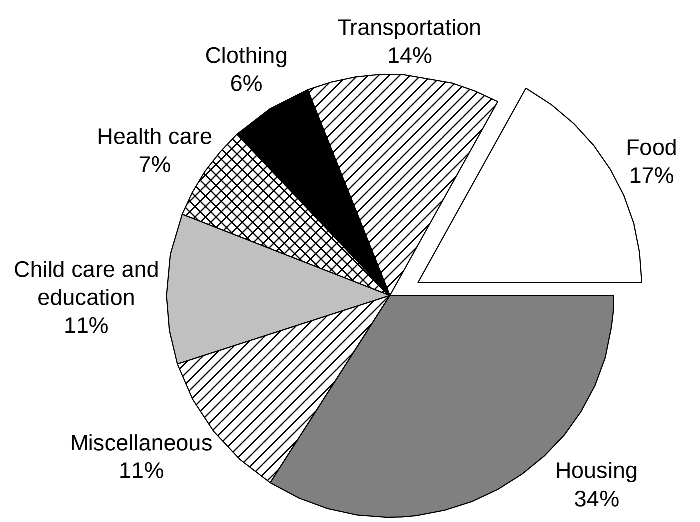
Across the three income groups, miscellaneous goods and services (personal care items, entertainment, and reading materials) was the fourth largest expense on a child for families, 10 to 12 percent. Clothing (excluding gifts or hand-me-downs) accounted for 5 to 7 percent of expenses on a child for families; child care and education, 8 to 12 percent; and health care, 6 to 8

Figure 1. Family expenditures on a child, by income level and age of child,[1] 2002



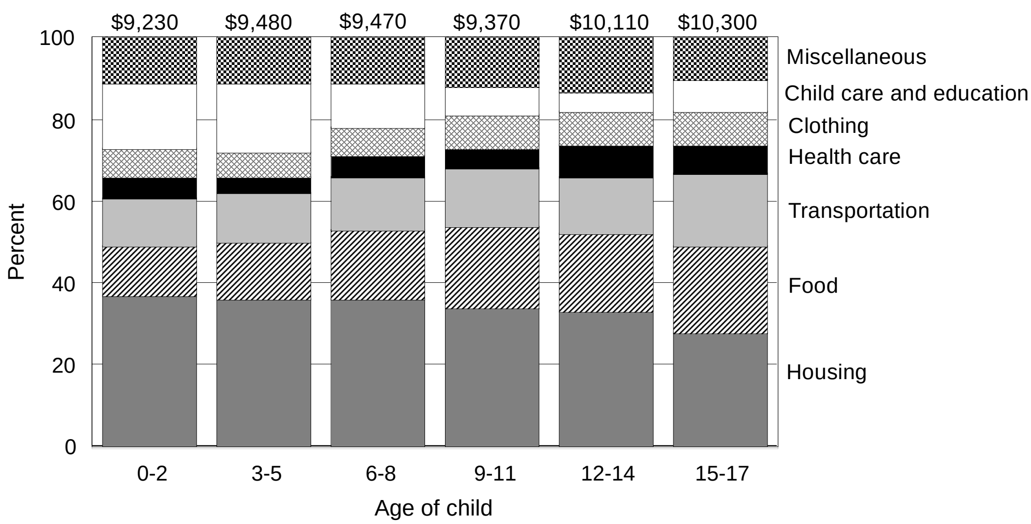
[1]U.S. average for the younger child in husband-wife families with two children.

Figure 2. Family expenditure shares on a child from birth through age 17,[1] 2002



[1]U.S. average for the younger child in middle-income, husband-wife families with two children.

Figure 3. Family expenditure shares on a child, by age of child,[1] 2002



[1]U.S. average for the younger child in middle-income, husband-wife families with two children.

percent. Estimated expenditures for health care consisted of out-of-pocket expenses only (including insurance premiums not paid by an employer or other organizations) and not that portion covered by health insurance.

Expenses Increase as a Child Gets Older

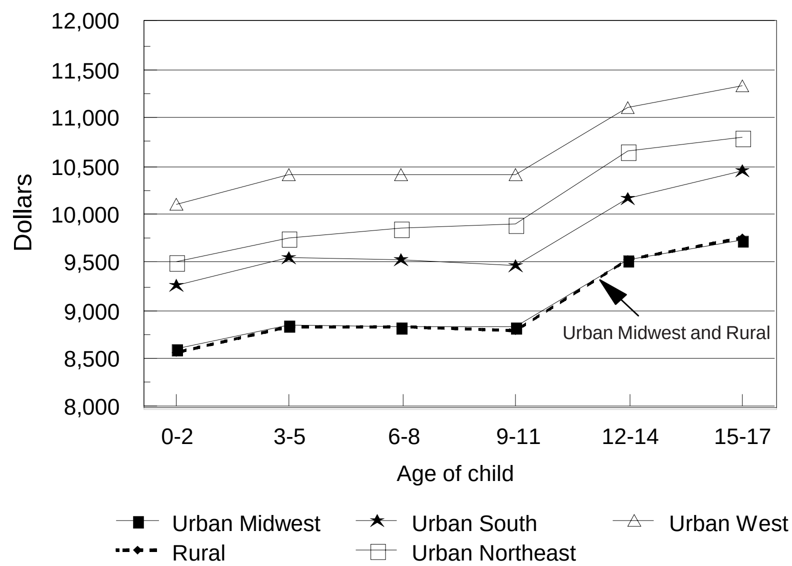
Expenditures on a child were generally lower in the younger age categories and higher in the older age categories. (Figure 3 depicts this for families in the middle-income group.) This relationship held across income groups even though housing expenses, the highest child-rearing expenditure, generally declined as a child grew older. The decline in housing expenses reflects diminishing interest paid by homeowners over the life of a mortgage. Payments on principal are not considered part of housing costs in the CE; they are deemed to be a part of savings.

For all three income groups, food, transportation, clothing, and health care expenses related to child-rearing generally increased as the child grew older. Transportation expenses were highest for a child age 15-17, when he or she would start driving. Child care and education expenses were highest for a child under age 6. Most of this expense may be attributed to child care at this age. The estimated expense for child care and education may seem low for those with the expenses, because these estimates reflect the average by households with *and* without the expense.

Child-Rearing Expenses Are Highest in the Urban West

Child-rearing expenses in the regions of the country reflect patterns observed in the overall United States; in each region, expenses on a child increased with household income level and, generally, with the age of the child. Figure 4 shows total child-rearing expenses by region and age of a child for middle-income families. Overall, child-rearing expenses were highest in the urban West, followed by the urban Northeast and urban South. Child-rearing expenses were lowest in the urban Midwest and rural areas. Much of the regional difference in expenses on a child was related to housing costs. Total housing expenses on a child were highest in the urban West and urban Northeast and lowest in rural areas. However, child-rearing transportation expenses were highest for families in rural areas. This likely reflects the longer traveling distances and the lack of public transportation in these areas.

Figure 4. Family expenditures on a child, by region and age of child,[1] 2002



[1]Regional averages for the younger child in middle-income, husband-wife families with two children.

Older Children and the "Cheaper-by-the-Dozen" Effect

The expense estimates on a child represent expenditures on the younger child, at various ages, who is one of two children in a husband-wife household. We cannot assume that expenses on the older child are the same at these various ages. The method for estimating expenses on the younger child was essentially repeated to determine whether expenses vary by birth order. The focus was on the older child in each of the same age categories as those used with the younger child. A two-child family was again used as the standard.

On average, for husband-wife households with two children, expenditures did not vary by birth order. Thus, annual expenditures on children in a husband-wife, two-child family may be estimated by summing the expenses for the appropriate age categories (fig. 1).

Although expenses on children did not vary by birth order, they did differ when a household had only one child or more than two children. Depending on the number of other children in the household, families spent more or less on a child—achieving a "cheaper-by-the-dozen" effect as they have more children.

The method to estimate child-rearing expenses was repeated for families with one child and families with three or more children. Compared with expenditures for each child in a husband-wife family with two children, expenditures in a husband-wife household with one child averaged 24 percent more on the single child; expenditures for those with three or more children averaged 23 percent less on each child. Hence, family income is spread over fewer or more children, subject to economies of scale. As families have more children, the children can share a bedroom, clothing and toys can be handed down to younger children, and food can be purchased in larger and more economical packages.

Expenditures on Children by Single-Parent Families

The estimates of expenditures on children by husband-wife families do not apply to single-parent families, a group that accounts for an increasing percentage of families with children. Therefore, USDA calculated separate estimates of child-rearing expenses in single-parent households for the overall United States. CE data were used to do so. Most single-parent families in the survey were headed by a woman (90 percent). The method previously described was followed; however, regional estimates were not calculated for single-parent families because of limitations in the sample size.

Estimates cover only out-of-pocket child-rearing expenditures made by the single parent with primary care of the child and do not include child-related expenditures made by the parent without primary care or expenditures made by others, such as grandparents. The data did not contain this information. Overall expenses by both parents on a child in a single-parent household are likely greater than the USDA's estimates of child-rearing expenses.

Table 1. Family expenditures on a child, by lower income single-parent and husband-wife households,[1] 2002

Age of child	Single-parent households	Husband-wife households
0 - 2	$5,540	$6,620
3 - 5	6,260	6,780
6 - 8	7,040	6,860
9 - 11	6,570	6,850
12 - 14	7,040	7,670
15 - 17	7,790	7,580
Total (0 - 17)	$120,720	$127,080

[1]Estimates are for the younger child in two-child families in the overall United States.

Table 1 presents estimated expenditures on the younger child in a single-parent family with two children, compared with those of the younger child in a husband-wife family with two children. Each family type was in the lower income group, having before-tax income less than $39,700. About 83 percent of single-parent families and 33 percent of husband-wife families were in this lower income group. More single-parent than husband-wife families, however, were in the bottom range of this income group and had an average income of $16,600, compared with $24,800 for husband-wife families. Although average income varied for these lower income families, total expenditures on a child through age 17 were, on average, only 5 percent lower in single-parent households than in two-parent households.

Single-parent families in this lower income group, therefore, spent a larger proportion of their income on children than did their counterpart two-parent families. On average, housing expenses were higher for single-parent families than for two-parent families; whereas, transportation, health care, child care and education, and miscellaneous expenditures on a child were lower in single-parent than in husband-wife households. Child-related food and clothing expenditures were similar, on average, for both family types.

For the higher income group of single-parent families with 2002 before-tax income of $39,700 and over,[2] estimates of child-rearing expenses were about the same as those for two-parent households in the before-tax income group of $66,900 and over. In 2002 dollars, total expenses for the younger child through age 17 were $254,940 for single-parent families versus $254,400 for husband-wife families. Child-rearing expenses for the higher income group of single-parent families, therefore, were also a larger proportion of income than was the case for husband-wife families. Thus, expenditures on children do not differ much between single-parent and husband-wife households; what differs is household income level. Because single-parent families have one less potential earner than do husband-wife families, on average, their total household income is lower, and child-rearing expenses as a percentage of income are greater.

[2]The two higher income groups were combined for single-parent families.

The same procedure was used to estimate child-rearing expenses on an older child in single-parent households as well as by household size. On average, single-parent households with two children spent 7 percent less on the older child than on the younger child (regardless of age-related differences). This contrasts with husband-wife households whose expenditures on children were unaffected by the children's birth order.

As with husband-wife households, single-parent households spent more or less if there was either one child or three or more children. Compared with expenditures for the younger child in a single-parent household with two children, expenditures for an only child in a single-parent household averaged 35 percent more; single-parent households with three or more children averaged 28 percent less on each child.

