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

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Monitoring dietary trends can make it easier to target dietary guidance. Trends in intakes among children age 6 to 11 years were examined by using data from the Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96, 1998; the CSFII 1989-91; and the Nationwide Food Consumption Survey 1977-78. Increases were seen in intakes of soft drinks, total grain products, 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, pork, and eggs. Lower percentages of calories from fat were partly due to increased carbohydrate intakes. Children had decreases in vitamin B₁₂ and increases in thiamin and iron. Servings per day from the food groups of the Food Guide Pyramid were used to discuss diet quality during 1994-96, 1998. For any given Pyramid group, less than one-half of the children consumed the recommended number of servings, and their intakes of discretionary fat and added sugars were much higher than recommended. Guidance should continue to encourage increases in intakes of whole grains, fruits, dark-green and deep-yellow vegetables, legumes, nonfat or lowfat dairy products, and lean meats; decreases in fats and added sugars; and increases in activity. Effective nutrition education efforts for children should be supported at every level.

Dietary guidance in the United States is given in terms of the types and amounts of food people should try to eat in a day (U.S. Department of Agriculture [USDA], 1996). To provide nutrition education messages that help people eat more healthfully, we need to know what people are actually eating, whether food intakes are changing, and, if so, how they are changing. The most recent USDA survey of dietary intakes provides an opportunity to update our knowledge of trends in dietary intakes by children.

To see whether children's 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 Nationwide Food Consumption Survey (NFCS) 1977-78, the Continuing Survey of Food Intakes by Individuals (CSFII) 1989-91, and the CSFII 1994-96, 1998 (Tippett et al., 1995; USDA, 1983; USDA, 1999; USDA, 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 6 to 11 years during all three periods.

Design and Methods

The Three Surveys

The CSFII 1998 was conducted because a larger sample of children under 10 years old was needed for adequate estimation of dietary exposure to pesticide residues (USDA, 2000a, documentation section 2). The CSFII 1998 was designed to be merged with the CSFII 1994-96, and combined data have been released (USDA, 1999; USDA, 2000a). Data collection methods, instruments, and procedures were the same in 1998 as in 1994-96 (Tippett & Cypel, 1998; USDA, 2000a). In each of the 4 years of the CSFII 1994-96, 1998, a nationally representative sample of noninstitutionalized individuals residing in the United States was surveyed. However, the CSFII 1998 sample included only children under 10 years old. The sampling weights developed for the combined 4-year data set permit the 3-year and 1998 samples to be combined statistically and ensure that the combined sample is appropriately representative of the U.S. population.

The CSFII 1994-96, 1998 was the most recent study 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, 1998 versus the 48 conterminous States in 1977-78 and 1989-91. In 1989-91 and 1994-96, 1998, the low-income population was oversampled. In 1977-78 and 1989-91, all children in the sample households were eligible for inclusion in the

survey; in 1994-96, 1998, selected individuals within each household were eligible. The number of children age 6 to 11 and the all-individuals Day-1 response rate, respectively, for each survey are 4,107 and 56.9 percent (NFCS 1977-78); 1,476 and 57.6 percent (CSFII 1989-91); and 2,000 and 81.5 percent (CSFII 1994-96, 1998).

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, 1998, the number of days was reduced to two, partly to reduce respondent burden (Tippett & Cypel, 1998). Both days of CSFII 1994-96, 1998 dietary data were collected by means of 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, 1998, the 1-day recall was modified to include multiple passes through the list of all foods and beverages recalled by the respondent (Tippett & Cypel, 1998). In 1977-78 and 1989-91, an adult household member reported intake information for children under 12 years old (Tippett et al., 1995; USDA, 1983). In 1994-96, 1998, children 6 to 11 years old were asked to describe their own food intake and were assisted by an adult household member. When necessary, additional information was obtained from school cafeteria personnel or baby-sitters. All these measures were designed to improve the completeness of the data collected.

