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***School Nutrition Dietary Assessment
Study—III:***

***Volume II: Student Participation and
Dietary Intakes***



United States
Department of
Agriculture

Food and
Nutrition
Service

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School Nutrition Dietary Assessment Study-III: Volume II: Student Participation and Dietary Intakes

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EXECUTIVE SUMMARY

The U.S. Department of Agriculture (USDA) National School Lunch Program (NSLP) and School Breakfast Program (SBP) provide subsidized meals to children in school, and provide these meals free or at a reduced price to children from low-income families. In school year 2004-2005, these two programs together provided benefits of nearly \$10 billion in cash and commodities. Created in 1946, the NSLP operates in nearly all public and many private schools. On an average school day in 2005, the NSLP provided lunch to 29.6 million children; 59 percent of these lunches were served free or at a reduced price. The SBP, which became a permanent Federal program in 1975, is offered in a somewhat smaller number of schools and serves fewer children per school. In 2005, the SBP provided breakfast to 9.4 million children per school day; the majority of these breakfasts (82 percent) were served free or at a reduced price.

The Food and Nutrition Service (FNS) of USDA sponsored the third School Nutrition Dietary Assessment study (SNDA-III) to provide up-to-date information on the school meal programs, the school environments that affect the food programs, the nutrient content of school meals, and the contributions of school meals to children's diets. During the time SNDA-III was conducted, many State agencies and schools were establishing nutrition policies, supplemental to USDA regulations, to address growing concerns about child obesity. Many of these policies included additional requirements for school meals and for foods that schools often sell in competition with USDA school meals, known as "competitive foods." State agencies and schools were also beginning to plan school wellness policies, required by Congress as of school year 2006-2007, which must include goals for nutrition education and physical activity, as well as nutrition standards for all foods sold on campus, including competitive foods.

A. BACKGROUND

The SNDA-III study, which is based on data collected in the second half of school year 2004-2005, builds on the methods used in two previous SNDA studies sponsored by FNS and, thus, allows some examination of trends over time:

- The first SNDA study (SNDA-I), in SY 1991-1992, determined that school meals provided targeted levels of vitamins and minerals, but offered, on average, higher levels of fat and saturated fat than recommended in the *Dietary Guidelines for Americans*.
- SNDA-I helped prompt new policies, known as the School Meals Initiative for Healthy Children (SMI), which required school meals to reduce fat and saturated fat levels while providing adequate levels of target nutrients (defined as one-quarter of daily needs at breakfast and one-third at lunch). School Food Authorities (SFAs)—school districts or groups of districts operating the NSLP—were encouraged to use computerized nutrient analysis to plan school meals, but were also given the option of continuing food-based menu planning.

- SNDA-II, conducted in school year 1998-1999, early in the SMI implementation period, showed that schools had reduced fat and saturated fat levels in school meals while maintaining levels of target nutrients. However, school meals were still not consistent with standards for fat and saturated fat content established under SMI.

SNDA-III offers information on how the programs are operating eight years after the start of SMI implementation. It also provides a baseline for FNS to use in determining how best to improve the programs.

This report, the second of three volumes, describes characteristics of students who participate in the school meal programs and those who do not participate, and discusses student and parent satisfaction with school meals. It also compares dietary intakes of school meal program participants and nonparticipants. Volume I describes the characteristics of schools that participate in the school meal programs and the food and nutrient content of NSLP and SBP meals offered and served. Volume III provides in-depth information on the sample design and data collection procedures used in the study.

B. RESEARCH QUESTIONS

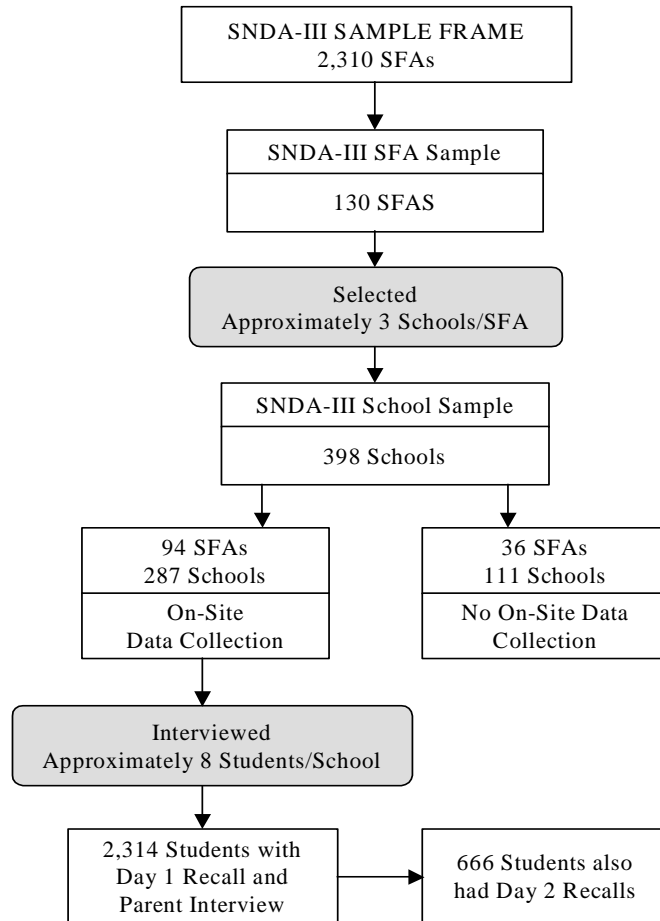
This study examined school meal program operations, foods and nutrients offered and served in school meals, competitive foods, and students' dietary intakes. Key research questions covered in this volume include:

- What are participation rates in the NSLP and SBP, overall and among key population subgroups?
- What are students' and parents' perceptions of and views on the school meal programs, and what factors affect satisfaction with the programs?
- What are the personal and family characteristics of school meal program participants and nonparticipants?
- What factors, including student characteristics, school food service program characteristics, and menu characteristics, are associated with school meal program participation?
- What is the quality of schoolchildren's diets and how do the diets of school meal program participants and nonparticipants compare? What are the roles of school meals and competitive foods in their diets?

C. DATA SOURCES

SNDA-III data represent all public SFAs that offer the NSLP in the contiguous United States, schools in those SFAs, and students in those schools. To represent these groups, the following three-stage sampling process was used: (1) SFAs were selected; (2) schools within these SFAs were selected (one elementary, one middle, and one high school, if possible); and (3) (for some SFAs and schools) students who attended these schools were selected (see Figure 1).

FIGURE 1
SNDA-III SAMPLES



Note: Samples (when weighted) are representative of all public SFAs, schools, and students in schools offering the NSLP.

SFA = School Food Authority.

Students were selected from lists of those enrolled at each school. Parents (or guardians) of the selected children provided consent for their child's participation, and were also interviewed.

Substantive data for the study were obtained at each of these levels; here, we describe the student-level data used in this volume. A centerpiece of the student data collection was a 24-hour dietary recall, which collected information on all foods and beverages the student had consumed during the preceding 24 hours. Approximately 30 percent of students were also asked to complete a second 24-hour recall the following week; the second recalls were needed to estimate students' usual dietary intakes.

Students were interviewed to collect information about their school meal consumption, opinions about school meals, opinions about the environment in which lunch was eaten (for example, cleanliness, crowding, and other activities during lunch), dietary supplement use, recreational activities, and exercise. Parents were interviewed to collect information about their child's consumption of school meals, their attitudes toward school meals, and perceptions about the availability of certain foods at their child's school. Parents were also asked whether the student was receiving free or reduced-price meals; whether the family had applied for such meals; and about the student's activity level, overall health, dietary habits, food allergies, and consumption of certain foods. Field staff measured students' heights and weights using standardized protocols.

All analyses in this report have been weighted to be representative of schoolchildren in public schools offering the NSLP in the contiguous United States.

D. PARTICIPATION IN, AND VIEWS OF, THE SCHOOL MEAL PROGRAMS

School meal programs can accomplish their policy goals only if students participate in the programs. Therefore, it is important to understand which students participate in the programs and the factors that influence their decisions, including parents' and students' satisfaction with school meals.

1. Participation in the NSLP and SBP

On a typical school day in the 2004-2005 school year, about 62 percent of students participated in the NSLP and about 18 percent participated in the SBP. Nearly three-quarters of children reported participating in the NSLP three or more days per week, and one-quarter reported participating in the SBP three or more days per week.

Participation rates in the school meal programs varied by gender, income, age, and race/ethnicity: boys participated at a higher rate than girls, low-income students participated at a higher rate than higher-income students, elementary school students participated at a higher rate than middle and high school students, and Hispanic and black students participated at much higher rates than non-Hispanic white students and those of other races. The latter finding is likely related to the fact that Hispanic and black students are more likely to be eligible for free or reduced-price meals.

2. Students' Reasons for Participation and Nonparticipation

Leading reasons students gave for participating in the NSLP included being hungry (35 percent), liking the food in general (21 percent), and liking what was served on the menu that day (13 percent). Leading reasons for not participating in the NSLP were bringing lunch from home (28 percent), not liking what was served that day (20 percent), and not liking school lunches in general (9 percent).

Leading reasons students gave for participating in the SBP included convenience (35 percent), liking the food (32 percent), and being hungry (22 percent). Leading reasons for not participating included eating breakfast at home (50 percent) and not having time to eat a school breakfast (26 percent). Fifty-nine percent of students who ate school breakfasts two or fewer days per week said they would eat them more often if breakfast were served in their classrooms.

Students were generally satisfied with their school's lunchtime environment. Almost two-thirds of students reported that tables were always or usually clean, and 54 percent agreed that the noise level was about right. Seventy-nine percent of students reported that there were enough seats and tables available, and 74 percent of students who ever ate a school lunch reported that they had adequate time to eat their lunch. Similarly, 85 percent of students who ever ate a school breakfast reported that they had enough time to eat breakfast before class, and 87 percent reported that the school breakfast was served at an acceptable time.

3. Parents' Reasons for Participation and Nonparticipation

When parents were asked why their child participated in the NSLP, 30 percent reported that it was convenient for them (the parents), 23 percent that their child liked the food, and 18 percent that they believed school lunches were a good value. Convenience was the most commonly cited reason among parents of elementary and middle school students, while value was most commonly cited by parents of high school students. Parents of students who did not participate in the NSLP reported some of the same reasons as students did for this decision—for example, that their child did not like the cafeteria food (68 percent) or preferred to bring a lunch from home (65 percent).

Among parents whose children received a school breakfast fewer than three days per week, 82 percent said that their child preferred to eat at home. The second most commonly cited reason for infrequent participation in the SBP was that students were not given an adequate amount of time to eat breakfast.

4. Students' Satisfaction with School Meals

Overall, about half of students who said they ever ate school lunches reported that they liked the lunches. Opinions of school lunches declined with students' grade level—among those who said they ever ate a school lunch, 56 percent of elementary school students reported liking the lunches, compared with 35 percent of middle school students and 32 percent of high school students.

When asked about specific aspects of school lunches, more than half of students reported that they were only sometimes or never satisfied with the taste, appearance, and smell of the food served at school. Nearly half of students reported that they would like to see more choices available on the daily lunch menu. In contrast, most students were satisfied with the portion sizes and the temperature of milk served.

About half of students who said they ever ate school breakfasts reported that they liked the breakfasts. Opinions of school breakfasts also declined with grade level—among those who said they ever ate a school breakfast, 61 percent of elementary school students reported liking the breakfasts, compared with 49 percent of middle school students and 47 percent of high school students.

5. Parents' Satisfaction with School Meals

In general, parents were satisfied or somewhat satisfied with the NSLP and SBP overall, as well as with specific components of the school meals. Twenty-one percent of parents said they felt school lunches were very healthy, and 68 percent felt the lunches were somewhat healthy. Most parents (81 percent) felt that school lunches were a good or pretty good financial value. Thirty-one percent of parents felt school breakfasts were very healthy and 63 percent felt they were somewhat healthy.

Among parents who expressed dissatisfaction with school lunches, almost half (48 percent) attributed it to their belief that school lunches were not healthy enough. Other reasons included poor quality or taste (38 percent), lack of menu choice (27 percent), and the fact that their child would not eat the food (18 percent).

6. Parents' Views on Availability of Competitive Foods

More than half of parents disapproved of the availability of certain competitive foods in schools. Almost 58 percent thought it was a bad idea to allow fast-food brand products in schools, and 60 percent thought it was a bad idea to allow vending machines. Disapproval of these competitive foods was highest among parents of elementary school students and lowest among parents of high school students.

E. CHARACTERISTICS OF SCHOOL MEAL PROGRAM PARTICIPANTS AND NONPARTICIPANTS

The NSLP and SBP are intended to improve the nutritional status of all schoolchildren, but their main benefits are targeted toward students from low-income families—those who qualify for free or reduced-price meals. The SBP also targets students who have long travel times to school, typically those in rural areas. Understanding the characteristics of those served by the two programs is necessary in order to assess how well the programs are reaching students in need, and where additional outreach efforts might best be targeted.

In the 2004-2005 school year, NSLP participants were generally more disadvantaged than nonparticipants. Participants were more likely to live with a single parent and to attend school in rural districts and in low-income districts. On average, their parents had lower levels of education, and their families had lower incomes and were more likely to participate in other public assistance programs than were the families of nonparticipants. However, the parents of NSLP participants and nonparticipants were equally likely to be employed (in both groups about 75 percent of parents who responded to the survey were working). Consistent with their differences in income, NSLP participants' families were more likely than nonparticipants' families to be food insecure. NSLP participants were also more likely than nonparticipants to be Hispanic or black, and less likely to be white or some other race.

Differences between SBP participants and nonparticipants were generally similar to those observed between NSLP participants and nonparticipants, but the magnitude of the differences tended to be larger. This reflects the fact that SBP participants are a smaller, more disadvantaged group than NSLP participants.

F. FACTORS RELATED TO SCHOOL MEAL PROGRAM PARTICIPATION

A student's decision to participate in the NSLP or SBP is a complex one, influenced by personal and family characteristics and preferences, as well as by program features (such as meal price and menu planning system), characteristics of the school menus (for example, the specific foods offered and the number of choices), and alternative food sources available to the student (availability of competitive foods as well as students' ability to leave school to obtain meals elsewhere). Multivariate regression models were used to examine the relationships between school meal participation, student characteristics, school foodservice program characteristics, and menu characteristics.

NSLP participation rates were higher in schools that used offer-versus-serve (that is, schools that allowed students to refuse some of the foods offered) than in schools that did not use this policy option. Characteristics of the lunches offered, including the percent of calories from fat, whether dessert or French fries were offered frequently, and the average number of fresh fruits and vegetables offered per day, were not significantly associated with NSLP participation. Among students who were ineligible for free or reduced-price meals, a higher meal price was associated with a lower probability of participation.

Several personal and family characteristics were significantly associated with NSLP participation. After controlling for other characteristics, NSLP participation was significantly higher among elementary school students, male students, students who were eligible for free or reduced-price meals, and students whose parents did not attend college than among other students.

Factors associated with SBP participation were generally similar to those noted in the analysis of NSLP participation. In particular, among students who were not eligible for free or reduced-price meals, a higher breakfast price was associated with a lower probability of SBP participation. In addition, SBP participation was significantly higher among elementary school students, male students, students who were eligible for free or reduced-price meals, non-Hispanic black students, and students who spoke Spanish at home than among other students.