Other Expenditures on Children

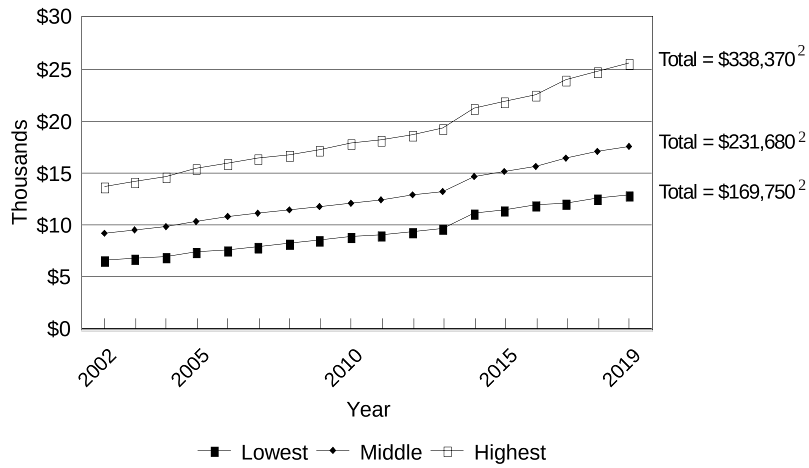
The USDA child-rearing expense estimates consist of direct expenses made by parents on children through age 17 for seven major budgetary components. The expenses exclude costs related to childbirth and prenatal health care and other expenditures, especially those incurred after a child turns age 18.

One of the largest expenses made on children after age 17 is the cost of a college education. The College Board estimated that in 2002-2003, annual average tuition and fees were $3,900 at 4-year public colleges and $15,639 at 4-year private colleges; annual room and board was $5,235 at 4-year public colleges and $6,039 at 4-year private colleges (The College Board, 2002). Other parental expenses on children after age 17 could include those

Child-Rearing Expenses Over Time

The estimates presented in this article represent household expenditures on a child of a certain age in 2002. Future price changes need to be incorporated to estimate these expenses over time. Thus, a future cost formula was used, and the results are presented in this graph. The estimated future expenditures are on the younger child in a husband-wife family with two children. The assumptions are that a child is born in 2002 and reaches age 17 in 2019 and that the average annual inflation rate over this time is 3.2 percent (the average annual inflation rate over the past 20 years). The result: total family expenses on a child through age 17 would be $169,750 for households in the lowest income group, $231,680 for those in the middle, and $338,370 for those in the highest income group.

Estimated annual expenditures on a child born in 2002, by income group, overall United States[1]



[1]Estimates are for the younger child in husband-wife families with two children.
[2]Total reflects expenses on a child through age 17.

associated with children living at home or, if children do not live at home, gifts and other contributions to them. A 1996 survey found that 47 percent of parents in their fifties support children over age 21 (Phoenix Home Life Mutual Insurance Company, 1996).

USDA's estimates do not include all government expenditures on children, such as public education, Medicaid, and subsidized school meals. Actual expenditures on children (by parents and the government), therefore, would be higher than reported here. The indirect costs of raising children—time allocated to child rearing and decreased earnings—are not included in the estimates. Although these costs are more difficult to measure than direct expenditures, they can be as high, if not higher, than the direct costs of raising children (Spalter-Roth & Hartmann, 1990; Bryant, Zick, & Kim, 1992; Ireland & Ward, 1995).

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Revision of USDA's Low-Cost, Moderate-Cost, and Liberal Food Plans

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The Center for Nutrition Policy and Promotion has revised the Low-Cost, Moderate-Cost, and Liberal Food Plans—three fundamental components of the U.S. food guidance system. These plans provide representative healthful market baskets at three cost levels. This revision of the plans incorporates recent developments in nutrition standards and dietary guidance, as well as updates that reflect food consumption patterns of Americans and the nutrient content of foods. This revision also maintains a constant real cost for each plan.

The U.S. Department of Agriculture's (USDA) Low-Cost, Moderate-Cost, and Liberal Food Plans are national standards for nutritious diets at various costs. These three plans—as well as the fourth, the Thrifty Food Plan[1]—are the official food plans maintained by the USDA Center for Nutrition Policy and Promotion (CNPP). Each plan represents a set of market baskets applicable to 1 of 12 age-gender groups. Each market basket contains a selection of foods in quantities that reflect dietary recommendations, food consumption patterns, food composition data, and food prices. The three plans have various policy uses:

- Bankruptcy courts often use the value of the Low-Cost Plan to determine the portion of a bankruptee's income to allocate to necessary food expenses.
- The Department of Defense uses the value of the Moderate-Cost and Liberal Food Plans to set the Basic Allowance for Subsistence rate for all enlistees.
- Many divorce courts use the value of the food plans to set alimony payments, and all three plans are used in USDA's Expenditures on Children by Families report, which is used to set State child support guidelines and foster care payments.
- Policymakers and others use the food plans as national standards in educational programs and as references for policies that are designed to help families budget their food dollars effectively and improve their diets.

This study presents the revision of the previous market baskets of the Low-Cost, Moderate-Cost, and Liberal Food Plans. Each plan reflects recent changes in dietary guidance, as well as updated information on food composition, consumption patterns, and food prices. Data and methods used in revising the food plan market baskets are described; then, the revised baskets are discussed.[2]

[1]The Thrifty Food Plan, which is the basis for food stamp allotments, was revised in 1999 (USDA, 1999).

[2]For more details on this revision, as well as market baskets for specific age-gender groups, see Carlson, Lino, Gerrior, and Basiotis (2003).

Data

CNPP used two main data sources to revise the market baskets of the food plans: (1) USDA's 1989-91 Continuing Survey of Food Intakes by Individuals (CSFII) and (2) the Food Price Database, which was created by CNPP by merging foods from the CSFII with data on national food prices.

The CSFII, administered to a nationally representative sample of households in the 48 conterminous States, assesses the food and nutrient intake by individuals both at home and away from home. One-day food intakes by 9,961 individuals, ages 1 and over, were used for this revision. One-day data have been shown to be reliable measures of usual food intakes by groups of people (Basiotis, Welsh, Cronin, Kelsey, & Mertz, 1987).

In the 1989-91 CSFII, people were asked what foods they consumed in a day both at home and away from home, resulting in about 4,800 different foods reported as being consumed. For children under age 12, the parent or main meal planner provided the information, often with the assistance of the child. These data were collected by using in-person interviews and a 24-hour dietary recall method. Information on the ingredients, nutrient content, and amount consumed of each of these foods is contained in the data set. CNPP used CSFII sampling weights that make the data representative of the U.S. population and weighted all the data in this study.

The CSFII does not contain information on food prices or expenditures for consumed foods (i.e., information needed to assign a price to a market basket). Thus, CNPP developed a method to estimate the price of foods "as consumed" in the survey and created the Food Price Database. To do so, CNPP used information on national average food prices from several sources: the Scantrack system developed by A.C. Nielsen; the retail prices database from the Bureau of Labor Statistics, U.S. Department of Labor; wholesale prices for fresh produce from the Agricultural Marketing Service, USDA; and fish prices from the National Marine Fisheries Service, U.S. Department of Commerce. Because the USDA food plans provide the cost of eating at home, for purposes of calculating the cost, CNPP assumed that all foods that people said they ate were prepared at home.

The Food Price Database was created by first identifying all foods reported in the CSFII as being consumed at home and away from home and using recipes to disaggregate foods into their specific ingredients and adjusting ingredient quantities for cooking and waste factors, when appropriate, to convert foods to a purchasable form. The database was completed by pricing the purchasable ingredients by using the data on national retail prices and then converting the priced retail ingredients back to the consumed form of the food with a price now attached to it. (For more details on the creation of the Food Price Database, see Bowman [1997].)

Methods

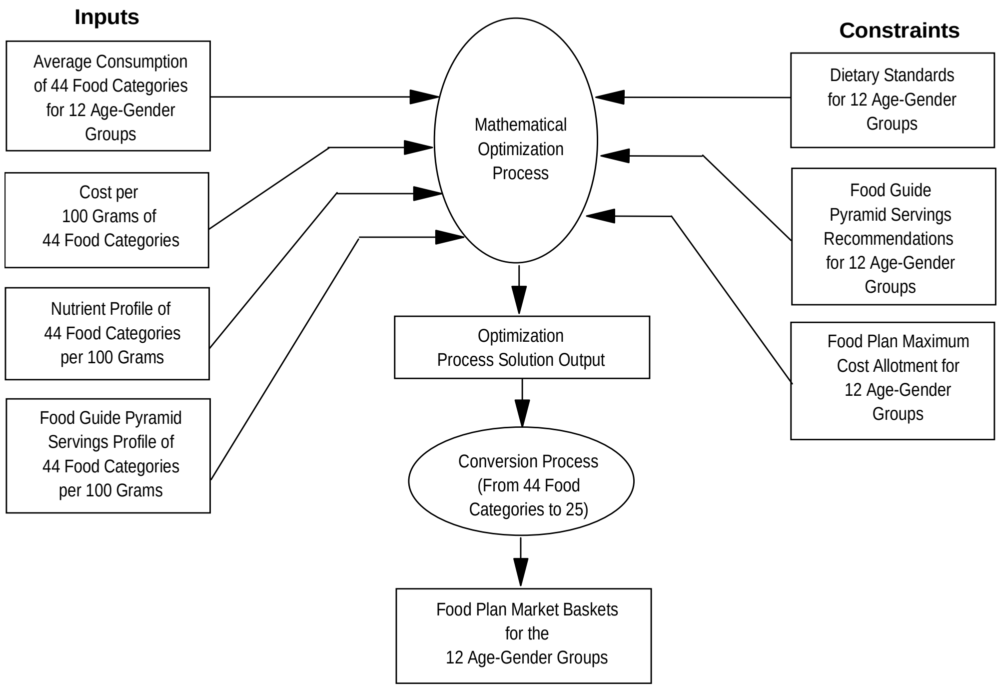
An overview of the methods used to update the market baskets of the Low-Cost, Moderate-Cost, and Liberal Food Plans is shown in figure 1. For each plan, CNPP calculated a revised market basket for 12 age-gender groups: children whose ages were 1, 2, 3-5, 6-8, and 9-11; females whose ages were 12-19, 20-50, and 51 and older; and males whose ages were 12-14, 15-19, 20-50, and 51 and older. For modeling purposes, CNPP assigned each of the 4,800 foods reported in the CSFII into 1 of 44 food categories. These foods were assigned to food categories based on similarity of nutrient content, food costs, use in meals, and their placement in the Food Guide Pyramid. A food-waste factor was a component of each plan.

To calculate a market basket of each food plan for each of the 12 age-gender groups, CNPP used mathematical optimization models that minimize deviations from average consumption patterns for the 44 food categories, that suggest new consumption patterns that meet required dietary standards, and that maintain constant cost levels. Each model consists of four sets of inputs and is subject to three constraints (fig. 1). The inputs relate to each of the 44 food categories and include average consumption, a price for each food category, a nutrient profile, and the servings profile of the Food Guide Pyramid. The constraints in each model are dietary standards—including serving specifications of the Food Guide Pyramid—and the cost[3] of the Food Plan.

Table 1 shows the exact dietary standards the market baskets met. Forming the nutritional basis of the market baskets are the 1989 Recommended Dietary Allowances (RDAs), the 1995 Dietary Guidelines for Americans, the National Research Council's Diet and Health report, and the serving recommendations of the Food Guide Pyramid. This revision of the market baskets is the first one to impose serving recommendations of the Food Guide Pyramid, which is important to their revision because the Pyramid specifies the number of

[3]Food Plan costs are those for 1989-91 that correspond to the period when the food consumption data were collected.

Figure 1. Food Plan Methods



servings of the five major food groups (grains, vegetables, fruits, milk products, and meat/meat alternates) that people of different age-gender groups need to eat to have a healthful diet.