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; USDA, 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 the first day's 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 they include intakes 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.¹ Food mixtures were not broken down; mixed foods reported by respondents were grouped by their main ingredient.² One effect of this method of classifying foods 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

¹Readers interested in subgroups not included here are directed to Tippett et al., 1995; USDA, 1983; and USDA, 1999.

²See "Table Notes" in Tippett et al., 1995, and USDA, 1983; see "Descriptions of Food Groups" in USDA, 1999.

In 1977-78 children drank about four times as much fluid milk as any other beverage; by 1994-96, 1998 they drank only about 1.5 times as much milk as soft drinks.

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 specialized standard error estimation procedures 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 variance inflation factors used in this study are 1.19 (1977-78), 2.26 (1989-91), and 2.24 (1994-96, 1998).

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, 1998; and 1977-78 versus 1994-96, 1998. All told, 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, 1998 than in 1977-78) or as “trends.”

The term “change” is used only if intakes (or percentages using) in 1977-78 and 1994-96, 1998 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, 1998), 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, 1998 *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, 1998 *t*-test was significant at *p* < 0.05, the latter level is shown in the table.

Results and Discussion

Beverages

In the past 20 years, the overall picture of beverage intakes by children has changed considerably. There was a decreasing trend in intake of total fluid milk—driven by a reduction in the intake of whole milk—for girls age 6 to 11 and a parallel change for boys the same age; an increasing trend in intakes of soft drinks was seen for both girls and boys (tables 1 and 2). In 1977-78 children drank about four times as much fluid milk as any other beverage; by 1994-96, 1998 they drank only about 1.5 times as much milk as soft drinks. Other beverages also contributed to the shift to a lesser degree. Both intakes and percentages of children using beverages from the groups “noncitrus juices and nectars” and “fruit drinks and ades” were higher in 1994-96, 1998 than in 1977-78 (tables 1 through 4).

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) reported a positive association between consumption of nondiet soft drinks and energy intake in an analysis of CSFII 1994 data. Wyshak (2000) found that high-school-age girls who drink carbonated beverages may have a higher risk of bone fractures than do 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 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 one-fifth to one-third higher in 1994-96, 1998 than in 1977-78 for girls and boys age 6 to 11 (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 children. Intakes of the grain mixtures subgroup and the percentages of children using grain mixtures increased between 1977-78 and 1994-96, 1998 (tables 3 and 4).

Increasing trends were observed in children's intakes of grain-based snack foods from the group "crackers, popcorn, pretzels, and corn chips." A trend toward higher intakes of ready-to-eat cereals was also evident for boys. Both intakes and percentages of individuals using yeast breads and rolls were lower for girls and boys in 1994-96, 1998 than in 1977-78 but did not meet the definition of a trend. Yeast breads and rolls are common components in sandwiches, and some sandwiches (especially fast-food items) are

Table 1. Trends and changes in girls' (6 to 11 years) mean intakes from selected food groups

Food group	Intake (grams)			Change ¹	Trend ²
	1977-78	1989-91	1994-96, 1998		
Grain products	230	268	280	+50	
Yeast breads and rolls	51	46	43	-8	
Ready-to-eat cereals	18	21	20		
Cakes, cookies, pastries, pies	34	33	42		
Crackers, popcorn, pretzels, corn chips	5	9	14	+9	**
Mixtures mainly grain	63	93	101	+38	
Vegetables	159	128	116	-42	
White potatoes	56	55	46		
Fried white potatoes	17	26	25	+9	
Dark-green vegetables	7	4	5		
Deep-yellow vegetables	7	7 ³	4		
Tomatoes	14	14	15		
Green beans	10	7	5	-5	
Corn, green peas, lima beans	22	16	12	-10	
Fruits	159	194	169		
Citrus juices	60	55	54		
Apples	27	32	21		
Melons and berries	7	6 ³	8		
Noncitrus juices and nectars	14	44	42	+28	
Milk and milk products	492	430	382	-110	*
Fluid milk	417	339	283	-133	**
Whole milk	244	171	108	-136	**
Lowfat milk	64	146	136	+72	
Skim milk	14	15	29		
Milk desserts	28	31	3		
Cheese	8	12	14	+6	
Meat, poultry, and fish	157	141	130	-28	
Beef	40	18	18	-22	
Pork	13	9	5	-8	*
Frankfurters, sausages, luncheon meats	17	20	19		
Chicken	18	17	17		
Fish and shellfish	6	9 ³	5		
Mixtures mainly meat, poultry, fish	55	63	60		
Eggs	16	15	11	-5	
Legumes	20	21	12		
Fats and oils	9	9	7		
Sugars and sweets	28	41	41	+13	
Candy	5	8	12	+7	
Beverages	250	264	370	+120	
Tea	51	40	34		
Fruit drinks and ades	91	86	134	+43	
Carbonated soft drinks	106	136	200	+94	*

