Chapter Three

Healthy Eating Index Scores and Usual Intake of Dietary Fiber Among Children Ages 2 to 4

This chapter describes the nutritional quality of diets consumed by WIC participants and nonparticipants. 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. The analysis is limited to children between the ages of 2 and 4. Children under 2 are excluded because the HEI is designed to assess the nutritional quality of diets consumed by individuals 2 years of age and older.

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 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, choles-

terol, 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* (see appendix C) rather than individual observations. 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).

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)

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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).

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 2-4-year-old children who consumed diets consistent with the various reference standards.

Total HEI Scores

On average, 2-4-year-old children scored 70.4, out of a possible 100, on the HEI (table D-30). Mean scores were consistently greater for 2-year-olds than 4-year-olds (statistical significance of age-based differences not tested).

Mean HEI scores indicate that the diets consumed by WIC children were comparable in nutritional quality to those consumed by both income-eligible and higher-income nonparticipants. WIC children scored, on average, 69.7 on the 100-point scale, compared with 68.6 for income-eligible nonparticipants and 72.2 for higher-income nonparticipants (figure 9).

Figure 9 - Mean Healthy Eating Index (HEI) scores: 2-4-year-old children
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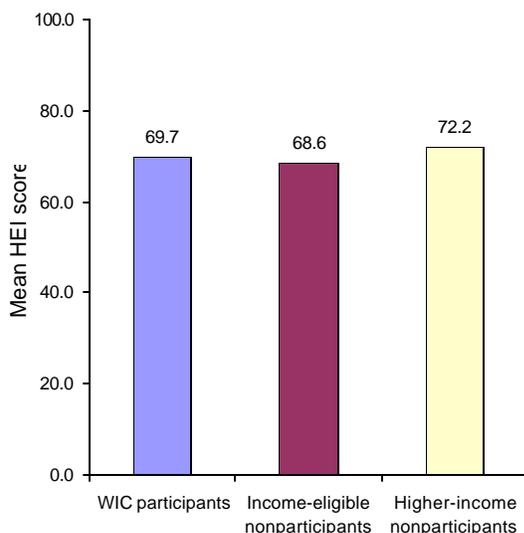
No statistically significant differences between WIC participants and either group of nonparticipants.
Source: NHANES-III, 1988-94.

Researchers at CNPP have defined cutoffs that can be used to interpret what HEI scores say about the overall quality of the diet (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 indicative of a "poor" diet. Using these criteria, a majority of 2-4-year-old children in all three groups needed to make improvements in their diets. Overall, 66 percent of children had HEI scores that indicated a need for improvement (table D-31). Slightly more than a quarter (26%) had "good" diets and 8 percent had "poor" diets. Diet quality decreased markedly with age. The percentage of 2-year-olds and 3-year-olds with good diets was substantially greater than the percentage of 4-year-olds with good diets (32% and 30% vs. 15%) (statistical significance of age-based differences not tested). Likewise, the percentage of 2-year-olds and 3-year-olds with poor diets was substantially lower than the percentages of 4-year-olds with poor diets (7% and 5% vs. 13%).

These general patterns were observed for all three groups of 2-4-year-old children (figure 10), and none of the differences between WIC participants and nonparticipants was statistically significant.

Food-based Component Scores

Standards for the food-based HEI component scores reflect daily goals for consumption of foods from each of the five good groups specified in the Food Guide Pyramid (USDA, CNPP, 1996). Serving guidelines are associated with recommended energy intake. For 2-4-year-old children, the recommended numbers of daily servings are:

- Grains: 6 servings for 2-3-year-olds and 7 servings for 4-year-olds

- Vegetables: 3 servings for 2-3-year-olds and 3.3 servings for 4-year-olds

20

Figure 10 - Distribution of total HEI scores: 2-4-year-old children
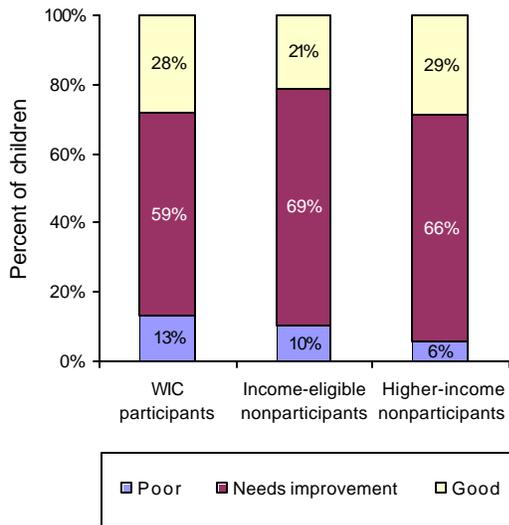
No statistically significant differences between WIC participants and either group of nonparticipants.
Source: NHANES-III, 1988-94.

