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# Changes in Children's Total Fat Intakes and Their Food Group Sources of Fat, 1989-91 Versus 1994-95: Implications for Diet Quality

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The *1995 Dietary Guidelines for Americans* recommends that children 2 through 5 years old should gradually adopt a diet that contains no more than 30 percent of calories from fat and continue this diet throughout life. This study compares total fat intakes of children 2 to 17 years old in 1989-91 to intakes in 1994-95 to determine if improvement took place. The U.S. Department of Agriculture's 1989-91 and 1994-95 Continuing Survey of Food Intakes by Individuals was used. Overall nutrient intake and food group consumption patterns were also compared. Although grams of fat consumed increased over the periods, percentage of calories from fat declined due to increased caloric intake, particularly from carbohydrates. Children consumed less dairy products overall but more low-fat milks. Grain consumption rose, but the grain products consumed were not any lower in fat over the years studied. Beverage consumption, particularly soft drinks, rose, especially for adolescent males and contributed importantly to an increase in carbohydrate consumption. When assessing progress in meeting fat recommendations, professionals need to consider overall diet quality.

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**E**xcess fat consumption in American diets is a concern and has been associated with heart disease, certain cancers, obesity, and gall bladder disease (4). To lower the risks of these health problems, the *1995 Dietary Guidelines for Americans* emphasizes that children 2 through 5 years old should gradually adopt a diet containing no more than 30 percent of calories from fat and continue this diet throughout life (18). To target behaviors that need to be changed to meet the *Dietary Guidelines for Americans*, we need to examine children's dietary patterns. By comparing current survey estimates of food and nutrient intakes with those of prior surveys, we can identify changes in diet over time to determine if children are making progress toward meeting current dietary advice.

This study compares total fat intakes by age/gender groups of children 2 to 17 years of age in 1989-91 to intakes in 1994-95 to determine if improvement took place. Also, overall nutrient intake patterns and consumption patterns of selected food groups are examined. Increasing our understanding of changes in dietary patterns that contributed to changes in children's overall fat intakes can help professionals develop nutrition education and promotion efforts for 2- to 17-year-olds.

## Methods

### The Continuing Survey of Food Intakes by Individuals

Data for this study were from the U.S. Department of Agriculture's (USDA) 1989-91 and 1994-95 Continuing Survey of Food Intakes by Individuals (CSFII). The CSFII was designed to obtain a nationally representative sample of

noninstitutionalized persons residing in households in the United States. Persons living in group quarters or institutions, residing on military installations or staying in shelters or otherwise were excluded. For both surveys, USDA developed sample weights to compensate for variable probabilities of selection, differential nonresponse rates, and sampling frame considerations. Use of weighted data provides results that are more generalizable to the U.S. population.

For the 1989-91 CSFII, food intake data were collected for 3 consecutive days and were obtained by a 1-day recall and 2-day record during two personal visits by trained interviewers (12). The 1989-91 CSFII included two separate samples, all income and low income, which were combined through sample weights. The low-income sample consisted of individuals with household income at or below 130 percent of the Federal poverty thresholds. The survey includes information on food and nutrient intakes by 15,200 individuals.

For the 1994-95 CSFII, 2 nonconsecutive days of dietary data for individuals of all ages were collected using the 24-hour recall method. The data were collected from selected individuals in each household rather than from all household members, as had been done previously. The method for collecting the 24-hour recall was also modified to improve the collection of dietary intake data and included more questions that probed the respondents' recollections (13,14). The low-income population was oversampled, with low-income defined as individuals in households with gross income for the previous month at or below 130 percent of the Federal poverty thresholds. The population of inference was individuals in households in the entire United States rather than the 48 coterminous States

and Washington, DC, as had been the case in the 1989-91 survey. The 1994 survey includes information on food and nutrient intakes by 5,589 individuals who provided at least 1 day of dietary data (13) and the 1995 survey, 1-day intake data by 5,326 individuals (14).

### Sample

The unweighted sample for this study consisted of children 2 to 17 years old who provided valid 1-day recall of dietary intake: 3,834 from the 1989-91 CSFII and 3,318 from the 1994-95 CSFII. Only the first day of dietary intake data was used because Day 1 data for 1989-91 and 1994-95 were collected using the 24-hour recall method. Methods of data collection used on subsequent days were not as comparable. We examined data on children in four age/gender groups: Preschoolers (aged 2-5), primary schoolers (aged 6-11), male adolescents (aged 12-17), and female adolescents (aged 12-17).

### Food Groups

Five major food categories were examined: Dairy products, meat, grains, fats and sugars, and an "other" food category. Foods in the "other" category were eggs and egg mixtures; nuts and seeds; legumes; fruits, including fruit juices; fruit juice bars and sorbets; vegetables, including potato chips; sugars; syrups; candies, popsicles, chewing gum; and beverages, including soft drinks. We chose these food categories because they are typically the main sources of dietary fat. Initially, we examined the traditional Food Guide Pyramid groups, but several food groups were not major sources of fat (e.g., vegetables), and these were placed in the "other" category. Thus, for this paper, food categories are different from those in the Food Guide Pyramid.

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**...while fat intakes as a percentage of calories declined over the periods, total grams of fat increased for preschoolers and adolescent males.**

Subgroups of these major food categories were examined in some analyses in order to provide more detailed information for nutrition educators. For example, the Food Guide Pyramid recommends that Americans consume 6 to 11 servings of grains daily; however, certain groups are higher in fat than others are. By examining high-fat grain products, we can offer indepth advice about the types of grain products that children should be encouraged to consume.