¹Change = mean intakes in 1977-78 and 1994-96, 1998 are significantly different at $p < 0.001$.

²Trend = mean intake rose or fell progressively from 1977-78 through 1989-91 to 1994-96, 1998.

³Estimate is based on small sample size or coefficient of variation ≥ 30 percent.

* = trend significant at $p < 0.05$.

** = trend significant at $p < 0.01$.

In 1994-96, 1998, only 24 percent of girls and 23 percent of boys consumed the number of servings of fruit recommended in the Food Guide Pyramid based on their caloric intake.

Table 2. Trends and changes in boys' (6 to 11 years) mean intakes from selected food groups

Food group	Intake (grams)			Change ¹	Trend ²
	1977-78	1989-91	1994-96, 1998		
Grain products	244	296	318	+74	
Yeast breads and rolls	57	47	46	-11	
Ready-to-eat cereals	20	24	31	+11	*
Cakes, cookies, pastries, pies	40	37	40		
Crackers, popcorn, pretzels, corn chips	5	9	15	+11	*
Mixtures mainly grain	61	108	115	+53	
Vegetables	154	130	115	-39	
White potatoes	61	57	50		
Fried white potatoes	18	26	27	+8	
Dark-green vegetables	6	5	5		
Deep-yellow vegetables	7	4	5		
Tomatoes	11	12	16		
Green beans	8	7	5	-4	
Corn, green peas, lima beans	23	14	11	-11	
Fruits	152	173	183		
Citrus juices	55	55	60		
Apples	23	29	28		
Melons and berries	9	5	16		
Noncitrus juices and nectars	15	37	40	+25	
Milk and milk products	527	459	450	-77	
Fluid milk	447	374	335	-112	
Whole milk	256	155	121	-135	
Lowfat milk	70	193	172	+102	
Skim milk	15	15	33		
Milk desserts	30	24	35		
Cheese	7	10	12	+5	
Meat, poultry, and fish	172	145	154		
Beef	39	18	19	-21	
Pork	15	11	7	-8	
Frankfurters, sausages, luncheon meats	19	18	24		
Chicken	21	18	20		
Fish and shellfish	6	10	6		
Mixtures mainly meat, poultry, fish	60	64	72		
Eggs	19	15	12	-6	
Legumes	22	13	13		
Fats and oils	10	9	7		
Sugars and sweets	30	28	42	+13	
Candy	5	9	12	+8	
Beverages	264	329	413	+149	**
Tea	50	44	39		
Fruit drinks and ades	99	114	155	+56	
Carbonated soft drinks	112	169	217	+105	*

¹Change = mean intakes in 1977-78 and 1994-96, 1998 are significantly different at $p < 0.001$.

²Trend = mean intake rose or fell progressively from 1977-78 through 1989-91 to 1994-96, 1998.

* = trend significant at $p < 0.05$.

** = trend significant at $p < 0.01$.

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, 1998, only 39 percent of girls and 47 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 (USDA, 1996), intake of whole grains by children in 1994-96, 1998 was only 1 serving per day or less.