G. DIETARY INTAKES OF SCHOOL MEAL PROGRAM PARTICIPANTS AND NONPARTICIPANTS

A key objective of the school meal programs is to provide children with healthy, well-balanced diets. Ideally, we would like to understand the programs' effects on schoolchildren's diets, relative to what the children would have consumed had they not participated. A comparison of the diets of school meal program participants and nonparticipants can provide some sense of these effects, but there are many other differences between participants and nonparticipants that may also influence their dietary intakes (for instance, age, gender, socioeconomic background, and food preferences), making it difficult to identify the causal effects of the programs.

Statistical techniques were used in most analyses of students' dietary intakes in this study to adjust for observable differences between participants and nonparticipants that might affect their nutrient intakes. Multivariate regression was used in analyses that compared mean intakes of participants and nonparticipants at breakfast and lunch (and the extent to which these differences dissipated during the day). Propensity-score matching techniques—in which participants were compared to “matched” nonparticipants who were similar on many observable characteristics—were used to assess the prevalence of inadequate and excessive nutrient intakes among participants and nonparticipants. Even with these statistical controls, unobserved differences between participants and nonparticipants may remain. For this reason, differences in the nutrient intakes of the two groups of students may not be indicative of causal effects of the school meal programs.

To assess the quality and adequacy of students' overall diets—considering foods consumed at school as well as those consumed elsewhere during the school day—students' usual daily intakes were compared to the dietary reference intakes (DRIs). The DRIs are the most up-to-date scientific standards for assessing diets of individuals and population groups. They define standards for different types of nutrients (see box). The DRIs do not include standards for saturated fat and cholesterol, so usual daily intakes of these dietary components were assessed relative to recommendations made in the 2005 *Dietary Guidelines for Americans* (U.S. Department of Health and Human Services/U.S. Department of Agriculture 2005).

DIETARY REFERENCE INTAKES (DRIs)

Acceptable Macronutrient Distribution Range (AMDR): The range of usual daily intakes that is associated with reduced risk of chronic disease while providing adequate intakes of essential nutrients. An AMDR is expressed as a percentage of total energy intake (calories). If an individual's usual daily intake is above or below this range, risks of chronic disease and/or insufficient intake of essential nutrients are increased. *[Used to assess usual daily intakes of total fat.]*

Estimated Average Requirement (EAR): The usual daily intake level that is estimated to meet the requirement of half the healthy individuals in a life stage and gender group. The proportion of a group with usual daily intakes less than the EAR is an estimate of the prevalence of inadequate daily intakes in that population group. *[Used to assess usual daily intakes of protein and most vitamins and minerals.]*

Adequate Intake (AI): The usual daily intake level of apparently healthy people who are maintaining a defined nutritional state or criterion of adequacy. AIs are used when scientific data are insufficient to establish an EAR. When a population group's mean usual daily intake exceeds the AI, the prevalence of inadequate usual daily intakes is likely to be low. However, mean usual daily intakes that fall below the AI do not indicate that the prevalence of inadequacy is high. *[Used to examine usual daily intakes of calcium, potassium, and fiber].*

Tolerable Upper Intake Level (UL): The highest usual daily intake level that is likely to pose no risk of adverse health effects to individuals in the specified life stage group. As usual daily intake increases above the UL, the risk of adverse effects increases. *[Used to assess usual daily intakes of sodium.]*

1. Dietary Intakes of NSLP Participants and Nonparticipants

a. Mean Intakes of Energy and Nutrients at Lunch

For most student groups, holding other characteristics constant, NSLP participants and nonparticipants consumed similar amounts of energy at lunch. High school students were an exception. On average, lunches consumed by high school NSLP participants were significantly higher in calories than those consumed by high school nonparticipants (733 versus 661 calories).

At all school levels, the average lunch consumed by NSLP participants provided a significantly larger percentage of energy from protein than the lunches consumed by nonparticipants, and a significantly smaller percentage of energy from carbohydrate. In addition, among middle school students, the lunches consumed by NSLP participants provided significantly more fat and saturated fat, as a percentage of total energy, than the lunches consumed by nonparticipants. The overall participant-nonparticipant difference in the percentage of energy provided by saturated fat was also statistically significant (12 versus 11 percent of energy from saturated fat).

The average lunches consumed by NSLP participants at all school levels provided significantly greater amounts of vitamin A, vitamin B₁₂, riboflavin, calcium, phosphorus, and potassium than lunches consumed by nonparticipants. This pattern of differences is, in large

part, attributable to the fact that NSLP participants were four times as likely as nonparticipants to consume milk for lunch. Milk was the first or second most important source of all these nutrients in students' lunches.

Among elementary school students, lunches consumed by NSLP participants were lower in vitamins C and E than lunches consumed by nonparticipants. Among middle school students, lunches consumed by NSLP participants provided more cholesterol than lunches consumed by nonparticipants. Middle school NSLP participants also consumed more folate, iron, zinc, and fiber at lunch than nonparticipants. Among high school students, NSLP participants consumed more vitamin C, vitamin B₆, niacin, thiamin, iron, magnesium, and zinc at lunch than nonparticipants. High school NSLP participants also consumed more sodium at lunch than nonparticipants.

Many of the significant differences in average intakes of NSLP participants and nonparticipants at lunch persisted over 24 hours, although there was substantial variation by school level. Among elementary school students, only the differences in mean intakes of vitamin A and calcium persisted over 24 hours. In addition, over 24 hours, elementary school NSLP participants had significantly lower mean intakes of niacin than nonparticipants. Among high school students, only the differences in the percentage of energy from protein and in mean potassium intakes persisted over 24 hours. In contrast, among middle school students, all the significant differences noted in lunch intakes persisted over 24 hours, except the difference in the percentage of energy from total fat.

b. Usual Daily Intakes of Energy and Nutrients

Usual Daily Intakes of Energy and Macronutrients

Among elementary and high school students, NSLP participants had significantly higher usual daily intakes of energy than matched nonparticipants. On average, the usual daily energy intakes of NSLP participants in elementary schools were about 100 calories higher than the usual daily energy intakes of elementary school nonparticipants (2,051 versus 1,952 calories). Among high school students, the difference between the usual daily energy intakes of NSLP participants and nonparticipants averaged 265 calories (2,386 versus 2,121 calories). At least part of this difference may be attributable to the fact that NSLP participants, by definition, consumed a lunch. Four percent of elementary school nonparticipants and eight percent of high school nonparticipants did not eat lunch.

Overall, there were no statistically significant differences between NSLP participants and matched nonparticipants in the extent to which usual daily intakes of macronutrients (fat, protein, and carbohydrate) conformed to DRI standards. Seventy-seven percent of NSLP participants and 94 percent of nonparticipants had usual daily fat intakes that fell within the Acceptable Macronutrient Distribution Range (AMDR) defined in the DRIs (25 to 35 percent of total energy) (see box). For both participants and nonparticipants, the usual daily fat intakes of students whose intakes were not within the AMDR were much more likely to exceed the recommended range (includeconsume more fat, as a percentage of energy, than recommended) than to fall below it.

Usual daily saturated fat intakes of both NSLP participants and nonparticipants typically exceeded the *Dietary Guidelines* recommendation. Only 20 percent of both NSLP participants and nonparticipants had usual daily intakes of saturated fat that met the *Dietary Guidelines* recommendation that saturated fat provide less than 10 percent of total calories.

Prevalence of Inadequate Usual Daily Intakes of Vitamins and Minerals

There were no significant differences between elementary school NSLP participants and nonparticipants in the prevalence of inadequate usual daily intakes of vitamins or minerals. Except for vitamin E, for which the prevalence of inadequacy was high for all groups of students, inadequate usual daily intakes of vitamins and minerals were rare among elementary school students.¹

Middle school NSLP participants were significantly less likely than nonparticipants to have inadequate usual daily intakes of vitamin A and magnesium. Fewer than 30 percent of middle school NSLP participants had inadequate usual daily intakes of vitamin A, compared to 44 percent of nonparticipants. In addition, 43 percent of middle school NSLP participants had inadequate usual daily intakes of magnesium, compared to 62 percent of nonparticipants. Middle school students in general had a notably higher prevalence of inadequate intakes than elementary school students—this was true for vitamin A, vitamin C, magnesium, phosphorus, and zinc. Analysis of data by school level and gender indicated that the prevalence of inadequacy for all these nutrients was notably higher for girls than for boys.

High school students—who have the highest nutrient requirements, relative to the other age groups considered in this study—had the highest prevalence of inadequate usual daily intakes. Nutrients that were problematic for high school students included vitamin A, vitamin C, vitamin E, magnesium, phosphorus, and zinc. Data analyzed by school level and gender indicate that the prevalence of inadequate intakes was particularly high for high school girls.

High school NSLP participants were significantly less likely than nonparticipants to have inadequate usual daily intakes of vitamin A, vitamin C, vitamin B₆, folate, thiamin, and phosphorus. Except for vitamin A, the differences between participants and nonparticipants were largely attributable to participant-nonparticipant differences among girls.

Usual Daily Intakes of Calcium and Potassium

Among middle and high school students, NSLP participants had significantly higher mean usual daily calcium intakes than nonparticipants. Usual daily calcium intakes of middle school and high school NSLP participants, expressed as a percentage of the Adequate Intake Level (AI)

¹ The high prevalence of inadequate intakes of vitamin E is consistent with most recent studies of vitamin E intake. Devaney and colleagues considered a range of possible reasons for these findings. They point out that the diets of most of the U.S. population do not meet the EAR for vitamin E, yet vitamin E deficiency is rare. They note limitations of both the data used to establish the EAR for vitamin E and the data used to assess vitamin E intakes (Devaney et al. 2007).

averaged 88 and 87 percent, respectively, compared with 64 and 71 percent for middle and high school nonparticipants. This difference in mean usual daily intakes does not necessarily imply that middle and high school NSLP participants had a lower prevalence of inadequate usual daily calcium intakes than nonparticipants (see box). Among elementary school students, mean usual daily intakes of calcium of both NSLP participants and nonparticipants exceeded 100 percent of the AI. This indicates that the prevalence of inadequate usual daily calcium intakes in this age group is likely to be low.

Middle school and high school NSLP participants had significantly greater mean usual daily intakes of potassium than nonparticipants. Middle and high school participants' mean usual daily intakes were 55 and 58 percent of the AI, respectively, while nonparticipants' mean usual daily intakes were 48 and 47 percent of the AI. As noted in the preceding discussion of usual daily calcium intakes, a higher mean usual daily intake does not necessarily indicate that the prevalence of inadequacy is lower. Mean usual daily potassium intakes of students at all school levels were less than their respective AIs.

Usual Daily Intakes of Sodium, Cholesterol, and Fiber

Mean usual daily sodium intakes of both NSLP participants and nonparticipants exceeded the Tolerable Upper Intake Level (UL) by a substantial margin (see box). Mean usual daily sodium intakes of both NSLP participants and nonparticipants were more than 200 percent of the UL (which is 2,300 mg). More than three-quarters of students in both groups had usual daily sodium intakes that exceeded the UL. This was true for students at all school levels. Among high school students, NSLP participants were significantly more likely than nonparticipants to have usual daily sodium intakes that exceeded the UL (96 versus 78 percent).

There were no significant differences between NSLP participants and nonparticipants in the proportion of students whose usual daily cholesterol intake exceeded the *Dietary Guidelines* recommendation. Overall, fewer than 10 percent of students had usual daily cholesterol intakes that exceeded the recommended maximum of 300 mg. The prevalence of excessive usual daily cholesterol intakes was higher among high school students (16 to 21 percent) than among elementary and middle school students (6 to 7 percent).

NSLP participants had significantly higher mean usual daily fiber intakes than nonparticipants. However, mean usual daily fiber intakes of all groups of students were less than the AI. Overall, the mean usual daily fiber intake of NSLP participants was equal to 51 percent of the AI for fiber, compared with 45 percent of the AI among nonparticipants.

c. Food Intakes at Lunch

There were large differences in beverage consumption patterns of NSLP participants and nonparticipants. NSLP participants were four times more likely than nonparticipants to consume milk at lunch (75 versus 19 percent). This difference persisted over 24 hours, although the disparity between the two groups became smaller (88 versus 69 percent). In contrast NSLP participants were significantly less likely than nonparticipants to consume beverages other than milk or 100% juice at lunch (18 versus 56 percent), including juice drinks, carbonated sodas, and bottled water. Over 24 hours, differences between NSLP participants and nonparticipants in the

proportion of students who consumed fruit drinks and bottled water persisted, but the difference in the consumption of carbonated sodas disappeared.

NSLP participants were more than twice as likely as nonparticipants to consume at least one vegetable (as a distinct food item) at lunch (51 versus 23 percent). These differences were driven primarily by differences in potato consumption. In middle and high schools, NSLP participants were significantly more likely than nonparticipants to consume French fries/tater tots at lunch, and NSLP participants at all three grade levels were significantly more likely than nonparticipants to consume other white potatoes at lunch. Over 24 hours, the significant difference between NSLP participants and nonparticipants in the proportion who consumed at least one vegetable persisted; however, the magnitude of the difference became smaller (72 versus 59 percent). The differences observed over 24 hours were also driven primarily by differences in potato consumption.

NSLP participants were more likely to consume pizza; sandwiches with breaded chicken, fish or meat; hamburgers; hot dogs; and breaded chicken products (such as nuggets, patties, poppers, and tenders) at lunch; while nonparticipants were more likely to consume plain meat sandwiches (such as turkey or ham) and peanut butter sandwiches. These differences persisted over 24 hours.

NSLP participants were significantly less likely than nonparticipants to consume desserts and other snack foods at lunch (38 versus 52 percent). Among elementary school students, NSLP participants were less likely than nonparticipants to consume candy and snack chips. Among middle and high school students, NSLP participants were less likely than nonparticipants to consume snack chips and cereal/granola bars. Many of these differences dissipated during the day; over 24 hours, there was no difference between NSLP participants and nonparticipants in the percentage of students who consumed one or more snack or dessert items or in the percentage who consumed snack chips. The percentage of NSLP participants who consumed candy remained significantly lower than the percentage of nonparticipants, but the size of the difference became smaller.

d. Food Sources of Nutrients

NSLP participants obtained significantly more of their lunch energy than nonparticipants from milk, pizza, hamburgers and cheeseburgers, condiments, and spreads, and significantly less of their lunch energy from juice drinks, carbonated sodas, peanut butter and plain meat/poultry sandwiches, chips, candy, crackers, and pretzels. NSLP participants also generally obtained a significantly greater share of their saturated fat and carbohydrate intakes at lunch from pizza and milk than nonparticipants, while nonparticipants obtained significantly greater shares of their saturated fat and carbohydrate intakes at lunch from plain meat/poultry sandwiches, peanut butter sandwiches, corn/tortilla chips, candy, other snack chips, and crackers and pretzels.

Milk and pizza products generally made significantly greater contributions to NSLP participants' lunch intakes of vitamin A, vitamin B₆, vitamin B₁₂, calcium, and iron than to nonparticipants' intakes, while plain meat/poultry sandwiches, hamburgers and cheeseburgers,

cheese, and juice drinks generally made significantly greater contributions to nonparticipants' lunch intakes of these nutrients.

Relative to nonparticipants, NSLP participants obtained significantly greater shares of their sodium intakes at lunch from pizza and pizza products, condiments and spreads, 1% flavored milk, and salad dressings, and significantly smaller shares from plain meat/poultry sandwiches, peanut butter sandwiches, crackers and pretzels, and corn/tortilla chips.

e. Competitive Foods

In recent years, interest in the healthfulness of foods offered in school meal programs has expanded to include competitive foods—foods and beverages sold on an a la carte basis in school cafeterias or through vending machines, snack bars, school stores, or other on-campus venues. Many observers have reasoned that competitive foods in schools—many of which are high in calories and fat and low in nutrients—may be contributing to child obesity. It is therefore important to understand the role of competitive foods in schoolchildren's diets.

