

Chapter Two

Usual Intake of Food Energy and Nutrients

This chapter describes usual intakes of food energy and key nutrients and, to the extent possible, the prevalence of adequate usual intakes among school-age children in three different income strata. Nutrients included in the analysis are vitamin C, iron, zinc, and calcium. Usual intakes of fat, saturated fat, cholesterol, sodium, and fiber were also examined. These data are presented in Chapter Three.

As noted in Chapter One, the age groups used in the analysis of dietary intake data differ from those used in the remainder of the report. The alternative age groups correspond to those used in the Dietary Reference Intakes (DRIs), the standards used to assess diets consumed by individuals and populations. The DRI age groups (5-8 years, 9-13 years, and 14-18 years) approximate the school-level age groups used in the remainder of the report.¹ To maintain consistency across all the dietary intake analyses presented in this report, the DRI age groups were also used in analyzing Healthy Eating Index (HEI) scores and related variables (Chapter Three).

To provide some context for the discussion, the chapter begins with information on several factors that may influence children's usual dietary intakes. These include participation in food and nutrition assistance programs, household food sufficiency status, and meal and snacking patterns.

¹It was necessary to use the DRI age groups in assessing the adequacy of usual nutrient intakes. The decision to estimate usual intakes was made after most of the tabulations included in this report had already been completed using the other age groups.

Participation in Food and Nutrition Assistance Programs

NHANES-III provides information on participation in three food and nutrition assistance programs that serve school-age children: the FSP and the two leading school-based programs, the NSLP and the SBP. In reviewing these data, it is important to bear three facts in mind. First, survey data tend to yield lower estimates of program participation than estimates derived from program administrative data. For example, data from the Survey of Income and Program Participation (SIPP), which is generally recognized as the optimal source of survey data on program participation, underestimates participation in most programs by 10 to 15 percentage points (Trippe, 2000). Second, data reflect participation rates at the time the NHANES-III data were collected (1988-94) and therefore are not expected to be representative of *current* program participation. Finally, questions related to the NSLP and SBP were included in the Household Youth Interview, which was administered to primary caregivers of children less than 17 years of age. Youth who were 17 and 18 years old completed the Household Adult Interview, which did not include NSLP/SBP questions. Consequently, information on participation in the school meal programs is not available for this oldest cohort of school-age children.

The Food Stamp Program

The survey question used to identify FSP participants asked about current participation: "(Are you/Is your family) receiving food stamps at the present time?" Although all children residing in households with incomes at or below 130

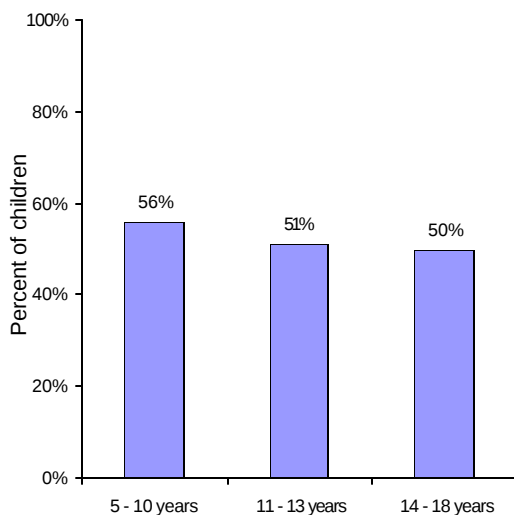
percent of poverty were eligible to participate in the FSP, only 53 percent of the school-age children in this income group (the lowest-income group) participated in the program at the time of the interview (table D-1). The rate of FSP participation was somewhat higher for 5-10-year-olds (56%) than for the two older groups of children (50-51%) (figure 1) (statistical significance of age-based differences not tested). Given the expected underreporting in survey data, these estimates are consistent with historical data on child participation in the FSP during the relevant time period (1988-94) (Cody and Trippe, 1997).

The School Meal Programs

The survey items used to identify participation in the school meal programs asked whether the school the child attended “serve[d] school lunch (or breakfast),” and defined school lunches (or breakfasts) as “complete [meals] costing the same fixed price every day.” In cases where children attended schools where such meals were offered, caregivers were asked to report the number of days per week the child usually ate the “complete [meal].”

Figure 1—Percent of income-eligible school-age children participating in the Food Stamp Program

Measured among those with income < 130% poverty



Source: NHANES-III, 1988-94.

Studies of school meal programs have shown that children who are eligible for free and reduced-price meals tend to participate more often than children who are not eligible and that, among older children, males tend to participate more often than females. Both of these patterns were reflected in the NHANES-III data.

The National School Lunch Program

The vast majority of all children attended schools in which the NSLP was offered (table D-2). Children in the lowest-income group were just as likely as children in the low-income group to attend a school that offered the NSLP. However, children in the lowest-income group were significantly more likely than children in the higher-income group to attend a school that offered the NSLP (96% vs. 91%). This difference was largely attributable to a difference among 5-10-year-olds (95% vs. 88%).

Differences in the availability of the NSLP were more pronounced among females than males (statistical significance of gender-based differences not tested). None of the between-group differences were statistically significant for males. In contrast, among females, significant differences were noted between the lowest-income group and the higher-income group for all age groups combined, as well as for 5-10-year-olds and 11-13-year-olds. In addition, the difference between the lowest-income group and the low-income group was statistically significant for 5-10-year-old females.

More than half (54%) of all children reported that they usually ate a school lunch 5 days per week (table D-3). The percentage of males who consumed school lunches 5 days per week was greater than the percentage of females. This was particularly true for the two oldest age groups. Among 14-16-year-olds, 62 percent of males usually consumed a school lunch 5 days per week, compared with 43 percent of females

(statistical significance of gender-based difference not tested).