- Fruits: 2 servings for 2-3-year-olds and 2.3 servings for 4-year-olds
- Milk: 2 servings for both 2-3-year-olds and 4-year-olds
- Meat: 2 servings for 2-3-year-olds and 2.1 servings for 4-year-olds [2]

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.

[2]One serving of meat is equivalent to 2.5 ounces of lean meat. Dried beans and peas, peanut butter, eggs, nuts, seeds, and tofu are also included in the meat group (see appendix B).

The food-based HEI component scores (tables D-32 to D-37) indicate that the food consumption goal that presented the greatest difficulty for 2-4-year-old children was the goal for vegetable consumption. Mean scores for the vegetable component ranged from 4.8 to 5.1, compared with a perfect score of 10, and less than one-quarter of the children in each group consumed the recommended number of vegetable servings (figures 11 and 12 and table D-33).

The food consumption goals that appeared to be the least problematic for 2-4-year-old children, although there was still room for improvement, were the goals for dairy foods and overall dietary variety. Mean scores for the dairy component ranged from 7.7 to 8.2 and the percentage of children in each group who consumed the recommended number of servings of dairy foods approximated or exceeded 50 percent (figures 11 and 12 and table D-35). Results for the variety component were equally positive. Mean scores for the variety component ranged from 7.3 to 7.8 and the percentage of individuals in each group who satisfied the HEI standard for dietary variety approximated or exceeded 50 percent (figures 11 and 12 and table D-37).

Overall, the only significant difference in food-based HEI component scores of WIC children and income-eligible nonparticipant children was observed for the fruit component. WIC children scored significantly higher on this component of the HEI than income-eligible children (6.4 vs. 5.3) (figure 11). This pattern was observed for all three age-specific cohorts, but the difference was not statistically significant for 2-year-olds (table D-34). Among 3-year-olds, WIC participants were also significantly more likely than income-eligible nonparticipants to consume the recommended number of fruit servings (58% vs. 42%) and to consume more fruit servings overall (3.2 servings vs. 2.1 servings). WIC food

Figure 11 - Mean scores for HEI food-based components: 2-4-year-old children
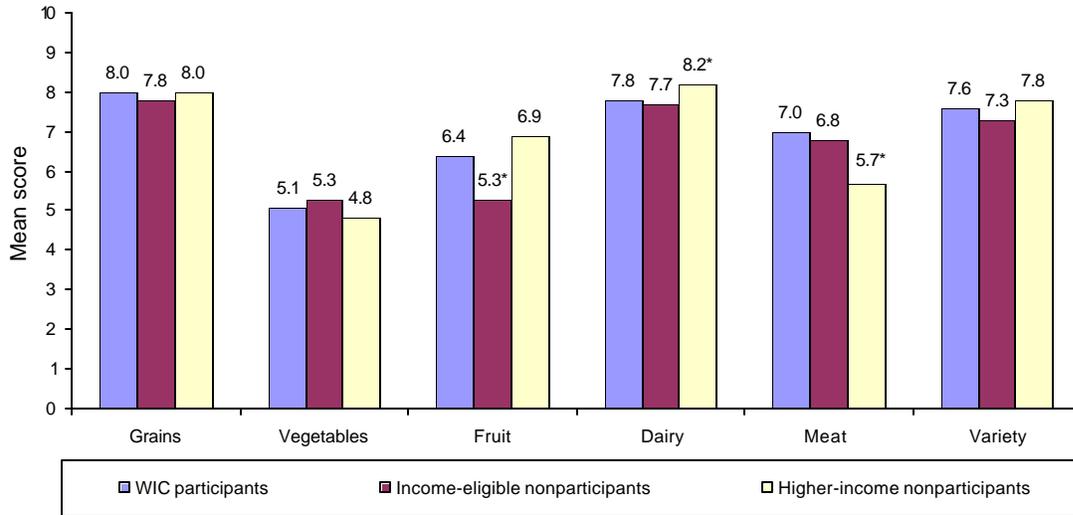
*Statistically significant difference from WIC participants at the .05 level or better.
Source: NHANES-III, 1988-94.