Cost in real terms was a primary constraint that needed to be met by the new market baskets: None could cost more than the previous market baskets. Thus, the real value of the food plans was kept constant across the years. CNPP, however, considered other food-cost options. The costs of the previous Low-Cost, Moderate-Cost, and Liberal Food Plans were set at the midpoint of the respective 1977-78 quartiles of food spending for each age-gender group. For example, the Low-Cost Plan for a male age 20-50 was set at the 37.5-percent level on the distribution of food spending (the midpoint of the 25th to 50th quartile) for a male in this age group. The midpoints of the quartiles of this distribution of estimated food costs were similar to the published costs of the Low-Cost and Moderate-Cost Food Plans; the midpoints were higher for the Liberal Plan. CNPP ultimately decided to keep the real value of the food plans consistent across the years.

Food Plan Market Baskets

The optimization model yielded 12 market baskets (one for each age-gender group) for each of the three food plans, with the optimization solution in “as consumed” quantities of the 44 food groups. The final market baskets were simplified to pounds per week that an individual would need to purchase to consume the recommended amounts. The market baskets were also based on 25 food categories, which many grocery shoppers can relate to, that were combinations of the original 44 food categories.

To examine how the market baskets differ from each other, CNPP calculated an average market basket for each plan. Average baskets were derived by weighting each age-gender group by its population size and calculating a weighted mean for each food plan. Table 2 shows these average food plan market baskets (in pounds per week per person).

The total amount of food in each average market basket increases—from that in the Low-Cost to the Moderate-Cost and then to the Liberal Food Plan. The primary reason for this is related to increases in food-waste factors in the more expensive food plans: 10 percent for the Low-Cost Plan, 20 percent for the Moderate-Cost Plan, and 30 percent for the Liberal Plan.

Quantities of food for each of the Pyramid food groups also increase across the food plans, with one exception, the “other” food group (fats, oils, and sweets). For the "other" food group, the Low-Cost Plan contains slightly higher quantities than does the Liberal Plan. Because the "other" food group is an inexpensive source of calories, it is more prominent in the Low-Cost Plan. This also represents the preference of the average person who consumes a low-cost diet. Although containing more of these "other" foods, the Low-Cost Plan still meets all the dietary standards, including serving requirements of the Pyramid that were used in this revision.

Quantities differ in each of the 25 food categories in the average market baskets of the three food plans. These differences reflect two things: First, as the plans increase in cost, more options are available to the optimization program. The plans that cost more represent more variety. Second, because the plans reflect the diets of individuals consuming foods at different cost levels, those who spend more on food are likely choosing foods that are more costly. The following are some of the more noticeable differences among food groups.

Grains

The amount of breakfast cereals in the Low-Cost Food Plan is greater than the amount in the other two food plans. The amount of breads also increases as the cost of the food plans rises (table 2).

Vegetables

Dark-green and deep-yellow vegetables, as well as other vegetables (e.g., corn, lettuce, and onions), increase in quantity across the food plans. These two vegetable categories are relatively expensive, compared with potatoes, so they increase in amount as the cost of the food plans rises.

Table 1. Dietary standards of the revised market baskets of the Low-Cost, Moderate-Cost, and Liberal Food Plans

Dietary standard	Description of constraint
Recommended Dietary Allowances (RDAs) for each age-gender group	1989 RDA
Food energy	Average energy allowance
Protein, vitamins (A, C, E, B_6, B_{12}, thiamin, riboflavin, niacin, folate) and minerals (calcium, phosphorus, magnesium, iron, zinc)	100% RDA
Dietary Guidelines	
Total fat	30% or less of total calories for adults and children ages 5[1] and older; at average consumption for children ages 2 to 4; unrestricted for children age 1
Saturated fat	Less than 10% of total calories for adults and children ages 5 and older; at average consumption for children ages 2 to 4; unrestricted for children age 1
Other recommendations	
Sodium	No more than 100% of average consumption; unrestricted for children age 1
Cholesterol	300 mg/day or less; unrestricted for children age 1
Fiber	No less than 100% of average consumption
Carbohydrate	55% or more of total calories/day
Caloric sweeteners/added sugars	No more than 100% of average consumption
Food Guide Pyramid servings	
Grains	Minimum of 6; maximum of 11 servings/day[2]
Vegetables	Minimum of 3; maximum of 5 servings/day[2]
Fruits	Minimum of 2; maximum of 4 servings/day[2]
Milk products	Minimum of 2; maximum of 3 servings/day[2]
Meat/meat alternates	Minimum of 2; maximum of 3 (5 to 7 ounces) servings/day[2]
Fats, oils, and sweets	No more than 100% of average consumption

[1]All ages are in years.
[2]Minimum and maximum servings vary by age-gender group. Maximum servings are specified to ensure that the minimum number of servings from all Pyramid food groups are included in the market baskets before the maximum number of servings of any one of the food groups is exceeded. Serving sizes for children through 3 years old are modified by reducing the serving size by one-third, except for servings of milk products.

Table 2. Average market baskets of the Low-Cost, Moderate-Cost, and Liberal Food Plans, pounds of food[1] per week

Food category	Low-cost	Moderate-cost	Liberal
		Pounds per week	
Grains			
Breads, yeast and quick	1.25	1.48	1.61
Breakfast cereals, cooked and ready to eat	.44	.42	.39
Rice and pasta	1.33	1.33	1.62
Flours	.47	.53	.58
Grain-based snacks and cookies	.17	.22	.18
Total Grains	**3.66**	**3.98**	**4.38**
Vegetables			
Potato products	2.39	2.27	2.59
Dark-green and deep-yellow vegetables	.56	.77	.94
Other vegetables (corn, lettuce, onions, etc.)	2.73	3.29	3.57
Total Vegetables	**5.68**	**6.33**	**7.10**
Fruits			
Citrus fruits, melons, berries, and juices	2.48	2.61	1.68
Noncitrus fruits and juices	1.84	2.46	4.78
Total Fruits	**4.32**	**5.07**	**6.46**
Milk products			
Whole milk, yogurt, and cream	1.69	1.86	1.87
Lower fat and skim milk and lowfat yogurt	5.03	5.33	6.27
Cheese	.30	.34	.29
Milk drinks and milk desserts	.34	.39	.44
Total Milk products	**7.36**	**7.92**	**8.87**
Meat/meat alternates			
Beef, pork, veal, lamb, and game	1.50	1.68	2.55
Chicken, turkey, and game birds	1.60	2.02	1.87
Fish and fish products	.48	.80	1.10
Bacon, sausages, and luncheon meats	.31	.33	.37
Eggs and egg mixtures	.41	.42	.44
Dry beans, lentils, peas, and nuts	.47	.44	.39
Total Meat/meat alternates	**4.77**	**5.69**	**6.72**
Other foods			
Table fats, oils, and salad dressings	.39	.45	.47
Gravies, sauces, condiments, spices, and salt	.23	.27	.29
Fruit drinks, soft drinks, and ades	4.84	3.82	4.64
Sugars, sweets, and candies	.39	.17	.44
Coffee and tea	.19	.17	.12
Total Other foods	**6.04**	**4.88**	**5.96**
Total	**31.83**	**33.87**	**39.49**

[1]Food as purchased includes uncooked grain products; raw, canned, and frozen vegetables; fruit juice concentrates; dry beans and legumes; and meat with bones. Coffee and tea are in dried weight. Also, while fruit drinks, soft drinks, and ades may appear to be large in quantity for some adults, they typically translate to less than one 16-oz bottle of such drinks per day.

More citrus fruits, melons, berries, and juices are in the Low-Cost Food Plan than are in the Liberal Food Plan; whereas, the amount of noncitrus fruits and juices are nearly three times higher in the Liberal Food Plan, compared with the Low-Cost Plan.

Fruits

More citrus fruits, melons, berries, and juices are in the Low-Cost Food Plan than are in the Liberal Food Plan; whereas, the amount of noncitrus fruits and juices are nearly three times higher in the Liberal Food Plan, compared with the Low-Cost Plan. Analysis of consumers' intake used as the basis for the Low-Cost Plan suggests that orange juice made from concentrate constitutes the bulk of the citrus fruits, melons, and berries group. Noncitrus fruits and juices are generally more expensive than orange juice.

Milk products

Lower fat and skim milk and lowfat yogurt increase in quantity across the three food plans. The amount of milk drinks and milk desserts also increases across the food plans. Both increases are likely the result of taste preferences and economic considerations.

Meat/meat alternates

More expensive meat/meat alternates increase in quantity across the three food plans, resulting in the greatest amount of beef, pork, veal, lamb, and game, and fish products being in the Liberal Food Plan. Less expensive meat/meat alternates generally decrease in quantity from the Low-Cost Food Plan to the Liberal Food Plan, with the smallest amount of dry beans, lentils, peas, and nuts in the Liberal Food Plan.

Other foods

Food categories in "other" foods are inexpensive sources of calories and fat. So, after dietary standards are met, the amounts of these food categories increase in the less expensive food plans because of consumer preference.

Average Food Plan Market Basket Versus Average Consumption

To understand how actual reported diets would need to change to meet the dietary standards of the revised Low-Cost, Moderate-Cost, and Liberal Food Plans, CNPP compared the average market basket (in pounds per week) for each plan with people's average consumption (in pounds per week) based on the food expenditure quartile corresponding to each plan. (Those quartiles refer to the second quartile for the Low-Cost Plan, the third quartile for the Moderate-Cost Plan, and the highest quartile for the Liberal Plan.) Using the same technique that produced the average market basket, CNPP calculated an average consumption basket. Table 3 shows the percentage difference between the average market basket for each plan and the average consumption basket for people in the corresponding food expenditure quartile.

More breakfast cereals and rice and pasta are in all three market baskets of the food plans than are in the respective consumption baskets. The market basket of the Low-Cost Food Plan contains slightly fewer pounds of bread and flours than does the market basket based on people's consumption patterns. The market baskets of all three plans contain fewer grain-based snacks and cookies than do the baskets based on consumption.

More vegetables and fruits are contained in the markets baskets of all three food plans, compared with the market baskets based on consumption. The Low-Cost Food Plan contains 242 percent more citrus fruits, melons, berries, and juices than does a market basket based on people's consumption pattern. This is not surprising, because

Table 3. Average market baskets of the Low-Cost, Moderate-Cost, and Liberal Food Plans versus corresponding average consumption, percentage difference

Food category	Low-cost	Moderate-cost	Liberal
		Percent difference[1]	
Grains			
Breads, yeast and quick	-2.7	22.1	59.9
Breakfast cereals, cooked and ready to eat	24.2	23.6	16.8
Rice and pasta	199.2	214.7	264.1
Flours	-15.7	2.0	14.6
Grain-based snacks and cookies	-32.9	-26.9	-36.7
Vegetables			
Potato products	105.4	93.6	112.6
Dark-green and deep-yellow vegetables	30.6	42.1	66.1
Other vegetables (corn, lettuce, onions, etc.)	0.2	10.6	11.7
Fruits			
Citrus fruits, melons, berries, and juices	241.6	183.6	50.9
Noncitrus fruits and juices	48.7	60.3	203.6
Milk products			
Whole milk, yogurt, and cream	-21.0	-11.4	-12.1
Lower fat and skim milk and lowfat yogurt	81.5	83.7	157.1
Cheese	-37.5	-30.3	-39.2
Milk drinks and milk desserts	-34.4	-28.4	-32.8
Meat/meat alternates			
Beef, pork, veal, lamb, and game	1.1	-4.2	-1.4
Chicken, turkey, and game birds	5.8	38.6	21.1
Fish and fish products	61.1	134.8	148.9
Bacon, sausages, and luncheon meats	-20.2	-8.2	27.6
Eggs and egg mixtures	-22.5	-13.3	-0.3
Dry beans, lentils, peas, and nuts	19.4	32.2	14.1
Other foods			
Table fats, oils, and salad dressings	-21.3	-17.1	-15.4
Gravies, sauces, condiments, spices, and salt	-21.1	-15.5	-21.3
Fruit drinks, soft drinks, and ades	-26.0	-38.4	-13.0
Sugars, sweets, and candies	-27.8	-67.2	-19.7
Coffee and tea	-22.1	-7.6	-19.3

[1]These percentages may not match the text because of rounding.

the market baskets of the food plans represent a nutritious diet at various cost levels—and the consumption of vegetables and fruits generally needs to increase (Basiotis et al., 2002).