Children’s intakes from the category “total vegetables” were lower in 1994-96, 1998 than in 1977-78. It is important to remember that vegetables are frequently consumed as part of meat mixtures and grain mixtures; in intakes by adults in the CSFII 1994, vegetables accounted for about 24 and 28 percent (by weight) of grain mixtures and meat mixtures, respectively (Enns, Goldman, & Cook, 1997). If vegetables account for a similar proportion of grain and meat mixtures for children 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, at least 80 percent of children 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,” children ate only one-tenth of a serving from either category on any given day. Children’s intakes of fried white potatoes were higher in 1994-96, 1998 than in 1977-78, and the percentages of children using tomatoes rose between 1977-78 and 1994-96, 1998. Children

Table 3. Trends and changes in girls’ (6 to 11 years) percentages using items from selected food groups

Food group	Percentage using			Change ¹	Trend ²
	1977-78	1989-91	1994-96, 1998		
Grain products	99	100 ^{†3}	99 [†]		
Yeast breads and rolls	79	73	71	-8	
Ready-to-eat cereals	51	48	46		
Cakes, cookies, pastries, pies	51	45	55		
Crackers, popcorn, pretzels, corn chips	18	22	37	+19	
Mixtures mainly grain	29	40	46	+17	
Vegetables	87	81	82		
White potatoes	54	51	51		
Fried white potatoes	30	37	39	+9	
Dark-green vegetables	7	7	5		
Deep-yellow vegetables	9	10	11		
Tomatoes	21	27	33	+12	
Green beans	14	8	8	-6	
Corn, green peas, lima beans	24	17	15	-9	
Fruits	62	67	62		
Citrus juices	31	24	22	-9	
Apples	18	21	16		
Melons and berries	4	3	7		
Noncitrus juices and nectars	6	16	15	+9	
Milk and milk products	95	93	90	-5	
Fluid milk	90	82	76	-14	*
Whole milk	58	44	33	-25	**
Lowfat milk	17	39	38	+21	
Skim milk	4	5	8	+5	
Milk desserts	24	21	22		
Cheese	17	28	32	+14	
Meat, poultry, and fish	94	90	86	-7	
Beef	35	22	20	-15	
Pork	20	15	10	-10	*
Frankfurters, sausages, luncheon meats	32	34	33		
Chicken	16	18	20		
Fish and shellfish	8	7	6		
Mixtures mainly meat, poultry, fish	31	36	33		
Eggs	22	21	13	-8	
Legumes	13	15	11		
Fats and oils	54	56	49		
Sugars and sweets	56	55	60		
Candy	11	16	29	+18	*
Beverages	60	60	73	+12	
Tea	16	11	11		
Fruit drinks and ades	27	25	36	+9	
Carbonated soft drinks	30	37	45	+14	*

¹Change = percentages in 1977-78 and 1994-96, 1998 are significantly different at p < 0.001.

²Trend = percentage rose or fell progressively from 1977-78 through 1989-91 to 1994-96, 1998.

³Estimate is based on small sample size or coefficient of variation \geq 30 percent.

[†]Value is between 99.5 and 100.

* = trend significant at p < 0.05.

** = trend significant at p < 0.01.

had both lower intakes and lower percentages using the subgroups “green beans” and “corn, green peas, lima beans” in 1994-96, 1998, compared with 1977-78.

Aside from the observed changes in intakes of noncitrus juices and nectars, few changes occurred in fruit consumption: Between 1977-78 and 1994-96, 1998, the percentage using citrus juices fell among girls. In 1994-96, 1998, only 24 percent of girls and 23 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, children’s 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.³ Decreasing trends were seen in girls’ intakes of whole milk and in the percentages of both girls and boys using whole milk. Intakes of lower fat milks (2-percent, 1-percent, and skim) surpassed those of whole milk in 1989-91 for boys and in 1994-96, 1998 for girls. Although the percentages of children drinking skim milk more than doubled between 1977-78 and 1994-96, 1998, they still remained low (8 to 9 percent), as did their intakes of skim milk (29 to 33 g, or about 1 fluid ounce). None of the shifts in intakes of lower fat milks or percentages using them qualified as a trend.