It is important to see changes in calories and fats consumed from these food categories, as well as changes in quantity (grams) consumed. Thus, changes can be detected in the types of food consumed within the food category, such as foods higher in caloric density and/or higher in fat. For example, in the grain category, we need to determine if higher fat grain products were consumed, then we can offer advice on choosing lower fat grain products. From the five major food categories, dairy products, grains, and the “other” category were examined further because the largest changes in amount (grams) consumed occurred here. In the grain group, grain mixtures and grain snacks were the primary focus. In the “other” category, beverages—particularly soft drinks—were the major focus.

Descriptive statistics for this study were derived using the SPSS statistical software package (10). Significance tests were not performed—the 1989-91 CSFII was not meant to be combined with the 1994-95 CSFII, and sample weights are not appropriate for use with combined data.

## **Results**

### **Household and Respondent Characteristics**

Compared with 1994-95, slightly more children in the 1989-91 survey came from households with a lower income, and fewer children came from households that received food stamps (table 1). Household income as a percentage of the poverty thresholds was similar. Twenty-nine percent of children lived in households with a before-tax income of \$19,999 or less in 1989-91, compared with 26 percent in 1994-95. Only 26 percent of children were from a household with a before-tax household income of \$50,000 in 1989-91, compared with 37 percent in 1994-95. Twenty-five to 27 percent of the children were from a household with income that was 0 to 130 percent of the poverty thresholds. More children, however, came from households with an income of 131 to 350 percent of the poverty thresholds in 1989-91 than did so in 1994-95 (47 and 44 percent, respectively). Thirteen percent of children came from households that received food stamps in 1989-91, compared with 19 percent in 1994-95.

The average age of respondents was 9 years for both 1989-91 and 1994-95. Compared with 1994-95, in 1989-91, there were more children 6- to 11-years-old and fewer children 12- to 17-years-old. The percentage of males and females (51 and 49 percent, respectively), were about the same and consistent over the periods. There were fewer non-whites in the 1989-91 sample than in the 1994-95 sample (22 and 28 percent, respectively). In both surveys, a higher percentage of respondents lived in the South than in other regions, and the lowest percentage

**Table 1. Characteristics of respondents, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**

Characteristics	1989-91 <sup>2</sup>	1994-95 <sup>3</sup>
Average age	9	9
	<i>Percent</i>	
<b>Household</b>		
Before-tax household income		
Less than \$10,000	12	11
\$10,000 - \$19,999	17	15
\$20,000 - \$29,999	15	13
\$30,000 - \$39,999	15	13
\$40,000 - \$49,999	15	11
\$50,000 and over	26	37
Household income as a percent of poverty thresholds		
0 - 130	25	27
131 - 350	47	44
Over 350	28	29
Households receiving food stamps	13	19
<b>Respondent</b>		
Age of children (years)		
2 - 5	27	27
6 - 11	40	37
12 - 17	33	36
Gender		
Male	51	51
Female	49	49
Race		
White	78	72
Non-White	22	28
Region of residence		
Northeast	19	19
Midwest	25	24
South	35	34
West	21	23
Urbanization		
Central city	29	31
Suburban	47	48
Nonmetropolitan	24	21

<sup>1</sup>Weighted data.

<sup>2</sup>n = 3,834, unweighted data.

<sup>3</sup>n = 3,318, unweighted data.

of respondents lived in the Northeast (19 percent). Over the two periods, the percentages remained relatively stable, and for both periods the highest percentage of respondents were from suburban areas, and the lowest percentage were from nonmetropolitan areas.

### Fat Intakes

Fat intakes as a percentage of calories declined for all children over the periods, from 34 percent of calories to 33 percent of calories (fig. 1). Fat intakes as a percentage of calories also declined for all subgroups. The largest declines occurred for adolescents, with fat intakes as a percentage of calories for females declining from 34 to 32 percent and for males, 35 to 33 percent.

These results indicate that children are moving closer to recommendations in the *Dietary Guidelines for Americans* and the *Healthy People 2000 National Health Promotion and Disease Prevention Objectives*,<sup>2</sup> which call for reducing dietary fat intake to an average of 30 percent of energy or less among people age 2 years and older (19). However, while fat intakes as a percentage of calories declined over the periods, total grams of fat increased for preschoolers and adolescent males (fig. 2). On average, compared with other children, adolescent males had the highest level of fat intakes, 99 grams in 1994-95 and 95 grams in 1989-91. Preschoolers increased their consumption of total grams of fat: from 53 grams in 1989-91 to 55 grams in 1994-95. Gram consumption of fat remained stable for primary school children (71 grams). Unlike other subgroups, female adolescents experienced a decline in total grams of fat, from 70 grams in 1989-91 to 68 grams in 1994-95.

<sup>2</sup>Objective 2.5: Reduce dietary fat intake to an average of 30 percent of energy or less and average saturated fat intake to less than 10 percent of energy among people age 2 and older.