The percentage of children who usually consumed a school lunch 5 days per week varied significantly by income. Roughly three-quarters of children in the lowest-income group (children who were eligible for free NSLP meals) usually ate a school lunch 5 days per week, compared with 64 percent of children in the low-income group (eligible for reduced-price NSLP meals) and 41 percent in the higher-income group (not eligible for NSLP meal benefits) (figure 2). This pattern is generally consistent with patterns of participation reported in the most recent national studies of the NSLP (Burghardt and Devaney, 1993 and Fox et al., 2001).

Differences between income groups varied substantially by gender. Among males, there was no difference between the lowest-income group and the low-income group in the percentage of children who usually ate a school lunch 5 days per week (74% vs. 71%). However, males in the lowest-income group were significantly more likely than males in the higher-income group to

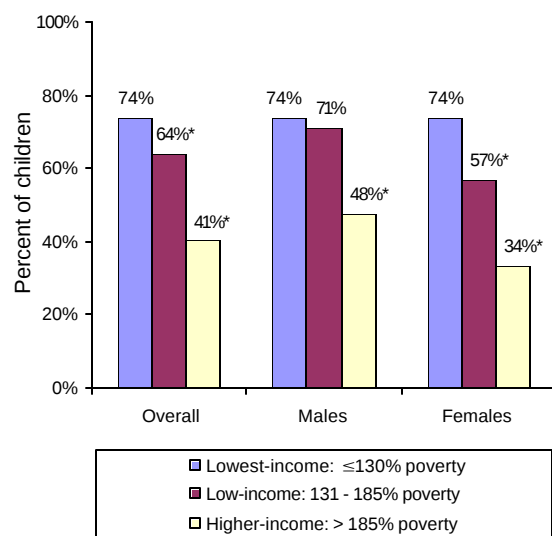
usually eat the school lunch 5 days per week (74% vs. 48%). Among females, the lowest-income group was significantly more likely than either the low-income group or the higher-income group to usually eat the school lunch 5 days per week (74% vs. 57% and 34%).

The School Breakfast Program

At the time the NHANES-III data were collected, about half of all school-age children attended schools that offered the SBP (table D-4). This estimate is consistent with historical data on SBP availability, but substantially underrepresents current program availability. In the 1992-93 school year, about two-thirds of the way through the NHANES-III data collection, approximately half of the Nation's schools offered the SBP (Burghardt and Devaney, 1993). Institutional participation in the SBP has increased substantially since that time. In the 1998-99 school year, when the most recent nationally representative study of the school meal programs was completed, more than three-quarters of all public schools that offered the NSLP also offered the SBP (Fox et al., 2001).²

Children in the lowest-income group were just as likely as children in the low-income group to attend a school that offered the SBP, but were significantly more likely to attend an SBP school than children in the higher-income group (66% vs. 59% and 40%) (table D-4). Although recent initiatives have focused on increasing the availability of the SBP for all children, historically, the program has been most commonly offered in low-income areas.

Figure 2—Percent of school-age children eating school lunch 5 days per week



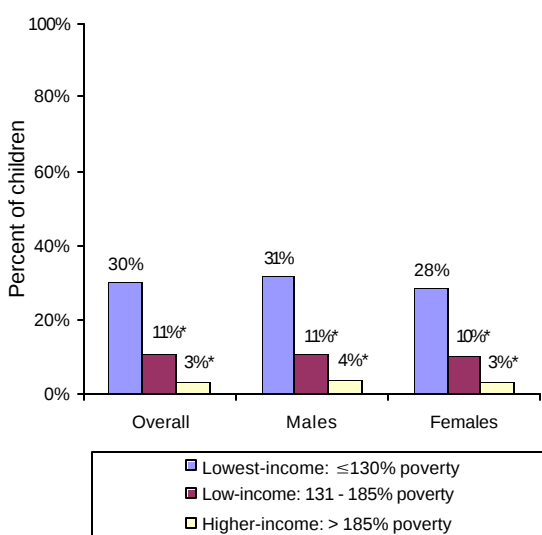
*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

² The 1992-93 and 1998-99 estimates are not directly comparable. The former is based on all schools, including private schools, while the latter is based on public schools that offered the NSLP. Given that private schools make up a small percentage of all schools nationwide and that the vast majority of all schools offer the NSLP, the difference between the two estimates is a reasonable proxy for the growth of the SBP over time.

About 13 percent of all children reported usually consuming a school breakfast 5 days per week (table D-5). Regular consumption of school breakfasts decreased as age increased. Sixteen percent of 5-10-year-olds usually ate a school breakfast 5 days per week, compared with 8 percent of 14-18-year-olds (statistical significance of age-based differences not tested). These patterns were observed for both males and females.

Children in the lowest-income group were significantly more likely to eat a school breakfast 5 days per week than children in either of the other income groups. Overall, 30 percent of children in the lowest-income group usually ate a school breakfast 5 days per week, compared with 11 percent of children in the low-income group and 3 percent of children in the higher-income group (figure 3). This pattern was observed for both males and females and is consistent with patterns of participation observed in the most recent national studies of the SBP (Burghardt and Devaney, 1993 and Fox et al., 2001).