Overall, nonparticipants were almost twice as likely as NSLP participants to consume one or more competitive foods (37 versus 19 percent). Consumption of competitive foods increased for both participants and nonparticipants from elementary school to middle school and from middle school to high school. Among high school students, about one-third (34 percent) of NSLP participants and close to one-half (46 percent) of nonparticipants consumed one or more competitive foods. At all school levels, competitive foods were most often consumed at lunch.

Among students who consumed one or more competitive foods, the most commonly consumed food groups (for both NSLP participants and nonparticipants) were dessert/snack items and beverages other than milk. Of students who consumed competitive foods, 50 percent or more consumed a dessert or snack item and 37 to 47 percent consumed a beverage other than milk. Nonparticipants were more likely than participants to consume milk, vegetables (most often French fries), or entree items obtained from competitive food sources. This reflects the fact that many middle school and high school nonparticipants who consumed competitive foods relied on competitive food sources for their lunchtime meal.

Candy was the most commonly consumed competitive food for both NSLP participants and nonparticipants. Candy consumption was reported by 28 percent of the NSLP participants who consumed one or more competitive foods and 24 percent of their nonparticipant counterparts. Cookies, cakes, and brownies were the second most common competitive food for both groups (18 to 19 percent). Carbonated soda and juice drinks were the third and fifth most common competitive foods among participants (16 and 13 percent, respectively) and were tied for the third most common competitive food among nonparticipants (17 percent). Among nonparticipants, milk was also tied for the third most common competitive food. This was primarily due to elementary school nonparticipants, many of whom purchased milk to go with lunches brought from home.

The competitive foods consumed by nonparticipants provided more calories and were significantly higher in fat and saturated fat than the competitive foods consumed by NSLP participants. On average, NSLP participants who consumed competitive foods obtained 218

calories from these foods, compared with 411 calories for nonparticipants. In addition, the competitive foods consumed by NSLP participants were significantly lower in total fat and saturated fat and significantly higher in carbohydrate, as percentages of total energy, than the competitive foods consumed by nonparticipants. This pattern is consistent with the fact that the competitive foods most commonly consumed by NSLP participants were candy; cookies, cakes, and brownies; carbonated sodas, and juice drinks—all likely to be high in sugar. These foods were also common among nonparticipants; however, the competitive foods consumed by nonparticipants were more likely than those consumed by NSLP participants to include milk, French fries, and entree items.

Students who consumed competitive foods obtained more than 150 calories from foods that were low in nutrients and energy dense. Foods considered to be low in nutrients and energy dense include all desserts and snacks; all beverages other than milk or 100% juice; French fries; corn/tortilla chips; and muffins, donuts, sweet rolls, and toaster pastries. Among NSLP participants, on average, 159 of 218 calories (73 percent of competitive food calories) came from these foods. Among nonparticipants, who, as noted above, often obtained their lunch meal from competitive food sources, low-nutrient, energy-dense foods contributed more calories, but a smaller overall proportion of competitive food calories (210 of 411 calories, on average, or 51 percent).

f. Comparison of Data from SNDA-III and SNDA-I

Between school year 1991-1992, when SNDA-I was conducted, and school year 2004-2005, the average number of calories consumed at lunch declined among NSLP participants, from 762 to 626 calories. The amount of calories consumed at lunch by nonparticipants fell from 679 to 641 over this period, but the decline was not statistically significant. The average amount of fat as a percentage of energy in lunches consumed by NSLP participants also declined over this period, from 37 to 33 percent, while the percent of calories from fat in lunches consumed by nonparticipants remained stable at 33 percent.

Among NSLP participants, there were significant declines in the average amount of several key nutrients consumed at lunch, including vitamin C, vitamin B₆, vitamin B₁₂, niacin, thiamin, iron, magnesium, phosphorous, and zinc. There were also significant declines in sodium and cholesterol consumption. Among nonparticipants, consumption of most nutrients at lunch remained relatively stable over this period, with the exception of significant declines in intakes of vitamin C, thiamin, and sodium.

2. Dietary Intakes of SBP Participants and Nonparticipants

a. Mean Intakes of Energy and Nutrients at Breakfast

After controlling for a number of characteristics that may be associated both with participation in the SBP and with dietary intakes, relatively few significant differences were observed in the mean breakfast intakes of SBP participants and nonparticipants. Breakfasts consumed by SBP participants in high schools and middle schools provided a significantly greater percentage of energy from monounsaturated fat, polyunsaturated fat, and linolenic acid

(an essential polyunsaturated fatty acid) than breakfasts consumed by nonparticipants in these schools.

Among middle school students, breakfasts consumed by SBP participants provided significantly less vitamin A, vitamin B₆, vitamin B₁₂, folate, niacin, riboflavin, iron, and zinc than breakfasts consumed by nonparticipants. Scattered differences were observed for other nutrients among elementary and/or high school students. SBP participants in both elementary schools and middle schools had significantly lower intakes of cholesterol at breakfast than nonparticipants. Among high school students, SBP participants had a significantly lower average intake of fiber at breakfast—on a gram per calorie basis—than nonparticipants. Few of the differences observed in the breakfast intakes of SBP participants and nonparticipants remained significant over 24 hours.

b. Usual Daily Intakes of Energy and Nutrients

Usual Daily Intakes of Energy and Macronutrients

Usual daily intakes of energy and macronutrients were comparable for SBP participants and nonparticipants at all school levels. More than three-quarters of SBP participants and nonparticipants had usual daily total fat intakes that fell within the AMDR of 25 to 35 percent of total energy. In addition, for both SBP participants and nonparticipants, usual daily fat intakes that were not within the AMDR were much more likely to exceed the recommended range (include more fat as a percentage of energy than recommended) than to fall below it. Roughly 70 percent of both SBP participants and nonparticipants had usual daily intakes of saturated fat that exceeded the *Dietary Guidelines* recommendation of less than 10 percent of total energy. Usual daily carbohydrate and protein intakes of both SBP participants and nonparticipants were generally consistent with the respective AMDRs.

Prevalence of Inadequate Usual Daily Intakes of Vitamins and Minerals

Except for vitamin E, the prevalence of inadequate usual daily intakes of vitamins and minerals was low among elementary school students. The prevalence of inadequate usual daily intakes of several vitamins and minerals was notably higher among middle school students, relative to elementary school students. This was true for vitamin A, vitamin E, magnesium, phosphorus, and zinc for both SBP participants and nonparticipants (and for vitamin C, vitamin B₆, folate, riboflavin, and thiamin for nonparticipants). Among high school students, the prevalence of inadequate usual daily intakes was high for vitamin A, vitamin C, vitamin E, and magnesium.

Although the prevalence of inadequate usual daily intakes was often lower among SBP participants, relative to nonparticipants, few of these differences were statistically significant. Among elementary school students, the prevalence of inadequate usual daily phosphorus intakes was significantly lower for SBP participants than for nonparticipants (4 versus 16 percent). Among middle school students, the prevalence of inadequate usual daily magnesium intakes was significantly lower for SBP participants than for nonparticipants (41 versus 57 percent). There

were no significant differences in the prevalence of inadequate usual daily intakes of vitamins and minerals among high school SBP participants and nonparticipants.

Usual Daily Intakes of Calcium and Potassium

There were no significant differences between SBP participants and nonparticipants in mean usual daily calcium intakes. Among elementary school students, mean usual daily calcium intakes of both SBP participants and nonparticipants exceeded the AI, suggesting that the prevalence of inadequate usual daily calcium intakes among elementary school students was likely to be low. Among middle and high school students, mean usual daily calcium intakes were less than 100 percent of the AI.

Overall and among elementary school students, mean usual daily potassium intakes were significantly higher for SBP participants than for nonparticipants. Mean usual daily intakes of potassium averaged 63 to 66 percent of the AI for SBP participants, versus 57 to 59 percent of the AI for nonparticipants.

Usual Daily Intakes of Sodium, Cholesterol, and Fiber

The majority of SBP participants and nonparticipants at all school levels had usual daily sodium intakes that exceeded the UL. SBP participants were significantly more likely than nonparticipants to have usual daily sodium intakes that exceeded the UL. Overall, more than 97 percent of participants and 87 percent of nonparticipants had usual intakes greater than the UL, and among middle school students more than 97 percent of participants and 75 percent of nonparticipants had usual intakes greater than the UL.

There were no significant differences between SBP participants and nonparticipants in the proportion of students whose usual daily cholesterol intake exceeded the *Dietary Guidelines* recommendation. Overall, fewer than 20 percent of SBP participants and nonparticipants had usual daily cholesterol intakes that exceeded the recommended maximum of 300 mg.

Mean usual daily fiber intakes of all groups of students were less than the fiber AI. There were no significant differences between SBP participants and nonparticipants in mean usual daily fiber intakes (53 percent of the AI for participants, 51 percent for nonparticipants).

c. Food Intakes at Breakfast

Overall, SBP participants were more likely than nonparticipants to consume both milk and 100% fruit juice at breakfast. These differences persisted over 24 hours.

Ready-to-eat breakfast cereal was the grain or bread product consumed most often at breakfast by both SBP participants and nonparticipants. Among high school students, SBP participants were less likely than nonparticipants to consume cereal that was unsweetened. Overall, breakfasts consumed by SBP participants were more likely than breakfasts consumed by nonparticipants to include sweet rolls, doughnuts, biscuits, and other higher-fat grain products. These differences persisted over 24 hours. Among middle school students, SBP participants

were less likely than nonparticipants to consume juice drinks or bottled water, both at breakfast and over 24 hours.

d. Food Sources of Nutrients

SBP participants obtained a significantly smaller share of their carbohydrate intakes at breakfast from cold cereal than nonparticipants, and a significantly greater share of their breakfast carbohydrate intakes from cakes, cookies, and brownies than nonparticipants. Flavored milks and pizza products accounted for significantly greater shares of SBP participants' breakfast intakes of protein, relative to nonparticipants, and cold cereal and unflavored skim/nonfat milk accounted for significantly smaller shares.

The overall contribution of cold cereals to intakes of vitamin B₆, folate, phosphorus, and potassium was generally greater for nonparticipants than for participants, while fruit juices and sweet rolls, doughnuts, and toaster pastries made significantly greater contributions to SBP participants' breakfast intakes of these nutrients than to nonparticipants' breakfast intakes.

Relative to nonparticipants, SBP participants obtained significantly greater shares of their sodium intakes at breakfast from pizza products and cookies, cakes, and brownies and a significantly smaller share from cold cereals. Cakes, cookies, and brownies also made a significantly larger contribution to SBP participants' breakfast intakes of cholesterol than to nonparticipants' breakfast intakes.

e. Competitive Foods

Overall, SBP participants were less likely than nonparticipants to consume one or more competitive foods throughout the school day. Competitive foods were most commonly consumed at lunch, and SBP participants were less likely than nonparticipants to consume a competitive food at lunch. Consumption of competitive foods at breakfast was uncommon among elementary school students; however, among high school students, 20 percent of SBP participants and 10 percent of nonparticipants consumed one or more competitive foods at breakfast.

f. Comparison of Data from SNDA-III and SNDA-I

Between school year 1991-1992, when SNDA-I was conducted, and school year 2004-2005, the average number of calories consumed at breakfast declined among SBP participants from 555 to 464 calories. The amount of calories consumed at breakfast by nonparticipants was lower and remained relatively stable at about 415 calories over this period.

The average amount of fat as a percentage of energy in breakfasts consumed by SBP participants also declined over this period, from 31 to 25 percent, while the percent of calories from fat in breakfasts consumed by nonparticipants remained relatively stable at about 24 percent. Among both groups, the percent of calories from carbohydrate consumed at breakfast increased, while the percent of calories from protein fell.

Among SBP participants, there were significant declines in the average amount of several key nutrients consumed at breakfast, including vitamin C, vitamin B₆, riboflavin, thiamin, and magnesium. There were significant increases in vitamin B₁₂ and zinc, and significant declines in sodium consumption. Most of these trends were mirrored in the breakfast intakes of nonparticipants; however, among nonparticipants there were no significant declines in breakfast intakes of vitamin B₆ or riboflavin.

I. INTRODUCTION

The U.S. Department of Agriculture (USDA) sponsors child nutrition programs to promote children's health and well-being by providing nutritious meals in schools, child care settings, and summer programs. The National School Lunch Program (NSLP) and the School Breakfast Program (SBP) provide subsidized meals to children in school, and provide these meals free or at a reduced price to children from low-income families. In school year 2004–2005, these two programs together provided benefits of nearly \$10 billion in cash and commodities. During this time, to address growing concerns about the high rates of child obesity, many State agencies, districts, and schools were establishing nutrition policies supplemental to USDA regulations that imposed additional requirements for school meals and for foods sold in competition with USDA school meals, known as “competitive foods.” Schools were also beginning to plan for the new Federal requirement that districts or schools offering USDA school meal programs develop a “wellness policy” that would set goals for nutrition education and physical activity and nutrition standards for all foods offered in schools. This requirement took effect in school year 2006–2007.

The Food and Nutrition Service (FNS) of USDA has sponsored the third School Nutrition Dietary Assessment study (SNDA-III) to provide up-to-date information on the school meal programs, the school environments that affect the food programs, the nutrient content of school meals, and the contributions of school meals to children's diets. The study builds on the methods used in two previous SNDA studies sponsored by FNS and, thus, allows some examination of trends over time. Mathematica Policy Research, Inc. (MPR) was awarded contracts by FNS to collect and analyze the study data and produce reports.

This report, the second of three volumes, focuses on the characteristics of students who participate in the NSLP and SBP, student and parent satisfaction with the school meals, and descriptions of the dietary intakes of schoolchildren. The first volume focuses on the analysis of school meal program characteristics at the school level, as well as at the level of the School Food Authority (SFA) (usually a school district or a small group of districts). A third volume provides in-depth information on the sample design and data collection procedures used in the study.

The rest of this chapter provides an overview of the NSLP and SBP, as well as the research and policy context for this study. It also summarizes the study's sampling and data collection procedures and key methodological features.

A. OVERVIEW OF THE NSLP AND SBP

The FNS Strategic Plan for 2000 through 2005 outlined two key targets for the agency: (1) reducing hunger among America's children, and (2) ensuring that USDA programs contribute to good nutrition for program participants. The NSLP and SBP play a central role in USDA's efforts to meet these objectives. Some of the key performance targets the plan set for these programs included:

- Ensuring that, by school year 2004–2005, 55 percent of children enrolled in school participate in the NSLP, and that 18 percent participate in the SBP (up from 51 and 13 percent, respectively, in school year 1995–1996).
- Ensuring that, by school year 2004–2005, NSLP and SBP meals provide fewer than 30 percent of calories from total fat and less than 10 percent of calories from saturated fat.
- Ensuring that the NSLP provides at least 33 percent of the Recommended Dietary Allowances (RDAs) for food energy and certain vitamins and minerals, and that the SBP provides at least 25 percent of the RDAs.

The SNDA-III analyses are part of an assessment of the success of the programs in meeting these targets using national data from school year 2004–2005. The study was shaped by a

substantial history of studying school meals, as well as by complex research and policy environments. This section provides information on the background of the programs, previous research, changes during the 1990s, and the policy context the programs faced in 2007.