### Energy Intakes

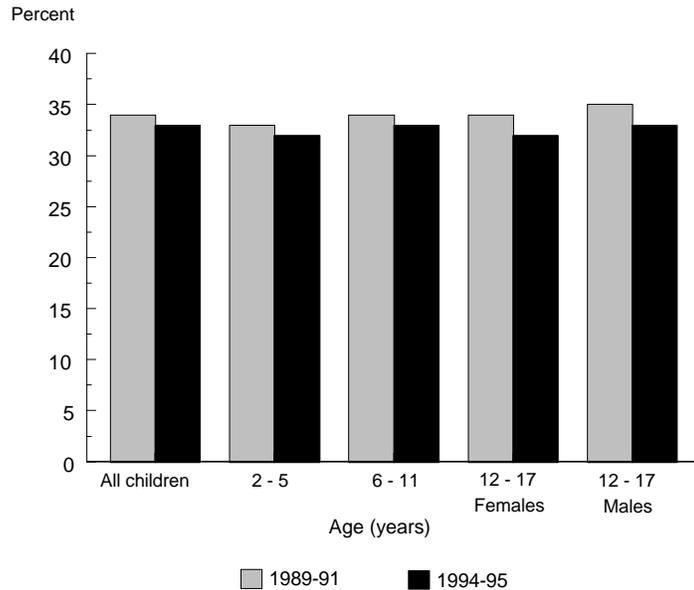
Considering caloric intake when examining changes in fat intakes as a percentage of calories provides a broader picture of the diet. Data show that caloric intake increased for all groups, especially for male adolescents, whose intake increased from 2,425 calories in 1989-91 to 2,698 calories in 1994-95 (fig. 3). Changes in caloric intake may be affected by revisions in the survey between the two periods. The 24-hour recall was revised in 1994 to include more probing questions and more exact measurement. This may have resulted in more complete reporting. However, USDA food supply data (1), which are based on disappearance data rather than self-reported data, also show an increase in food energy for each person each day from 3,500 calories in 1989 to 3,800 calories in 1994. Data collection methods did not change for food supply data over these years.

The National Research Council's Recommended Energy Allowances (REA) for 1989 were 1,300, 1,800, and 2,000 calories for children aged 1 to 3, 4 to 6, and 7 to 10, respectively, at light to moderate activity levels (5). For males aged 11 to 14 and 15 to 18, the recommendations average 2,500 and 3,000 calories, whereas for females aged 11 to 18, the recommended average is 2,200 calories. The energy intakes of all age/gender groups studied in this research, therefore, were within the recommended ranges.

### Carbohydrate Intakes

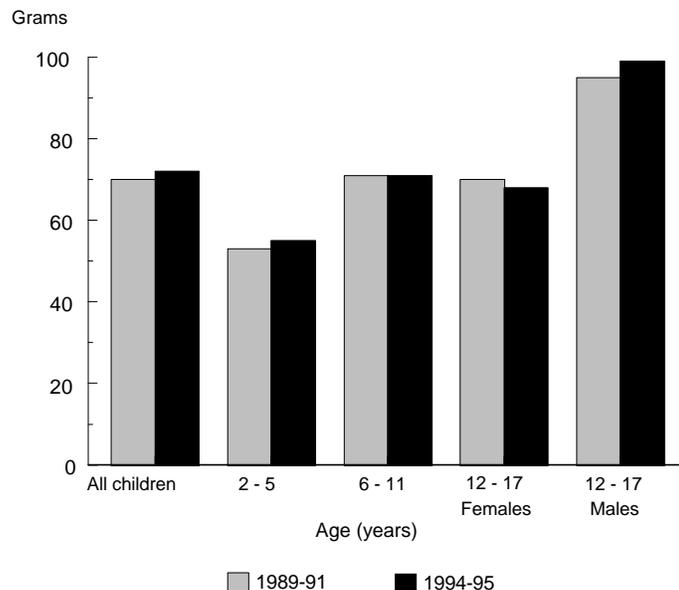
Consumption of carbohydrates increased for all age groups between the 1989-91 and 1994-95 surveys. The largest increase—309 to 366 grams—occurred for adolescent males (fig. 4). This change has contributed to a lower percentage of calories from fat in the diets of adolescent males and an increased percentage

**Figure 1. Fat intakes as a percent of total calories for children aged 2-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**



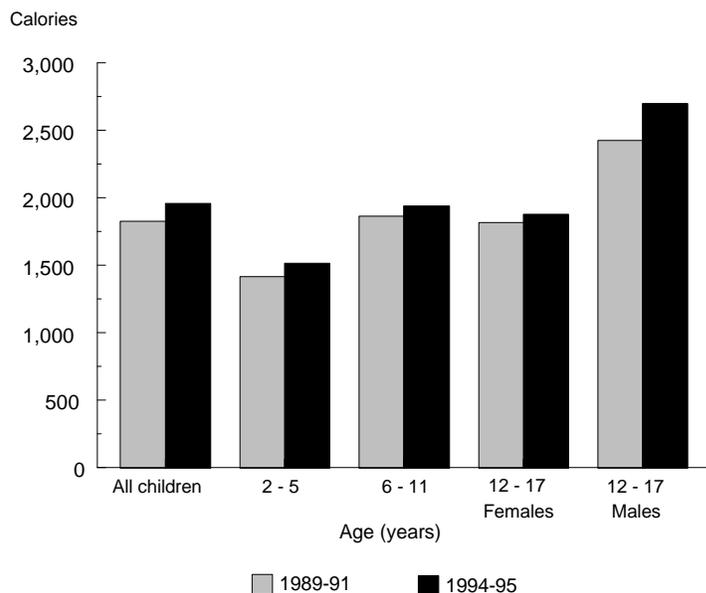
<sup>1</sup>Weighted data.