³Another 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, since 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 4. Trends and changes in boys’ (6 to 11 years) percentages using items from selected food groups

Food group	Percentage using			Change ¹	Trend ²
	1977-78	1989-91	1994-96, 1998		
Grain products	100 ^{†3}	100 ^{†3}	99 ³		
Yeast breads and rolls	81	68	69	-12	
Ready-to-eat cereals	52	51	52		
Cakes, cookies, pastries, pies	52	39	52		
Crackers, popcorn, pretzels, corn chips	16	22	34	+18	
Mixtures mainly grain	26	46	45	+19	
Vegetables	85	80	79		
White potatoes	56	46	49		
Fried white potatoes	31	31	38		
Dark-green vegetables	5	5	6		
Deep-yellow vegetables	10	8	12		
Tomatoes	18	28	39	+21	**
Green beans	13	10	7	-6	
Corn, green peas, lima beans	24	16	14	-10	
Fruits	59	63	57		
Citrus juices	28	22	22		
Apples	16	19	18		
Melons and berries	4	5	7		
Noncitrus juices and nectars	7	12	13	+6	
Milk and milk products	94	90	92		
Fluid milk	90	79	79	-10	
Whole milk	58	40	31	-27	*
Lowfat milk	17	41	43	+26	
Skim milk	3	5	9	+6	
Milk desserts	22	18	25		
Cheese	15	25	32	+17	**
Meat, poultry, and fish	95	88	88	-7	
Beef	33	18	22	-11	
Pork	22	15	12	-10	
Frankfurters, sausages, luncheon meats	33	30	36		
Chicken	17	18	20		
Fish and shellfish	7	9	5		
Mixtures mainly meat, poultry, fish	31	35	36		
Eggs	23	20	16	-8	
Legumes	14	9	10		
Fats and oils	55	46	47		
Sugars and sweets	56	49	60		
Candy	9	16	29	+20	**
Beverages	62	64	74	+12	
Tea	15	11	9		
Fruit drinks and ades	27	27	39	+12	
Carbonated soft drinks	31	38	47	+16	

¹Change = percentages in 1977-78 and 1994-96, 1998 are significantly different at p < 0.001.

²Trend = percentage rose or fell progressively from 1977-78 through 1989-91 to 1994-96, 1998.

³Estimate is based on small sample size or coefficient of variation \geq 30 percent.

[†]Value is between 99.5 and 100.

* = trend significant at p < 0.05.

** = trend significant at p < 0.01.

On the other hand, an increasing trend in the percentage using cheese was seen for boys, while the increase for girls did not meet the definition of a trend. Cheese intakes were higher in 1994-96, 1998 than in 1977-78 for both girls and boys. Because cheese is a common component in both grain and meat mixtures, estimates for cheese would be even higher if the cheese that was an ingredient in these mixtures was included here. In 1994-96, 1998, only 29 percent of girls and 40 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 children using foods from the meat, poultry, and fish group were lower in 1994-96, 1998 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. Intakes and percentages of individuals eating eggs were lower in 1994-96, 1998 than in 1977-78 for both boys and girls.

In 1994-96, 1998, only 12 percent of girls and 21 percent of boys consumed the number of servings of meat and meat alternates recommended in the Food Guide Pyramid based on their caloric intake (USDA, 2000b). It is noteworthy that 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.

Percentages using candy exhibited upward trends for both girls and boys. Children’s candy intakes were higher in 1994-96, 1998 than in 1977-78. Fats, oils, and sugars are common ingredients in foods; thus, 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, 1998, intakes of discretionary fat and added sugars⁴—items from the tip of the Pyramid—were much higher than recommended (USDA, 2000b). At that time, discretionary fat intake accounted for about 25 percent of calories for girls and boys age 6 to 11. 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, 1998, children age 6 to 11 consumed 21 to 23 teaspoons of added sugars in a diet providing around 1,800 to 2,000 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 6- to 11-year-olds in the United States who were overweight⁵ nearly doubled—from 7 to 8 percent in 1976-80 to 13 to 15 percent in 1988-94 (U.S. Department of Health and Human Services [DHHS], 2000). 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 children (American Diabetes Association, 2000).