The NSLP provided \$7 billion in cash reimbursements in fiscal year 2005. Created in 1946, the program operates in nearly all public and many private schools throughout the country, providing reimbursement for nutritious meals to 27.5 million children each day in 2005 (USDA Food and Nutrition Service 2006). The NSLP's companion program, the SBP, was made a permanent Federal program in 1975. The SBP is implemented in a smaller number of schools and serves fewer children per school; in 2005 it provided about 8.7 million children per day with breakfast. A key objective of these programs is to ensure that children have access to healthy, well-balanced meals.

Although few restrictions have been placed on which schools can participate in the NSLP and SBP, participating schools face several key requirements. Schools must make meals available to all children and provide free and reduced-price meals to qualifying low-income children. NSLP and SBP meals must also meet nutrition requirements concerning their energy (calorie) and nutrient content. (These requirements are discussed in detail below.)

Decentralized Administration. The programs are Federally funded and administered through State child nutrition agencies and local SFAs. The Federal government establishes overall program rules, as expressed in legislation and regulations. The States convey these requirements to their SFAs, serve as conduits for meal reimbursements, provide technical assistance, and monitor local schools and districts for compliance with established regulations. The individual SFAs have responsibility for determining student eligibility for free and reduced-price meals, and for offering meals that meet nutrient standards to all children who participate.

Eligibility for Free and Reduced-Price Meals. Children living in households with incomes at or below 130 percent of the poverty level are eligible to receive meals for free. Those with incomes between 130 and 185 percent of the poverty level are eligible to receive reduced-price meals, which are substantially subsidized by the program, with a maximum price of 40 cents for lunch and 30 cents for breakfast. Children from households with incomes greater than 185 percent of poverty are referred to as “paid” or “full-price” students; their meals are also subsidized, although to a much lower degree than are the meals for low-income children. (For example, SFAs received a reimbursement of 21 cents per full-price lunch and 23 cents per full-price breakfast in fiscal year 2005.)

The SFAs are responsible for determining the eligibility of students for free or reduced-price meals, largely by assessing applications submitted by households at the start of the school year. Other means of determining eligibility are available, however, including direct certification procedures based on evidence of the households’ receipt of means-tested public assistance.

Meal Requirements. Until 1995, to qualify for Federal reimbursements, school meals had only to follow prescribed meal patterns. The overall goal was to provide 25 percent of the RDA for energy (calories) and key nutrients at breakfast¹ and 33 percent of the RDA at lunch. The traditional meal pattern for lunch required four components (and five items): components are fluid milk, a meat or meat alternate, a bread or grain product, and fruits and vegetables, with two servings of different fruits and/or vegetables required.² Serving sizes for each item were

¹ This goal of 25 percent of the RDA for breakfast was not officially established in regulations until 1995; however, it was used as a guideline in developing the meal patterns and assessing the SBP.

² Two different fruits or two different vegetables may be used to meet the requirement. Fruit or vegetable juice could be counted as a fruit/vegetable serving, as long as the beverage contained at least 50% juice. In a 50% juice drink, only the juice portion counted toward the meal pattern.

specified for various age groups, but the meal pattern for grades 4–12 could be served to all grades in a school.

1. Previous Research

At its most basic level, the need for the proposed study arises from concerns about the food and nutrient intakes of the 27.5 million American schoolchildren who eat NSLP meals each school day, as well as those of the 8.7 million who eat SBP meals each school day. It is well established that at all ages, diet is an important aspect of health (U.S. Department of Health and Human Services/U.S. Department of Agriculture 2005). Furthermore, for most American children, food from the school cafeteria represents a significant amount of their overall energy intake on the days they attend school: on average, in 1994 through 1996, cafeteria foods provided 19 percent of calories for all schoolchildren, 34 percent of calories for NSLP-only participants, and about half of all calories for participants in both the SBP and NSLP (Gleason and Suitor 2001).

In light of these factors, USDA has for some time monitored the dietary quality of the meals produced and consumed in schools under the NSLP and SBP, particularly because the school meals system operates at a very decentralized level, with most meal production decisions made in individual school districts and often in individual schools. No mechanisms exist to enable USDA to dictate the content of the meals centrally, and attempts to influence meal content have proved to be challenging. Thus, USDA must monitor school meal quality periodically to assess whether school meals are meeting nutrition goals. Thus, FNS has sponsored a series of national

studies to assess the role of the school meal programs in student's diets, including the three SNDA studies.³

In the early 1990s, in SNDA-I, MPR examined school meals offered and dietary intakes of schoolchildren (Burghardt et al. 1993a, 1993b, and 1993c, and Devaney et al. 1993). That study was extremely influential in shaping subsequent policy, largely because of its finding that, on average, 38 percent of calories from school lunches were obtained from fat. That figure was widely reported, and it had a significant effect on the policy climate because of its contrast to the 1990 dietary guideline that no more than 30 percent of calories should be derived from fat. SNDA-I also found that school lunches contained higher-than-recommended levels of saturated fat and sodium.

At the same time, SNDA-I found that school meals, on average, provided one-fourth of the RDA at breakfast and one-third at lunch for most vitamins and minerals, which was consistent with the SBP and NSLP targets. In addition, school meal participation led to higher intakes of several key nutrients, even after adjusting for other factors.

The SNDA-I findings concerning fat were one factor leading to legislation that altered the nutrition goals and menu-planning requirements of the school meal programs (as discussed further below). In addition, FNS increased training and technical assistance for school foodservice staff. Overall, these changes are known as the School Meals Initiative for Healthy Children (SMI). Based on menu data collected relatively early in the SMI implementation period, the SNDA-II study found that schools had made some improvement in meeting nutrition

³ The first study to assess the effects of the school nutrition programs, sponsored by FNS in 1980, was known as the National Evaluation of the School Nutrition Programs (NESNP-I) (Wellisch et al. 1983). The study collected data on student participation, dietary intakes, and household and school characteristics from approximately 6,500 students and their parents. These data were further analyzed by Devaney and Fraker (1989), who reanalyzed data on nutrients consumed at breakfast, and Fraker (1987), who examined sodium and macronutrients.

goals, but that policy objectives had not been fully met (Fox et al. 2001). Specifically, the percentage of calories from fat in school lunches was estimated as 33 to 34 percent, on average, which was lower than the SNDA-I finding but still above the *Dietary Guidelines* recommendation of no more than 30 percent.

The FNS-sponsored study by Gleason and Sutor (2001 and 2003) used data from the 1994–1996 Continuing Survey of Food Intakes by Individuals, a national survey of what people eat, to analyze the role of school meals in the dietary intakes of schoolchildren in the mid-1990s. Their work confirmed the SNDA-I finding that children who ate school meals had diets that were higher in fat than those of children who did not consume reimbursable meals. A new finding of theirs, however, was that the diets of children who ate school meals were lower in added sugars than the diets of children who did not.⁴

2. The School Meals Initiative

After the SNDA-I findings that school lunches did not meet the dietary guidelines for fat and saturated fat were released, USDA and Congress responded to the findings in several stages. First, USDA drafted regulations for SMI that created nutrient standards applicable to school meals so that they would be consistent with the *Dietary Guidelines*. The original proposal for SMI regulations also called for all school districts to replace the traditional menu-planning system with a computer-based system known as Nutrient Standard Menu Planning (NSMP).⁵ In November 1994, Congress passed the Healthy Meals for Healthy Americans Act (P.L.104-448), which required that schools in the NSLP and SBP serve meals consistent with the *Dietary*

⁴ Added sugars are sugars added to foods as sweeteners (such as cane sugar or high fructose corn syrup), rather than sugars inherently part of foods such as fruit and dairy products.

⁵ Assisted Nutrient Standard Menu Planning (ANSMP) was also proposed at this time and remains an option. ANSMP is a system whereby SFAs or schools obtain menus from an outside source that have been planned using NSMP.

Guidelines, but also required that USDA develop a food-based menu-planning system as an option. Final SMI regulations were published in 1995 and implementation began in school year 1996–1997. Later legislation allowed SFAs to comply with SMI nutrient guidelines using NSMP, the traditional menu-planning system, an enhanced food-based menu-planning system, or any reasonable approach.

SMI Nutrition Standards. A major change from past practice was that SMI required that school menus be evaluated for compliance with appropriate nutrition standards, in addition to compliance with menu-planning system requirements. Furthermore, SMI set nutrition standards that were consistent with the *Dietary Guidelines* (see Table I.1) and required schools to reduce the fat content of meals to no more than 30 percent of calories and the saturated fat content to less than 10 percent. As required in the 1995 legislation, the regulations formalized the standard that breakfasts should provide 25 percent of the RDA and retained the standard that lunch should provide 33 percent of the RDA for energy (calories), protein, vitamin A, vitamin C, calcium, and iron. In addition, the regulations encouraged reductions in sodium and cholesterol, and increased availability of fiber, without setting quantitative targets.

TABLE I.1
SMI NUTRITION STANDARDS

Nutrient	Standard
Based on 1989 RDAs: ^a	
Calories, protein, vitamin A, vitamin C, calcium, and iron	Breakfast: One-fourth of the RDA Lunch: One-third of the RDA
Based on 1995 Dietary Guidelines for Americans: ^b	
Total fat	Breakfast and Lunch: ≤ 30 percent of total calories
Saturated fat	< 10 percent of total calories

^aNational Research Council (1989a).

^bU.S. Departments of Agriculture and Health and Human Services (1990, 1995). Regulations were based on the 1990 Dietary Guidelines from 1995 to 2000, and were updated to the 1995 Dietary Guidelines in May 2000.

RDA = Recommended Dietary Allowance; SMI = School Meals Initiative for Healthy Children.

Meal-Planning Systems. Under SMI, schools participating in the NSLP and SBP have five options for planning menus that meet the programs' nutrition requirements:

1. ***Traditional Food-Based Menu-Planning System.*** The traditional system for lunch of four meal components and five food items (because of two different servings from the fruit/vegetable component), and minimum serving sizes by age/grade group, remains an option. Breakfasts must offer fluid milk, a fruit or vegetable, and two servings from either the bread/grain group or the meat/meat alternate group (or one of each).
2. ***Enhanced Food-Based Menu-Planning System.*** This system, which is similar to the traditional food-based system, requires more servings of grain products and larger serving sizes for fruits and vegetables.
3. ***Nutrient Standard Menu Planning.*** NSMP provides schools with more flexibility in planning menus. Foodservice staff can create their own menus, using computerized nutrient analysis systems to ensure that the menus meet the programs' nutrition requirements. Lunch menus are required to offer milk, an entree, and one or more side dishes. Breakfast menus must offer milk and at least two side dishes.⁶
4. ***Assisted Nutrient Standard Menu Planning.*** ANSMP allows schools to contract with external sources for assistance with NSMP.
5. ***Other Reasonable Approaches.*** Schools may use any other reasonable approach to planning menus, as long as the menus still meet the nutrition requirements. However, such an approach usually must be approved by their State agency.

3. Current Policy Context

This study was conducted at a time of unparalleled public interest in the nutrition status of children and the role of foods eaten at school in affecting children's health. The incidence of overweight is increasing for virtually all groups of Americans, including schoolchildren. In 2006, the role of schools in preventing or reducing child obesity was featured in sources ranging from a report from an eminent Institute of Medicine panel (Institute of Medicine 2005) to a cover story in the *New York Times Magazine* (Belkin 2006). Both USDA-funded school meals and competitive foods—such as a la carte snacks or entrees, vending machine offerings, or foods sold

⁶ Side dishes may include bread/grain items, fruits, vegetables, or desserts. Schools can group side dishes so students must choose a variety of sides.

in a school store or snack bar—have been identified as policy targets, along with other school policies that affect students’ food consumption.

Competitive Foods. Many observers have reasoned that competitive foods in schools—many of which are high in calories and fat and low in nutrients—may be contributing significantly to child obesity. For example, the American Academy of Pediatrics recently published a policy statement against having soft drinks available in schools (American Academy of Pediatrics 2004). They recommend that pediatricians work “to eliminate sweetened drinks in school,” and they are critical of pouring rights contracts with soft drink manufacturers (in which schools earn revenue by allowing manufacturers exclusive rights to sell beverages, other than milk, in their vending machines and, at times, in the cafeteria).

The widespread availability of competitive foods in schools has been well documented, both by the previous SNDA studies and by other sources (Weschler et al. 2001). This study provides information as of spring 2005 on school policies regarding competitive foods and specific types of competitive foods offered.

School Meals and the School Environment. The NSLP and SBP can play a prominent role in obesity prevention—particularly for the low-income students who receive free and reduced-priced meals—as these meals can constitute a substantial portion of a student’s daily intake. Providing students with access to balanced, nutritious meals can help improve the dietary choices that the students make.

In addition, aspects of the school environment other than the meal programs can affect children’s eating habits. These aspects include whether students are allowed to leave campus during lunch periods, the timing and duration of lunch periods, whether younger children have recess before or after lunch (or not at all), and whether nutrition education is part of the school curriculum. Some of these issues have also been part of current or proposed policy initiatives.

B. STUDY RESEARCH QUESTIONS

Stated in its broadest terms, the objective of the SNDA-III study is to provide a basis for the next generation of school meal program policies and associated research. The data analyses provide a comprehensive picture of the nutrient content of meals offered and served to students in school year 2004–2005, as well as an assessment of whether and how well school meals meet nutrition standards. In addition, the study provides national data on what schoolchildren eat on school days, and on the role in children’s diets of USDA-sponsored school meals and competitive foods sold in school. These results have taken on particular importance amid the growing concern about childhood obesity.

Research questions examined in SNDA-III fit into four basic categories:

1. What are the characteristics of SFAs and schools participating in the NSLP and SBP? How do they provide school meals, what is the environment in which meals are offered, and to what extent are competitive food sources available?
2. What is the food and nutrient content of USDA meals offered and served to students? How well do these meals meet SMI nutrition standards?
3. What are the levels of school meal program participation and customer satisfaction, the characteristics of participants and nonparticipants, and the factors that affect participation and satisfaction?
4. What is the quality of schoolchildren’s diets and the role of school meals and competitive foods in their diets?

Volume I presents analyses that fit under the first two research areas and draw on data collected at the SFA and school levels. This volume analyzes the third and fourth research areas, using data on the dietary intakes of schoolchildren and data from interviews with students and their parents. As appropriate, both volumes compare SNDA-III findings to those in the SNDA-I and SNDA-II reports and other relevant earlier studies.

C. STUDY DESIGN AND DATA COLLECTION METHODS

The SNDA-III study was designed to provide national estimates at the SFA, school, and student levels of analysis. This section provides an overview of the sample design and data collection, focusing on the student- and parent-level data. Volume I presents similar information on the SFA- and school-level data. Volume III of this report describes the design and data collection methods for the full study in detail.

1. Sample Design

SNDA-III was based on a multistage sampling approach, which first sampled SFAs, then schools served by these SFAs, and then children who attended these schools. Children were sampled from lists of all students enrolled at the sampled school. Parents of the sampled children were also interviewed. Substantive data for the study were obtained at each of these levels. This volume primarily uses data collected from students and parents.

The SFA sample was divided randomly into two parts: (1) SFAs that would participate in SFA-, school-, student-, and parent-level data collection (*the student sample*); and (2) SFAs that would participate only in SFA- and school-level data collection (*the supplemental sample*). The latter sample was included to increase the precision level of the menu survey and school-level interview data; together, they comprised *the menu survey sample* at the SFA level.