Figure 12 - Percent of 2-4-year-old children meeting HEI standards for food-based components
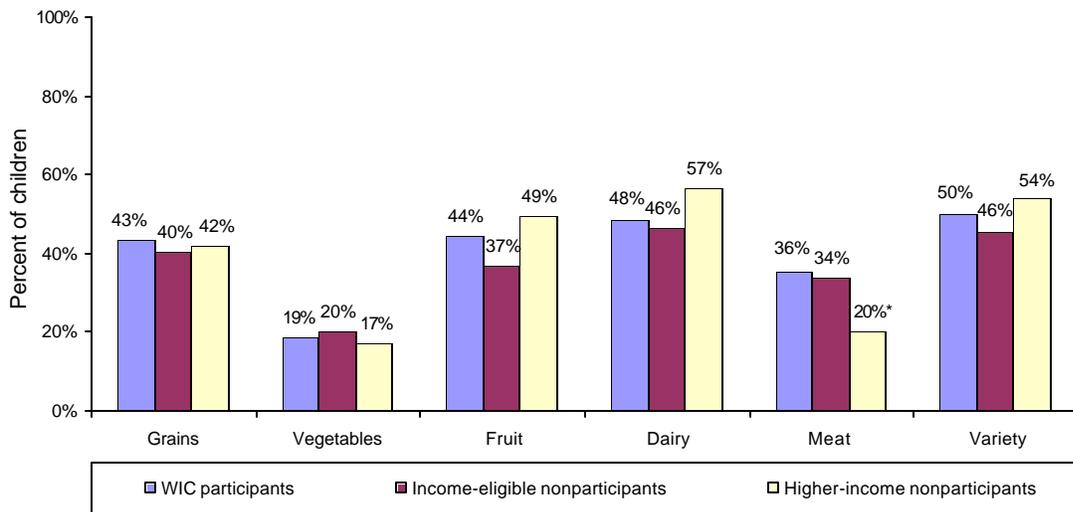
*Statistically significant difference from WIC participants at the .05 level or better.
Source: NHANES-III, 1988-94.

packages include 100% fruit juices, which are counted in the fruit component of the HEI.

In comparison with higher-income children, WIC children had significantly *lower* scores for the dairy component and significantly *higher* scores for the meat component (figure 11). The size of the difference in scores on the dairy component was relatively small (7.8 vs. 8.2) and was concentrated among 3-year-olds (table D-35). There was no significant difference between the two groups in the percentage of children who actually consumed the recommended number of dairy servings (figure 12).

The difference between WIC children and higher-income children in mean scores for the meat component was more substantial (7.0 vs. 5.7) (figure 11). Moreover, a significant difference was also observed in the percentage of children who consumed the recommended number of meat servings (36% vs. 20%) (figure 12) and in the mean number of meat servings consumed (1.7 servings vs. 1.3 servings) (table D-36). These patterns were observed for each of the three age-specific cohorts, but between-group differences were not always statistically significant. None of the differences were statistically significant for 4-year-olds. Among 3-year-olds, only the difference in mean HEI scores for the meat component was statistically significant. WIC food packages include eggs, peanut butter, and dried beans and peas—all foods that are considered in the meat component of the HEI.

Nutrient-based Component Scores

The four nutrient-based component scores of the HEI 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 less than 300 mg. and the standard for sodium is 2,400 mg.

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.

There were relatively few differences between 2-4-year-old WIC participants and either group of comparably aged nonparticipants on mean scores for the nutrient-based HEI components (figure 13 and tables D-38 to D-41). There were no significant differences between scores of WIC children and income-eligible nonparticipant children. In comparison with higher-income nonparticipant children, however, WIC children had significantly lower mean scores for the total fat component of the HEI (6.6 vs. 7.4), as well as for the cholesterol component (8.1 vs. 9.3). The difference in mean scores for the fat component was concentrated among 2-year-olds (table D-38). A significant difference in mean scores for the cholesterol component was observed for both 2-year-olds and 3-year-olds (table D-40).

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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*.