**Figure 2. Total grams of fat consumed by children aged 2-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**



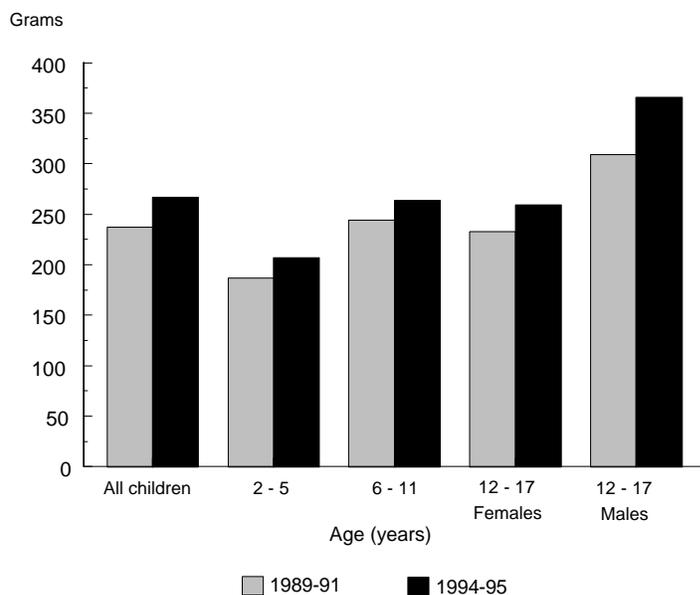
<sup>1</sup>Weighted data.

**Figure 3. Changes in total caloric intake for children aged 2-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**



<sup>1</sup>Weighted data.

**Figure 4. Carbohydrate intake (grams) for children aged 2-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**



<sup>1</sup>Weighted data.

of calories from carbohydrates. The National Research Council (4) recommends a diet with a carbohydrate intake of more than 55 percent of calories. In 1994-95, the carbohydrate intake for adolescent males was 54 percent of caloric intake; hence, their intake was near the recommended range. In 1989-91, carbohydrate intake as a percentage of calories for males was 51 percent, so a change did occur in percentage of calories from carbohydrates for this subgroup. Carbohydrate intake as a percentage of calories was also up for the other subgroups; however, each subgroup was at or below 55 percent of calories from carbohydrates (data not shown).

### Food Intake and Fat Obtained From Major Food Sources

Over the periods, calories and carbohydrates were up, and fat as a percentage of calories was down for children aged 2 to 17. Examining changes in food consumption provides a better understanding of the reasons for those changes. Grams of meat consumed and fat obtained from meat remained relatively stable over the periods as did total grams and grams of fat from visible fats and oils (table 2). All four age/gender groups of the 2- to 17-year-olds were examined. Because consumption patterns were similar across groups, food group intake data are not shown.

### Dairy Product Consumption

Overall, mean consumption of milk and milk products declined from 422 to 396 grams between 1989-91 and 1994-95. Also declining were mean calories (309 to 296 calories), mean fat intake in grams (15 to 14 grams), and fat as a percentage of calories (44 to 42 percent). Whole milk consumption declined, lowfat milk consumption remained stable, and skim milk consumption and other dairy (e.g., cheese, ice cream bars, and puddings) consumption rose (fig. 5).

**Table 2. Food intake (grams) and fat obtained from major food sources for children aged 2-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**

Food group	1989-91				1994-95			
	Grams	Kcal	Fat	Fat % Kcal	Grams	Kcal	Fat	Fat % Kcal
Dairy	422	309	15	44	396	296	14	42
Meat	144	311	18	52	149	308	18	52
Grains	279	653	19	27	297	731	23	28
Fats/oils	8	46	5	97	7	38	4	95
Other <sup>2</sup>	715	509	13	23	876	584	13	21

<sup>1</sup>Weighted data.

<sup>2</sup>Includes eggs and egg mixtures; nuts and seeds; legumes; fruits, including fruit juices; fruit juice bars, and sorbets; vegetables, including potato chips; sugars; syrups; candies, popsicles, chewing gum; and beverages, including soft drinks.

**Table 3. Food intake (grams) and fat obtained from grains for children aged 2-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**

Food group	1989-91				1994-95			
	Grams	Kcal	Fat	Fat % Kcal	Grams	Kcal	Fat	Fat % Kcal
Regular grains <sup>2</sup>	149	357	7	17	140	375	8	19
Cakes and cookies	30	113	5	38	34	133	6	37
Grain mixtures <sup>3</sup>	97	167	7	39	117	199	8	38
Grain snacks <sup>4</sup>	4	16	1	34	5	22	1	34

<sup>1</sup>Weighted data.

<sup>2</sup>Includes flour and dry mixes, yeast breads, quick breads, pancakes and waffles, pastas and cooked cereals, and not-cooked cereals.

<sup>3</sup>Includes Mexican dishes, pizza, other dough dishes such as oriental and Puerto Rican mixtures, pasta, grain dishes, and grain-based soups.

<sup>4</sup>Includes salty snacks from grain products such as crackers, rice cakes, popcorn, corn and tortilla chips, pretzels, and bagel chips.