Fewer pounds of whole milk, yogurt, and cream; cheese; and milk drinks and milk desserts are contained in the market baskets of all three food plans versus the market baskets based on consumption. The market baskets of all three food plans provide calcium and protein from lower fat milk products while reducing the total fat and saturated fat available from these foods.

The three food plans have meat/meat alternate components that are relatively lower in fat. More chicken, turkey, and game birds; fish and fish products; and dry beans, lentils, peas, and nuts are in the market basket of each food plan than is the case for the market baskets based on consumption. The market baskets of the three food plans contain fewer pounds of “other” foods (fats, oils, and sweets) than do the market baskets based on

Table 4. Average revised market baskets of the Low-Cost, Moderate-Cost, and Liberal Food Plans versus average previous market baskets, in pounds of food per week[1]

	Low-Cost market basket			Moderate-Cost market basket			Liberal market basket		
	Previous	Revised	Difference	Previous	Revised	Difference	Previous	Revised	Difference
	Pounds			*Pounds*			*Pounds*		
Grains	4.11	3.27	-20%	4.29	3.56	-17%	4.63	3.89	-16%
Vegetables	4.40	5.08	+15%	5.28	5.59	+6%	5.78	6.32	+9%
Fruits	3.75	5.16	+38%	4.54	6.11	+35%	5.21	7.12	+37%
Milk products	8.35	8.08	-3%	9.25	8.84	-4%	9.45	9.76	+3%
Meat/meat alternates	4.04	4.24	+5%	4.84	5.06	+5%	5.50	5.88	+7%
Other foods (fats, oils, and sweets)	3.74[2]	5.28		4.03[2]	6.42		4.69[2]	5.13	
Total	**28.39**	**31.11**		**32.23**	**35.58**		**35.26**	**38.11**	

[1]Figures are an unweighted average in terms of pounds of food per week for all age-gender groups.
[2]Does not contain added fats, oils, and sugars. These items are included in the food groups to which they apply; therefore, no meaningful comparisons can be made.

consumption. Foods in this group are typically high in fat and calories and are not nutritionally dense, so they represent a smaller share of nutritious market baskets than do market baskets based on average consumption.

New and Previous Food Plans

CNPP also compared the average market basket of the new and previous Low-Cost, Moderate-Cost, and Liberal Food Plans. Such a comparison shows how dietary guidance has changed over time (table 4). New and previous market baskets represent an unweighted average for pounds of foods per week for all age-gender groups.

Compared with their respective previous market baskets, the new market baskets of the Low-Cost, Moderate-Cost, and Liberal Food Plans contain fewer pounds of grains (16 to 20 percent), more vegetables (6 to 15 percent), more fruits (35 to 38 percent), and slightly more meat/meat alternates (5 to 7 percent). The new market baskets of the Low-Cost and Moderate-Cost Food Plans contain slightly fewer pounds of milk products, compared with the previous market baskets (3 to 4 percent); whereas, the new market basket of the Liberal Food Plan contains slightly more milk products (3 percent) than its previous market basket.

These percentage changes from the previous market baskets are likely distorted, because for the previous baskets, added fats, oils, and sugars were allocated to their respective food group component (e.g., fats added to vegetables were allocated to the vegetable category). Thus, for vegetables, fruits, and meat/meat alternates, the percentage changes from the previous to the new market baskets are likely underestimates; whereas, for grains, the percentage changes are likely overestimates. For milk products, the percentage change is likely an underestimate for the Liberal Food Plan and overestimates for the other two food plans. A true comparison of the “other” food category (fats, oils, and sweets) cannot be made between the respective previous and revised market baskets because the “other” category in the previous baskets does not contain added fats, oils, and sugars; whereas, it does for the new baskets.

It is important to note the larger quantity of food (measured in pounds per week) in the revised market baskets of the food plans, compared with the previous ones. This partly reflects changes in dietary guidance. For example, the previous food plans allowed up to 35 percent of calories from fat, compared with 30 percent for the revised plans. This translates to higher food weight (pounds). However, all three revised food plans provide the Recommended Energy Allowance for each age-gender group.

Cost Update of the Food Plans

Each month CNPP uses the method described here to update the cost of the market baskets of the Low-Cost, Moderate-Cost, and Liberal Food Plans for each of the 12 age-gender groups. This method was approved by an expert interagency panel of economists and uses the monthly Consumer Price Indexes (CPIs) for specific food categories to update prices for the food categories of each food plan's market baskets. Each of the 25 food categories of the food plans has a corresponding CPI or set of corresponding CPIs that are applied to update the appropriate food-category cost for the market basket of each age-gender group. For food categories with more than one corresponding CPI, CNPP uses a weighted average of the appropriate CPIs. The weights are based on expenditure patterns. After the CPIs are applied to each food category, the costs of the food categories are summed to determine the total cost of the food plan market basket for each age-gender group.

A Final Word

The revised market baskets of the Low-Cost, Moderate-Cost, and Liberal Food Plans successfully incorporate recent dietary guidance and nutrient recommendations and maintain constant real-cost levels. The market baskets serve as a valuable framework for providing advice to households regarding nutritious food selection at various cost levels. This is especially important because most people have a diet that needs improvement. This revision of the market baskets of the Low-Cost, Moderate-Cost, and Liberal Food Plans is an important step in helping households eat more healthfully.

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Insight 25

September 2001

Report Card on the Diet Quality of Children Ages 2 to 9

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The diet quality of most children ages 2 to 9 is less than optimal. This is of concern because poor eating habits in young children may impair their growth and development and serve as the foundation for poor eating behaviors as adults. Such eating behaviors, as well as inactivity among American children, are key factors in the prevalence of overweightness among children over the past decades. Recent data show that 13 percent of American children 6 to 11 years old are overweight, compared with 4 percent in the 1960s. Overweight children are at risk for cardiovascular diseases, Type II diabetes, and other serious health problems. Information on their diets is critical to help develop strategies for healthier children.

This *Nutrition Insight* uses the Healthy Eating Index to examine the diet quality of American children ages 2 to 9. Data used for analysis are from the U.S. Department of Agriculture (USDA), Agricultural Research Service's 1998 Continuing Survey of Food Intakes by Individuals (Supplemental Children's Survey), a nationally representative survey containing information on the diets of 4,011 children ages 2 to 9.

How the Healthy Eating Index Is Computed

The Healthy Eating Index (HEI), computed on a regular basis by USDA, is a summary measure of people's diet quality. The HEI provides an overall picture of the type and quantity of foods people eat, their compliance with specific dietary recommendations, and the variety in their diets. The Index consists of 10 components, each representing different aspects of 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 0. 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."[1]

Most Children Have a Diet that "Needs Improvement" or Is "Poor"

Most children ages 2 to 9 have a diet that "needs improvement" or is "poor" (fig. 1). Older children in this age group have a lower HEI score than do younger children (table 1). For children ages 2 to 3, 36 percent have a good diet and 4 percent have a poor diet. For children ages 7 to 9, only 12 percent have a good diet and 8 percent have a poor diet. Much of the decline in diet quality for children occurs between the age groups 2 to 3 and 4 to 6. Between these two age groups, the percentage of children having a good diet falls from 36 to 17 percent. The average HEI score for children ages 2 to 3 is 74.4; for children ages 4 to 6, 68.4; and for children ages 7 to 9, 68.0.

The decline in children's overall HEI score as they get older is linked to significant declines in their fruit and sodium component scores of the HEI. The average fruit score falls from 7.4 for children ages 2 to 3 to 5.0 for children ages 7 to 9, and the average sodium score falls from 8.7 for children ages 2 to 3 to 6.1 for children ages 7 to 9. For children ages 7 to 9, only 25 percent meet the dietary recommendation for fruit and 32 percent meet the dietary recommendation for sodium. This decline may occur because as children get older, they consume more fast food and salty snacks.

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

Figure 1. Healthy Eating Index rating for children ages 2 to 9, 1998

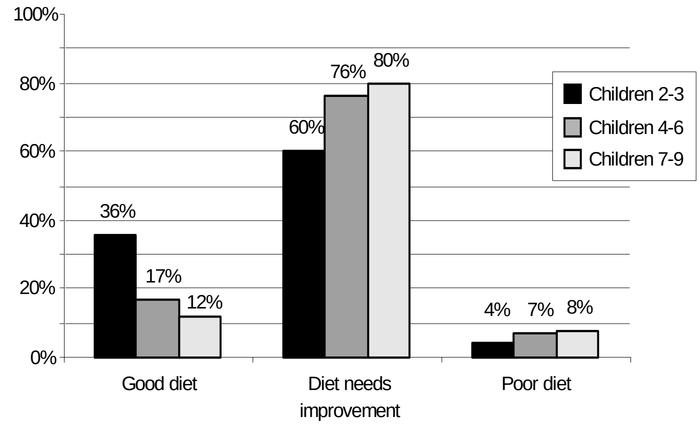

Table 1. Healthy Eating Index: Overall and component mean scores for children ages 2 to 9, 1998 (percent of children meeting the dietary recommendations for each component in parentheses)

	Mean		
	Children 2-3	Children 4-6	Children 7-9
Total HEI Score	74.4[a]	68.4[b]	68.0[b]
Grains	8.5[a] (57)	7.6[b] (31)	7.9[c] (34)
Vegetables	6.3[a] (35)	5.1[b] (19)	5.6[c] (22)
Fruit	7.4[a] (60)	5.8[b] (35)	5.0[c] (25)
Milk	7.4 (45)	7.7 (50)	7.6 (50)
Meat	6.6[a] (29)	5.6[b] (17)	5.9[b] (13)
Total fat	7.3 (39)	7.4 (38)	7.3 (38)
Saturated fat	5.4 (30)	5.7 (30)	6.2 (39)
Cholesterol	8.6 (82)	8.7 (81)	8.5 (78)
Sodium	8.7[a] (61)	7.5[b] (40)	6.1[c] (32)
Variety	8.0[a] (54)	7.5[b] (46)	7.8[b] (47)

Note: Scores with different superscripts are significantly different from each other at the .05 level.

Children's grain, vegetable, and meat scores also decline as the children get older. The HEI score for grains is relatively good (8.5) for children ages 2 to 3 but significantly declines as children get older. The majority of children do not meet the dietary recommendation for vegetables or meat. Milk, total fat, saturated fat, and cholesterol scores are similar among the three age groups of children. Cholesterol scores are relatively good for children ages 2 to 9, and most of these children (78 to 82 percent) meet the dietary recommendation for cholesterol (300 milligrams or less per day). Only 38 to 39 percent of these children meet the dietary recommendation for total fat (30 percent or less of total calories from total fat).

Children's HEI Scores Have Not Changed Much Since 1989

The HEI was first computed by using 1989 food consumption data. It is therefore possible to compare the scores for children ages 2 to 9 in 1989 and 1998. Although there were changes in the way the milk and variety components of the HEI were calculated in each year, comparisons based on average scores may be made. The overall HEI score for children ages 2 to 9 has not changed significantly from 1989 to 1998—approximately 70 points in both years—indicating a diet that needs improvement. There was no significant difference in HEI component scores for children between the 2 years.