Figure 3—Percent of school-age children eating school breakfast 5 days per week



*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

Household Food Sufficiency

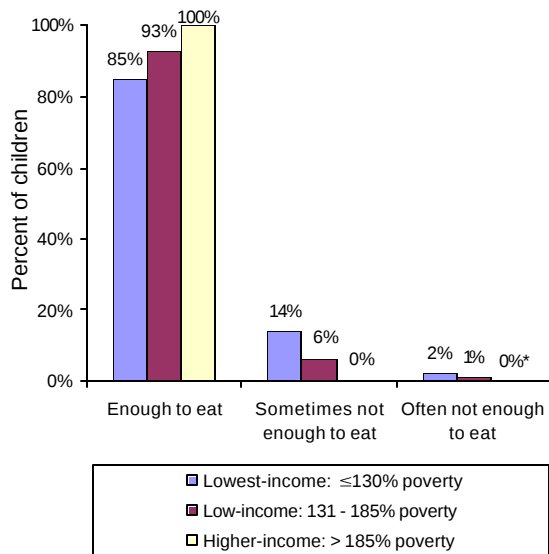
NHANES-III data were collected before dissemination of the 18-item Federal food security module, the currently accepted standard for measuring household and individual food security (Price et al., 1997 and Bickel et al., 2000). NHANES-III included a question that asked whether the household had enough to eat, sometimes did not have enough to eat, or often did not have enough to eat. Respondents who indicated that their household sometimes or often did not have enough to eat were asked how many days this occurred during the past month and why it occurred.³ This measure has been used in NHANES-III as well as in other studies to identify households with food insufficiency (defined as households that report that there is “sometimes” or “often” not enough food to eat) (Alaimo, et al., 1998).

The majority of school-age children in all three income groups lived in households that always had enough to eat (figure 4 and table D-6). However, approximately 14 percent of school-age children in the lowest-income group resided in households that sometimes did not have enough to eat. The same was true for only six percent of school-age children in the low-income group and virtually none (0.2%) of the school-age children in the higher-income group.

More severe problems with food sufficiency (often not having enough to eat) were relatively rare. About two percent of school-age children in the lowest-income group, one percent of school-age children in the low-income group, and none of the school-age children in the higher-income group lived in households that

³Versions of the questionnaires used in the last two rounds of data collection included additional followup questions about whether children or adults in the household had decreased the size of their meals because there was not enough food. This latter group of questions was not tabulated for this report because of the restricted nature of the sample.

Figure 4—Distribution of school-age children by household food sufficiency status



*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

experienced this problem. The difference between the lowest-income group and the higher-income group (2% vs. 0%) was statistically significant.

Because so few school-age children resided in households that sometimes or often did not have enough to eat, the followup questions on how often and why households experienced these problems were not analyzed. Sample sizes for some subgroups were too small to produce reliable estimates.

Meals and Snacks Consumed

This analysis examined the number of meals and snacks consumed by school-age children in the preceding 24 hours. Data from the 24-hour dietary recall were used to compute, for each child, the total number of meals and snacks consumed. (As dietary intakes were reported, respondents were asked to identify eating occasions as meals (breakfast, brunch, lunch, or dinner/supper) or snacks.) Responses to a separate survey question about daily breakfast consumption were also tabulated.

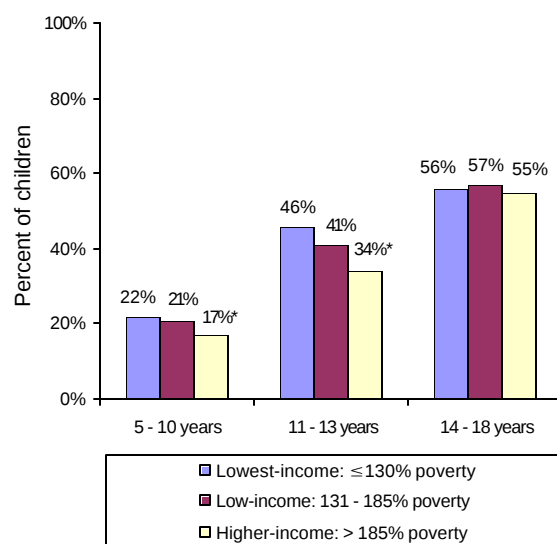
Number of Meals Consumed

Overall, 36 percent of school-age children consumed fewer than three meals in the preceding 24 hours (table D-7).⁴ The percentage of children who ate fewer than three meals per day increased with age, from a low of 20 percent for 5-10-year-olds to a high of 55 percent for 14-18-year-olds (statistical significance of age-based differences not tested).

There were no significant differences, overall, between the lowest-income group and the low-income group in the percentage of children who consumed fewer than three meals in the preceding 24 hours. In comparison with the higher-income group, however, children in the lowest-income group were significantly more likely to have consumed fewer than three meals (39% vs. 34%). This difference was concentrated among 5-10-year-olds (22% vs. 17%) and 11-13-year-olds (46% vs. 34%) (figure 5).

⁴Data on the mean number of meals consumed is presented in table D-8.

Figure 5—Percent of school-age children consuming fewer than three meals per day



*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

Differences between income groups were strongest for 11-13-year-old females. In this age group, females in the lowest-income group were significantly more likely than females in either of the other income groups to have consumed fewer than three meals (47% vs. 29% and 34%) (table D-7).

Consumption of Breakfast

NHANES-III included a separate question about usual breakfast consumption habits: “How often [does CHILD/do you] eat breakfast?” Response options were: every day, on some days, rarely, never, and on weekends only. This question is not directly comparable to the question about consumption of school breakfasts. The two questions have a different frame of reference (SBP breakfasts on school days vs. any type of breakfast on all days of the week) and were answered by different respondents. The question about consumption of school breakfasts was answered by caregivers of all children between 5 and 16; 17- and 18-year-olds were not asked this question. The question about usual breakfast consumption habits was answered by caregivers of children 5-11 years. Children 12-18-years answered the question themselves.