For each sampled SFA, the sample design called for selecting three schools, if available: one elementary school, one middle school, and one high school. Our definitions of elementary, middle, and high schools match those used in the previous SNDA studies:

- **Elementary schools** are either (1) those with lowest grades between pre-kindergarten and 3rd grade, and the highest up through 12th grade; or (2) those with the lowest grade either 4 or 5 and the highest less than 8. Schools with grade ranges such as K-8

and K-12 are classified as elementary schools somewhat arbitrarily, so all schools fit into one category or the other.⁷

- **Middle schools** are schools in either of two situations: (1) the lowest grade is 4 or 5, and the highest grade is 8 or higher; or (2) the lowest grade is 6, 7, 8, or 9, and the highest is less than 10.
- **High schools** are those with either (1) both the lowest grade 6, 7, 8, or 9 and the highest grade 10 or above; or (2) the lowest grade 10, 11, or 12.

Within each school in the student sample, children were randomly selected as eligible for completing a 24-hour dietary recall interview; both the student and one of his or her parents (or guardian) were interviewed, if possible. A subsample of students completed another dietary recall interview about a week later, to capture the variability of students' intakes from day to day.⁸ Although the goal was roughly eight student interviews per school, larger numbers were selected to allow for failure to obtain consent from parents for the student interview (in districts where active consent was required) and for parent nonresponse to the parent interview.⁹

A final stage in student sampling took place on the day of data collection. Lists of students for whom consent was obtained were randomly ordered, and students were called from their classrooms for the interview. If the student was absent or otherwise unavailable, the next student on the list was contacted, until the desired number of interviews had been completed.

SFAs, schools, and students who declined to participate in the data collection were replaced by randomly chosen substitutes. Student-level data were collected in 287 schools in 94 SFAs. In

⁷ This classification was chosen to be consistent with the SNDA-I and SNDA-II studies. Note that only 11 schools (2 K-12 and 9 K-8) fell into these categories.

⁸ Students in kindergarten and pre-kindergarten were omitted from the study because of concerns about their ability to provide accurate dietary recall information. For similar reasons, special education students in self-contained classes were also ineligible. Schools that served only these groups were also treated as ineligible.

⁹ For elementary school students, parents were asked to complete an in-person interview and help their child complete their 24-hour recall, which often involved a trip to the school. For older students, parents did not help with the dietary recall, and the parent interview was conducted by telephone.

all, 2,709 students were interviewed in school, and 2,330 of their parents were interviewed. The analysis sample is defined as all students who completed a dietary recall and whose parent completed the parent interview—2,314 students met those criteria. A subsample of nearly 800 students completed a second 24-hour dietary recall, and 666 of these students were included in the analysis sample.

2. Data Collection

MPR conducted most of the data collection from January through August 2005. Data were collected from SFA directors and their staff (SFA level), school foodservice managers and principals (school level), and parents and students (student level). In addition, field interviewers completed checklists during their visits to the schools sampled for student-level data collection. Table I.2 summarizes the data collection instruments included in the SNDA-III database. Because this volume focuses on the student-level analysis, data collection instruments used at the SFA and school levels are described briefly, and student and parent data collection are described in more detail.

a. SFA-Level Data

At the SFA level, the Initial Contact Survey (Part I) collected data on the characteristics of the three schools in the main sample from SFA staff, and the SFA Director Survey collected data on SFA characteristics and on SFA policies and practices regarding menu planning, food purchases, competitive foods, and other issues, such as nutrition promotion and meal pricing.

b. School-Level Data

At the school level, data were collected through interviews with the school foodservice manager and the principal (the Foodservice Manager Survey and the Principal Survey). School-level data were also collected via checklists that field interviewers completed when they were

TABLE I.2
SNDA-III INSTRUMENTS

Instrument	Respondent(s)	Mode
SFA Level		
Initial Contact Survey Part I	SFA director or designee	Telephone interview prior to visit or data collection (mailed upon request).
Survey of SFA Directors	SFA director	Telephone interview after visit or data collection (mailed upon request).
School Level		
Initial Contact Survey Part II	School staff in visited schools	Telephone interview prior to visit (visited schools only)
Menu Survey	School foodservice manager	Mail with intensive telephone training, technical assistance, and followup; in-person followup in 287 visited schools; the proportion a la carte form was completed by telephone after remaining menu survey forms were returned.
1. Daily Meal Counts Form		
2. Reimbursable Foods Form: Breakfast		
3. Reimbursable Foods Form: Lunch		
4. Recipe Form		
5. Self-Serve/Made-to-Order Bar Form		
6. Point-of-Sale Form		
School Foodservice Manager Survey	School foodservice manager	Telephone (mailed upon request) in 111 schools; in-person interview in 287 visited schools
Principal Survey	Principal	Telephone (mailed upon request) in 108 schools; in-person interview in 287 visited schools
Alternative Food Source Checklist	n.a.	Completed by interviewer during visit to 287 schools
A La Carte Checklist	n.a.	Completed by interviewer during visit to 287 schools
Vending Machine Checklist	n.a.	Completed by interviewer during visit to 287 schools
Student/Parent Level		
Student Dietary Recall and Interview Student Interview	Student	In-person interview
Day 1 Recall (plus parent-assisted recall for elementary school students)		
Day 2 Recall (plus parent-assisted recall for elementary school students)		
Weight and Standing Height Measurement	Student	In-person observation
Parent Interview	Parent	In-person interview for parent of elementary student/telephone interview for parent of secondary student

n.a. = not applicable.

on-site for the student-level data collection. These checklists allowed observers to check off the types of foods offered a la carte in the cafeteria, in vending machines, and in other in-school venues that compete with the NSLP lunch. In addition, school foodservice managers completed detailed forms concerning foods offered on their menus for one school week (the Menu Survey). The foodservice managers received support by telephone from trained technical assistants. The goal of the survey was to collect data on all foods offered in school lunches and school breakfasts (if available) during a typical school week, along with information on the number of servings of each food that students selected. Data on each food needed to be specific enough to allow for nutrient coding, so detailed food descriptions, recipes, purchased product manufacturers' codes, and serving size information all were collected. Volume I of this report describes the analysis of the menu survey and other school-level surveys in detail.

c. Student and Parent Data Collection

Data collected from students and their parents included their reports of participation in the NSLP and SBP, reasons for participation or nonparticipation, and satisfaction with school meals. Data were also collected on the student's dietary intakes over a 24-hour period and on the student's characteristics, such as age, height, and weight.

Student Interview. The focal point of this interview was a 24-hour dietary recall. The interview also collected information about school meal consumption, the student's perception of availability of and opinions about school meals (including reasons for eating or not eating the meals, when they were available), and about the environment in which lunch was eaten (for example, cleanliness, crowding, and other activities during lunch). Also included were items about dietary supplements, recreational activities, and exercise; some of these items were asked only of children in middle and high schools. The dietary recall interviews are described further in Chapter V of this report.

Parent Interview. This interview collected information about parents' perceptions of their children's consumption of school meals, attitudes toward school meals (their own attitudes and perceptions of their children's attitudes), and the availability of certain foods at school. It also asked whether the student was receiving free or reduced-price meals; whether the family had applied for such meals; and, if it had not applied, why not. Questions about the student's activity level, overall health, dietary habits, food allergies, and consumption of certain foods were also included. Finally, the parent interview collected demographic and economic data on the student and the family, and food security measures.

Weight and Height Information Form. This form was completed by field staff as they measured the child's height and weight, using standardized equipment. This information was used to determine estimated energy requirements.

3. Response Rates

Recruiting SFAs to participate in SNDA-III was challenging, for several reasons. School districts face many requests for information and requirements to complete forms related to various funding sources; they also have security and confidentiality concerns. In addition, participation in the SNDA-III study was time-consuming for districts and schools.

To recruit SFAs, FNS and then MPR first contacted State child nutrition directors and requested that they contact sampled SFAs and encourage support of the study. Recruiters began to contact SFA directors by telephone in October 2004. Initial calls discussed the background and purpose of the study, as well as methods for student sampling and the scheduling of data collection. The recruiters also obtained information on the district's policy on research participation, district characteristics, and any recent changes in district configuration that were not reflected in data originally used for sampling. If an SFA did not initially agree to participate,

additional contacts were attempted, and FNS and State agency staff were employed to try to persuade the SFA to do so.

Recruiting efforts led to an 83 percent response rate among SFAs in the full menu sample and a 79 percent rate among SFAs selected for student data collection (Table I.3).¹⁰ This rate is based on all SFAs ever released for recruitment efforts, including replacements for those that refused. Essentially all nonresponse at the SFA level was due to refusals; only one SFA agreed to participate (and provided school-level data) but did not complete the SFA Director Survey. After the SFA agreed to participate, schools in the SFA generally agreed as well. About 95 percent of schools in SFAs that agreed to participate completed the menu survey, the criterion for considering a school a completed sample case; 93 percent of schools selected for both school- and student-level data collection participated.

TABLE I.3
SNDA-III RESPONSE RATES

	Response Rate (Percentage)	Completed Sample Size
SFAs (Menu Sample)	83	130
SFAs (Student Sample)	79	94
Schools (Menu Sample)	95	398
Schools (Student Sample)	93	287
Students (Recall Sample)	63	2,709
Parents (Parent Interview Sample)	89	2,330

Source: School Nutrition Dietary Assessment-III.

Note: Response rates for schools reflect the percentage of eligible sample members participating, given agreement to participate at the SFA level. The response rate for students reflects the percentage of eligible students participating, given the school participated, and the response rate for parents reflects the percentage of parents participating, given their child completed a dietary recall. Response rates are weighted using raw sampling weights—that is, weights that correct for unequal probability of selection, before any nonresponse adjustments. See Volume III, Chapter III for additional details.

¹⁰ These response rates were weighted using raw sampling weights—the inverse of the probability of selection, before nonresponse adjustment. They thus reflect the proportion of SFAs or schools nationally represented in the sample.

Obtaining interviews with students was another challenging stage of data collection. Most SFAs or schools required that parents either actively consent to their child's participation by returning a signed form (active consent), or that they be offered the chance to opt out of participation for their child by returning a form (passive consent). School staff assisted in circulating consent forms and reminding students and parents to return them. The response rate includes in the denominator families who did not return consent forms in sites requiring active consent. Almost all of the nonresponse to the student interview resulted from failure to obtain active consent.

D. OVERVIEW OF ANALYSIS METHODS

In this section, we provide background on aspects of our analysis approach that apply throughout this report.

1. Analysis Samples

For consistency in the analyses, analysis samples for each level of analysis were limited to observations with valid information on key data elements. The analysis samples were defined as follows:

- ***SFA Sample:*** Responded to the SFA Director Survey (n = 129).
- ***School Sample:*** Provided data for the menu survey (n = 398 overall, n = 397 lunch menus and n = 331 breakfast menus). The full menu survey samples are used in the analysis of meals offered and served. In the analysis of SFA and school characteristics, the staff surveys were of critical importance, so the main sample analyzed was defined as those schools that completed the menu survey and the principal survey (n = 395).
- ***Student Sample:*** Completed 24-hour dietary recall and parent completed parent survey (n = 2,314).

2. Weighting and Estimation

All analyses in this report are weighted so that the sample is nationally representative. The final weights adjust both for unequal probabilities of selection at each stage of sampling and for nonresponse at each stage of data collection. Instead of preparing separate weights for each data collection instrument, one weight was developed for the SFA level of analysis, one for the school level of analysis, and one for the student level of analysis. These final weights were based on the largest analysis samples at each level (129 SFAs, 398 schools, and 2,314 students).

Because of the complex sample design for SNDA-III, when standard errors were estimated and/or statistical tests were conducted for this report, estimates were adjusted for the complex study sample design using the SUDAAN statistical package (Research Triangle Institute 2006) or the survey commands of the Stata statistical package (StataCorp 2006).

3. Tests of Statistical Significance

Throughout the analysis in this volume, statistical tests of the differences in average outcomes for school meal program participants and nonparticipants were performed. These tests (based on two-tailed *t*-statistics) indicate whether an observed difference between the two groups in the SNDA-III sample is large enough that it is unlikely to have occurred by chance alone. Asterisks indicate whether a difference is significant at the 5 percent level (meaning that there is only a 5 percent chance a difference of this magnitude or greater would have been observed by chance alone if the true difference in the full population were zero) or the 1 percent level (indicating there is only a 1 percent chance the difference is due to chance alone).

However, it is important to keep in mind that *lack* of statistical significance does not necessarily imply that there is *no* true difference between participants and nonparticipants in the population at large. In some cases, a true difference may exist and may be large enough to be substantively important, but may simply not be detected as statistically significant in the

SNDA-III sample. In general, the smaller the sample, the more likely it is that a true difference in the population may not be detected as statistically significant in the analysis.

Researchers use a concept known as the “minimum detectable difference” (MDD) to determine the smallest true population difference that would have a high probability (or “statistical power”) of being found to be statistically significant in a given sample at a specified level of significance. Typically, researchers specify a power level of 80 percent. MDDs are a function of the variance of the outcome and covariance between the two groups, the sample size, and the specified power and significance levels. Table I.4 displays MDDs for a hypothetical binary outcome variable with no clustering, with mean value of 50 percent, with a 5 percent significance level and 80 percent power. The table shows MDDs for comparisons across program participants and nonparticipants for both the NSLP and the SBP, overall and for subgroups defined by grade level. As shown in the table, all else equal, MDDs increase (meaning that statistical power—the likelihood of detecting a true difference of a given magnitude—falls) as sample size decreases. For example, for the full sample of NSLP participants and nonparticipants, researchers could expect to detect a true difference in this outcome as small as 6 percentage points 80 percent of the time; while for smaller subgroups, such as elementary school students, researchers could only expect to detect a true difference as small as 12 percentage points with the same level of power. For this smaller elementary school sample, the probability of detecting a true difference as small as 6 percentage points would be lower than 80 percent.

Failure to detect a true difference will therefore be more likely in analyses of population subgroups, such as those defined by age and gender or grade level, for which sample sizes may be relatively small. The text of this report primarily discusses differences that are statistically significant at the 5 percent level or lower. However, particularly among subgroups with small

TABLE I.4
 MINIMUM DETECTABLE DIFFERENCES IN THE SNDA-III SAMPLE
 FOR A HYPOTHETICAL BINARY OUTCOME

	Percentage of Population with Outcome = 1	Sample Size			Minimum Detectable Difference (Percentage Points)
		Total	Participants	Nonparticipants	
National School Lunch Program	50	2,314	1,386	928	5.9
Elementary School	50	732	531	201	11.6
Middle School	50	787	497	290	10.3
High School	50	795	358	437	10.0
School Breakfast Program	50	2,314	381	1,933	7.8
Elementary School	50	732	160	572	12.5
Middle School	50	787	127	660	13.6
High School	50	795	94	701	15.4

Source: School Nutrition Dietary Assessment-III.

Note: Minimum detectable differences computed for a hypothetical binary outcome with no clustering, with mean 0.5, 80 percent power, and 5 percent significance level for a two-tailed t-test, based on actual SNDA-III sample sizes. Minimum detectable difference computed as $2.80 \times$ standard error of difference.

sample sizes, patterns of differences across groups, or a difference for a particular outcome that is substantive in magnitude, may be suggestive of differences between participants and nonparticipants even if these differences are not statistically significant at conventional levels.