Figure 13 - Mean scores for HEI nutrient-based components: 2-4-year-old children
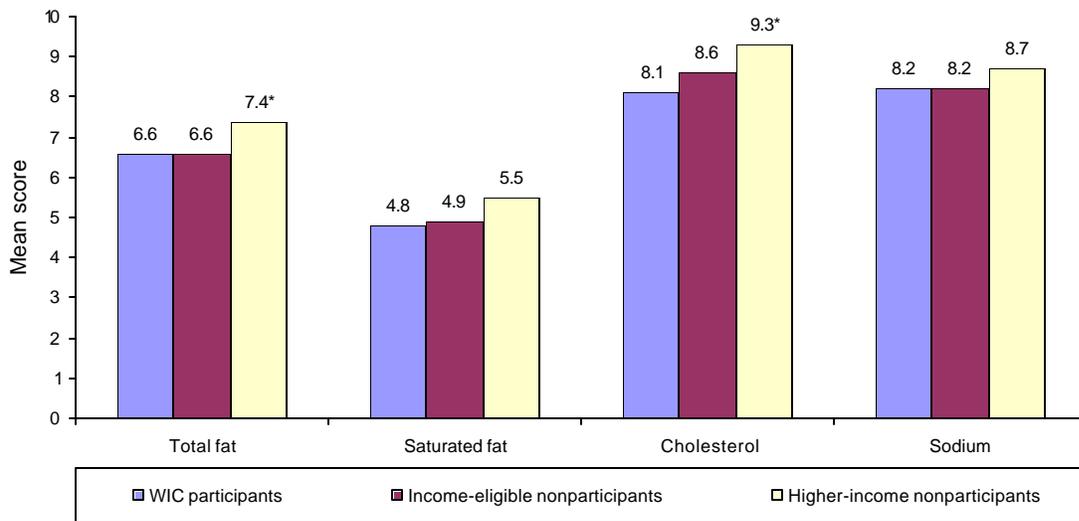
*Statistically significant difference from WIC participants at the .05 level or better.
Source: NHANES-III, 1988-94.

Percentage of 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 children who satisfied the *Dietary Guidelines* recommendations considered in the HEI. These findings are contrasted with those from the HEI analysis. Estimates based on 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

On average, the usual diets of 2-4-year-old children were high in fat compared with the *Dietary Guidelines* recommendation. Overall, children's usual diets provided 33 percent of energy from fat, compared with the *Dietary*

Guidelines recommendation of no more than 30 percent (table D-42). This was true for all three age-specific cohorts.

There was no significant difference between WIC children and income-eligible nonparticipant children in the percent of energy provided by fat (33.6% vs. 33.8%). In comparison with higher-income nonparticipant children, however, WIC children consumed a significantly greater amount of fat, relative to total energy intake (33.6% vs. 31.7%). This significant difference was noted for all three of the age-specific cohorts.

According to the HEI data, which are based on a single 24-hour recall, the percentage of 2-4-year-old children who satisfied the *Dietary Guidelines* recommendation for fat intake ranged from a low of 28 percent to a high of 41 percent (figure 14 and table D-38). Overall, there were no significant differences between WIC participants and either group of nonparticipants in this regard. Among 2-year-olds, however, WIC children were significantly less likely than higher-income nonparticipant children to consume the recommended amount of fat (27% of children vs. 46%) (table D-38).

Figure 14 - Percent of 2-4-year-old children meeting *Dietary Guidelines* recommendation for total fat: One-day (HEI) estimates vs. usual intake estimates
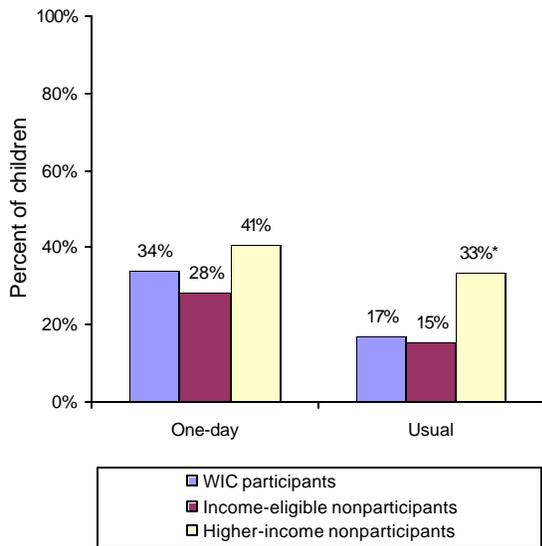
*Statistically significant difference from WIC participants at the .05 level or better.

Note: *Dietary Guidelines* recommendation has been replaced by AMDR (see text and appendix B).

Source: NHANES-III, 1988-94.