The data indicate that fewer than half (46%) of all school-age children consumed breakfast every day (table D-9). Reported breakfast consumption habits differed markedly by age. Eighty-seven percent of 5-10-year-olds ate breakfast every day, compared with 27 percent of 11-13-year-olds and 8 percent of 14-18-year-olds (statistical significance of age-based differences not tested). This general pattern was observed for both males and females and for all three income groups.

There was no significant difference in reported breakfast consumption habits of school-age children in the lowest-income and low-income groups. In comparison with the higher-income group, however, school-age children in the

lowest-income group were significantly less likely to consume breakfast every day (44% vs. 48%). This difference was concentrated among 11-13-year-olds, females in particular, and among males. Among 11-13-year-olds, 21 percent of the lowest-income group reportedly ate breakfast every day, compared with 31 percent of the higher-income group. Among school-age males, 45 percent of the lowest-income group ate breakfast every day, compared with 50 percent of the higher-income group.

Number of Snacks Consumed

Eighty-nine percent of all school-age children consumed at least one snack in the preceding 24 hours (table D-10). On average, school-age children consumed two snacks in the preceding 24 hours (table D-11). There were virtually no significant differences between income groups in snacking behaviors and little noteworthy variation by gender or age.

Usual Intake of Food Energy and Key Nutrients

This section describes usual intakes of food energy, vitamin C, iron, zinc, and calcium among school-age children. Tabulations are based on the single 24-hour recall collected in NHANES-III. The data have been adjusted, however, to account for within-person variation using variance estimates from the Continuing Survey of Food Intakes by Individuals (CSFII). (The procedures used in making these adjustments are described in appendix C.) As such, the data presented are indicative of children’s *usual* dietary intakes, exclusive of vitamin and mineral supplements, and can be used to assess the prevalence of adequate intakes.⁵

⁵Data on usual dietary intake do not include contributions from vitamin and mineral supplements. At the time this report was prepared, other investigators were working on methods for incorporating supplement data into estimates of usual nutrient intake. In NHANES-III, however, there is a lack of congruence in recall period—24 hour recall for foods vs. the preceding month for supplements.

Standards Used to Assess Usual Intakes

The usual nutrient intakes of school-age children were assessed relative to Estimated Average Requirements (EARs) and Adequate Intakes (AIs). EARs and AIs are part of a newly established set of dietary standards—the Dietary Reference Intakes (DRIs) (Institute of Medicine (IOM), 1999, 2000a, 2000b, 2002a, 2002b, 2004). The DRIs replace the *Recommended Dietary Allowances* (RDAs) used in most previous research (National Research Council (NRC), 1989a).⁶ When adequate scientific evidence is available, an EAR is established. The EAR is the level of intake that is estimated to meet the requirements of half of the healthy individuals in a particular life stage and gender group. When the available data are insufficient to estimate requirements, an AI is established rather than an EAR. The AI is the level of intake that is assumed to be adequate, based on observed or experimentally determined estimates of intake.

EARs have been defined for three of the four nutrients examined in this chapter (vitamin C, iron, and zinc). For the fourth nutrient (calcium), AIs have been defined. For nutrients that have EARs and a symmetrical requirement distribution, the IOM recommends that usual nutrient intakes be assessed using the “EAR-cutpoint method” (IOM, 2001).⁷ This approach compares the distribution of usual intakes in a population with a population-specific EAR. The proportion of the population with usual intakes below the EAR is an estimate of the proportion of the

population with inadequate intakes—intakes that do not meet nutrient requirements.

For nutrients with AIs, methods for assessing usual intakes are more limited. AIs cannot be used to determine the proportion of a population with inadequate intakes. Instead, assessment focuses on comparison of mean usual intakes to the AI. Populations with a mean usual intake equivalent to or greater than the population-specific AI can be assumed to have adequate intakes.

At the time the analyses presented in this report were completed, DRIs had not been established for food energy.⁸ Therefore, assessment of usual energy intakes also focuses on comparison of mean intakes, expressed as a percentage of the 1989 Recommended Energy Allowance (REA) (NRC, 1989a).

Because the EARs and the calcium AI are relatively new reference standards, appendix B includes a table that shows the 1989 RDAs for vitamin C, iron, zinc, and calcium—the reference standards used in most previous research. The interested reader can compare data on mean usual intakes with the most appropriate RDA to obtain a reasonable approximation of how these data compare with previously published data. In addition, appendix D includes tables that show means and the full distribution of usual intakes (the 5th, 10th, 15th, 25th, 50th, 75th, 85th, 90th, and 95th percentiles) for food energy and each of the four nutrients.

Food Energy

On average, children’s usual intake of food energy approached 100 percent of the 1989 REA (table D-13).⁹ Usual energy intake varied

⁶In addition to EARs and AIs, the DRIs define two other reference standards: Recommended Dietary Allowances (RDAs) and Tolerable Upper Intake Levels (ULs) (see appendix B).

⁷The EAR-cutpoint method could not be used to assess the prevalence of adequate iron intakes among menstruating females because iron requirements for this population are not symmetrical. An alternative method, known as the probability approach (IOM, 2001), was used to assess the prevalence of adequate iron intakes in this subgroup of school-age children (9-13-year-old and 14-18-year-old females).