Conclusion

As indicated by the Healthy Eating Index, the diet of most children ages 2 to 9 needs substantial improvement to meet dietary recommendations. Children ages 7 to 9 have a lower quality diet than do younger children. The decline in children's diet quality as they get older is associated with a decline in their fruit and sodium HEI scores. Nutrition promotion activities should focus particularly on this younger age group to prevent or even reverse a worsening of the diet as children get older. There has not been any significant change in the diet quality of children ages 2 to 9 from 1989 to 1998. This *Nutrition Insight* provides a better understanding of children's diets and the types of dietary changes needed to improve children's eating behaviors.

Insight 26
July 2002

Food Insufficiency and Prevalence of Overweight Among Adult Women

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A limited number of studies have shown that, in the United States, women in food insufficient households are more likely to be overweight than women in food sufficient households (Olson, 1999; Townsend, Peerson, Love, Achterberg, & Murphy, 2001). However, these studies utilized self-reported heights and weights to define overweight. To further examine this paradoxical association between food insufficiency and overweight, we used data from the 1988-94 National Health and Nutrition Examination Survey (NHANES III). In that survey, heights and weights were measured. To gain additional insight, we also examined women's overall diet quality as gauged by the Healthy Eating Index (HEI) and its components.

The 1988-94 NHANES contains information on people's (1) self-reported household food sufficiency status, (2) body mass index (BMI) based on measured height and weight, and (3) self-reported individual food intake for a 1-day period (which has been shown to be a reliable depiction of the usual diets of population groups). The survey is designed to be nationally representative, and we used weighted data to reflect the population of interest. We used this data set for analysis because it contains the most recent information on measured BMI, food intake, and food sufficiency status. In testing for statistical differences between groups, we used the SUDAAN version 8 statistical software.

For analysis, women ages 19 to 55 who did not live alone were selected. This group was chosen because prior research has shown them to have higher rates of food insufficiency. Food sufficiency was measured by a woman reporting that her household had enough food to eat (food sufficient households); food insufficiency was measured by a woman reporting that her household sometimes or often did not have enough to eat (food insufficient households). The sample size was 4,804 women in food sufficient households and 437 women in food insufficient households.

Healthy Eating Index

Diet quality of women was gauged by the HEI, which provides an overall picture of the type and quantity of foods people eat, their compliance with specific dietary recommendations, and variety in their diets. The Index consists of 10 components, each representing different aspects of a healthful diet.

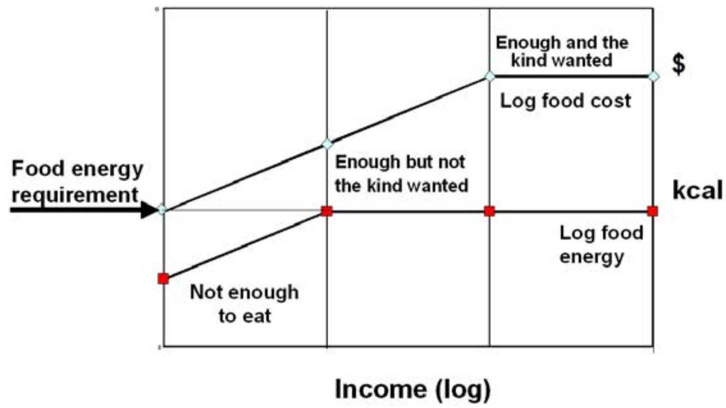
Components 1-5 measure the degree to which a person's diet conforms to the USDA's Food Guide Pyramid serving recommendations for the five major food groups: Grains (bread, cereal, rice, and pasta); vegetables, fruits, milk (milk, yogurt, and cheese), and meat (meat, poultry, fish, dry beans, eggs, and 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 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 0. 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" (Bowman, Lino, Gerrior, & Basiotis, 1998).

A Greater Percentage of Women Reporting Food Insufficiency Were Overweight

Looking at the BMI of women ages 19 to 55, we found a significantly higher percentage of those in food insufficient households were overweight (defined as having a BMI of 25 or more), compared with those in food sufficient households (58 vs. 47 percent). There were no significant differences between women in food sufficient and insufficient households in terms of mean BMI and percentage being obese (defined as having a BMI of 30 or more).

Figure 1. The food insufficiency curve



Source: Basiotis (1992).

Various possible reasons have been suggested for this paradox. First, an overweight woman may indeed view her household as being food insufficient because her view of the amount of food deemed necessary is too high. Second, a woman may engage in binge eating when food is available, thereby resulting in being overweight but not having enough food at hand during certain time periods. Third, a food insufficient woman may be consuming cheaper, less nutritious (more calorie-dense) food that leads to being overweight.

This last reason has received more attention recently. Basiotis (fig. 1) hypothesized and confirmed a behavioral mechanism by which household members faced with diminishing resources will first consume less expensive and more calorie-dense foods to maintain caloric intake at less cost. When resources diminish even further, household members reduce the amount of energy they consume to less than that needed. It is also known that in households with children, "maternal deprivation" is often observed where the mother will eat less food so that the children can eat more. To examine the plausibility of this hypothesis in explaining the food insufficiency-overweight paradox, we looked at women's diet quality.

Women Reporting Food Insufficiency Had a Worse Diet

On average, caloric intake by women in food insufficient households was *statistically* similar to that of women in food sufficient households (1,959 kcal per day vs. 1,868 kcal per day). This, however, amounts to a difference in caloric intake of 4.6 percent which, if true, would be of *practical* significance and would help explain the paradox. Women from food insufficient households had a significantly worse diet quality than women in food sufficient households. The average HEI score was 58.8 for women in food insufficient households, compared with 62.7 for women in food sufficient households, a 6.2-percent difference. However, the average HEI score for both groups of women indicated that their diets needed improvement.

There also were significant differences between women in food sufficient and insufficient households with regards to HEI component scores. Compared with women in food sufficient households, women in food insufficient households had significantly lower HEI component scores for vegetables (5.1 vs. 5.8), fruits (2.2 vs. 3.4), milk (5.2 vs. 6.1), cholesterol (7.4 vs. 8.2), and food variety (6.4 vs. 7.3). There were no statistically significant differences in the remaining HEI component scores between the two groups.

The Paradox Remains

Analysis of the NHANES III data reveals that women reporting to be in food insufficient households have a greater prevalence of being overweight and have a lower diet quality than do women in food sufficient households. While the association between food insufficiency and lower diet quality may be expected, that between food insufficiency and prevalence of being overweight seems to be a contradiction. How can a person report that in her household sometimes or often they do not have enough food to eat, yet be overweight? A definitive solution to this paradox must await additional research.

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Federal Studies

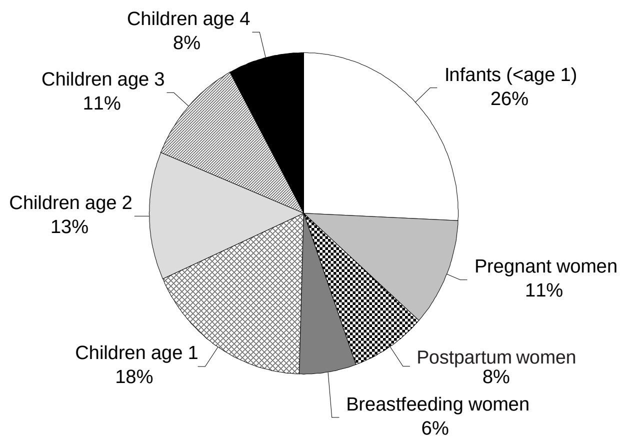
WIC Participant and Program Characteristics[1]

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides a combination of prescribed supplementation, nutrition education and counseling and increased access to health care and social services to lower income and at-nutritional-risk (1) pregnant, breastfeeding, and postpartum women; (2) infants up to age 1; and (3) children age 1 to 4. Participants receive supplemental food benefits through vouchers or checks that allow them to obtain specific types of food (e.g., milk, juice, and cereal) from participating retail grocers. This report, generated biennially since 1992 from WIC State management information systems, summarizes demographic characteristics of WIC participants nationwide in April 2002, along with information on participant income and characteristics related to nutrition risk. In addition to describing WIC members of migrant farmworker families, the report also estimates the breastfeeding initiation for WIC infants 7 to 11 months old.

Half of WIC participants are children

As of April 2002, 8.02 million women, infants, and children were enrolled in the WIC Program, an increase of 2 percent over the program's April 2000 enrollment. Children accounted for half of WIC participants; infants, 26 percent; and women, 25 percent. From 1998 to 2002, the proportion of children enrolled in WIC declined slightly, the proportion of infants stayed the same, and the proportion of women increased slightly.

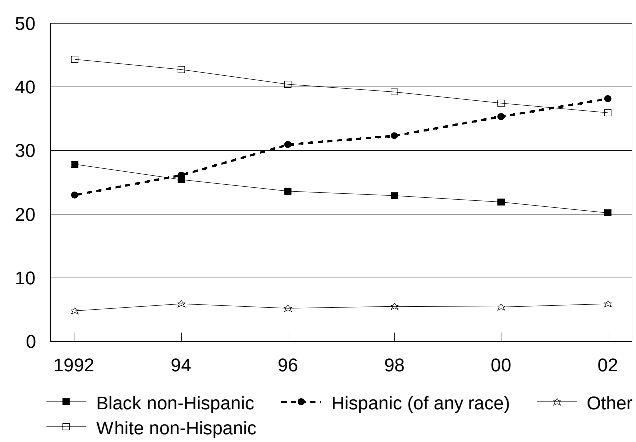
People enrolled in WIC Program



Hispanics account for largest ethnic group of WIC participants

Hispanics made up the largest ethnic group of WIC participants (38 percent), up from 23 percent in 1992. Whites were the next largest group (36 percent) followed by Blacks (20 percent), and others (Asian, Pacific Islander, American Indian, or Alaskan Native) (5 percent). The racial/ethnic composition of WIC participants has changed steadily since 1992: The percentage of Hispanic WIC participants rose while percentages of Black and White participants decreased.

Racial and ethnic characteristics of WIC participants, 1992-2002

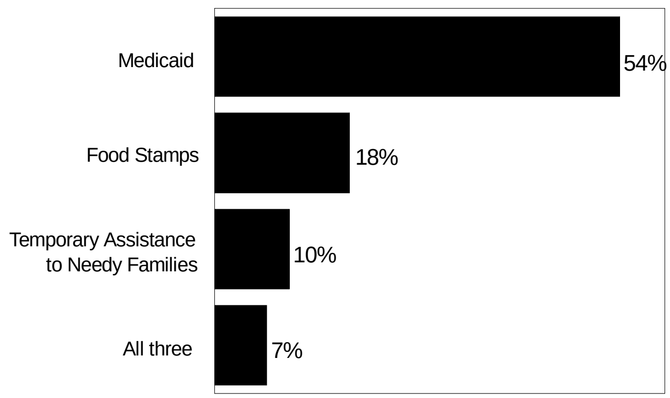


[1]Percentages have been rounded.

Majority of WIC participants receive benefits from other public assistance programs

In 2002, 57 percent of WIC participants received benefits from at least one other public assistance program. Fifty-four percent of WIC clients received Medicaid benefits (up from 50 percent in 2000), 18 percent received food stamps (down from 27 percent in 1998), and 10 percent participated in the Temporary Assistance for Needy Families Program (down from 17 percent in 1998).