The more reliable estimates of usual intake indicate that the proportion of children who satisfied the *Dietary Guidelines* recommendation for fat intake was substantially lower than suggested by the HEI data. This was particularly true for WIC participants and income-eligible nonparticipants: fewer than 20 percent of children in these two groups had usual fat intakes that satisfied the recommendation (figure 14 and table D-43). Moreover, estimates of usual intake indicate that WIC children were significantly less likely than higher-income children to consume the recommended amount of fat (17% of children vs. 33%). This pattern was observed for all three age-specific cohorts, and between-group differences were statistically significant for 2-year-olds and 4-year-olds (table D-43).

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. The AMDR for fat is 30-40 percent of total energy for 2-3-year-olds and 25-35 percent of total energy for 4-year-olds. By comparison, the *Dietary Guidelines* recommendation (no more than 30% of energy from fat) defines a more stringent upper bound for fat intake, particularly for young children (who make up the majority of WIC children), and does not define a lower bound.

Mean usual fat intakes for all groups of children fell within defined AMDRs (table D-42). Distributions of usual intake provide some information about the percentage of children whose usual fat intakes were consistent with the AMDR. Among 2- and 3-year-olds (AMDR = 30-40 percent of total energy), usual intakes that fell outside the AMDR tended to be lower than the recommended range rather than higher. For these two age groups, the 25th percentiles of the distribution of usual fat intake were 29.9 and 30.4 percent of total energy intake, respectively, while the 95th percentiles were 39.8 and 39.6 percent, respectively (table D-44).

The situation was notably different for 4-year-olds, who have an AMDR of 25-35 percent of total energy. The data suggest that relatively few 4-year-olds had usual fat intakes that fell below the lower end of the AMDR. The 5th percentile of the distribution was 26.7 percent of total energy. In contrast, somewhere between 15 and 25 percent of 4-year-olds had usual fat intakes that exceeded the upper end of the AMDR (75th percentile = 34.9% and 85th percentile = 36.2%).

There were no significant differences between WIC children and income-eligible nonpartici-pant children in distributions of usual fat intake. In contrast, there were significant differences

between WIC children and higher-income nonparticipant children at every percentile of the distributions. Differences were concentrated among 2-year-olds and 4-year-olds and, in all cases, fat intakes of WIC children were significantly greater than those of higher-income nonparticipant children.

Among 2-year-olds, usual fat intakes of WIC participants were significantly greater than those of higher-income nonparticipants at the 25th, 50th, 75th, 85th, 90th, and 95th percentiles. At the 25th percentile, the usual fat intake of WIC participants fell within the AMDR, while the usual intake of higher-income nonparticipants was below the AMDR (30.8% and 28.6%, respectively, vs. AMDR of 30-40%). At the 95th percentile, the opposite was true. At this end of the distribution, the usual fat intake of WIC participants exceeded the AMDR, while the usual intake of higher-income nonparticipants fell within the acceptable range (40.6% vs. 38.0%).

Among 4-year-olds, usual fat intakes of WIC participants were significantly greater than those of higher-income nonparticipants at the 5th, 10th, 15th, and 25th percentiles. In all cases, however, intakes of both groups fell within the AMDR.

**Percent of Energy from Saturated Fat**

On average, the usual diets of WIC children and both groups of nonparticipant children exceeded the *Dietary Guidelines* recommendation of less than 10 percent of energy from saturated fat.[4] In all three groups, saturated fat contributed an average of 12-13 percent of total energy (table D-45). WIC children consumed significantly more saturated fat, on average, than nonparticipating children in the higher-income group (12.9% vs. 12.1%). This pattern was observed for all three age-specific cohorts and the be-

tween-group difference was statistically significant for both 2-year-olds and 4-year-olds.

According to the single-day recall used to compute HEI scores, the percentage of children who satisfied the *Dietary Guidelines* recommendation for saturated fat intake varied from 21 percent to 32 percent, and there were no statistically significant differences between WIC children and either group of nonparticipant children (figure 15 and table D-39). The more reliable estimates of usual intake indicate that the proportion of children who satisfied the recommendation for saturated fat intake was actually quite a bit lower, ranging from a low of 6 percent to a high of 17 percent (figure 15 and table D-46). In addition, WIC children were significantly less likely than higher-income children to consume the recommended amount of saturated fat (6% of children vs. 17%). This difference was noted for all three age-specific cohorts.