### Grain Consumption

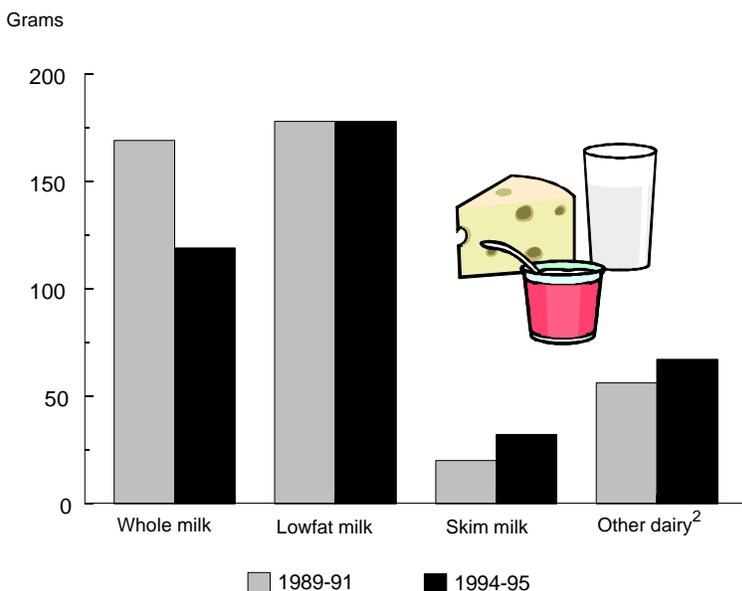
Grain consumption rose from 279 grams in 1989-91 to 297 grams in 1994-95. From this food source, caloric intake rose from 653 to 731 calories; fat grams, from 19 to 23 grams; and fat as a percentage of calories, from 27 to 28 percent. For this paper, we focused on grain mixtures and grain snacks because of their popularity with children.

### Grain mixtures

Consumption of grain mixtures increased greatly—from 97 to 117 grams—over the periods (table 3). Calories obtained from grain mixtures also increased. Fat obtained from grain mixtures increased slightly, and fat as a percentage of calories declined slightly.

Mean intake for all grain mixtures increased (fig. 6). The largest increases occurred for the pasta dishes, grain-based soups, and Mexican foods. Pizza, grain dishes, and other dough (Asian and Puerto Rican mixtures, turnovers, and croissants) also increased. Children consumed pasta in the largest quantity (grams).

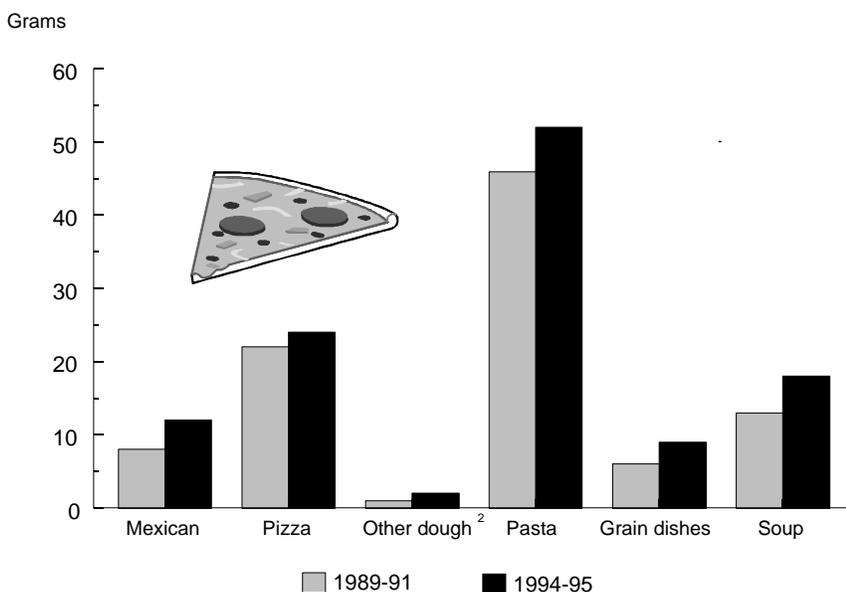
**Figure 5. Dairy product intake (grams), by type consumed for children aged 2-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**



<sup>1</sup>Weighted data.

<sup>2</sup>Other dairy includes products such as cheese, ice cream bars, and puddings.

**Figure 6. Grain mixture intake (grams) for children aged 2-17, by type of grain mixture, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**



<sup>1</sup>Weighted data.

<sup>2</sup>Other dough includes Asian and Puerto Rican mixtures, turnovers, and croissants.

Mean percentage of calories from fat decreased for some grain mixtures: Mexican, pizza, and pasta (fig. 7). The percentage of calories from fat from “other dough” grain mixtures increased greatly—from 35 percent in 1989-91 to 55 percent in 1994-95—and formed the main source of calories from fat for the grain mixture category. Fat as a percentage of calories from grain-based soups also increased sharply: from 13 to 34 percent.

*Grain snacks*

Grain snacks includes salty snacks from grain products such as crackers, rice cakes, popcorn, corn and tortilla chips, pretzels, and bagel chips. Mean intake of grain snacks in grams and caloric intake from this food source increased slightly for all children between 1989-91 and 1994-95 (table 3). Fat and fat as a percentage of calories remained stable. Intake of grain snacks increased for all subgroups. Adolescent males had the largest increase, from 2 to 5 grams, followed by adolescent females, from 3 to 5 grams. Intake for the other subgroups increased from 4 to 5 grams (data not shown). Mean percentage of calories from fat for grain snacks increased for primary school children from 30 to 35 percent and for adolescent males from 32 to 33 percent; it remained stable for the other age/gender groups (data not shown).