In the face of increasing overweight, one would expect to see either increasing energy intake, 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, 1998 (table 5). Energy intake stayed about the same for girls and dipped in 1989-91 for boys.

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)⁶ based on self-reported body weight, sex, and age and then comparing the BMR estimates with a cutoff level.⁷ 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 children than among adults: Only 7.8 percent of children age 2 to 11 in the CSFII 1994-96 were found to be low

⁴For definitions of discretionary fat and added sugars, see appendix D in Pyramid Servings table set 1 (USDA, 2000b).

⁵Overweight is defined as body mass index (BMI) at or above the sex- and age-specific 95th percentile BMI cutoff points from the revised *CDC Growth Charts: United States* (Kuczmarski et al., 2000).

⁶BMR was estimated by using the formula developed by Schofield (1985).

⁷Eighty 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.

energy reporters (S.M. Krebs-Smith, personal communication, March 8, 2002). Livingstone and Robson (2000) have stated that determining whether a child's energy intake is implausibly low should take into account detailed information on the child's activity level; however, such information is not available from the three surveys in the present analysis.

Inactivity is probably a strong factor in the increased prevalence of overweight in the United States (Weinsier, Hunter, Heini, Goran, & Sell, 1998). On any given day in 1994-96, 1998, 27 percent of girls and 32 percent of boys age 6 to 11 watched 4 or more hours of television or videos; 38 percent of girls and 40 percent of boys watched 2 to 3 hours; 35 percent of girls and 29 percent of boys watched 1 hour or less (unpublished data). For children, accumulating at least 60 minutes of moderate physical activity on most or all days of the week has been identified as a goal to promote better long-term health (DHHS, 2001; USDA & DHHS, 2000).

Energy-Providing Nutrients (Macronutrients)

A trend toward higher carbohydrate intakes was evident among boys age 6 to 11. For girls, carbohydrate intake was 38 g per day higher in 1994-96, 1998 than in 1977-78, although the *p*-value criterion for a trend was not met. For both girls and boys, protein and fat intakes were lower in 1994-96, 1998 than in 1977-78.

These shifts in macronutrient intakes between 1977-78 and 1994-96, 1998 were reflected in trends toward a lower proportion of food-energy intake from fat and a higher proportion from carbohydrate. Children's percentage of calories from protein was also lower in 1994-96, 1998 than in 1977-78, but the decrease only reached trend status for boys. The proportion of energy from fat

in children's diets in 1994-96, 1998 (33 percent) was still higher than that recommended by the Dietary Guidelines for Americans: 30 percent of calories or less (USDA & DHHS, 2000). At 12 percent of calories, 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 closer 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 about 100 kcal or less, but carbohydrate intake increased by about 150 to 200 kcal, based on estimates in table 5 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

For girls age 6 to 11, the only trend in vitamin or mineral intakes was a decrease in intake of vitamin B₁₂; changes included higher intakes of thiamin and iron in 1994-96, 1998 than in 1977-78 (table 5). For boys, there were increasing trends in intakes of thiamin and iron; additional changes included higher intakes of vitamin C, riboflavin, niacin, and vitamin B₆ and a lower intake of vitamin B₁₂.

Mean dietary fiber intakes in 1994-96, 1998 were 12 g for girls and 14 g for boys (unpublished data). One current recommendation suggests that fiber intakes for children should equal "age plus 5 grams per day" (Williams, Bollella, & Wynder, 1995) (e.g., 13 g fiber for an 8-year-old). 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

A French proverb states, "The more things change, the more they remain the same." The survey data used in preparing this article span nearly a quarter of a century. Those who were 6 to 11 years old in 1977-78 at the time of the first survey used in this study were 22 to 32 years old in 1994-96, 1998—old enough to be the parents of the children in the third survey used here. Although children's food intakes have changed in various ways over time, the list of improvements that are still needed has remained nearly identical.