Figure 15 - Percent of 2-4-year-old children meeting *Dietary Guidelines* recommendation for saturated fat: One-day (HEI) estimates vs. usual intake estimates
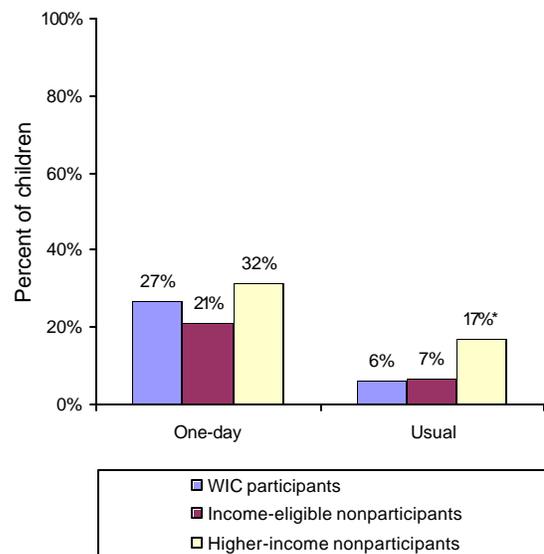
*Statistically significant difference from WIC participants at the .05 level or better.
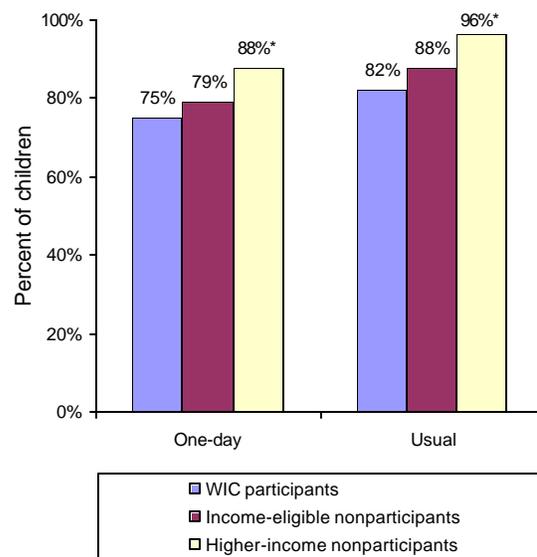Source: NHANES-III, 1988-94.

Cholesterol

The *Dietary Guidelines* recommend that cholesterol intake not exceed 300 mg. per day. Mean usual cholesterol intakes of all three groups of children were consistent with this goal (table D-48).[5] However, the usual diets of WIC children provided significantly more cholesterol than the usual diets of children in either of the nonparticipant groups (231 mg. vs. 208 mg. and 166 mg.). The difference between WIC children and income-eligible children was concentrated among 2-year-olds. The difference between WIC children and higher-income children was observed for all three age-specific cohorts.

The HEI data and usual intake data lead to relatively comparable conclusions about the proportion of children who satisfied the recommendation for cholesterol intake. Both datasets indicate that 75 percent or more of the children in all three groups met the recommendation for cholesterol intake (figure 16 and tables D-40 and D-49). Moreover, both datasets indicate that WIC children were significantly less likely than higher-income children to meet the recommendation. According to the usual intake data, 82 percent of WIC children met the *Dietary Guidelines* recommendation for cholesterol intake, compared with 96 percent of higher-income children.

Sodium

The *Dietary Guidelines* recommend a maximum daily sodium intake of 2,400 mg. On average, usual sodium intakes of all three groups of children came close to this goal, but only higher-income children actually met it (table D-51). The mean usual sodium intake of WIC children was 2,513 mg. compared with 2,460 mg. for income-eligible nonparticipant children and 2,277 mg. for higher-income children. The

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[5]The full distribution of usual cholesterol intakes is presented in table D-50.

Figure 16 - Percent of 2-4-year-old children meeting *Dietary Guidelines* recommendation for cholesterol: One-day (HEI) estimates vs. usual intake estimates
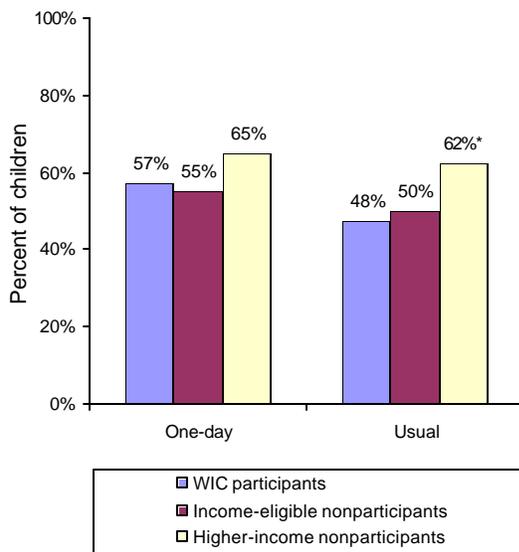

*Statistically significant difference from WIC participants at the .05 level or better.
Source: NHANES-III, 1988-94.

difference between WIC children and higher-income children was statistically significant. This pattern was observed for all three age-specific cohorts, and the between-group difference was statistically significant for 2-year-olds and 3-year-olds.