Children’s increased intake of grain products is consistent with current recommendations. The *Food Guide Pyramid (17)* recommends 6 to 11 grain servings each day, depending on caloric intake. Grain products that are made with little fat or sugars are recommended. However, the grain snacks that children chose in 1994-95 were not lower in fat than the grain snacks they chose in 1989-91.

### Consumption of Foods in the “Other” Category

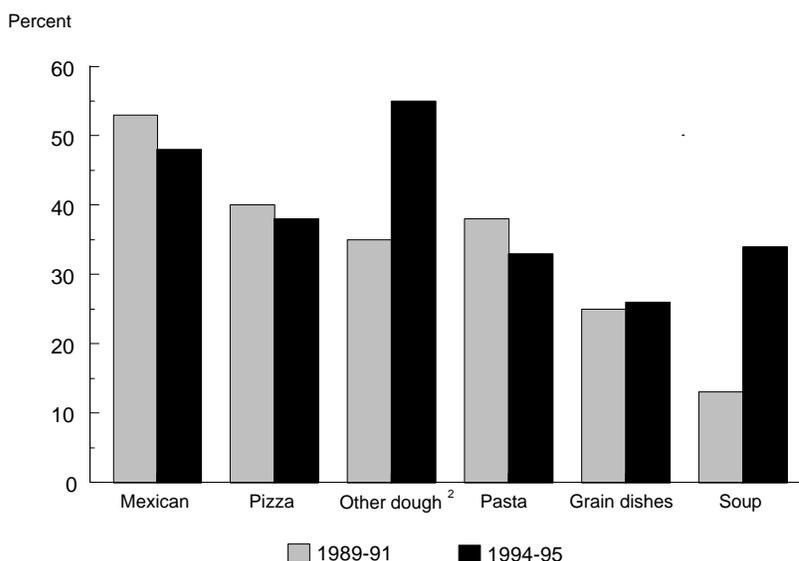
For the “other” food category, major changes occurred. In 1989-91, children consumed 715 grams of “other” food, compared with 876 grams in 1994-95 (table 2). This category provided fewer calories for children in 1989-91 than it did in 1994-95. Fat remained stable at 13 grams, and fat as a percentage of calories declined, moving from 23 percent in 1989-91 to 21 percent in 1994-95.

Major changes occurred with beverages (fig. 8). Beverage consumption increased for all types: Coffee, tea, breakfast drinks, soft drinks, fruitades and drinks, non-fruit beverages, noncarbonated beverages without vitamin C made from powdered mixes, and unreconstituted dry-beverage concentrates. The largest increase occurred for the soft drink category (including carbonated water and carbonated juice drinks), which increased from 198 grams in 1989-91 to 279 grams in 1994-95. Compared with their consumption of other beverages, male adolescents increased their consumption of soft drinks (fig. 9). Their consumption of soft drinks rose from a mean intake of 352 grams in 1989-91 to 580 grams in 1994-95. Increased soft drink consumption was a contributor to increased carbohydrate consumption, especially among adolescent males. The average soft drink has 9 teaspoons of sugar for a 12-ounce container.

### Nutrient Intakes

Appreciable changes in nutrient intakes did not occur between the two periods (table 4). However, slight changes did occur for certain nutrients. All children 2 to 17 years old, as well as all subgroups, increased their iron intake. Female adolescents increased their iron intake slightly, from 82 to 89 percent of the Recommended Daily Allowances

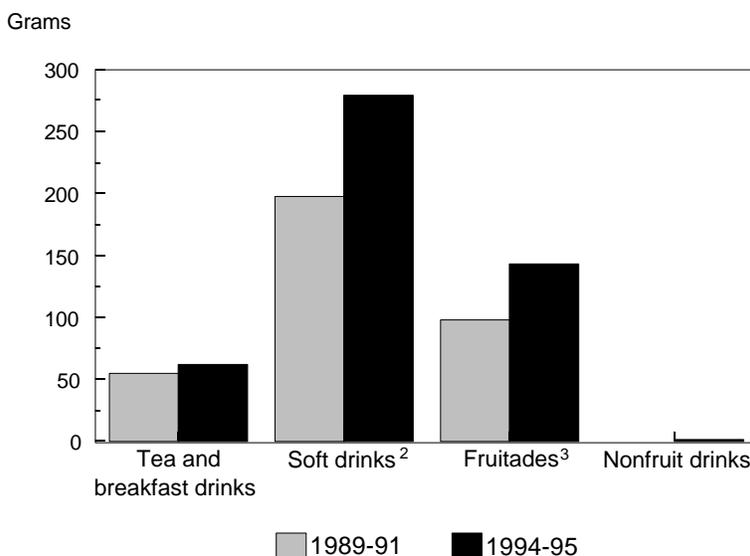
**Figure 7. Percent of calories from fat for grain mixtures consumed by children aged 2-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**



<sup>1</sup>Weighted data.

<sup>2</sup>Other dough includes Asian and Puerto Rican mixtures, turnovers, and croissants.