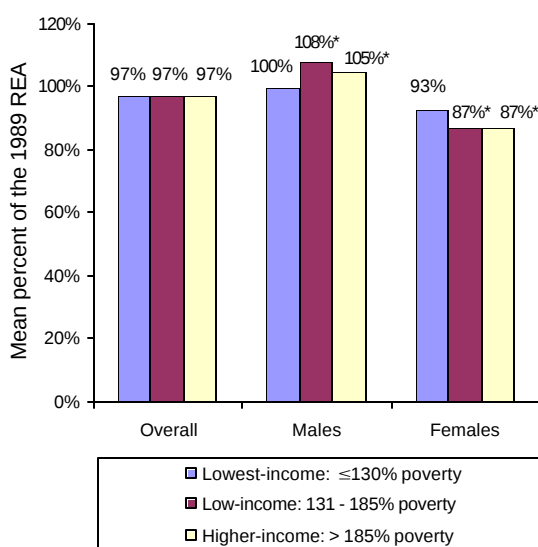
⁸DRIs for food energy have subsequently been released (IOM, 2002b).

⁹Data on mean intakes in kilocalories are presented in table D-12 and the full distribution of intakes is presented in table D-14.

substantially by gender. Even among the youngest age groups, males consumed more energy than females, relative to the 1989 REA. Male school-age children consumed 104 percent of the 1989 REA, on average, while females consumed 89 percent (statistical significance of gender-based differences not tested).

There were no significant differences between income groups, overall, in mean energy intake as a percent of the 1989 REA (figure 6). Significant differences were observed, however, in gender-specific analyses. Among males, school-age children in the lowest-income group had significantly *lower* mean energy intakes than school-age children in the low-income and higher-income groups (100% of the 1989 REA vs. 108% and 105%). Among females, the difference between income groups went in the opposite direction. That is, among females, the lowest-income group consumed significantly *more* food energy, on average, than either of the other income groups (93% of the 1989 REA vs. 87% for both of the other groups).

Figure 6—Mean usual intake of food energy as a percent of the 1989 Recommended Energy Allowance: School-age children



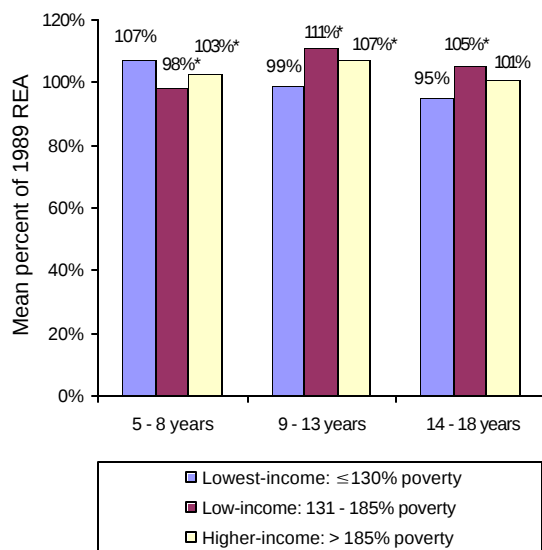
*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

For both males and females, the pattern of differences between income groups varied by age. Among males, 5-8-year-olds in the lowest-income group consumed significantly *more* energy than their counterparts in either of the other income groups (107% vs. 98% and 103%) (figure 7). For the two older groups of males, the pattern was reversed. Among 9-13-year-olds and 14-18-year-olds, males in the lowest-income group consumed *less* energy, on average, than males in either the low-income or higher-income groups. For 9-13-year-old males, both of the between-group differences were statistically significant (99% vs. 111% and 107%). For 14-18-year-old males, only the difference between the lowest-income group and the low-income group was significant (95% vs. 105%).

Among females, the direction of the difference between income groups was consistent for all age groups, but the statistical significance of the differences varied (figure 8). There were no significant between-group differences for 9-13-year-old females. Among 5-8-year-old females, the usual energy intake of the lowest-income group was comparable to the usual intake of the low-income group, but was significantly greater than the usual intake of the higher-income group (92% vs. 91% and 84%). Among 14-18-year-old females, the lowest-income group consumed significantly more food energy than either the low-income or higher-income groups (97% vs. 81% and 84%).

Finally, it is interesting to note that the magnitude of the disparity between energy intakes of males and females, mentioned at the beginning of this section, was substantially smaller in the lowest-income group than in the two other income groups. In the lowest-income group, males consumed an average of 100 percent of the 1989 REA and females consumed an average of 93 percent—a difference of 7 percentage points (table D-13). Comparable differences for males and females in the low-income and higher-

Figure 7—Mean usual intake of food energy as a percent of the 1989 Recommended Energy Allowance: School-age males



*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

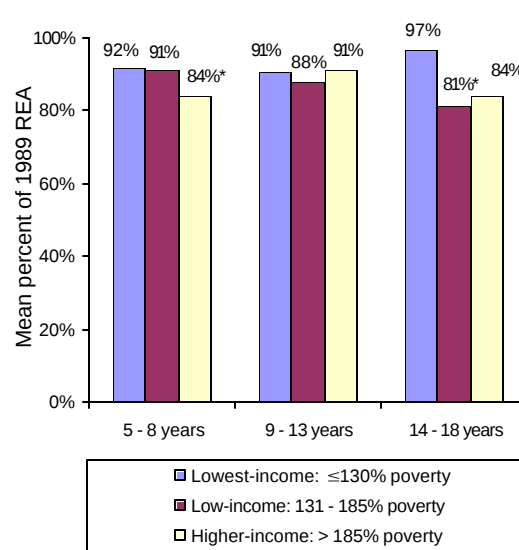
income groups were 21 percentage points and 18 percentage points, respectively (statistical significance of gender-based differences not tested).