The HEI data indicate that 55 to 65 percent of children satisfied the *Dietary Guidelines* recommendation for sodium, and that WIC children were no more or less likely than nonparticipant children to meet this goal (figure 17 and table D-41). Data on usual sodium intakes indicate that the percentage of children who satisfied the recommendation for sodium was actually lower, in all three groups, than suggested by the HEI data. The usual intake data also indicate that WIC children were significantly less likely than higher-income children to satisfy the recommendation for sodium (figure 17 and table D-52). Fewer than half (48%) of WIC children had usual sodium intakes that were consistent with the *Dietary Guidelines* recommendation, compared with 62 percent of higher-income

Figure 17 - Percent of 2-4-year-old children meeting *Dietary Guidelines* recommendation for sodium: One-day (HEI) estimates vs. usual intake estimates

*Statistically significant difference from WIC participants 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 keeping with previously noted differences in mean usual sodium intakes, this pattern was observed for all three age-specific cohorts and the between-group difference was statistically significant for 2-year-olds and 3-year-olds.

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]

[4]The AI is 1,000 mg. (1.0 gm.) for 2-3-year-olds and 1,200 mg. (1.2 gm.) for 4-year-olds. Given the mean usual intakes of sodium described in the preceding text and shown in table D-51, sodium intakes of all three groups of 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 adverse effects. In the case of sodium, the primary potential adverse effect is the development of high blood pressure (IOM, 2004). The UL for sodium has been set at 1,500 mg. (1.5 gm.) for 2-3-year-olds and 1,900 mg. (1.9 gm.) for 4-year-olds. Thus, the UL is notably more stringent than the *Dietary Guidelines* recommendation, particularly for the youngest children (who make up the majority of WIC participant children).

Mean usual sodium intakes of all three groups of children, as described previously and shown in table D-51, exceeded the UL by a substantial margin. Moreover, detailed distributions of usual sodium intake indicate that few children consumed diets that did not exceed the UL (table D-53). For 2-year-olds (UL = 1,500 mg), usual sodium intake was 1,450 mg. at the 10th percentile of the distribution and 1,559 mg at the 15th percentile. For 3-year-olds, who have the same UL as 2-year-olds, usual intake was 1,472 mg. at the 5th percentile and 1,637 mg. at the 10th percentile. Finally, for 4-year-olds, who have a higher UL (1,900 mg.), usual sodium intake was 1,808 mg. at the 10th percentile and 1,926 mg. at the 15th percentile.

There were few significant differences in the distributions of usual sodium intake of WIC children and income-eligible nonparticipant children. Among 2-year-olds, there were significant differences at the 5th, 10th, and 15th percentiles, and in each case, intake was greater for WIC participants than income-eligible nonparticipants. The difference at the 15th percentile (1,559 mg. vs. 1,505 mg.) suggests that the percentage of 2-year-olds with usual intakes consistent with the UL for sodium may be greater for income-eligible nonparticipants than for WIC participants.

Significant differences in usual sodium intakes of WIC children and higher-income children were noted at every percentile of the distribution. In all cases, usual intake was greater for WIC children. Differences were concentrated among 3-year-olds. In this group, the difference in usual intakes at the 10th percentile (1,637 mg. vs. 1,584 mg.) suggests that a greater proportion of higher-income children than WIC children may consume diets that are consistent with the sodium UL.

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 calculations because its use cannot 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, overall, there were no significant differences between WIC children

and either group of nonparticipant children in the use of table salt (table D-54).

Among 2-year-olds, however, WIC children were significantly more likely to use table salt than either group of nonparticipant children (37% vs. 26% and 19%). Therefore, actual between-group differences in usual sodium intake are likely to be greater for this age group than observed in the preceding analysis.