An additional consideration—sometimes referred to as the “multiple comparisons problem”—is the fact that, when conducting significance tests for multiple outcomes or population subgroups, the likelihood of finding a difference that is significant at the 5 percent level for any given outcome or subgroup simply due to chance is greater than 5 percent. For example, in examining 40 outcomes, one would expect to find, on average, two significant test results (5 percent of 40) simply due to chance alone, even if there were no true underlying differences between the two groups being compared in the population at large. Since the SNDA-III data analysis includes significance tests for many outcomes and population subgroups, it is important to keep in mind that some statistically significant differences (roughly 5 percent) may

reflect “false positives” rather than true underlying differences in the populations being compared. Unfortunately, there is no way to know which of these differences are false positives. Therefore, it is important to keep in mind that while significance test results provide an important gauge of true underlying population differences, these tests are not a definitive measure of true population differences, and should be considered in conjunction with broader patterns of estimated differences and their magnitudes and in the context of available sample sizes and the design used in selecting the sample.

4. Statistical Reporting Standards

To help readers assess the reliability of the estimates, reporting standards are applied here that are based on those of the joint USDA/National Center for Health Statistics Working Group (Federation of American Societies for Experimental Biology 1995) and a roughly calculated student-level design effect of 2.0. Specifically, for the nutrient data, estimates that have a coefficient of variation greater than 0.3 were flagged with a ~. All means and percentiles, as well as percentages between 25 and 75, were also flagged if the sample size was less than 60 (30 times the estimated design effect of 2.0). Percentages (but not percentiles) in the tails of a distribution (less than 25 percent or greater than 75 percent) were flagged when the number of cases represented by $p*n$ (where p is the percentage and n is the sample size) or by $(1-p)*n$ was less than 16 (8 times the estimated student design effect of 2.0).

5. Analysis Methods for Assessing Dietary Intakes

The assessment of students’ dietary intakes involves two different types of estimates: (1) estimates of students’ *mean intakes* of energy and nutrients from breakfast/lunch and over 24 hours, and (2) estimates of the *proportion of students with inadequate or excessive nutrient intakes*. A distinct analytic approach was required for each set of estimates. In both cases,

however, a major focus of the analysis is on comparing intakes of NSLP and SBP participants with those of nonparticipants.¹¹ In interpreting results of these comparisons, it is important to keep in mind that differences in intakes between participants and nonparticipants are not necessarily *caused* by the school meal programs. Students who participate in the NSLP or SBP are likely to differ from nonparticipants in many ways, both observable and unobservable, and some of these differences would likely contribute to differences in dietary intakes even in the absence of the school meal programs.

To adjust for some of the underlying differences between participants and nonparticipants, the estimates of mean intakes were regression-adjusted for observable factors that might be correlated both with a student's decision to participate in the school meal programs and with his or her dietary intakes. (This procedure is described in greater detail in Chapter V and Appendix E of this report.) These adjustments ensure that significant differences between participants and nonparticipants in regression-adjusted mean intakes represent true differences among students who are similar in many important observable characteristics. However, because there may be important unobservable differences between the two groups that could not be accounted for in the regression adjustment, differences between the two groups still do not represent causal effects of the school meal programs.

Estimates of the proportion of students with inadequate or excessive nutrient intakes are based on comparisons of students' *usual* dietary intakes on school days to the DRIs. Usual intakes can seldom, if ever, be directly observed. The 24-hour dietary recalls provided information on students' observed *daily* intakes. A well-established procedure, recommended by the Institute of Medicine and described in Chapter V and Appendix H of this report, was used to

¹¹ Comparisons of meal-specific (breakfast or lunch) intakes exclude students who skipped that particular meal, while comparisons of daily intakes include all students in the sample.

estimate the distribution of usual intakes from information on daily intakes, and to compare this distribution to the DRIs to determine the proportion of the population with inadequate or excessive intakes of various nutrients. One important feature of the procedure for estimating usual intake distributions is that it produces estimates for *groups* rather than for individuals. While this allows accurate estimation of the proportion of students in a group with inadequate or excessive intakes, it prevents the use of the regression-adjustment techniques described above, which can be applied only to individual-level data. Therefore, as an alternative to regression-adjustment, propensity score matching was used to adjust for differences in observable characteristics at the group level for the analysis of nutrient inadequacy and excess. (This procedure is described in greater detail in Chapter V and Appendix I of this report.) As with regression-adjustment, because there may be important unobservable differences between the two groups that could not be accounted for in the propensity score matching, differences between the two groups still do not represent causal effects of the school meal programs.

E. PLAN OF THE REPORT

This report has two parts, corresponding to the key research questions covered. The first part describes participation in the school meal programs and customer satisfaction (Chapter II), characteristics of school meal program participants and nonparticipants (Chapter III), and factors related to school meal program participation (Chapter IV). The second part presents the analysis of schoolchildren's dietary intakes, including an overview of the approach for analyzing dietary intakes (Chapter V), analysis of the dietary intakes of NSLP participants and nonparticipants (Chapter VI), and analysis of the dietary intakes of SBP participants and nonparticipants (Chapter VII).

II. PARTICIPATION IN, AND VIEWS OF, THE SCHOOL MEAL PROGRAMS

School meal programs can accomplish their policy goals only if students participate in the programs. Therefore, an understanding of which students participate and the factors driving participation is highly policy-relevant. Closely tied to participation is the extent to which students and their parents (the “customers”) are satisfied with school meals, as well as the characteristics of the meals and meal programs with which they are either more or less satisfied. Because the nation’s schoolchildren are the potential customers for school meals, many American families have a stake in the school meal programs. In the context of good nutrition, customer satisfaction is thus a high priority for the school meal programs. The perceptions and opinions of students and parents can provide valuable insight as to whether the National School Lunch Program (NSLP) and the School Breakfast Program (SBP) are accomplishing their goals of reducing hunger and contributing to good nutrition among participants.

A. SUMMARY OF FINDINGS

- Based on foods students consumed, their sources, and comparison to the menu offered, the SNDA-III data indicate that, on a typical day in school year 2004-2005, about 62 percent of students participated in the NSLP and about 18 percent of students participated in the SBP.
- Nearly three-quarters of children reported participating in the NSLP three or more days per week (usual participation). One-quarter reported usually participating in the SBP.
- As in previous studies, participation rates in the school meal programs varied by subgroups of students: boys participated at a higher rate than girls, low-income students participated at a higher rate than higher-income students, and elementary school students participated at a higher rate than middle and high school students. These patterns were similar for lunch and breakfast, and for usual and target day participation measures.
- Hispanic students and non-Hispanic black students participated in the NSLP at much higher rates than non-Hispanic white students and those of other races (about 70 percent for the first two groups versus less than 60 percent for the latter two), most

likely because blacks and Hispanics are more often eligible for free or reduced-price meals. Non-Hispanic black students had the highest rates of participation in the SBP (32 percent), followed by Hispanics (20 percent) and non-Hispanic whites (13 percent).

1. Students' Reasons for Participation and Nonparticipation

- As leading reasons for participating in the NSLP on the target day—the day covered by the dietary recall—students mentioned being hungry (35 percent), liking the food in general (21 percent), and liking what was served on the menu that day (13 percent). Liking the food in general was the most common reason for participation among elementary school students, while middle and high school students were most likely to cite hunger as their primary reason for participating.
- Among students who did not participate in the NSLP on the target day, reasons mentioned most often were that they brought lunch from home (28 percent), did not like what was served that day (20 percent), and did not like school lunches in general (9 percent).
- Students were generally satisfied with their school's lunchtime environment. Almost two-thirds of students reported that tables were always or usually clean, and more than half agreed that the noise level was about right. Most students reported that there were enough seats and tables available and that they had adequate time to eat their lunch.
- Among the 40 percent of students who ever participated in the SBP, convenience, liking the food, and being hungry emerged as the three most commonly cited reasons for eating school breakfasts.¹ Elementary school students were most likely to cite liking the food as their top reason for participating, while middle and high school students were most likely to cite convenience.
- Of those students who did not participate in the SBP, almost half said that they ate breakfast at home instead, and one-quarter said that they did not have time to eat a school breakfast. Fifty-nine percent of students who ate school breakfasts two or fewer days per week said they would eat them more often if they were served in their classroom.

2. Parents' Reasons for Participation and Nonparticipation²

- When parents were asked why their child participated in the NSLP, 30 percent reported that it was convenient for them (the parents), 23 percent that their child liked

¹ This question was phrased in terms of participation in general, rather than for the target day.

² The parent survey could be completed by a parent, a parent's partner, or a guardian. For brevity, this chapter refers to "parents."

the food, and 18 percent that they believed school lunches were a good value. Convenience was the most commonly cited reason among parents of elementary and middle school students, while value was most commonly cited by parents of high school students.

- Parents of NSLP nonparticipants reported some of the same reasons for their children not getting school lunches as students did—for example, their child did not like the food (68 percent), and/or preferred to bring a lunch from home (65 percent).³
- Among parents whose children received a school breakfast fewer than three days per week, 82 percent said that their child preferred to eat at home. The second most commonly cited reason cited was an inadequate amount of time to eat breakfast at school.

3. Parents’ Knowledge of, and Views on, the School Meal Programs

- Nearly three-quarters of parents strongly agreed or somewhat agreed that they had enough information from their child’s school or district on the NSLP. Parents whose children were in lower grades were more likely to indicate having enough information.
- Most parents knew whether their child’s school offered school breakfasts; awareness was highest among parents whose children were in lower grades. About 65 percent of parents who reported that the SBP was offered in their child’s school strongly agreed or somewhat agreed that they received enough information on the program.
- Most parents somewhat or strongly agreed that the NSLP gives all children an opportunity to eat lunch and that the SBP gives all children an opportunity to eat breakfast. Most somewhat or strongly disagreed that both the NSLP and the SBP are only for needy families.

4. Satisfaction with School Meals Among Students

- Overall, about half of students who said they ever ate school lunches reported that they liked the lunches. Opinions of school lunches declined with students’ grade level—among those who said they ever ate a school lunch, 56 percent of elementary school students reported liking the lunches, compared with 35 percent of middle school students and 32 percent of high school students.
- Students were less satisfied with specific aspects of school lunches. More than half of students reported that they were sometimes or never satisfied with the taste, appearance, and smell of the food served at school. Nearly half of students reported that they would like to see more choices available on the daily lunch menu. In

³ Parents gave reasons why their children did not participate in the NSLP in general, whereas students gave reasons why they did not participate on the target day.

contrast, most students were satisfied with the portion sizes and temperature of milk served.

- Likewise, about half of students who said they ever ate school breakfasts reported that they liked the breakfasts. Opinions of school breakfasts also declined with grade level—among those who said they ever ate a school breakfast, 61 percent of elementary school students reported liking the breakfasts, compared with 49 percent of middle school students and 47 percent of high school students.

5. Satisfaction with School Meals Among Parents

- In general, parents were satisfied or somewhat satisfied with the NSLP and SBP overall, as well as with some components of the school meals. Twenty and 31 percent of parents noted that school lunches and breakfasts, respectively, were very healthy, and about two-thirds thought that school meals were somewhat healthy. Most parents said that school lunches were a good or pretty good financial value.
- Among parents who expressed dissatisfaction with school lunches, almost half (48 percent) attributed it to their belief that school lunches were not healthy enough. Other reasons included poor quality or taste (38 percent), lack of menu choice (27 percent), and that their child would not eat the food (18 percent).

6. Parents' Views on Availability of Competitive Foods

- Parents were well informed about the availability of vending machines in their child's school, with 86 percent correctly reporting the presence or absence of these machines. Parents were less knowledgeable about the availability of a la carte items or school stores and snack bars in their child's school, with 69 percent correctly reporting on the presence or absence of these competitive food sources.
- More than half of parents disapproved of the availability of certain competitive foods in schools. Almost 58 percent thought it was a bad idea to allow fast-food brand products in schools, and 60 percent thought it was a bad idea to allow vending machines. Disapproval of these competitive foods was highest among parents of elementary school students and lowest among parents of high school students.

7. Parents' Suggestions for Improving the School Meal Programs

- Sixty-five percent of parents in the sample offered suggestions on ways to improve the school meal programs. They were particularly concerned with making meals more healthy (24 percent), offering more fruits and/or vegetables (21 percent), and expanding variety in the foods served overall (19 percent).

This chapter presents an analysis of participation in, and satisfaction with, the school meal programs. It first examines who participated in the NSLP and SBP. Next, it considers reasons students and/or their parents reported explaining their participation decisions. The chapter then focuses on the degree to which students and parents were satisfied with the NSLP and SBP, and the factors that influenced these levels of satisfaction. Finally, it describes suggestions from parents on ways to improve the school meal programs. Primary data sources for this chapter included the Student Interview, the Parent Interview, and the 24-Hour Dietary Recalls.

B. PARTICIPATION RATES IN THE SCHOOL MEAL PROGRAMS

This section presents estimates of NSLP and SBP participation rates for all students and key subgroups, based on data collected from students and parents.⁴ Estimating participation rates when administrative data on certification status and participation are not available raises important challenges: (1) self-reports may not be reliable, because students may not distinguish reimbursable meals from other cafeteria offerings; (2) students report what they ate, but not items that they were served (or selected) that they did not eat; and (3) many food items are available both in reimbursable meals and a la carte. The first part of this section describes the approach to these challenges used in this analysis (with further details in Appendix A); the second and third parts present estimates of participation rates of students on the target day—the day that their dietary recall covered—and usual participation rates as reported by the students. Results are presented first for lunch and then for breakfast participation rates, overall and for a range of subgroups.⁵

⁴ Administrative data on certification status and participation were not collected because of the extra burden that would have been imposed on school districts and the possible need for parental consent. In addition, not all schools track the participation of individual students.

⁵ Table B.1 in Appendix B presents participation rates for secondary students.

Comparisons of participation rates across groups have not been tested for statistical significance. Even more important, they have not been adjusted for other characteristics of the students, families, or schools that may affect participation. Differences by race/ethnicity, for example, may reflect differences in income levels, parents' education, language spoken in the home, or many other factors. Chapter IV presents results from a multivariate analysis of factors affecting participation rates.

1. Measures of Participation

Measures of NSLP and SBP participation were developed for two time frames: (1) "target day" participation, defined as participation on the single school day that the student's dietary intake interview covered; and (2) "usual" participation, defined as the student's report that he or she usually ate a school lunch or school breakfast three or more days per week.⁶

Defining Target Day Participation. To assess whether a student ate a school lunch or breakfast on the intake day, four sources of information were used: (1) data from the dietary recall on the types and amounts of foods the student ate; (2) data from the recall on the source of that food, matched to interviewers' records on the specific sources available in each school; (3) information on whether a specific food in the dietary recall was likely to have been on the school menu, based on a careful matching of foods in the menu data and the recall data (see further discussion in Volume III); and (4) the student's self-report of participating or not participating on the target day, for lunch only (because a self-report for the target day was not collected for breakfast).

⁶ If the student completed two intake interviews, the day of the first interview was used to determine target day participation.

Previous studies have found that self-reported participation in the NSLP and SBP is consistently higher than participation rates estimated from administrative data (Gleason and Sutor 2001). One possible explanation is that students (and parents) may not clearly distinguish a la carte purchases from purchases counted as reimbursable school meals. In SNDA-III, parents' reports were consistently higher than their children's. This could be because students tell their parents that they take the school lunch or breakfast more often than they actually do.

On the other hand, relying on the recall data could lead to *measures* of participation that are too low, even if the measures account for offer-versus-serve (OVS) rules. One reason for this is that students may take a food item so their meal will count as a reimbursable meal, but not eat any of it, and thus not report it during the dietary recall.

Thus, the measure of target day participation used in this report uses both types of data.⁷ The measures also consider whether a food was on the menu, as that provides somewhat more confidence that the food was part of a reimbursable meal. The participation measures differ slightly according to the menu-planning and meal-counting method used by the school, as the rules for OVS differ by menu-planning method.