Vitamin C

More than 90 percent of all school-age children had adequate usual intakes of vitamin C (table D-16).¹⁰ The prevalence of adequate usual intakes decreased with age from 100 percent for 5-8-year-olds to 97 percent for 9-13-year-olds and 80 percent for 14-18-year-olds (statistical significance of age-based differences not tested). This trend was observed for both males and females.

Overall, there was no significant difference between the lowest-income group and the low-income group in the percentage of school-age children with adequate usual intakes of vitamin C (93% vs. 92%). The difference between the lowest-income group and the higher-income group was statistically significant, but the magnitude of the difference was small (93% vs. 91%).

Figure 8—Mean usual intake of food energy as a percent of the 1989 Recommended Energy Allowance: School-age females



*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

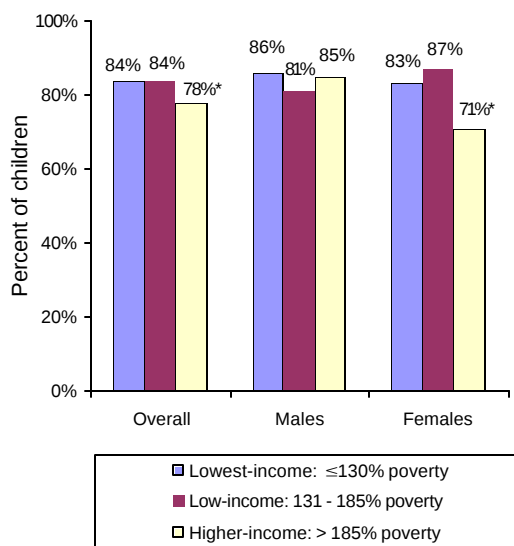
Several significant differences were noted between income groups for specific age and gender-and-age subgroups (table D-16). The most noteworthy difference was observed for 14-18-year-olds. For this age group, children in the lowest-income group were significantly more likely to have adequate usual intakes of vitamin C than children in the higher-income group (84% vs. 78%) (figure 9). This difference was due to a difference among females. Among 14-18-year-old females, 83 percent of the lowest-income group had adequate usual intakes of vitamin C, compared with 71 percent of the higher-income group.

Iron

With the exception of 14-18-year-old females, virtually all school-age children had adequate usual intakes of iron (table D-19).¹¹ Among 14-18-year-old females, the prevalence of adequate usual iron intakes was substantially lower, at 86 percent. In this subgroup, the lowest-income

¹⁰Data on mean intakes of vitamin C (in mg.) are presented in table D-15 and the full distribution of intakes is presented in table D-17.

Figure 9—Percent of 14-18-year-olds with adequate usual intake of vitamin C



*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

group was significantly more likely than the higher-income group to have an adequate usual iron intake, and the magnitude of the difference between groups was sizeable. Ninety-two percent of 14-18-year-old females in the lowest-income group had adequate usual iron intakes, compared with 80 percent of comparably aged females in the higher-income group (figure 10). The difference between the lowest-income group and the low-income group (92% vs. 88%) was not statistically significant.

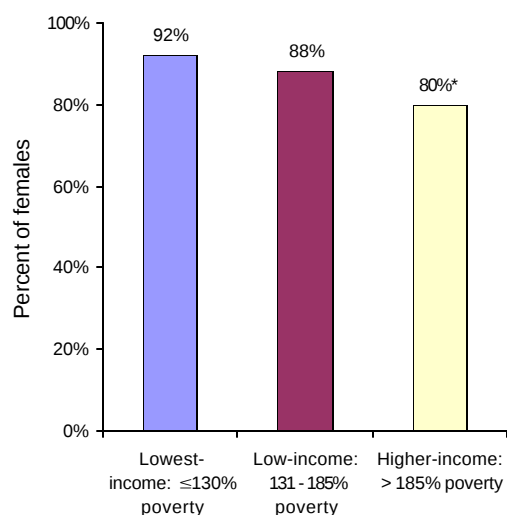
Zinc

Roughly nine out of ten school-age children had adequate usual intakes of zinc (table D-22).¹² The prevalence of adequate intakes decreased with age, from 100 percent for 5-8-year-olds to 83 percent for 14-18-year-olds. Moreover, for the two older age groups of school-age children, the prevalence of adequate usual zinc intakes

¹¹Data on mean intakes of iron (in mg.) are presented in table D-18 and the full distribution of intakes is presented in table D-20.

¹²Data on mean intakes of zinc (in mg.) are presented in table D-21 and the full distribution of intakes is presented in table D-23.

Figure 10—Percent of 14-18-year-old females with adequate usual intake of iron



*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

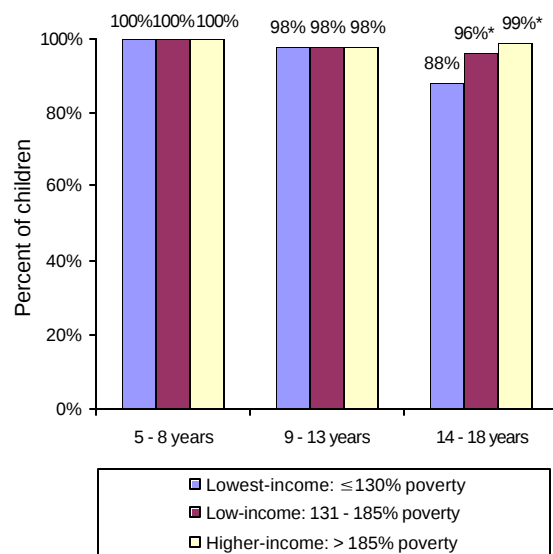
was notably higher for males than for females (99% and 97% vs. 84% and 70%) (statistical significance of age- and gender-based differences not tested).