**Figure 8. Beverage intake (grams), by type consumed for children aged 2-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**

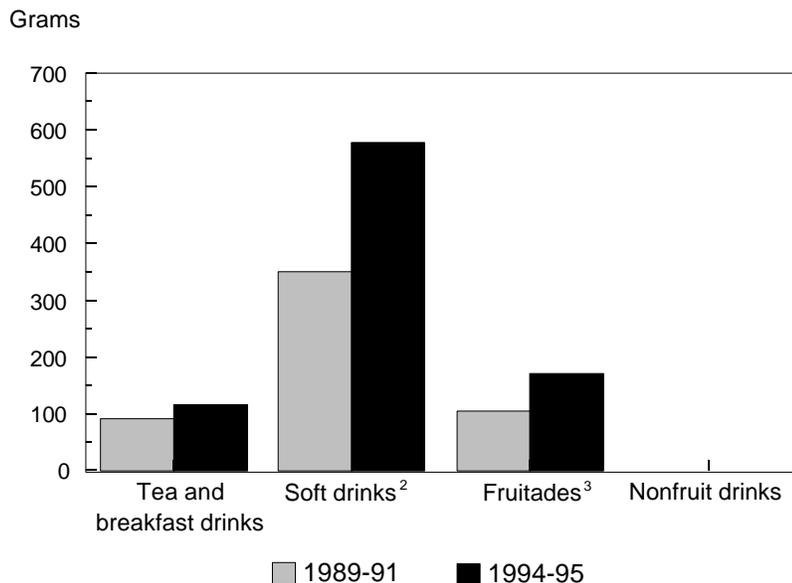


<sup>1</sup>Weighted data.

<sup>2</sup>Soft drinks includes carbonated water and carbonated juice drinks.

<sup>3</sup>Fruitades includes fruitades and drinks—low calorie and regular, ready to drink, from concentrate and powder.

**Figure 9. Beverage intake (grams), by type consumed for males aged 12-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**



**The largest increase occurred for the soft drink category (including carbonated water and carbonated juice drinks), which increased from 198 grams in 1989-91 to 279 grams in 1994-95.**

<sup>1</sup>Weighted data.

<sup>2</sup>Soft drinks includes carbonated water and carbonated juice drinks.

<sup>3</sup>Fruitades includes fruitades and drinks—low calorie and regular, ready to drink, and concentrate and powder.

(RDAs). The increase in iron intake may be related to the increased intake of grain products, which are frequently iron-fortified.

New Dietary Reference Intakes for calcium were released by the National Academy of Sciences in 1997 to replace the RDAs (6). These new guidelines set standards for adequate intakes (AI's) as well as for tolerable upper limits of intakes. The new AI's call for consumption of 500 milligrams (mg) of calcium per day for children aged 1 to 3, 800 mg for children aged 4 to 8, and 1,300 mg per day for children aged 9 to 18. One 8-ounce glass of skim milk equals about 300 mg of calcium.

Previous RDAs advised an intake of 800 mg per day for children aged 1 to 10 and 1,200 mg for both genders aged 11 to 24 (5). Puberty, and particularly early puberty, has been identified as an important time for bone formation in which calcium intake plays a major role.

The mean intake of calcium, based on the AI measure, was 99 and 96 percent in 1989-91 and 1994-95, respectively. Children aged 2 to 5 had a higher mean intake as a percentage of the AI than any other age group had. This figure seems high, compared with those in previous reports of this group's intake as a percentage of the 1989 calcium RDA because the AI for children aged 2 to 3 is 300 mg lower than the 1989 RDA.

**Table 4. Percent of Recommended Dietary Allowances for children aged 2-17, CSFII 1989-91 versus 1994-95, 1-day data set<sup>1</sup>**

Nutrient	1989-91					1994-95				
	All	2-5 years	6-11 years	Females 12-17 years	Males 12-17 years	All	2-5 years	6-11 years	Females 12-17 years	Males 12-17 years
	<i>Percent</i>									
Protein	222	275	235	151	177	218	277	230	144	180
Zinc	86	74	94	80	90	90	83	99	81	93
Magnesium	137	199	137	78	92	136	202	138	77	94
Iron	118	108	128	82	148	131	120	143	89	164
Phosphorus	129	125	145	96	132	128	125	144	93	135
Thiamin	148	154	154	129	143	154	163	162	126	151
Riboflavin	165	183	170	134	154	168	188	174	135	158
Folate	252	351	259	143	184	248	345	261	138	188
Vitamin B <sub>6</sub>	115	125	118	100	108	122	136	123	104	119
Vitamin B <sub>12</sub>	324	438	315	188	295	311	407	311	198	282
Vitamin C	200	200	206	176	209	219	233	226	180	222
Vitamin A	145	182	149	109	111	148	195	142	118	120
Vitamin E	85	74	92	83	87	89	81	94	83	94
Calcium <sup>2</sup>	99	132	95	63	89	96	129	92	61	90

<sup>1</sup>Weighted data.

<sup>2</sup>Adequate intake recommendations rather than recommended dietary allowances were used.

At both periods, adolescent females had particularly low intakes. Their mean calcium intake was 61 percent of the AI in 1994-95, down from 63 percent in 1989-91. Additionally, female teens continued to have mean intakes of zinc, magnesium, phosphorus, and vitamin E that were below 100 percent of the RDA. The shortcomings in the female adolescents' diets may be related to their eating patterns. Previous analysis found that compared with other children, female adolescents are more likely to skip morning meals that are high in calcium and iron, eat the smallest number of meals and snacks, have the largest proportion of meals and snacks away from home, and drink the least amount of fluid milk (3).