Target day lunch participation was defined as follows:

- ***Food-Based Menu-Planning Schools.*** Students were counted as NSLP participants if they either:
 - Reported consuming at least three of the five required food items (one grain, one meat/meat alternate, two fruits and/or vegetables, one milk) and all three were on the school menu, or

⁷ Similar approaches were used in SNDA-I (Burghardt et al. 1993a) and in an FNS-sponsored study using the 1994-1996 Continuing Survey of Food Intakes by Individuals (Gleason and Sutor 2001). The approach used in this SNDA-III study was updated to apply to schools using nutrient-standard menu planning. It also improved on past work by merging the menu and dietary recall data to identify whether foods consumed by students were likely to have been “on the menu.”

- Reported consuming at least one of the five required food items that was on the school menu, and also reported consuming a school lunch on the target day.
- ***Nutrient Standard Menu-Planning Schools.*** Students were counted as NSLP participants if they either:
 - Reported consuming at least one entree and one side and both were on the school menu, or
 - Reported consuming at least one entree *or* side that was on the school menu, and also reported consuming a school lunch on the target day.

Target day breakfast participation was defined similarly, as follows:

- ***Food-Based Menu-Planning Schools.*** Students were counted as SBP participants if they reported consuming at least one of the four required food items (two grains or meat/meat alternates, one fruit or vegetable, one milk), and this item was on the school menu.
- ***Nutrient Standard Menu-Planning Schools.*** Students were counted as SBP participants if they reported consuming at least one item (including milk) that was on the school menu.

The measures were selected because they provided a good match to administrative data and were internally consistent.⁸ Appendix A provides more details on these measures and other definitions considered.

Defining Usual Participation. In the student and parent interviews, each was asked how many days in a typical week the student ate a school breakfast and asked the same question regarding school lunch.⁹ In this analysis, “usual” participation is defined as the child reporting participation three or more days per week. Parents’ reports of usual participation were consistently higher than students’ reports.

⁸ These measures of participation include students who consumed items in addition to the reimbursable meal—for example, a student who consumed a reimbursable lunch plus an a la carte item would be classified as an NSLP participant.

⁹ Children in grades 1 to 3 were asked only if they ever ate the school lunch/breakfast, and if so, if they ate the school lunch/breakfast three or more days per week.

2. Target Day Participation Rates

Lunch. Overall, 62 percent of students were estimated to participate in the NSLP (Table II.1). This estimate is slightly higher than the participation rate estimate of 60 percent derived from administrative data. However, this discrepancy is not unexpected, because the administrative data include students enrolled in private schools offering NSLP, who may have lower participation rates than public school students. Participation decreased as grade level increased, dropping from 73 percent among elementary students to 60 percent among middle school students to 44 percent among high school students.¹⁰ This general trend applied within most demographic groups. Boys were about as likely as girls to participate in the NSLP at the elementary level, but they were much more likely to participate at the middle and high school levels. About 79 percent of children whose parents reported they received free or reduced-price meals were estimated to have participated on the target day, versus 50 percent of children whose parents did not report that they received meal benefits. Hispanics and non-Hispanic black students participated at high rates (67 and 70 percent), while non-Hispanic whites and students of other races (including Asians and Pacific Islanders, Native Americans, and students whose parents reported they were biracial) were less likely to participate (57 percent for both groups). These comparisons do not control for other differences between these groups that may affect participation rates (see Chapter IV for such an analysis).

Breakfast. Considerably fewer students participated in the SBP—the participation rate was 18 percent on average (including students in schools that did not offer the program), and it ranged by school level from 23 percent for elementary school students to 15 percent for middle

¹⁰ Statistical significance tests were not conducted for tables in this chapter.

TABLE II.1
 AVERAGE TARGET DAY PARTICIPATION RATES IN THE NSLP
 (Percent)

	Elementary Schools	Middle Schools	High Schools	All Schools
Gender				
Male	73.8	66.0	50.0	65.4
Female	71.4	54.9	38.2	58.0
Income Relative to Poverty				
Less than or equal to 130 percent	86.9	71.7	55.5	75.7
Between 130 and 185 percent	86.5	63.5	64.1	75.5
More than 185 percent	62.1	54.6	36.3	52.6
Receipt of Free or Reduced-Price Meals (Parent Report)				
Receives free or reduced-price meals	86.5	70.7	66.4	78.8
Does not receive free or reduced-price meals	60.1	51.9	34.3	49.6
Race/Ethnicity				
Hispanic	82.7	62.3	39.8	67.4
White, non-Hispanic	65.3	62.6	42.1	57.3
Black, non-Hispanic	85.8	51.4	56.7	70.3
Other	62.0	63.3	44.1	56.7
All Students	72.6	60.2	43.9	61.7
Number of Students	732	787	795	2,314

Source: School Nutrition Dietary Assessment Study-III, school year 2004-2005, Child Interview, Dietary Recalls, Parent Interview. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: Target day participation is defined using several sources, primarily the foods reported in the dietary recall data and sources of foods; see further discussion in text and Appendix A.

school students and 10 percent for high school students (Table II.2).¹¹ Patterns of participation in the SBP were similar to those for the NSLP, but relative differences in participation rates were larger: boys were about 50 percent more likely than girls to participate in the SBP (21 versus 15 percent), and students with incomes less than 130 percent of poverty were three times more likely to participate than students with family incomes more than 185 percent of poverty (31 versus 10 percent). The pattern of participation by race/ethnicity was somewhat different than for the NSLP—non-Hispanic black students were more likely to participate than Hispanics (32 versus 21 percent), while participation rates for the NSLP were about the same for the two groups. As with the NSLP, non-Hispanic whites and students of other races were the least likely to participate.

3. Usual Participation Rates

Usual participation rates in the NSLP and SBP, as reported by students, were somewhat higher than target day participation rates, but they showed similar patterns of variation among subgroups (Tables II.3 and II.4). Seventy-two percent of students reported they usually participated in the NSLP, while 25 percent of students who had the SBP available to them reported that they usually participated. Students in elementary grades, low-income students, and students receiving free or reduced-price meals were more likely to report that they usually participated in each program. Patterns by race and ethnicity were also similar to those found in target day participation rates.

¹¹ These estimates include students in schools that did not offer the SBP to provide a sense of participation rates among all public school students, acknowledging that the SBP may not be available to some. Among only those students attending schools that offered the SBP, participation rates were somewhat higher—29 percent among elementary school students, 17 percent among middle school students, 12 percent among high school students, and 21 percent overall.

TABLE II.2
 AVERAGE TARGET DAY PARTICIPATION RATES IN THE SBP
 (Percent)

	Elementary Schools	Middle Schools	High Schools	All Schools
Gender				
Male	26.2	18.9	12.8	21.0
Female	19.9	12.0	7.6	14.5
Income Relative to Poverty				
Less than or equal to 130 percent	37.9	28.9	19.0	31.2
Between 130 and 185 percent	36.2	14.9	12.3	25.2
More than 185 percent	12.5	8.8	6.6	10.0
Receipt of Free or Reduced-Price Meals (Parent Report)				
Receives free or reduced-price meals	38.8	26.8	20.3	32.3
Does not receive free or reduced-price meals	8.9	5.6	5.8	7.2
Race/Ethnicity				
Hispanic	27.6	15.7	11.1	20.9
White, non-Hispanic	15.8	12.3	7.4	12.5
Black, non-Hispanic	41.3	23.5	19.3	31.6
Other	18.9	11.3	12.6	15.5
All Students	23.1	15.3	10.1	17.7
Number of Students	732	787	795	2,314

Source: School Nutrition Dietary Assessment Study-III, school year 2004-2005, Child Interview, Dietary Recalls, Parent Interview. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: Target day participation is defined using several sources, primarily the foods reported in the dietary recall data and sources of foods; see further discussion in text and Appendix A.

TABLE II.3
AVERAGE USUAL PARTICIPATION RATES IN THE NSLP
(Percent)

	Elementary Schools	Middle Schools	High Schools	All Schools
Gender				
Male	81.2	80.2	64.0	76.0
Female	79.6	67.9	49.1	67.9
Income Relative to Poverty				
Less than or equal to 130 percent	91.8	86.4	66.6	84.1
Between 130 and 185 percent	86.1	81.0	77.1	82.5
More than 185 percent	73.2	66.6	49.1	64.4
Receipt of Free or Reduced-Price Meals (Parent Report)				
Receives free or reduced-price meals	93.6	85.2	79.4	88.7
Does not receive free or reduced-price meals	68.8	64.9	46.9	60.4
Race/Ethnicity				
Hispanic	84.0	76.1	61.1	76.3
White, non-Hispanic	76.0	74.0	52.4	68.0
Black, non-Hispanic	89.2	70.5	63.0	78.2
Other	81.2	71.9	62.6	73.6
All Students	80.4	73.8	56.3	71.9
Number of Students	732	787	795	2,314

Source: School Nutrition Dietary Assessment Study-III, school year 2004-2005, Child Interview, Dietary Recalls, Parent Interview. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: Usual participation is defined as participation three or more days per week, per child report.

TABLE II.4
AVERAGE USUAL PARTICIPATION RATES IN THE SBP
(Percent)

	Elementary Schools	Middle Schools	High Schools	All Schools
Gender				
Male	33.4	26.8	19.8	28.1
Female	28.9	17.8	13.0	21.7
Income Relative to Poverty				
Less than or equal to 130 percent	52.9	38.2	30.3	43.9
Between 130 and 185 percent	44.6	23.7	23.4	33.8
More than 185 percent	17.5	13.6	8.9	14.1
Receipt of Free or Reduced-Price Meals (Parent Report)				
Receives free or reduced-price meals	52.5	38.2	34.0	45.3
Does not receive free or reduced-price meals	12.8	8.6	8.6	10.5
Race/Ethnicity				
Hispanic	36.5	29.1	20.6	30.7
White, non-Hispanic	21.0	16.1	11.1	16.9
Black, non-Hispanic	56.7	29.2	33.3	44.0
Other	30.0	22.9	14.5	23.8
All Students	31.2	22.1	16.3	24.9
Number of Students	632	713	666	2,011

Source: School Nutrition Dietary Assessment Study-III, school year 2004-2005, Child Interview, Dietary Recalls, Parent Interview. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: Usual participation is defined as participation three or more days per week, per child report.

C. REASONS FOR PARTICIPATION OR NONPARTICIPATION

Examining why students and parents say they chose to participate or not participate in the school meal programs could help researchers better understand the factors affecting customer choice. These views have important implications for policymakers because they may identify ways to modify practices, regulations, or meal components to help achieve the USDA's key performance objectives, such as NSLP and SBP participation targets described in the FNS Strategic Plan (see Chapter I). Using data from student and parent interviews, this section first presents student reports of reasons why they did or did not participate in the NSLP. It then presents parents' reports of why their children chose to participate or not participate. Next, this section presents a comparable analysis for the SBP. Finally, the section considers parents' knowledge of, and views on, the school meal programs.

1. Reasons Why Students Participated or Did Not Participate in the NSLP

The students who reported that they ate the school lunch on the designated target day were asked to provide the most important motivation for doing so.¹² Being hungry was the most common reason mentioned, and its frequency steadily increased with grade level (see Table II.5). Liking the food served at lunchtime in general (21 percent) and liking the meal served that day (13 percent) were also common responses, but students were less likely to mention these reasons as they got older. Elementary school students were more likely to indicate parental preference as

¹² The analysis in this section is based on students' (or their parents') reports of whether they ate the school lunch on the target day rather than on the measure of target day participation developed based on dietary intakes. This is because only self-reported participants (or nonparticipants) were asked questions about their reasons for participating (or not participating) on the target day.

TABLE II.5

TOP REASON FOR EATING SCHOOL LUNCH ON TARGET DAY, BY SCHOOL TYPE
(Percentage of Participants)

	Elementary School Students	Middle School Students	High School Students	All Students
Among Students Who Ate School Lunch on Target Day, Top Reason for Eating School Lunch				
Felt hungry	25.1	42.1	55.0	35.2
Likes the food (general)	26.2	18.0	10.6	21.0
Liked meal served that day	15.1	10.2	8.6	12.6
Easy/convenient to get	7.5	11.3	11.7	9.2
Parents want me to/no other choice	12.5	4.7	2.5	8.7
No one at home/no time to make lunch	7.6	6.8	1.5	6.1
It's free, prices are good	1.8	2.7	3.8	2.4
Other	4.2	4.0	6.3	4.7
Number of Students	556	552	410	1,518

Source: School Nutrition Dietary Assessment-III, Student Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 1,518 (16 respondents who reported that they ate a school lunch on the target day did not give a top reason). List of possible answers was read out loud to respondents.

their top reason, as one would expect, because parents have more control over the eating patterns of younger children.¹³

Other students were asked why they did *not* eat a school lunch on the designated target day. They most often reported that they brought a lunch that day (28 percent), and elementary school students were the most likely to do this (Table II.6). Not liking the food items that were served that day was the second most common reason overall (20 percent), but its frequency also decreased as grade level increased. Other reasons were mentioned by less than 10 percent of all students.

The conditions under which students eat lunch also may influence NSLP participation rates. Students offered feedback on several components of the lunchtime environment (Table II.7). Almost two-thirds of students (64 percent) reported that tables were always or usually clean, and nearly half (49 percent) reported that the floors were always or usually clean. More than half of all students (54 percent) indicated that the noise level was about right, although 45 percent said that it was too noisy during lunch; elementary school students were considerably more likely than middle and high school students (65 percent versus 27 and 21 percent) to report high noise levels. Most students (79 percent) reported that there were enough seats and tables, although they were less likely to agree with this statement as grade levels increased. In terms of scheduling, most students indicated that when they eat lunch and how long they have to eat lunch is adequate. Just over 80 percent of students said that the time that their lunch was scheduled

¹³ Reasons for choosing the school lunch were also analyzed according to usual NSLP participation status and household income. Usual participants were more likely than students who were not usual participants to report hunger, cost, convenience, and parents making them or having no choice (see Table B.2). In contrast, students who were not usual participants were almost twice as likely (21 versus 12 percent) to have eaten lunch on the target day because they liked the specific menu items served. Students from lower-income households more often indicated hunger as a reason for participating (40 percent) than did students from higher-income households (31 percent), whereas the latter group more frequently mentioned convenience and liking what was served on the menu that day (12 versus 6 percent; see Table B.3). Subgroups for household income (as reported by parents) are defined as low-income (income less than or equal to 185 percent of poverty) and higher-income (income greater than 185 percent of poverty).

TABLE II.6

REASONS FOR NOT PARTICIPATING IN THE NSLP ON TARGET DAY,
BY SCHOOL TYPE
(Percentage of Nonparticipants)

	Elementary School Students	Middle School Students	High School Students	All Students
Brought lunch from home	39.9	29.4	18.1	28.0
Didn't like that day's school lunch menu	28.2	22.8	11.5	19.6
Doesn't like them (in general), doesn't like taste	7.5	9.0	10.2	9.0
Monetary reasons	4.6	5.0	10.8	7.5
Never/almost never eats school lunch	3.0	5.6	11.2	7.2
Ate lunch off campus	1.1	0.8	14.0	6.9
Not hungry, didn't feel like eating	3.9	8.9	8.4	6.9
No time, long lines	1.6	3.0	6.9	4.3
Wanted a la carte item	0.0	3.1	5.2	3.0
Not enough variety, tired of what was offered	1.8	1.3	3.5	2.5
Busy with school activities	0.0	3.2	3.7	2.3
Special diet (such as vegetarian, religious restrictions, weight)	3.4	1.2	1.7	2.2
Parent prohibits or limits frequency of eating school lunches	4.8	0.6	0.7	2.1
Not nutritious	0.9	1.7	2.7	1.9
Leaves school early	0.0	1.3	3.4	1.8
Doesn't eat <i>any</i> lunch	0.0	2.1	2.4	1.5
Portions not big enough, not enough food	0.0	0.0	0.5	0.2
Other	5.4	8.8	2.6	4.8
Number of Students	136	210	346	692

Source: School Nutrition Dietary Assessment-III, Student Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 725 (33 respondents who reported that they did not eat a school lunch on the target day did not give a reason for not eating one). Multiple answers allowed; open-ended question.