Children's diets exhibited trends toward large increases in intakes of soft drinks as well as 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, pork, and eggs.

Despite those shifts in intakes, most of the take-home messages about how to improve children's 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.

Table 5. Trends and changes in girls' and boys' (6 to 11 years) mean intakes of food energy and selected nutrients and mean percentages of calories from protein, fat, and carbohydrate

Food group	Intake			Change ¹	Trend ²
	1977-78	1989-91	1994-96, 1998		
	Girls				
	n=2,101	n=722	n=969		
Energy (kcal)	1,806	1,832	1,825		
Protein (g)	69.3	67.2	62.7	-6.6	
Fat (g)	77.8	69.8	66.8	-11.0	
Carbohydrate (g)	211.9	241.6	250.0	+38.1	
Protein (% kcal)	15.5	15.1	13.9	-1.6	
Fat (% kcal)	38.2	33.8	32.6	-5.6	*
Carbohydrate (% kcal)	47.4	52.6	54.9	+7.6	**
Vitamin A (IU)	4,822	5,225	4,475		
Vitamin C (mg)	86	90	95		
Thiamin (mg)	1.32	1.53	1.48	+0.16	
Riboflavin (mg)	1.93	2.00	1.91		
Niacin (mg)	16.7	18.6	18.1		
Vitamin B ₆ (mg)	1.46	1.58	1.52		
Vitamin B ₁₂ (μg)	5.36	4.34	3.87	-1.49	*
Calcium (mg)	906	916	865		
Phosphorus (mg)	1,184	1,215	1,138		
Magnesium (mg)	230	230	219		
Iron (mg)	10.7	13.0	13.8	+3.1	
	Boys				
	n=2,006	n=754	n=1,031		
Energy (kcal)	1,950	1,891	2,050		
Protein (g)	75.6	70.1	71.2	-4.4	
Fat (g)	84.7	72.7	75.1	-9.6	
Carbohydrate (g)	226.2	245.5	279.6	+53.3	**
Protein (% kcal)	15.7	15.0	14.0	-1.6	*
Fat (% kcal)	38.5	34.2	32.6	-6.0	**
Carbohydrate (% kcal)	46.8	52.0	54.8	+8.0	**
Vitamin A (IU)	5,056	4,902	5,242		
Vitamin C (mg)	87	98	103	+16.0	
Thiamin (mg)	1.46	1.59	1.77	+0.31	*
Riboflavin (mg)	2.11	2.11	2.28	+0.17	
Niacin (mg)	18.4	19.4	21.5	+3.1	
Vitamin B ₆ (mg)	1.59	1.62	1.84	+0.26	
Vitamin B ₁₂ (μg)	5.88	4.42	4.53	-1.35	
Calcium (mg)	967	978	984		
Phosphorus (mg)	1,278	1,261	1,292		
Magnesium (mg)	244	233	249		
Iron (mg)	11.5	13.7	16.6	+5.1	**

¹Change = mean intakes (or percentages) in 1977-78 and 1994-96, 1998 are significantly different at p < 0.001.

²Trend = mean intake (or percentage) rose or fell progressively from 1977-78 through 1989-91 to 1994-96, 1998.

* = trend significant at p < 0.05.

** = trend significant at p < 0.01.

- Shift to lean meats and meat alternates.
- Drink more skim or 1-percent 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 children's diets is much higher than is recommended by the Food Guide Pyramid. Children's 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, children would do well to shift toward items lower in fat and sugar. Increases in intakes of foods high in fiber and complex carbohydrates—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 carbohydrates. 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.

Nutrition education can successfully change dietary behavior among elementary school-aged children, and factors leading to the effectiveness of nutrition education have been identified (Contento et al., 1995). Resources must be committed on every level—national, State, local, community, school, and family—to help children eat more healthfully and become more active.

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