Usual Intake of Dietary Fiber

On average, 2-4-year-old children usually consumed 10.5 gm. of dietary fiber per day (table D-55).[7] Overall, there were no significant differences between WIC participants and either group of nonparticipants in mean usual intake of dietary fiber (figure 18). However, among 2-year-olds, WIC participants consumed significantly *more* dietary fiber per day than income-eligible nonparticipants (10.5 gm. vs. 9.6 gm.). In contrast, among 4-year-olds, WIC participants consumed significantly *less* dietary fiber per day than income-eligible nonparticipants (10.3 gm. vs. 12.0 gm.).

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[5]The full distribution of usual fiber intakes is presented in table D-57.

Figure 18 - Mean usual intake of dietary fiber: 2-4-year-old children
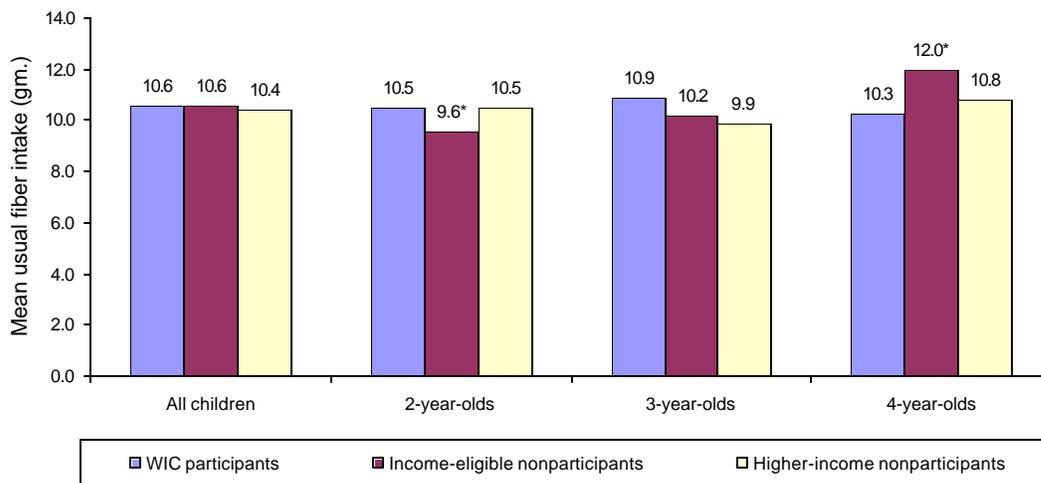
*Statistically significant difference from WIC participants at the .05 level or better.
Source: NHANES-III, 1988-94.

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). Using the "age-plus-five rule," recommended intake of dietary fiber (in gm.) is equivalent to age in years plus five, up to a maximum of 25 gm.

More than three-quarters of children in all three groups had usual fiber intakes that were consistent with this standard (table D-56). Overall, there were no significant differences between WIC participants and nonparticipants in this regard. However, in keeping with differences noted in the mean usual intake of dietary fiber, as described above, 2-year-old WIC children were significantly *more* likely than their counterparts in the income-eligible nonparticipant group to meet the "age-plus-five" standard (84% vs. 76%). And 4-year-old WIC children were significantly *less* likely to meet the standard than 4-year-old, income-eligible nonparticipants (65% vs. 80%).

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 as 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 of Individuals (CSFII) because CSFII data, like the data used in this analysis, include only dietary fiber (IOM, 2002b).

The AIs for total fiber are shown in appendix B. The AIs are substantially greater than standards based on the "age-plus-five rule." The AI for 2-3 year-olds is 19 gm., compared with "age-plus-five" standards of 7 gm. for 2-year-olds and 8 gm. for 3-year-olds. The discrepancy is even greater for 4-year-olds, where the AI is 25 gm. and the "age-plus-five" standard is 9 gm.

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 age-appropriate AIs. As the data in figure 18 indicate, mean usual intakes of dietary fiber among 2-4-year-olds fell short of the new AIs. Indeed, for all three groups of children, usual fiber intakes fell below the AI even at the 95th percentile of usual intake (table D-57). Some of this disparity is due to the differences 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 previously—a generous assumption for this age group), mean intakes for all groups of children would still fall substantially short of the AI.

The differences observed between WIC participants and nonparticipants in mean usual intakes of dietary fiber are real, regardless of which reference standard is used to assess intakes. However, the advent of the AIs for fiber means that results of the analysis that assessed usual intakes of dietary fiber relative to the "age-plus-five rule" must be interpreted with caution. These estimates cannot be interpreted as valid estimates of the percentage of 2-4-year-old children consuming adequate amounts of fiber.