## Discussion and Conclusions

Results demonstrate the complexity of assessing dietary change in relation to current recommendations. Between 1989-91 and 1994-95, 2- to 17-year-olds reduced the percentage of calories obtained from fat. On the surface, this suggests that children are moving closer to the recommendations of the *1995 Dietary Guidelines for Americans* and the goals for fat consumption of *Healthy People 2000*. Although the percentage of calories from fat declined, actual fat intakes did not decrease. Only female adolescents reduced the total grams of fat obtained over the periods.

Caloric intake increased for children. However, survey methods changed between the two periods. The 24-hour recall was revised in 1994 to include more probing questions and more exact measure, which may have resulted in more complete reporting. Changes in caloric intake could be affected by this. Carbohydrate intake, mainly from grain mixtures and beverages, (particularly soft drinks) rose over the periods, and percentage of calories from carbohydrates increased.

Increased consumption of soft drinks is a concern because soft drinks may contribute excess calories or displace more nutritious foods from the diet. As soft

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drink consumption rose, consumption of dairy products declined slightly. Consumption of skim milk and other dairy products increased; whereas, consumption of whole milk declined. This change in the type of milk consumed has helped children achieve a lower percentage of calories from fat. If total dairy products continue to decline, however, it is unlikely that improvement in calcium intakes will occur.

Previous research has indicated that soft drinks can displace milk in children's diets, with negative consequences for total diet quality (2). Although children ate more calories in 1994-95 than they did in 1989-91, nutrient intakes (except for iron) were not notably higher, and calcium intakes were lower. This finding is consistent with another finding—additional calories were largely obtained from soft drinks, which do not add nutrients to the diet.

Per capita food consumption data (9) released by USDA's Economic Research Service (ERS) confirm the increase in soda consumption found in this study. ERS data show that consumption of carbonated soft drinks rose from 45.4 to 52.2 gallons per year from 1989 to 1994, respectively. In the carbonated soft drink category, diet soda consumption rose from 10.7 to 11.9 gallons per year; whereas, regular soda consumption rose from 34.7 to 40.3 gallons per year. These data indicate that the increase in beverage intake between 1989-91 and 1994-95 actually occurred and was not due solely to the change in the 24-hour recall method.

The increased consumption of carbohydrates contributed to a lower percentage of calories from fat. It appears, however,

that fat in the diet was largely diluted by refined carbohydrates, such as the sweeteners in sodas, rather than replaced by complex carbohydrates, as recommended by the National Research Council (4) and the *1995 Dietary Guidelines for Americans*. It would be useful to conduct further research, such as multivariate analysis, that explored factors contributing to these changes.

Our findings regarding increased carbohydrate intake are consistent with those of the Bogalusa Heart Study (8), which has been collecting data on children's dietary intakes for more than 20 years. The Bogalusa study found that although total energy intakes remained the same from 1973 to 1988, the composition of macronutrients shifted: the percentage of energy from protein and carbohydrates increased and the percentage of energy from total fat, particularly saturated fat, decreased (7).

The Bogalusa Heart Study (8) also found that when children were grouped on the basis of fat intake, the low-fat intake group consumed 25 percent less calories than did the high-fat intake group, and the percentage of calories from sugar was greater for the low-fat intake group, compared with their counterparts. A high percentage of total sugar intake in the low- and high-fat intake groups came from beverages, 25 to 19 percent, respectively (8). Less nutrient-dense food, such as soft drinks, are major contributors to energy and carbohydrates and may substitute for intake of more nutritious foods (11). Although these less nutrient-dense foods contribute to the decline in percentage of calories from fat, they are not in keeping with dietary guidance and may displace more nutrient-dense foods such as juice or milk.

Grain consumption increased, indicating progress toward meeting the 1995 Dietary Guidelines Advisory Committee's recommendation to consumers to "make grains the center of your plate" (15). Grain mixture intake (grams) increased for all types of grain mixtures studied, and grain snack intake increased for all age/gender groups. However, the grain products that children chose in 1994-95 were not lower in fat than the grain products they chose in 1989-91. Nutrition promotion messages and strategies encouraging children to choose lower fat grain products could be helpful. Food supply interventions, such as the design and marketing of lower fat versions of grain products that are popular with children, could also be used.

Children's nutrient intakes did not change remarkably over the periods. All age/gender groups increased their iron intake slightly. Female adolescents continued to have a calcium intake that is far below recommendations—clearly this issue needs attention. Also, female adolescents continued to have average intakes of several other nutrients that are below recommendations.

This study demonstrates how important it is that nutrition promotion messages and strategies directed toward children emphasize total diet quality. A well-chosen, low-fat diet that provides carbohydrates primarily from low-fat grains, vegetables, and fruits provides generous amounts of essential nutrients and fiber. A diet that is low in fat as a percentage of calories because of high intakes of soft drinks does not provide the same benefits. Messages and strategies—such as those based on the *Food Guide Pyramid*—are needed to promote total diet quality (17). Also needed are dietary evaluation tools such as the *Healthy Eating Index* (16) that assess total diet quality.

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The dietary concerns of specific age/ gender groups of children may vary, and guidance specifically tailored to these groups may be needed. Adolescent males, for example, had the largest increase in soda consumption of any group and may benefit especially from guidance on avoiding overconsumption of low nutrient-dense foods. Efforts to increase intake of essential nutrients, particularly calcium, should be targeted toward female adolescents.

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