Overall, school-age children in the lowest-income group were *less* likely than those in the low-income group and *more* likely than those in the higher-income group to have adequate usual intakes of zinc (91% vs. 98% and 89%). However, the pattern of between-group differences varied by gender and age.

Among males, significant differences between income groups were observed only for 14-18-year-olds (figure 11). Among males in this age cohort, the lowest-income group was less likely than either of the other income groups to have an adequate usual intake of zinc (88% vs. 96% and 99%).

Among females overall, the lowest-income group was *less* likely than the low-income group and *more* likely than the higher-income group to have an adequate usual intake of zinc (88% vs. 98% and 79%) (table D-22). This pattern was

Figure 11—Percent of school-age children with adequate usual intake of zinc: Males



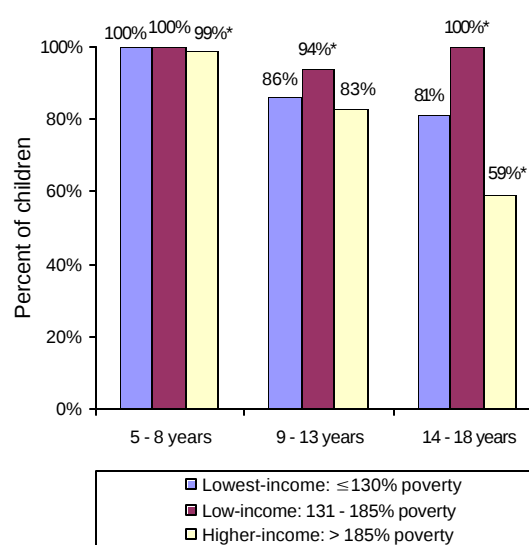
*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

observed for both 9-13-year-old females and 14-18-year-old females (figure 12). However, among 9-13-year-old females, the difference between the lowest-income and higher-income groups was not statistically significant.

Calcium

As noted in the introduction to this section, it is not possible to determine the percentage of school-age children with adequate intakes of calcium because EARs for calcium have not been established. Therefore, in comparing calcium intakes of children in different income groups, the analysis examined mean usual intakes, expressed as a percentage of the AI. In reviewing these data, readers should note that the AI is expected to exceed the actual needs of essentially all healthy individuals. Thus, mean intakes below the AI cannot be interpreted as indicative of inadequate intakes. On the other hand, populations with mean intakes that meet or exceed the population-specific AI can be assumed to have adequate intakes.

Figure 12—Percent of school-age children with adequate usual intake of zinc: Females



*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

On average, the usual diets consumed by school-age children provided 83 percent of the AI defined for their gender-and-age group (table D-25).¹³ The data indicate that 5-8-year-olds had adequate usual calcium intakes (120% of the AI), while mean intakes of older children fell short of the AI (74-75%). In the two older age groups, mean usual intakes were notably higher for males (83% and 88% of the AI) than for females (67% and 60%) (statistical significance of gender-based differences not tested).

Overall, the mean usual calcium intake of the lowest-income group, as a percent of the AI, was comparable to the mean usual intake of the low-income group but was significantly lower the mean usual intake of the higher-income group (81% vs. 83% and 85%). There was substantial variation in this pattern of between-group differences by gender and age.

As a group, males in the lowest-income group consumed significantly *less* calcium than males

¹³Data on mean intakes of calcium (in mg.) are presented in table D-24; the distribution of intakes is shown in table D-26.

in either of the other income groups (88% of the AI vs. 96% and 97%). This pattern was noted for 9-13- and 14-18-year-old males but not for 5-8-year-old males (figure 13).

Among females, the pattern of between-group differences was reversed. That is, females in the lowest-income group consumed significantly *more* calcium, on average, than females in the other two income groups (75% of the AI vs. 70% for each of the other groups) (table D-25). This pattern was observed for 5-8-year-old females and 14-18-year-old females, and three of the four between-group differences were statistically significant (figure 14).

Consumption of Milk and Soft Drinks

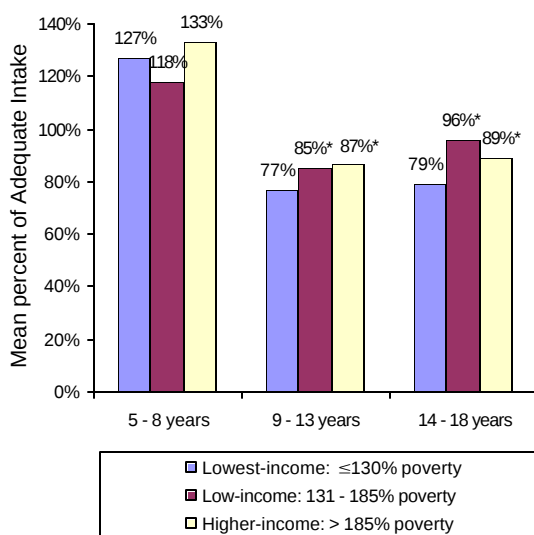
Data on trends in the national food supply indicate that Americans are consuming substantially less milk and substantially more soft drinks than they were 25 years ago (Putnam and Gerrior, 1999). On average, Americans consume more soft drinks per day than milk. Concerns

have been raised about the potential impact of this trend on calcium intake, particularly among children (Yen and Lin, 2002).

To determine whether the relative consumption of soft drinks and milk differed for school-age children in the three income strata, 24-hour recall data were used to compute the total grams of fluid milk consumed and the total grams of soft drinks consumed in the preceding 24-hour period. Both carbonated and noncarbonated soft drinks were included in the tabulations. Coffee and tea were not included. For ease in interpretation, gram weights were translated into 8-ounce equivalent servings.