TABLE II.7
STUDENTS' VIEWS ON LUNCHTIME ENVIRONMENT, BY SCHOOL TYPE
(Percentage of Students)

	Elementary School Students	Middle School Students	High School Students	All Students
Sound Level				
Too noisy	65.3	27.1	21.1	44.6
Too quiet	2.2	0.7	1.0	1.6
About right	32.5	72.2	77.9	53.9
Cleanliness of Tables				
Always clean	30.3	29.9	27.2	29.3
Usually clean	28.4	39.7	41.0	34.4
Sometimes clean	38.7	28.5	28.8	33.8
Never clean	2.7	1.9	3.0	2.6
Cleanliness of Floors				
Always clean	14.6	19.5	20.2	17.2
Usually clean	24.7	37.1	40.1	31.7
Sometimes clean	46.9	35.5	34.8	41.1
Never clean	13.8	7.9	4.8	10.0
Plenty of Seats and Tables	87.3	77.7	63.9	78.5
Scheduled Lunch Period Is...				
Too early	5.2	9.0	11.8	7.9
Too late	12.1	10.9	11.5	11.7
About right	82.7	80.1	76.7	80.4
Enough Time to Eat Lunch After Getting Food and Sitting Down^a				
Yes	80.3	66.2	68.2	74.2
No	8.0	16.3	14.9	11.5
Sometimes	11.7	17.5	16.9	14.3
Length of Time Students Usually Spend in Line to Get Lunch				
Long	65.3	74.0	78.4	70.9
Short	17.8	12.4	10.1	14.5
No waiting time	2.9	1.8	1.1	2.1
Depends on what is served	14.0	11.8	10.4	12.5
Number of Students	732	787	795	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 2,314. Missing values range from 9 to 32.

^aThis question was restricted to those who ever eat a school lunch (n = 2,005).

was about right (neither too early nor too late), and 74 percent reported that they had enough time to eat lunch after they got their food and sat down. Although most students reported that they had enough time to eat lunch, nonetheless, 71 percent said that they spent too much time waiting in line.

Another factor that could influence NSLP participation is students' awareness of meal benefits. The fact that some students knew who received free or reduced-price school lunches may offer insight into perceptions of stigma related to participating in the NSLP.¹⁴ More than two-thirds of all students (68 percent) thought that lunch prices varied according to the individual, with low-income students being more likely to assert this (Table II.8). However, among students who knew that prices varied, only 24 percent could tell—or at least thought they could tell—which students received lunches free or at a reduced price, with low-income students more likely to have reported this knowledge.

These students reported several ways that they could tell who receives meal benefits. Common indicators had to do with the payment transaction or checkout process, including the specific dollar amount charged (32 percent), form of payment (21 percent), cashier behavior (9 percent), a separate serving line (5 percent), and meal price status indicated on the register (3 percent). Almost 15 percent of students could tell from personal knowledge (because they themselves participated or other students told them their meal price status), and 9 percent knew from the portion size or inclusion of specific food items (as, for example, when reimbursable meals have a set menu that students automatically receive). A small percentage of students offered stigma-related reasons, such as other students' appearance or behavior, and this was more prevalent in higher grades.

¹⁴ Although SBP participation rates might also be influenced by awareness of meal benefits and which students receive them, these questions were asked only for the NSLP.

TABLE II.8

AWARENESS OF WHICH STUDENTS RECEIVE FREE OR REDUCED-PRICE LUNCHES,
BY HOUSEHOLD INCOME
(Percentage of Students)

	Low-Income Students	Higher-Income Students	All Students
Students' Views of How Lunch Prices Vary			
All pay same amount	17.3	36.6	28.7
Everyone gets it free	4.8	2.2	3.3
Some pay less/some get it free	77.9	61.2	68.0
Number of Students Reporting	944	1,181	2,125
Among Students Who Report that Some Students Pay Different Amounts for School Lunches or Get Them Free, Can Tell Who Gets Regular School Lunches for Free or Less Than Full Price	27.7	21.1	24.2
Number of Students Reporting	732	771	1,503
Among Students Who Can Tell Who Gets Free or Reduced-price Lunches, How They Can Tell: ^a			
Amount paid to cashier	43.8	19.2	31.9
Form of payment (e.g., ticket, PIN)	19.2	22.5	20.8
Personal knowledge (e.g., recipient tells student or others, self)	13.6	16.2	14.8
Cashier checks list or says something to student	13.2	5.1	9.3
Portion size, items on lunch tray	3.0	15.7	9.1
Separate line	1.6	8.5	4.9
Appearance (e.g., clothes) or behavior	2.6	7.0	4.7
Can see on register/screen	2.2	4.1	3.1
They help in lunch line	0.9	1.7	1.3
Other	0.3	2.6	1.4
Number of Students Reporting	181	145	326
Number of Students	994	1,232	2,226

Source: School Nutrition Dietary Assessment-III, Student Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 2,213 (101 respondents did not answer the question on how prices varied, 5 did not answer the question on knowledge of who gets free or reduced-price lunches, and 39 did not answer the question on how students can tell who gets free or reduced-price lunches).

^aMultiple answers allowed; open-ended question.

When taking household income into account, students from low-income households were more likely to cite payment amounts and cashier behavior as ways to identify students who received free or reduced-price lunches. They were also more likely to identify which students received meal benefits, probably because they more often received them or knew those who did. Students from higher-income households more frequently mentioned portion size or items on the tray, a separate line, or factors related to appearance or behavior.

2. Parents' Perspectives on NSLP Participation

Parents whose children ate school lunches two or fewer days per week (26 percent) reported that the top three reasons why their child did not participate at all or more often were linked with preferences—by students and/or parents—for food from other sources (Table II.9). About two-thirds of parents said students did not like the lunches served at school (70 percent) and preferred food brought from home (65 percent), although both responses were less prevalent as grade level increased. Similarly, 45 percent of parents preferred that their children bring food from home, with parents of elementary school students the most likely to say this (65 percent) and parents of high school students the least likely (28 percent). About half of parents of older students (middle and high school) indicated a long wait in line to get lunch as a reason for not participating more, while only 15 percent of elementary parents did. Likewise, parents of middle and high school students were more likely to say their children did not have enough time to get and eat lunch at school (32 and 36 percent, respectively, compared with 14 percent of elementary school parents). Inadequate time for middle and high school students may reflect larger and more populated schools at higher grades, which could translate into shorter lunch periods and/or longer serving lines. Parents of middle and high school students were much more likely than those of elementary school students to mention that the student's friends did not eat school lunches. In

TABLE II.9

REASONS FOR NONPARTICIPATION OR INFREQUENT PARTICIPATION IN NSLP,
BY SCHOOL TYPE^a
(Percentage of Parents)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
Child does not like food served	76.2	71.5	58.9	67.9
Child prefers to eat lunch brought from home	81.0	64.0	51.7	65.4
Parent prefers that child eats food sent from home for lunch	65.4	41.9	28.2	45.3
Doesn't like waiting in line to get lunch	15.1	48.1	50.2	35.8
Doesn't have enough time to get and eat lunch at school	14.4	32.0	36.4	26.9
Friends don't eat school lunches	2.7	19.6	30.3	17.3
Thought child could not participate in NSLP	3.7	7.6	5.8	5.3
Too expensive/cost issue	4.8	7.1	4.4	5.0
Dietary restrictions (e.g., vegetarian, religious)	8.6	2.2	2.2	4.8
Eats off campus/at home	0.0	0.0	9.5	4.1
Child thinks only needy kids eat school lunches and doesn't want to be thought of that way	0.2	3.4	4.0	2.4
Other	6.4	5.4	5.9	6.0
Number of Parents	143	163	288	594

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aAmong parents whose child participated in NSLP less than three days per week (n = 594), according to parent self-report. Multiple answers allowed; list of possible answers was read out loud to respondents.

addition, high school students were more likely to be free to leave campus with friends at lunchtime under an open-campus policy.

Parents whose children ate school lunches at least three days per week gave the most important reason for doing so. The most commonly cited reason was convenience for the parent (30 percent), followed by the child liking the food served at school (23 percent), and that school lunches were inexpensive and a good value (18 percent) (Table II.10). The probability of mentioning liking the food, convenience for the parent, and enjoying eating with friends/friends eat school lunches dropped as grade levels increased. Instead, parents of high school students were more likely to report that their child ate school lunches due to being hungry or because they were the only option, monetary reasons, and convenience for the child. Six percent of parents mentioned the healthfulness of school lunches as the top reason why their child participated in the NSLP.

3. Reasons Why Students Participated or Did Not Participate in the SBP

Students who said that they ever ate a school breakfast (40 percent) reported their top reason for participating in the SBP. The three most common reasons given across all grade levels were convenience (35 percent), that the food was good (32 percent), and being hungry (22 percent) (Table II.11).

Convenience and being hungry were more important for middle and high school students, whereas liking the food was more important for elementary school students. Elementary school students (three percent) and middle school students (five percent) were more likely to say that they ate school breakfasts because they had no other choice, compared with only one percent of high school students. Six percent of elementary school students reported that they ate school breakfasts because their parents made them, compared with less than one percent of middle and

TABLE II.10

TOP REASONS FOR EATING SCHOOL LUNCHES, BY SCHOOL TYPE
(Percentage of Parents)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
Among Parents Whose Child Participates in NSLP at Least Three Days per Week, Top Reason Why Child Eats School Lunches				
Convenient for parent	36.2	24.4	19.4	29.8
Likes the food	29.2	16.5	15.0	23.2
Inexpensive/free/good value	15.2	20.6	23.3	18.2
Gets hungry/wouldn't eat lunch otherwise	5.5	15.7	21.0	11.3
Good/healthy meals	5.9	7.0	6.5	6.3
Likes to eat with friends/friends get school lunches	6.2	6.0	3.1	5.4
Easy for child/convenient	0.6	4.9	5.9	2.8
Other	1.3	4.8	5.7	3.1
Number of Parents Reporting	587	605	474	1,666
Number of Parents	588	614	483	1,685

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 1,685 (19 respondents did not answer the question about the top reason why their child eats school lunches). List of possible answers was read out loud to respondents.

TABLE II.11

TOP REASONS FOR EATING SCHOOL BREAKFASTS, BY SCHOOL TYPE
(Percentage of Students Who Ever Eat School Breakfasts)

	Elementary School Students	Middle School Students	High School Students	All Students
Easy/convenient to get	30.4	39.7	42.6	35.0
Food is good	41.0	20.0	20.6	32.3
Being hungry	16.1	29.1	29.0	21.6
Parents make me	6.4	0.9	0.5	4.0
No other choice	3.0	5.0	1.3	3.0
Friends eat there	2.2	2.4	2.9	2.4
Prices are good	0.6	2.0	2.6	1.3
Other	0.3	0.8	0.6	0.5
Number of Students	356	300	262	918

Source: School Nutrition Dietary Assessment-III, Student Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 918 (12 respondents did not give a top reason for eating school breakfasts). List of possible answers was read out loud to respondents.

high school students.¹⁵ Overall, students who ever eat school breakfasts were very likely to report they had enough time to eat breakfast (85 percent) and that breakfast was served at a reasonable time (87 percent) (Table II.12).

In contrast, those who said they ate school breakfasts no more than twice a week explained why they did not participate—or participate more often—in the SBP. Eating breakfast at home (50 percent) emerged as the most common reason, with younger students more likely to give this response (Table II.13). The second most common reason mentioned was a lack of time (26 percent), which seemed to be a more important factor among high school students. The Student Interview did not ask details about this issue. For example, the response could reflect when classes started or something independent of school meal policies, such as a student’s preference to sleep later. (Few students indicated that transportation or inconvenience were reasons for not participating in the SBP.) Nine percent said that they did not eat breakfast from any source, with elementary school students less likely to give this as a reason than middle or high school students (4 percent versus 14 and 12 percent, respectively).

Ease of access to services or products (in this case, school meals), which can be influenced by time, location, transportation, and other barriers, is often a key factor in why customers select them. Therefore, students who ate school breakfasts three or fewer days per week were asked if they would be more likely to participate in the SBP if breakfasts were served in their classrooms—places where they had to be at the start of each school day (Table II.13). Almost 60 percent indicated that they would be more likely to do so. High school students were the group

¹⁵ Cross-tabulating the data according to household income revealed that students from lower-income households were more likely to report that being hungry (23 percent) or thinking that the food is good (35 percent) were the top reasons for eating school breakfasts, compared with 19 and 29 percent, respectively, among students from higher-income families. On the other hand, 40 percent of students from higher-income households mentioned convenience as the top reason, whereas 32 percent of lower-income students did so (see Table B.4).

TABLE II.12

STUDENTS' VIEWS ON SCHOOL BREAKFAST SCHEDULES, BY SCHOOL TYPE
(Percentage of Students Who Ever Eat School Breakfasts)

	Elementary School Students	Middle School Students	High School Students	All Students
Enough Time to Eat Breakfast Before Classes Start	86.7	87.2	76.9	84.5
School Breakfast Is Served				
Too early	8.4	5.2	5.6	7.1
Too late	6.9	4.4	6.6	6.3
Okay time	84.8	90.4	87.9	86.6
Number of Students	356	300	262	918

Source: School Nutrition Dietary Assessment-III, Student Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 918 (12 respondents did not give their views on the school breakfast schedule).

TABLE II.13

REASONS FOR NOT PARTICIPATING IN THE SBP, BY SCHOOL TYPE
(Percentage of Students)

	Elementary School Students	Middle School Students	High School Students	All Students
Among Students Who Do Not Usually Eat School Breakfasts, Reasons for Not Eating School Breakfasts^a				
Eats breakfast at home	57.4	47.3	42.5	49.6
No time	18.6	23.1	35.1	25.7
Never eats breakfast	4.0	13.9	11.9	9.2
Doesn't like what is served	5.6	11.3	6.6	7.3
Monetary reasons	6.4	2.2	4.6	4.8
Lack of choice	3.0	2.2	1.0	2.1
Transportation issue	2.6	4.1	0.4	2.1
Not convenient	0.0	1.8	1.6	1.0
Not nutritious enough	0.9	1.6	0.9	1.0
Busy with school activities	1.0	1.1	1.5	1.2
Doesn't like taste	0.3	0.7	0.4	0.4
Other	6.3	4.0	4.2	5.0
Number of Students Reporting	258	395	427	1,080
Likely to Eat School Breakfasts More Often if Served in Classroom^b				
	55.1	56.6	63.9	59.1
Number of Students Reporting	71	156	149	376
Number of Students	354	517	500	1,371

Source: School Nutrition Dietary Assessment-III, Student Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 1,371 (291 respondents did not report on why they do not usually eat school breakfasts).

^aMultiple answers allowed; open-ended question.

^bAmong students who eat school breakfasts three or fewer days per week and who do not eat school breakfasts in the classroom (n = 376).

most likely to say that they would be more likely to eat school breakfasts if served in the classroom.¹⁶

4. