Chapter Three

Healthy Eating Index Scores and Usual Intake of Dietary Fiber

This chapter describes the nutritional quality of diets consumed by the Nation's school-age children. The analysis focuses on the Healthy Eating Index (HEI), a summary measure of overall nutritional quality developed by USDA's Center for Nutrition Policy and Promotion (CNPP) (Kennedy et al., 1995). Usual intake of dietary fiber is also examined.

To maintain consistency across all analyses of diet-related measures, the age groups used in this chapter are the same as those used in the preceding chapter and differ slightly from those used elsewhere in the report. Specifically, the age groups used are those used in the DRIs, the most current nutrition standards (5-8 years, 9-13 years, and 14-18 years).

Healthy Eating Index Scores

The HEI provides an overall picture of the types and quantities of food individuals consume and their compliance with recommended dietary practices (Basiotis et al., 2002). The index includes an overall score as well as 10 component scores, all of which are weighted equally in the overall score. The 10 component scores measure different aspects of a healthy diet relative to current public health recommendations. The HEI scores used in this analysis were computed by NCHS staff, following USDA guidelines, and were included in a public-release data file (NCHS, 2000).

Six of the component scores are food-based and evaluate food consumption in comparison with USDA Food Guide Pyramid recommendations for intake of grains, vegetables, fruits, dairy, and meat, as well as the level of variety in the diet (USDA, CNPP, 1996). Four component scores are nutrient-based and assess compliance with *Dietary Guidelines for Americans* recommendations for daily intake of fat, saturated fat, cholesterol, and sodium (USDA and U.S. DHHS, 2000).[1] The specific reference standards used for each HEI component are described in the following discussions and are listed in appendix B. The appendix also provides technical details about how food consumption data needed to estimate HEI scores were derived from the NHANES-III 24-hour recall data.

The HEI data are based on the single 24-hour recall collected in NHANES-III. It was not possible to develop HEI scores that reflect usual intakes, as was done for the nutrients assessed in the preceding chapter. There were two major impediments to such an analysis. First, the HEI scoring algorithm is applied at the *individual* level but the adjustment technique used to generate estimates of usual nutrient intakes adjusts *distributions* rather than individual observations (see appendix C). Second, the HEI includes six food-based components and it is not possible to generate estimates of usual food intake (as opposed to usual nutrient intake) because distributions of daily food intake tend to be highly skewed and to include a large proportion of zeros (Dodd, 2001).

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[1]When the HEI was first developed, the standards for cholesterol and sodium were based on recommendations made in the NRC's *Diet and Health* report (NRC, 1989b) because the version of the *Dietary Guidelines* in effect at the time did not include quantitative standards for these nutrients (USDA and U.S. DHHS, 1995). Since that time, the NRC standards for sodium and cholesterol have been incorporated into both the Nutrition Facts section of food labels and the most recent version of the *Dietary Guidelines* (USDA and U.S. DHHS, 2000).

Although it was not possible to incorporate information on usual nutrient intakes into HEI scores, usual intake distributions were estimated for the nutrients considered in the HEI. These include the percentage of food energy (calories) from fat and saturated fat as well as total intakes of cholesterol and sodium. In addition, a separate analysis was conducted to compare HEI data and usual intake data on estimates of the percentage of school-age children who consumed diets consistent with the various reference standards.

Because of the large number of variables examined and the additional comparisons (HEI estimates vs. usual intake estimates) presented in this chapter, the text discussion is generally limited to significant findings for the aggregate analysis (all school-age children) and the gender-specific analyses. Information about significant between-group differences that may have been observed only for specific gender- and/or age-groups may be found in the detailed appendix tables referenced throughout the text.
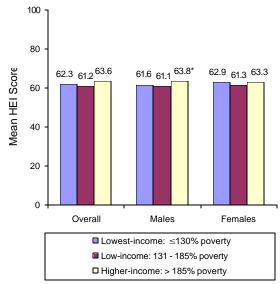
Total HEI Scores

On average, school-age children scored 62.8, out of a possible 100, on the HEI (table D-34). There were no significant differences in overall mean HEI scores of the three income groups (62.3 vs. 61.2 and 63.6) (figure 16).

Among males, the mean HEI score for the lowest-income group was significantly lower than the mean HEI score for the higher-income group (61.6 vs. 63.8). There were no significant between-group differences for females.

Researchers at CNPP have defined cutoffs that can be used to interpret what HEI scores say about overall diet quality (Basiotis et al., 2002). Total HEI scores over 80 imply a "good" diet. Scores between 51 and 80 indicate a "need for improvement." And scores below 51 are indica-tive of a "poor" diet. Using these criteria, a
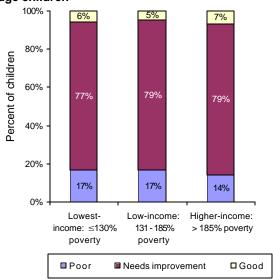
Figure 16—Mean Healthy Eating Index (HEI) scores: School-age children

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

majority of school-age children needed to make improvements in their diets. Overall, 78 percent of school-age children showed a need for improvement (table D-35). Only 6 percent of all school-age children had "good" diets and 16 percent had "poor" diets. This pattern was observed for all three income groups (figure 17).

Figure 17—Distribution of total HEI scores: School-age children

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

This general pattern was also observed for both males and females. However, among males, the lowest-income group was more likely than the higher-income group to have a "poor" diet (18% vs. 12%) (table D-35). In the lowest-income group, more males had poor diets than females (18% vs. 16%). In the other two income groups, the trend was reversed, with a greater percentage of females than males having "poor" diets (18% vs. 16% for the low-income group and 16% vs. 12% for the higher-income group) (statistical significance of gender-based differences not tested).

Food-based Component Scores

Standards for the food-based HEI component scores reflect daily goals for consumption of foods from each of the five food groups specified in the Food Guide Pyramid (USDA, CNPP, 1996). Serving guidelines are associated with recommended energy intake and vary by age and gender. For school-age children, the recommended numbers of daily servings range as follows:

- Grains: 7-11 servings
- Vegetables: 3.3-5 servings
- Fruits: 2.3-4 servings
- Milk: 2-3 servings
- Meat: 2.1-2.8 servings[2]

Specific recommendations for each age-and-gender group are shown in appendix B.

The HEI also includes a food-based score for dietary variety. Although the need for variety in the diet is a theme in all major public health nutrition guidelines, there are no specific quantitative recommendations. For purposes of the HEI, dietary variety is assessed by totaling the number of different types of food a person

consumes in a day. Similar foods are grouped together and tabulations consider only food components that contribute at least one-half serving toward any food group. Fats, sweets, seasonings, and similar foods are not included (NCHS, 2000). A perfect score of 10 is assigned when a person consumes at least one-half serving of eight different foods.
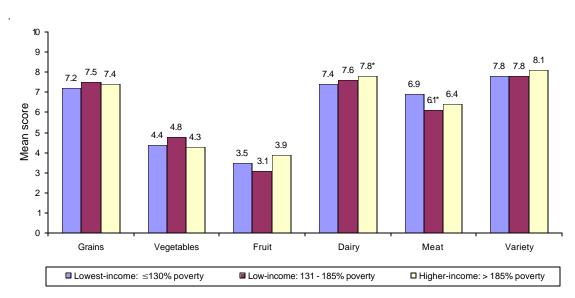
Males

Data on food-based HEI component scores (tables D-36 to D-41) indicate that the food consumption goals that presented the most difficulty for school-age males were the goals for fruit and vegetables. Mean scores for the fruit component ranged from 3.5 to 3.9, compared with a perfect score of 10 (figure 18), and less than 20 percent of school-age males in each income group met the HEI standard for fruit (consumed the recommended number of servings) (figure 19). Mean scores for the vegetable component were somewhat higher (4.3 to 4.8); however, the percentage of school-age males who consumed the recommended number of vegetable servings was less than 15 percent for each of the three income groups (figures 18 and 19).

The food consumption goals that were the least problematic for school-age males, although there was still room for improvement, were the goals for dairy foods and dietary variety. Mean scores for these components ranged from 7.4 to 8.1 (figure 18). In addition, in all three income groups, the percentage of school-age males who met the HEI standard was notably higher for these components than for the four other food-based HEI components (figure 19). Forty-five percent or more of school-age males in each income group met the HEI standards for dairy foods and dietary variety.

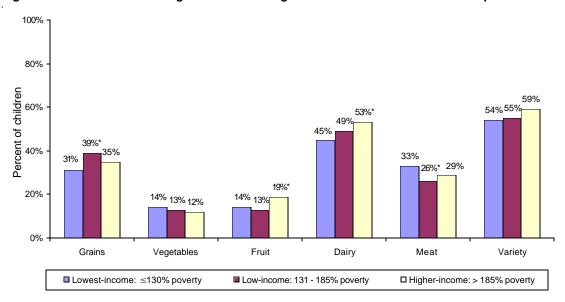There were relatively few statistically significant differences between income groups in mean

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[2] One serving of meat is equivalent to 2.5 ounces of lean meat.

Figure 18—Mean scores for HEI food-based components: School-age males

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

Figure 19—Percent of school-age children meeting HEI standards for food-based components: Males

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

scores for food-based HEI components or in the percentage of school-age males who met the various HEI standards (figures 18 and 19). School-age males in the lowest-income group had a significantly lower mean score for the dairy component than school-age males in the higher-income group (7.4 vs. 7.8) and were significantly less likely to consume the recommended number of dairy servings (45% vs. 53%). Males in the lowest-income group also had a significantly *higher* mean score for the meat component than males in the low-income group (6.9 vs. 6.1) and were significantly *more* likely to consume the recommended number of meat servings (33% vs. 26%). In addition, males in the lowest-income group were less likely than males in the low-income group to consume the recommended number of grain servings (31% vs. 39%) and were less likely than males in the higher-income group to consume the recommended number of fruit servings (14% vs. 19%).

Data on the mean number of servings consumed from each food group (tables D-36 to D-40) reveal that, among school-age males, there were no significant differences between the lowest-income group and the low-income group in the mean number of servings consumed from the five major Food Pyramid food groups. In comparison with the higher-income group, however, males in the lowest-income group consumed almost three quarters of a serving (0.7 serving) less grains per day and about a third of a serving less fruit.

Females

Goals for fruit and vegetable consumption also proved to be the most challenging goals for school-age females (tables D-36 to D-41). Mean scores for the fruit component ranged from 3.2 to 4.0 (figure 20), and less than 20 percent of school-age females in each income group consumed the recommended number of fruit
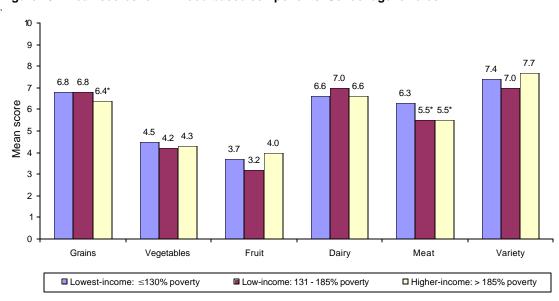
servings (figure 21). Similar to the pattern observed for males, mean scores for the vegetable component were somewhat higher (4.2 to 4.5), but less than 15 percent of the school-age females in each income group consumed the recommended number of vegetable servings (figures 20 and 21).

Although there was still room for improvement, the food consumption goal that was the least problematic for school-age females was the goal for dietary variety. Mean scores for this components ranged from 7.4 to 7.7 (figure 20). In addition, in all three income groups, the percentage of school-age females who met the HEI standard for dietary variety was higher than for any of the five other food-based components, approximating or exceeding 45 percent (figure 21).

Among school-age females, there were relatively few statistically significant differences between income groups in either mean food-based component scores or in the percentage of individuals meeting the various food-based HEI standards (figures 20 and 21). Females in the lowest-income group had significantly higher mean scores than females in the higher-income group for the grain component (6.8 vs. 6.4) and the meat component (6.3 vs. 5.5). For the meat component, the difference in mean scores of the lowest-income and low-income groups was also statistically significant (6.3 vs. 5.5). In addition, school-age females in the lowest-income group were more likely than their counterparts in the higher-income group to consume the recommended number of servings of both grains (23% vs. 16%) and meat (27% vs. 20%).
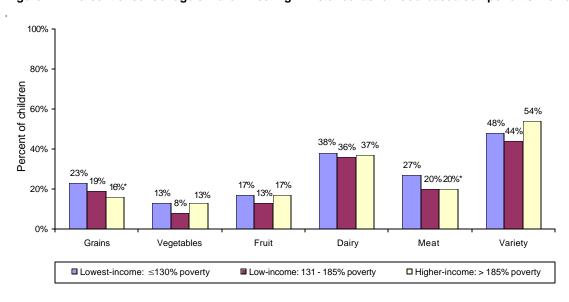
Data on the mean number of servings consumed from each food group (tables D-36 to D-40) reveal that, among school-age females, the lowest-income group consumed about a half of a serving more grains than the higher-income

Figure 20—Mean scores for HEI food-based components: School-age females

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

Figure 21—Percent of school-age children meeting HEI standards for food-based components: Females

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

group and about a third of a serving more fruit than the low-income group.

Nutrient-based Component Scores

The four nutrient-based HEI component scores assess nutritional quality on the basis of how well individuals' diets conform to recommendations for intake of total fat, saturated fat, cholesterol, and sodium. The standards used in making these assessments are based on recommendations included in the *Dietary Guidelines for Americans* (USDA and U.S. DHHS, 2000).[3] The standards for total fat, saturated fat, and sodium are also included in the *Healthy People 2010* objectives (U.S. DHHS, 2000a). Standards for total fat and saturated fat are no more than 30 percent of total energy and less than 10 percent of total energy, respectively. The standard for cholesterol is a maximum of 300 mg. and the standard for sodium is a maximum of 2,400 mg.

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[3]As noted previously, HEI standards for cholesterol and sodium were initially based on recommendations made in the NRC's *Diet and Health* report (NRC, 1989b). These recommendations have subsequently been incorporated into the Nutrition Facts section on food labels and the most recent version of the *Dietary Guidelines* (USDA and U.S. DHHS, 2000).

Since the time HEI scores were computed by NCHS staff and the tabulations presented in this report were prepared, new reference standards have been established for fat (IOM, 2002b) and sodium (IOM, 2004) intake. These new standards are discussed in the text that follows. The IOM report in which the new standard for fat intake is defined also discusses intake of saturated fat and cholesterol, but does not define specific standards for intake of these dietary components.

Among school age children overall, there were few significant differences between the three income groups on mean scores for the nutrient-based components of the HEI (figure 22 and tables D-42-45). The only difference that was statistically significant, overall, was a difference in the mean score for the total fat component. School-age children in the lowest-income group had a significantly lower mean score for this component than school-age children in the higher-income group (6.5 vs. 6.9).

In the gender-specific analyses, this difference was observed for males (6.4 vs. 7.1), but not for females (6.7 vs. 6.8) (table D-42). Among
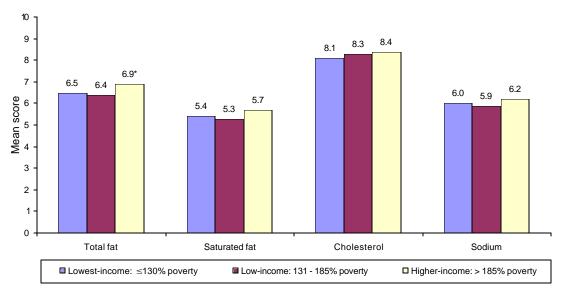
Figure 22—Mean scores for HEI nutrient-based components: School-age children

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

school-age males, a significant difference between the lowest-income and higher-income groups was also observed for the mean HEI score for saturated fat (5.2 vs. 5.7) (table D-43). Among school-age females, significant differences were observed between the lowest-income and low-income groups for the cholesterol score (8.5 vs. 9.1) and between the lowest-income and higher-income groups for the sodium score (6.7 vs. 7.3).

Percentage of School-Age Children Meeting Standards for HEI Nutrients: Usual Intakes vs. 24-hour Intakes

As noted in the introduction to this chapter, usual intakes of fat, saturated fat, cholesterol, and sodium were estimated, as described in Chapter Two and appendix C, even though these data could not be incorporated into HEI scores. The following sections describe findings from the usual intake analyses, particularly with respect to estimates of the percentages of school-age children who satisfied the *Dietary Guidelines* recommendations considered in the HEI. These findings are contrasted with those from the HEI analysis. Estimates based on the usual intake analyses are more reliable than those available from the HEI because the former have been adjusted to remove within-person variation (see appendix C).

Percent of Energy from Total Fat

The diets usually consumed by school-age children were high in fat, compared with the *Dietary Guidelines* recommendation that fat provide no more than 30 percent of total food energy (calories). On average, fat contributed 33.6 percent of the energy consumed by school-age children (table D-46).
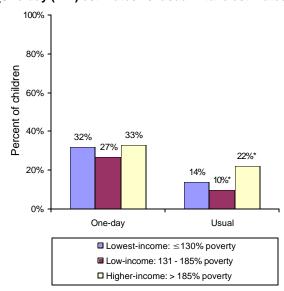
Overall, there was no difference between the lowest-income group and the low-income group in the mean percentage of energy provided by fat. However, in comparison with the higher-

income group, school-age children in the lowest-income group obtained a significantly greater percentage of energy from fat (34.0% vs. 33.0%).

This pattern was observed for males, but not for females. Among school-age females, the lowest-income group obtained a significantly *smaller* percentage of energy from fat than females in the low-income group (33.6% vs. 34.7%) and the difference between the lowest-income and higher-income groups was not statistically significant.

According to the HEI data, which are based on a single 24-hour recall, between 27 and 33 percent of school-age children in each of the three income groups consumed diets that were consistent with the *Dietary Guidelines* recommendation for fat intake (figure 23 and table D-42). The more reliable estimates of usual fat intakes indicate that the percentage of children who met the *Dietary Guidelines* recommenda-

Figure 23—Percent of school-age children meeting *Dietary Guidelines* recommendation for total fat: One-day (HEI) estimates vs. usual intake estimates

*Statistically significant difference from lowest-income group at the .05 level or better.
Note: *Dietary Guidelines* recommendation has been replaced by AMDR (see text and appendix B).
Source: NHANES-III, 1988-94.

tion for fat was actually much lower, ranging from 10 to 22 percent (figure 23 and table D-47).

According to the HEI data, there were no significant differences between the lowest-income group and either of the other income groups in the percentage of school-age children who satisfied the *Dietary Guidelines* recommendation for fat (figure 23 and table D-42). In contrast, the more reliable estimates of usual intakes indicate that school-age children in the lowest-income group were *more* likely than children in the low-income group and *less* likely than children in the higher-income group to satisfy the *Dietary Guidelines* recommendation for fat intake (figure 23 and table D-47). Overall, 14 percent of school-age children in the lowest-income group had usual intakes that were consistent with the *Dietary Guidelines* recommendation for fat, compared with 10 percent of school-age children in the low-income group and 22 percent of school-age children in the higher-income group. The difference between the lowest-income group and the low-income group was primarily attributable to a difference among females, and the difference between the lowest-income group and the higher-income group was primarily attributable to a difference among males (table D-47).

As mentioned in the introduction to this section, a new reference standard has been established for fat intake since the time HEI scores were computed by NCHS staff and the tabulations presented in this report were prepared. This standard, referred to as an Acceptable Macronutrient Distribution Range (AMDR), defines a range of acceptable intakes for different life-stage groups. For children 4-18 years, the AMDR for fat is 25-35 percent of total energy (IOM, 2002b). By comparison, the *Dietary Guidelines* recommendation (no more than 30% of energy from fat) defines a more stringent

upper bound for fat intake and does not define a lower bound.

Mean usual fat intakes of all three income groups fell within the AMDR (table D-46). This was true for both males and females. Distributions of usual fat intake provide some information about the percentage of school-age children whose usual fat intakes were consistent with the AMDR. The data suggest that usual intakes that fell outside the AMDR tended to be higher than the recommended range rather than lower. For all school-age children, the 5th percentile of the distribution of usual fat intake was 27.2 percent of total energy, compared with the AMDR lower bound of 25 percent, while the 50th and 75th percentiles were 33.6 percent and 36.2 percent, respectively, compared with the AMDR upper bound of 35 percent (table D-48). This indicates that, overall, somewhere between 25 and 50 percent of school-age children had usual fat intakes that exceeded the AMDR. This general pattern was observed for both males and females.

There were relatively few statistically significant differences between income groups in the distribution of usual fat intakes. The distributions suggest, however, that school-age males in the lowest-income group may be less likely to satisfy the AMDR for total fat than school-age males in the higher-income group. At the 75th percentile, usual fat intakes of the two groups were 36.9 percent of total energy and 34.9 percent, respectively.

Percent of Energy from Saturated Fat

On average, the usual diets consumed by school-age children provided 12.1 percent of food energy from saturated fat (table D-49).[4] This exceeds the *Dietary Guidelines* recommenda-
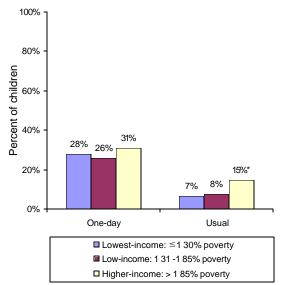
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[4]The full distribution of usual saturated fat intakes (as a percent of usual energy intake) is presented in table D-51.

tion of less than 10 percent. Means were comparable for males and females.

Mean usual saturated fat intakes of school-age children in all three income groups exceeded the *Dietary Guidelines* recommendation. There was no significant difference between the lowest-income group and the low-income group in usual saturated fat intake. In comparison with the higher-income group, however, school-age children in the lowest-income group consumed significantly more energy from saturated fat (12.3% vs. 11.9%). These patterns were observed for both males and females.

According to the single-day recall used to compute HEI scores, the percentage of school-age children who satisfied the *Dietary Guidelines* recommendation for saturated fat intake ranged from a high of 31 percent for the higher-income group to a low of 26 percent for the low-income group, and neither of the tested between-group differences was statistically significant (figure 24 and table D-43). The more

Figure 24—Percent of school-age children meeting *Dietary Guidelines* recommendation for saturated fat: One-day (HEI) estimates vs. usual intake estimates

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

reliable estimates of usual dietary intake indicate that the percentage of children who satisfied the recommendation for saturated fat intake was actually substantially lower, ranging from 7 to 15 percent (figure 24 and table D-50).

There was no significant difference between the lowest-income group and the low-income group in the percentage of children whose usual intakes satisfied the *Dietary Guidelines* recommendation for saturated fat. In comparison with the higher-income group, however, school-age children in the lowest-income group were significantly less likely to satisfy the *Dietary* Guidelines recommendation. In fact, the percentage of higher-income children who satisfied the recommendation for saturated fat intake was more than double the percentage of lowest-income children (15% vs. 7%). These patterns were observed for both males and females (table D-50).
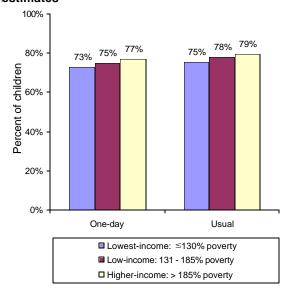
Cholesterol

The *Dietary Guidelines* recommend a maximum of 300 mg. of cholesterol per day. On average, the diets usually consumed by school-age children were consistent with this recommendation, providing 245 mg. of cholesterol per day (table D-52).[5] School-age children in the lowest-income group consumed significantly more cholesterol, on average, than children in the higher-income group (254 mg. per day vs. 236 mg.). This pattern was noted for both males and females.

The HEI data and the usual intake data lead to comparable conclusions about the percentage of school-age children who satisfied the *Dietary Guidelines* recommendation for cholesterol. Both data sets showed that more than 70 percent of children in each of the three income groups met the recommendation (figure 25 and

[5]The full distribution of usual cholesterol intakes is presented in table D-54.

Figure 25—Percent of school-age children meeting *Dietary Guidelines* **recommendation for cholesterol: One-day (HEI) estimates vs. usual intake estimates**

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

tables D-44 and D-53). Both data sets also showed that, overall, there were no significant between-group differences in the percentage of school-age children who satisfied the recommendation for cholesterol.

When the data were examined separately by gender, the HEI data indicated that females in the lowest-income group were significantly less likely than females in the low-income group to satisfy the recommendation for cholesterol intake (78% vs. 87%) (table D-44). The more reliable estimates of usual intake showed that there were no significant differences between the lowest-income and low-income groups on this measure (for males or for females) (table D-53). However, the usual intake estimates showed that both males and females in the lowest-income group were significantly less likely than their higher-income counterparts to satisfy the recommendation for cholesterol intake (table D-53).
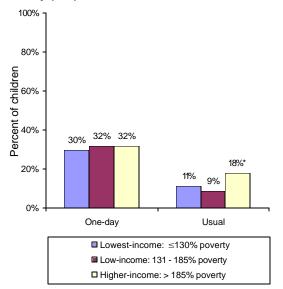
Sodium

The *Dietary Guidelines* recommend that daily intake of sodium not exceed 2,400 mg. On average, the usual diets of school-age children exceeded this goal. The mean usual intake of sodium among school-age children was 3,456 mg. (table D-55). Usual intakes were greater for males than for females; however, mean intakes of both genders exceeded the standard (statistical significance of gender-based difference not tested).

Overall, there were no significant between-group differences in mean usual sodium intake. Some significant between-group differences were detected in the gender-specific analyses; however, means for all subgroups of school-age children exceeded the 2,400 mg. maximum. Among males, the mean usual sodium intake of the lowest-income group was significantly *lower* than the mean usual intake of the low-income group (3,761 mg. vs. 4,286 mg.). Among females, the difference observed between income groups ran in the opposite direction. Females in the lowest-income group consumed significantly *more* sodium, on average, than females in the higher-income group (3,195 mg. vs. 2,898 mg.).

According to the single-day HEI data, between 30 and 32 percent of school-age children in the three income groups satisfied the *Dietary Guidelines* recommendation for sodium intake, and there were no significant between-group differences (figure 26 and table D-45). Estimates of usual sodium intake indicate that the percentage of school-age children who satisfied the recommendation for sodium was substantially lower, ranging from 9 percent to 18 percent (figure 26 and table D-56).

Moreover, the data on usual intakes indicate that school-age children in the lowest-income group were significantly less likely than school-age

Figure 26—Percent of school-age children meeting _Dietary Guidelines_ recommendation for sodium: One-day (HEI) estimates vs. usual intake estimates

*Statistically significant difference from lowest-income group at the .05 level or better.

Note: _Dietary Guidelines_ recommendation has been replaced by UL (see text and appendix B).

Source: NHANES-III, 1988-94.

children in the higher-income group to consume the recommended amount of sodium (11% vs. 18%). This pattern was observed for both males and females. Among school-age females, the lowest-income group was _more_ likely than the low-income group to satisfy the standard for sodium (14% vs. 5%).

As noted previously, new reference standards have been established for sodium intake since the time HEI scores were computed by NCHS staff and the tabulations presented in this report were prepared. Standards have been defined for both Adequate Intake (AI) and the Tolerable Upper Intake Level (UL) (IOM, 2004). Given that the major concern about sodium is the potential for excess consumption, the standard of greatest interest for this analysis is the UL.[6]

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[1]The AI for sodium is 1,200 mg. (1.2 gm.) for children 4-8 years and 1,500 mg. (1.5 gm.) for children 9-18 years. Given the mean usual intakes of sodium described in the text and shown in table D-55, sodium intakes of all three groups of school-age children can be assumed to be "adequate."

The UL is the highest intake likely to pose no adverse health effects; chronic consumption above the UL may increase risk of adverse effects. In the case of sodium, the primary potential adverse effect is the development of high blood pressure (IOM, 2004). For school-age children, ULs for sodium are 1,900 mg (1.9 gm.) for 4-8-year-olds, 2,200 mg. (2.2 gm.) for 9-13-year-olds, and 2,300 mg. (2.3 gm.) for 14-18-year-olds. So, sodium ULs for school-age children are roughly 4 to 21 percent lower than the _Dietary Guidelines_ recommendation.

Detailed distributions of usual sodium intake indicate that less than 5 percent of 5-8-year-olds had sodium intakes that did not exceed the UL (usual sodium intake at the 5th percentile was 1,940 mg. compared with a UL of 1,900 mg.) (table D-57). Fewer than 10 percent of 9-13-year-olds and 14-18-year-olds had usual sodium intakes that satisfied their ULs (intakes at the 10th percentile were 2,381 mg. and 2,330 mg., respectively, compared with ULs of 2,200 mg. and 2,300 mg.).

The data suggest that, among 9-13-year-olds, the lowest-income group may be less likely than the higher-income group to meet the UL for sodium (intakes at the 5th percentile were 2,227 mg. and 2,042 mg., compared with a UL of 2,200 mg., and the difference was statistically significant). The same is true for 14-18-year-olds (intakes at the 10th percentile, which were significantly different, were 2,639 mg. and 2,155 mg. compared with a UL of 2,300 mg.).

It is important to note that NHANES-III estimates of sodium intake include only sodium found in foods and beverages reported by respondents. Sodium from table salt is not included in nutrient tabulations because its use can not be measured (estimated) reliably. To get some insight into additional sources of sodium, the NHANES-III dietary intake interview included a question about use of table salt.
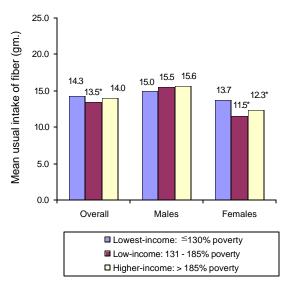
These data indicate that about half of all school-age children used salt (table D-58), and that there were no statistically significant differences between income groups in this behavior.

Usual Intake of Dietary Fiber

On average, the usual diets of school-age children provided approximately 14.1 gm. of dietary fiber (table D-59). Mean intakes were greater for males than for females and, for both genders, increased with age (statistical significance of gender- and age-based differences not tested).

The usual diets of school-age children in the lowest-income group provided significantly more dietary fiber than the usual diets of school-age children in the low-income group (14.3 gm. per day vs. 13.5 gm.) (figure 27). This difference was attributable to a difference among females (13.7 gm. vs. 11.5 gm.). Indeed, among females, the usual fiber intake of the lowest-income group was also significantly greater than the usual intake of the higher-income group (13.7 gm. vs. 12.3 gm.).

Figure 27—Mean usual intake of dietary fiber: School-age children

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

At the time the analyses presented in this report were completed, there was no established standard for intake of dietary fiber. To assess the adequacy of fiber intakes, the analysis used a standard referred to as the "age-plus-five rule." This standard, originally developed by Williams et al. (1995), was adapted by the American Heart Association (AHA) (Van Horn, 1997) and has been used in previous research (Gleason and Suitor, 2001). Recommended intake of dietary fiber (in gm.) is equivalent to age in years plus five, up to a maximum of 25 gm.

Less than half (46%) of all school-age children had usual intakes of dietary fiber that were consistent with this standard (table D-60). The difference between males and females on this measure was striking. Fifty-six percent of school-age males had usual intakes of dietary fiber that were consistent with the standard, compared with 36 percent of school-age females (statistical significance of gender-based difference not tested).

Overall, school-age children in the lowest-income group were significantly more likely to meet the "age-plus-five" standard for dietary fiber than school-age children in the low-income group (48% vs. 40%). There was no difference between the lowest-income group and the higher-income group in the aggregate analysis. In the gender-specific analyses, however, significant differences were detected for both income-group comparisons. Among males, school-age children in the lowest-income group were *less* likely than school-age children in either the low-income or the higher-income groups to meet the "age-plus-five" standard for dietary fiber (34% vs. 54% and 58%). Among females, the opposite was true. School-age females in the lowest-income group were *more* likely than school-age females in either of the other income groups to meet the "age-plus-five" standard (43% vs. 25% and 34%).

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Since this analysis was completed, AIs have been defined for fiber (IOM, 2002b). The AIs have been defined for *total* fiber, which includes dietary fiber as well fructo-oligosaccharides, compounds which are destroyed in the current analytic methods used to quantitate fiber in foods (IOM, 2002b). Although fructo-oligosaccharides are assumed to make up a relatively small percentage of total fiber, it is estimated that, on average, American adults consumed approximately 5.1 gm. more fiber per day than estimated in the most recent Continuing Survey of Food Intakes by Individuals (CSFII) because CSFII data, like the data used in this analysis, include only dietary fiber (IOM, 2002b).

Fiber AIs are shown in Appendix B. In comparison with the "age-plus-five" rule, AIs for school-age children are substantially higher. For example, for 5-8-year-olds, the AI for dietary fiber is 25 gm., compared with "age-plus-five" standards of 10 to 13 mg.

As noted in Chapter Two, AIs cannot be used to assess the prevalence of adequate intakes, so assessment of usual intakes must focus on comparison of mean intakes to gender-and-age appropriate AIs. Mean usual intakes of all gender-and-age-specific subgroups fall short of the new AIs (table D-59). Some of this disparity is due to the difference in fiber data (dietary fiber vs. total fiber). However, even if one were to assume that mean usual intakes of dietary fiber were actually 5 gm. higher (the average increment estimated for American adults, overall, to account for fructo-oligosaccharides, as described above; a generous assumption for these age groups), mean usual intakes of all gender-and-age-specific subgroups would still fall short of the AI.

The differences observed between income groups in mean usual intakes of dietary fiber are real, regardless of which reference standard is used. However, the advent of the AIs for fiber means that results of the analysis that compared usual intakes of dietary fiber to the "age-plus-five" reference standard must be interpreted with caution. These estimates cannot be interpreted as valid estimates of the percentage of school-age children consuming adequate amounts of dietary fiber.