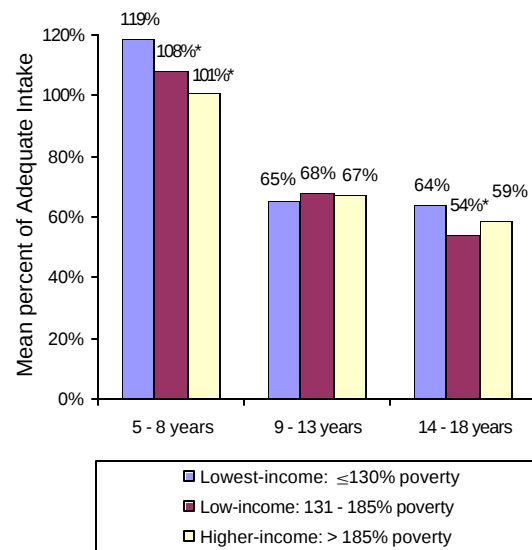
The data, presented in tables D-27 to D-30, verify that soft drink consumption outstripped consumption of fluid milk in all gender and age subgroups examined in this analysis. Moreover, the data revealed no significant differences between income groups in these behaviors, overall, indicating that these consumption patterns crossed income lines (figure 15).

Figure 13—Mean usual intake of calcium as a percent of Adequate Intake: School-age males



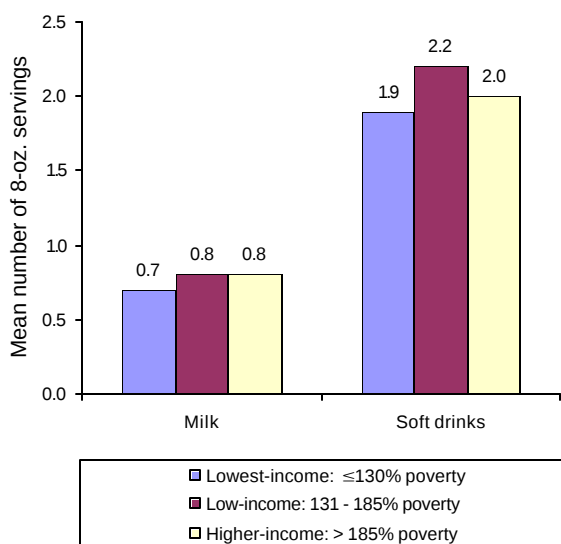
*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

Figure 14—Mean usual intake of calcium as a percent of Adequate Intake: School-age females



*Statistically significant difference from lowest-income group at the .05 level or better.
Source: NHANES-III, 1988-94.

Figure 15—Mean daily servings of milk and soft drinks: School-age children



No statistically significant differences between income groups.
Source: NHANES-III, 1988-94.

On average, school-age children consumed less than one full (8-ounce) serving of fluid milk per day (table D-28). In contrast, school-age children consumed an average of 2 (8-ounce) servings of soft drinks per day (Most soft drinks purchased in individual containers include more than 8 ounces). Males consumed more milk and more soft drinks per day than females (0.9 and 2.3 servings, respectively, for males vs. 0.7 and 1.7 servings for females) (statistical significance of gender-based differences not tested). Males between 14 and 18 years consumed the most soft drinks, averaging 3.3 servings (or 26.4 ounces) per day.

Use of Dietary Supplements

As noted earlier in this chapter, NHANES-III dietary intake data do not include nutrients provided by dietary supplements. To provide some insight into the potential contribution of dietary supplements, data on reported supplement use were analyzed. The available data do not permit a detailed analysis of this issue by specific nutrient, but provide some information on the prevalence of supplement use among

school-age children and general information about the number and types of supplements taken.

NHANES-III respondents were asked whether they used vitamin or mineral supplements during the preceding month. If supplements were used, respondents were asked to show the actual bottles or jars to interviewers so the type of supplement and associated dosage information could be recorded. Respondents were not asked specifically about use of other types of dietary supplements, such as herbs, botanicals, and fish oils; however, many respondents volunteered information about these types of supplements (CDC, 2001).

Overall, less than a third (30%) of school-age children used some type of dietary supplement in the month preceding the NHANES-III interview (table D-31). Supplement use generally declined as age increased. For the population as a whole, 40 percent of 5-8-year-olds took some type of dietary supplement during the preceding month, compared with 29 percent of 9-13-year-olds and 24 percent of 14-18-year-olds (table D-31) (statistical significance of age-based differences not tested).

There was no significant difference between the lowest-income group and the low-income group in reported use of dietary supplements. In comparison with the higher-income group, however, school-age children in the lowest-income group were significantly less likely to have used dietary supplements (20% vs. 37%). This pattern was observed for all three age cohorts, overall as well as by gender.

Among children who used dietary supplements in the preceding month, the majority (84%) used one supplement (table D-32). There were no significant differences between income groups in the number of supplements used by children who used supplements. The types of supplements

used most often were multivitamins (48%) and multivitamin-with-mineral combinations (35%) (table D-33). The latter supplements are likely to include vitamin C, iron, and zinc, three of the four minerals examined in the preceding section. Calcium is likely to be included as well, but generally at levels well below other minerals, relative to recommended intakes. There were isolated differences between income groups on the types of supplements taken, but there was no consistent pattern. These data should be interpreted with some caution given the relatively low prevalence of supplement use and the resulting small samples for the multiple gender- and-age subgroups examined in this report.