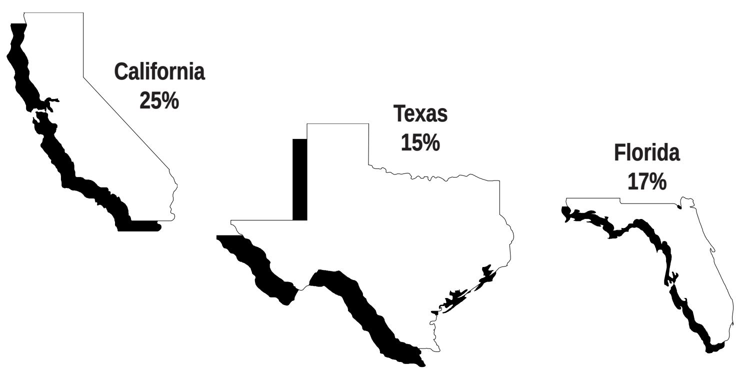
Participation in other programs by WIC participants



47,950 migrants in WIC Program

One-half of 1 percent of people receiving WIC services were migrants (farmworkers or their families). More than half of these migrants were enrolled in the WIC Program in three States: California, Florida, and Texas. Migrant children enrolled in WIC were older than the general population of WIC children.

Over half of migrant farmworker WIC participants in three States



Source: Kresge, J. (2003, September). WIC Participant and Program Characteristics, PC2002: Executive Summary. Office of Analysis, Nutrition and Evaluation, Food and Nutrition Service, U.S. Department of Agriculture.

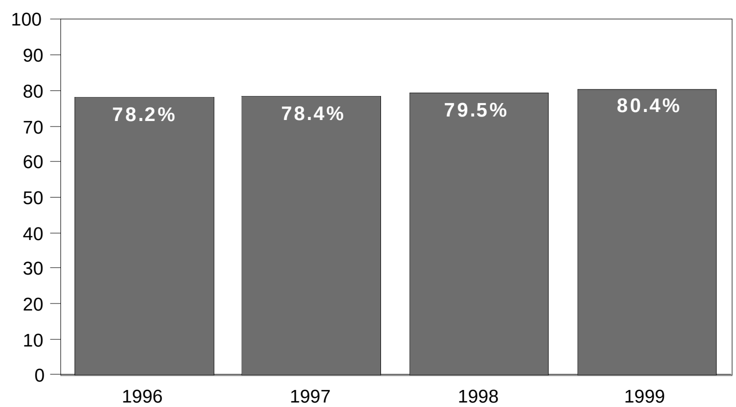
Health Insurance Coverage: 1996-99

This report uses longitudinal data from the 1996 panel of the Survey of Income and Program Participation to examine 1996 to 1999 health insurance coverage. During the 48-month survey period, respondents reported their health insurance status for each month, providing the opportunity to observe how long people are covered by health insurance or how long they go without coverage. The report focuses on the dynamics of health insurance coverage and how patterns vary across economic and demographic groups. The number of months without health insurance varied for different groups: 96.7 percent of all people were covered for at least 1 month of the 48-month period, about two-thirds of all people had some kind of health insurance for the entire 48-month period, and only 3.3 percent had no health insurance coverage during the whole period.

Coverage rates improved each year

Health insurance coverage rates increased over the years. Throughout the calendar year, 78.2 percent of the people were covered in 1996; 80.4 percent, in 1999. Conversely, 8.8 percent of all people lacked health insurance for the entire year in 1996, decreasing to 8.0 percent in 1999.

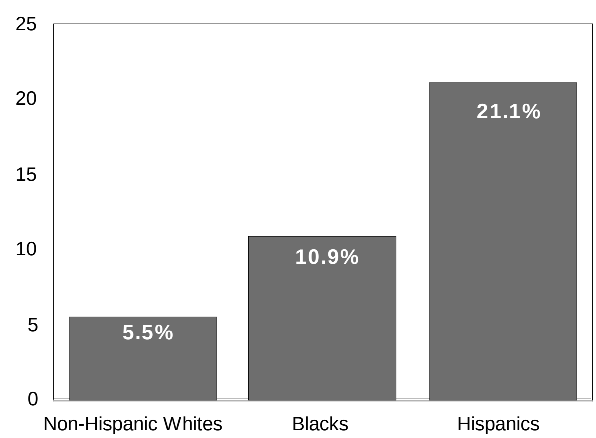
Percentage of people covered by health insurance during the entire year



Hispanics least likely to have continuous coverage

Among the racial/ethnic groups, non-Hispanic Whites were the most likely and Hispanics (of any race) were the least likely to have continuous coverage every year (1996 to 1999). The likelihood of no coverage during all of 1999 was also highest among Hispanics: 21.1 percent of Hispanics versus 10.9 percent of Blacks and 5.5 percent of non-Hispanic Whites.

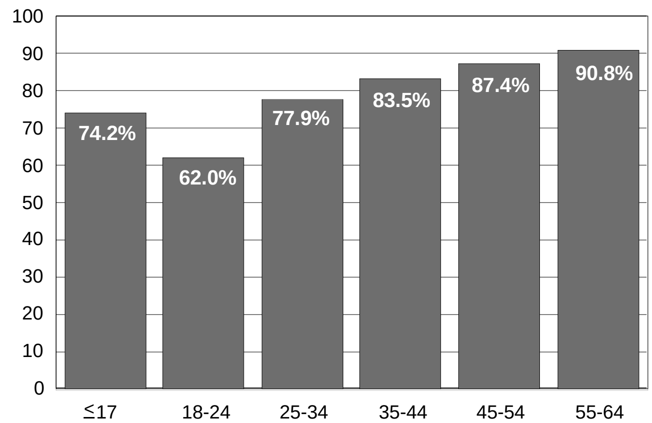
Percentage of people not covered by health insurance during all of 1999, by race/ethnicity



People age 18 to 24 also least likely to be insured

People age 55 to 64 were the most likely and those age 18 to 24 were the least likely to have entire-year health insurance coverage. In 1999, while 9 of 10 people age 55 to 64 reported entire-year coverage, only 6 of 10 people age 18 to 24 did so.

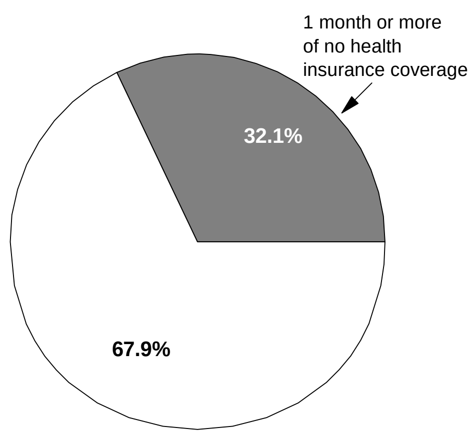
Percentage of people with entire-year health insurance coverage in 1999, by age



1 in 3 people without health insurance for at least 1 month

While 67.9 percent of all people had health insurance coverage for the entire 48 months, the rest (32.1 percent) had at least 1 month of no coverage. Unemployed people were the most likely (71.6 percent) and people age 65 or over were the least likely (2.3 percent) to experience at least 1 month of no coverage. The median duration without health insurance was 5.6 months for all people who experienced at least one spell of no health insurance.

Percentage of people with 1 month or more of no health insurance coverage during 1996-99



Source: Bhandari, S., & Mills, R. (2003). Dynamics of economic well-being: Health insurance 1996-1999. Current Population Reports P70-92. U.S. Census Bureau.

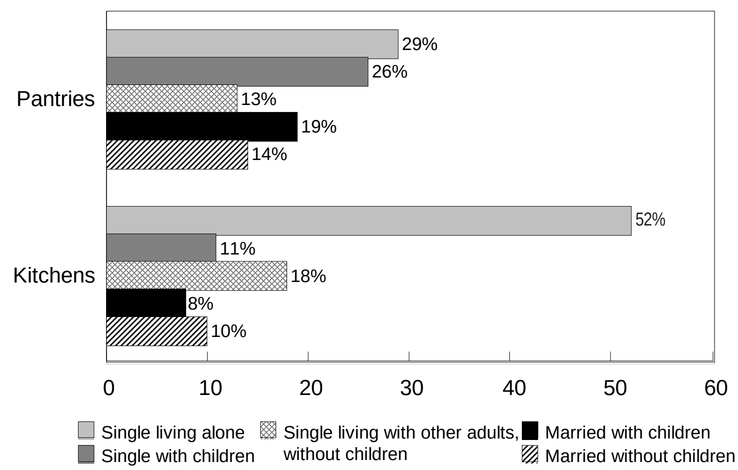
The Emergency Food Assistance System[1]

During a typical month in 2001, food pantries (distribution centers that provide groceries and other basic necessities that clients use in their homes or at locations away from distribution sites) served about 12.5 million people, and emergency kitchens (which supply meals for on-site consumption) served about 1.1 million people. Food pantries and emergency kitchens have an important role in feeding America's low-income and needy population. These organizations are part of the Emergency Food Assistance System (EFAS), a network operated largely by private organizations that receive some Federal support. This report presents findings from a national study that surveyed EFAS clients who receive emergency food assistance from selected food pantries and emergency kitchens. The study finds that food pantries and emergency kitchens serve a diverse clientele. Most EFAS households, including two-thirds of food-pantry clients and over two-fifths (45 percent) of emergency-kitchen clients, receive Federal food assistance. However, a substantial number of EFAS households do not receive food stamps, although they appear to be eligible for them.

Almost half of households using food pantries have children

Forty-five percent of pantry-client households included children, compared with 19 percent of kitchen-client households. Kitchen clients typically were men living alone (38 percent) or were single adults living with other adults.

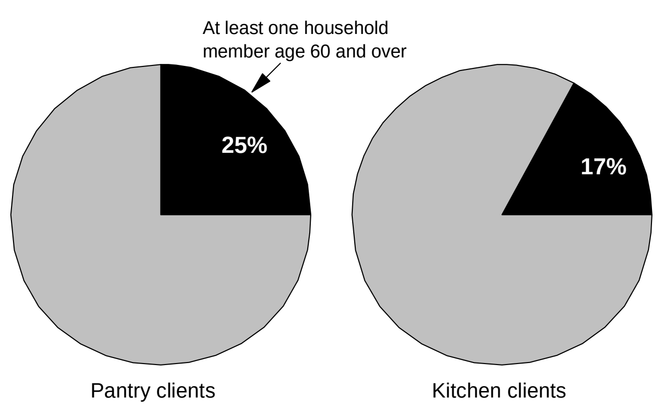
Household composition of food pantry and emergency kitchen clients



One-quarter of households using food pantries also include seniors

Twenty-five percent of pantry-client households and 17 percent of kitchen-client households included seniors (age 60 and over) but no children. Compared with other pantry-client households, those with seniors were more likely to rely only on pantries.

Percentage of households using food pantries and emergency kitchens with senior members but no children

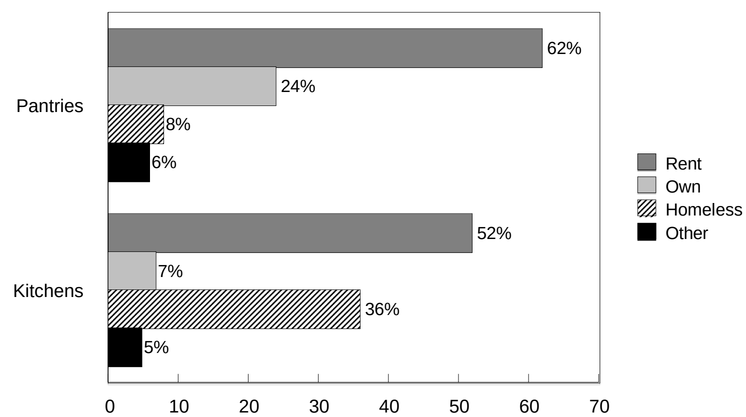


[1]Percentages have been rounded.

Kitchen clients experience more severe hardships than do pantry clients

Thirty-six percent of kitchen-client and 8 percent of pantry-client households were homeless, having limited or no access to facilities to prepare, store, or cook meals. Food insecurity was common among households that visited pantries or kitchens: 80 percent of pantry-client households and 75 percent of kitchen-client households.

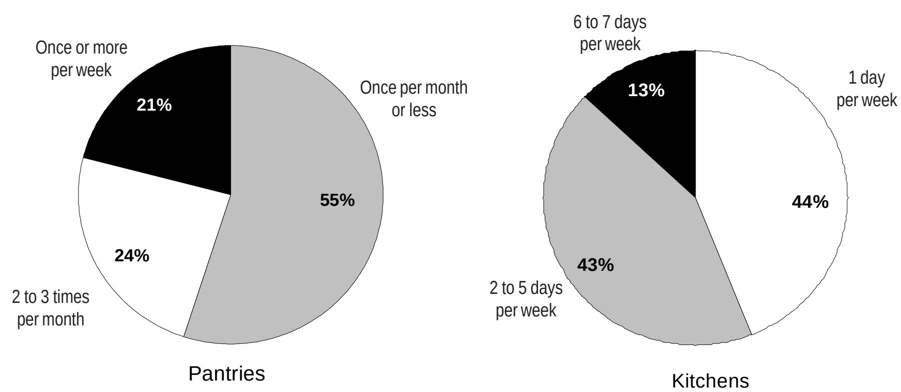
Residential status of households using food pantries and emergency kitchens



Clients visit pantries less often than kitchens

Over half of pantry-client households (55 percent) visited a pantry once a month or less, most likely because providers restricted the frequency of visits not because the clients had limited needs. Forty-three percent of kitchen clients received meals from an emergency kitchen 2 to 5 days during the week.

Frequency of visits to food pantries and emergency kitchens



Source: Briefel, R., Jacobson, J., Clusen, N., Zavitsky, T., Satake, M., Dawson, B., & Cohen, R. (2003, July). The Emergency Food Assistance System—Findings From the Client Survey: Executive Summary. Food Assistance and Nutrition Research Report No. 32. Economic Research Service, U.S. Department of Agriculture.

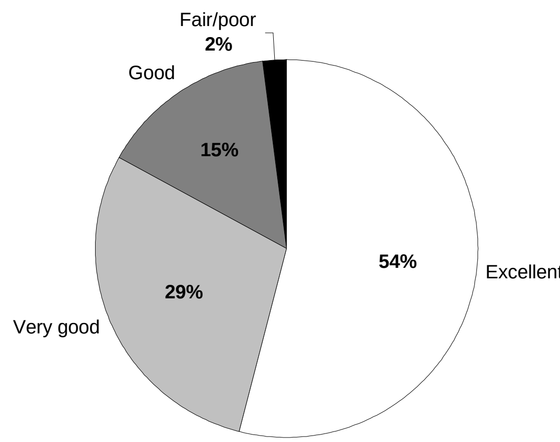
Health Statistics for U.S. Children: 2000

This report presents statistics from the 2000 National Health Interview Survey (NHIS) on selected health measures for children under 18 years old, classified by gender, age, race, Hispanic origin, family structure, parent's education, family income, poverty status, health insurance coverage, residence, region, and health status. The topics covered are asthma, allergies, learning disability, Attention Deficit Hyperactivity Disorder, prescription medication, respondent-assessed health status, school-loss days, usual place of health care, time since the last contact with a health care professional, unmet dental need, time since the last dental contact, and selected measures of health care access. The NHIS is a multistage probability sample survey conducted annually by interviewers of the U.S. Census Bureau for the National Center for Health Statistics, Centers for Disease Control and Prevention, and is representative of the civilian noninstitutionalized population of the United States. Information about the children is collected for one randomly selected child per family. Face-to-face interviews, with an adult proxy respondent familiar with the child's health, are used to collect the data.

Most children in excellent or very good health

In 2000, of the 72.3 million children in the United States, the majority were reported to be in excellent (54 percent) or very good health (29 percent). Two percent were reported to be in fair or poor health. Poverty status was associated with children's health: Only 4 of 10 children in poor families were in excellent health, compared with 6 of 10 children in families that were not poor.

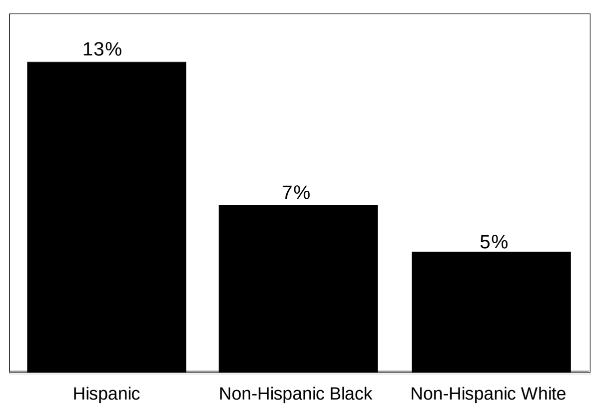
Reported health status of children



Hispanic children less likely to have usual place of health care

Although most children (93 percent) had a usual place of health care, typically a doctor's office or clinic, Hispanic children were less likely than other children to have a usual place. Thirteen percent of Hispanic children did not have a usual place of health care, compared with 7 percent of non-Hispanic Black children and 5 percent of non-Hispanic White children.

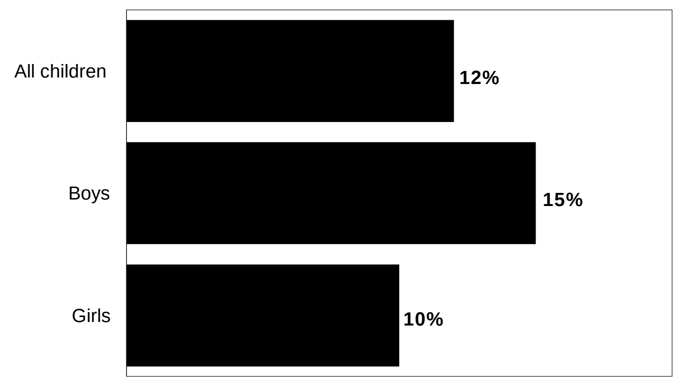
Children without usual place of health care, by race/ethnicity



Twelve percent of children diagnosed with asthma

Nine million U.S. children under age 18 (12 percent) have ever been diagnosed with asthma. Boys were more likely than girls to have ever been diagnosed with asthma (15 vs. 10 percent).

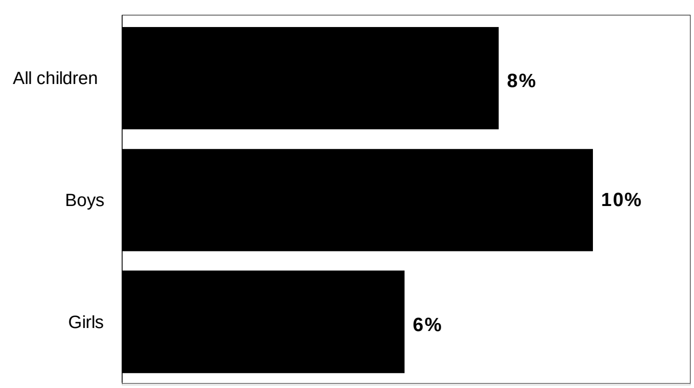
Children with asthma, by gender



Eight percent of children have a learning disability

Almost 5 million children 3 to 17 years old (8 percent) had a learning disability. Ten percent of boys had a learning disability, compared with 6 percent of girls. Almost 4 million children 3 to 17 years old (7 percent) had Attention Deficit Hyperactivity Disorder.

Children with a learning disability, by gender



Source: Blackwell, D.L., Vickerie, J.L., & Wondimu, E.A. (2003). Summary health statistics for U.S. children: National Health Interview Survey, 2000. National Center for Health Statistics. Vital Health Statistics 10(213).

Journal Abstracts

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

Carlson, A. & Senauer, B. (2003). The impact of the Special Supplemental Nutrition Program for Women, Infants, and Children on Child Health. *American Journal of Agricultural Economics, 85*(2), 479-491.

Data from the third National Health and Nutrition Examination Survey are used to analyze the effect of the Women, Infants, and Children (WIC) Program and other factors on the health of U.S. preschool children. Ordered probit equations are estimated for the physician's overall evaluation of the child's health. The WIC Program has a significant positive impact on the overall health of children. In particular, children in households participating in WIC are significantly more likely to be in excellent health. Increased household income also improves their health.

Finke, M.S. & Huston, S.J. (2003). Factors affecting the probability of choosing a risky diet. *Journal of Family and Economic Issues, 24*(3), 291-303.

Eating a poor diet is risky behavior. Inadequate nutrition compromises health and can increase the probability of premature death and/or reduced life quality. This paper uses a cost-benefit analysis from a health economic perspective to assess impact of costs and benefits associated with the odds of choosing a risky diet. Results indicate that time preference as measured through education, smoking, exercise, nutrition panel use, and motivation for nutrition knowledge significantly affect the odds of choosing a risky diet. In addition, variables hypothesized to influence the associated costs of tradeoff between present and future utility—location (both region and urbanization), income, race, gender, and age—are found to have an impact on the likelihood of choosing a risky diet.

Getter, D.E. (2003). Contributing to the delinquency of borrowers. *The Journal of Consumer Affairs, 37*(1), 86-100.

What contributes most to borrower delinquency—"excessive" borrowing that results in greater financial stress or unforeseen negative income and wealth shocks? Using data from the 1998 Survey of Consumer Finances, this paper provides evidence that consumer delinquency problems are mainly the result of unexpected negative events that neither the lender nor the borrower could have anticipated at the time the credit request was evaluated. The size of the household payments burden has an insignificant effect on delinquency risk and very little effect on default risk. Finally, household financial assets that can be used as a buffer against negative shocks also serve as a very important predictor of delinquency risk.

Kempson, K., Keenan, D.P., Sadani, P.S., & Adler, A. (2003). Maintaining food sufficiency: Coping strategies identified by limited-resource individuals versus nutrition educators. *Journal of Nutrition Education, 35*(4), 179-188.

Objective: This study's purposes were to identify food acquisition and management coping strategies used by limited-resource individuals to maintain food sufficiency, compare strategies named by the target audience to those previously identified by nutrition educators, and examine these strategies to advance grounded theory.
Design: Eleven focus groups, conducted with 62 limited-resource individuals, elucidate coping strategies that they or others they knew used to acquire or manage food to maintain food sufficiency. The results were compared with practices as previously identified by nutrition educators who regularly worked with this audience.
Subjects/Settings: Subjects aged 19 to 67 from throughout New Jersey were recruited by Food Stamp agencies, low-income outreach programs, soup kitchens, welfare offices, Head Start centers, shelters, and food pantries.
Results: Of the 95 coping strategies identified, 83% were known from nutrition educators previously. Ten new practices (eg, selling blood) had not previously been identified by educators. Four of 10 practices were not found in the literature (eg, repeated participation in research studies).
Six practices previously reported by nutrition educators were not mentioned by the study population.

Implications: Educators who work with limited-resource individuals are a good resource for research with this audience. Study findings may be important considerations for nutrition program planning and policy making.

Kolodinsky, J., DeSisto, T.P., & Labrecque, J. (2003). Understanding the factors related to concerns over genetically engineered food products: Are national differences real? *International Journal of Consumer Studies, 27*(4), 266-276.

Along with the rapid introduction of genetically engineered (GE) foods into the marketplace have come concerns about possible risks associated with this new technology. This study expands on previous research by exploring the relationships between certain sociodemographic, attitudinal and behavioural variables and North American college students' levels of concern over GE foods. Six index scales are created from the data and a series of anovas are conducted, and displayed visually using bar graphs, to examine the relationships between the explanatory variable and the students' levels of concern. The findings indicate that attitudinal and behavioural variables should be included in future models for predicting levels of concern for GE foods in addition to the socio-demographic variables currently used.

Schaffer, D.M., Gordon, N.P., Jensen, C.D., & Avins, A.L. (2003). Nonvitamin, nonmineral supplement use over a 12-month period by adult members of a large health maintenance organization. *Journal of the American Dietetic Association, 103*(11), 1500-1505.

Objective. National survey data show an increase in the prevalence of nonvitamin, nonmineral (NVNM) supplement use among adults over the past 10 years. Concern over this trend is based in part on reports of potential drug-supplement interactions. The type and prevalence of supplement use by demographic and behavior characteristics were examined among members of a large group model health plan, including those with selected health conditions.
Design. Data on the use of herbal medicines and dietary supplements among survey respondents were analyzed. Questions employed a checklist for six specific NVNM supplements with optional write-ins.
Subjects/setting. A stratified random sample of 15,985 adult members of a large group model health maintenance organization in northern California, who were respondents to a 1999 general health survey.
Statistical analyses performed. Analyses were conducted with poststratification weighted data to reflect the actual age, gender, and geographic distribution of the adult membership from which the sample was drawn.
Results. An estimated 32.7% of adult health plan members used at least one NVNM supplement. The most frequently used herbs were Echinacea (14.7%) and Gingko biloba (10.9%). Use of all NVNM supplements was highest among females, 45 to 64 years of age, whites, college graduates, and among those with selected health conditions.
Applications. Dietetics professionals need to uniformly screen clients for dietary supplement use and provide accurate information and appropriate referrals to users.

Wheelock, J., Oughton, E. & Baines, S. (2003). Getting by with a little help from your family: Toward a policy-relevant model of the household. *Feminist Economics, 9*(1), 19-45.

Recent decades have seen dramatic changes in the ways in which households in developed Western economies gain their livelihoods, with marked elements of a return to old ways of working. There has been a shift from reliance upon one family *wage* to the need for family *employment* as well as growing reliance on self-employment and small business. These changes mean that childcare for working parents, and the promotion of a new small enterprise, are key areas of policy concern. Drawing on original English empirical research around both these themes, this article shows the ways in which UK households draw on re-distribution between the generations as a —generally decommodified— contribution to livelihoods and "getting by." We argue that these results confound widely utilized models of how people behave, and take particular issue with how economists and policy-makers model the household and its boundaries as the institutional context for individual decisions.

Official USDA Food Plans: Cost of Food at Home at Four Levels, U.S. Average, December 2003[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 year	$17.50	$21.80	$25.50	$31.40	$75.80	$94.50	$110.50	$136.10
2 years	17.40	21.40	25.50	30.80	75.40	92.70	110.50	133.50
3-5 years	19.00	23.50	29.10	35.20	82.30	101.80	126.10	152.50
6-8 years	23.80	31.60	39.00	45.40	103.10	136.90	169.00	196.70
9-11 years	27.80	35.50	45.40	52.90	120.50	153.80	196.70	229.20
MALE:								
12-14 years	28.90	40.00	49.60	58.50	125.20	173.30	214.90	253.50
15-19 years	29.80	41.20	51.60	60.10	129.10	178.50	223.60	260.40
20-50 years	31.90	41.30	51.60	63.00	138.20	179.00	223.60	273.00
51 years and over	29.30	39.60	48.70	58.60	127.00	171.60	211.00	253.90
FEMALE:								
12-19 years	28.90	34.70	42.10	50.90	125.20	150.40	182.40	220.50
20-50 years	29.00	36.10	44.20	57.10	125.70	156.40	191.50	247.40
51 years and over	28.60	35.10	43.80	52.70	123.90	152.10	189.80	228.30
FAMILIES:								
FAMILY OF 2[3]:								
20-50 years	67.00	85.10	105.40	132.10	290.30	368.90	456.60	572.40
51 years and over	63.70	82.20	101.80	122.40	276.00	356.10	440.90	530.40
FAMILY OF 4:								
Couple, 20-50 years and children—								
2 and 3-5 years	97.30	122.30	150.40	186.10	421.60	529.90	651.70	806.40
6-8 and 9-11 years	112.50	144.50	180.20	218.40	487.50	626.10	780.80	946.30

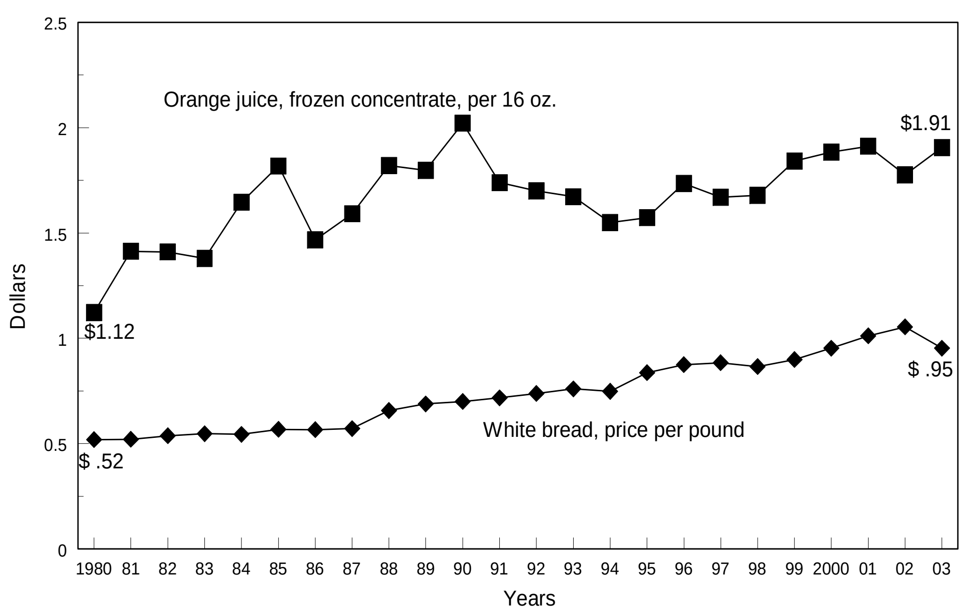
[1]Basis is that all meals and snacks are purchased at stores and prepared at home. For specific foods and quantities of foods in the Thrifty Food Plan, see *Family Economics and Nutrition Review*, Vol. 13, No. 1 (2001), pp. 50-64; for specific foods and quantities of foods in the Low-Cost, Moderate-Cost, and Liberal Plans, see *The Low-Cost, Moderate-Cost, and Liberal Food Plans, 2003 Administrative Report* (2003). All four Food Plans are based on 1989-91 data and are updated to current dollars by 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; 4-person—no adjustment; 5- or 6-person—subtract 5 percent; 7- (or more) person—subtract 10 percent. To calculate overall household food costs, (1) adjust food costs for each person in the household; then (2) sum these adjusted food costs.
[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	2000	Percent change 12 months ending with December 2003
All Items	6.1	2.5	3.4	1.9
Food	5.3	2.1	2.8	3.6
Food at home	5.8	2.0	3.0	4.5
Food away from home	4.5	2.2	2.4	2.3
Housing	4.5	3.0	4.3	2.2
Apparel	5.1	0.1	-1.9	-2.1
Transportation	10.4	1.5	4.3	0.3
Medical care	9.6	3.9	4.2	3.7
Recreation	NA	2.8	1.4	1.1
Education and communication	NA	4.0	1.2	1.6
Other goods and services	7.6	4.3	4.5	1.5

Price per pound for orange juice and white bread, as of December in each year



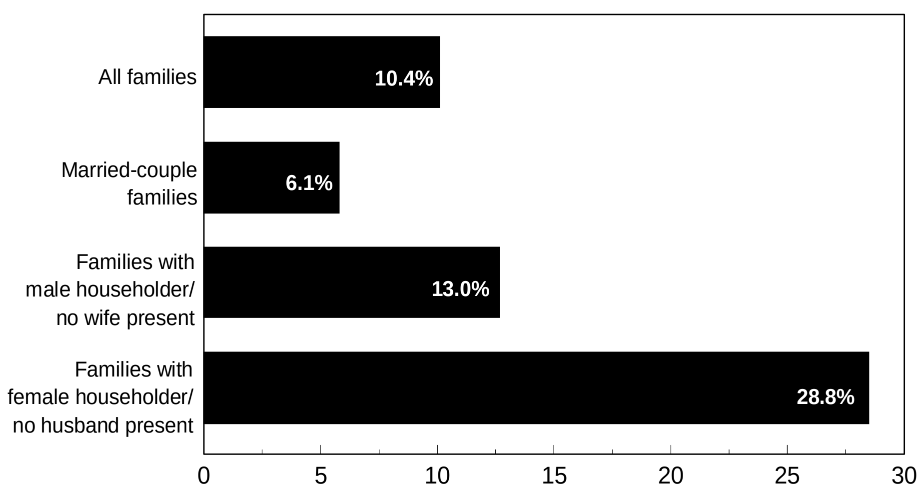
U.S. Poverty Thresholds and Related Statistics

Poverty Thresholds in 2002, by size of family and number of related children under age 18

	Related children under age 18								
Size of family unit	None	One	Two	Three	Four	Five	Six	Seven	Eight or more
One person									
Under age 65	$9,359								
Age 65 and over	8,628								
Two people									
Householder under age 65	12,047	$12,400							
Householder age 65 and over	10,874	12,353							
Three people	14,072	14,480	$14,494						
Four people	18,556	18,859	18,244	$18,307					
Five people	22,377	22,703	22,007	21,469	$21,141				
Six people	25,738	25,840	25,307	24,797	24,038	$23,588			
Seven people	29,615	29,799	29,162	28,718	27,890	26,924	$25,865		
Eight people	33,121	33,414	32,812	32,285	31,538	30,589	29,601	$29,350	
Nine people or more	39,843	40,036	39,504	39,057	38,323	37,313	36,399	36,173	$34,780

Source: U.S Census Bureau, February 2003.

Poverty rate of people by family structure, 2002



Source: U.S Census Bureau, Current Population Survey, 2003 Annual Social and Economic Supplement.

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Your submission should contain the following:

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- a short abstract (150 words) that summarizes the major findings. Abstracts are required for research articles, not for research briefs.
- text of 12 to 20 double-spaced pages for research articles or 5 to 10 double-spaced pages for research briefs. Tables are single spaced. Articles over 20 pages in length will be considered by the FENR editorial staff only in exceptional circumstances. Page limits include references but exclude author's(s') affiliation page, abstract page, tables, and graphs.
- no more than a total of five tables, graphs, and boxes for research articles and two for research briefs to illustrate major findings. Tables larger than 1 full page will not be considered. Tables and graphs labeled "1a, 1b, 1c," for example, will count as three submissions.
- acknowledgment of the source of funding for the research.

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The writing style must be more journalistic than that used in purely academic journals. We encourage authors to report descriptive statistics rather than multivariate analyses. We also encourage authors to use the active voice, to avoid jargon, to keep acronyms to a minimum, and to explain any technical terms. To be considered for publication, all manuscripts must follow the guidelines of the *Publication Manual of the American Psychological Association*, 5th edition.

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FENR articles follow this general format: (1) abstract (for research articles only), (2) introduction, (3) background, (4) methods, (5) results, (6) conclusions, (7) acknowledgments, and (8) references.

Tables, boxes, graphs, and other graphics should include titles in bold and sources at the bottom (if the data are from another source). Tables should be arranged to fit vertically (portrait style) on the page and should be done in a word processing program (Word, WordPerfect) by using tabs rather than a table function.

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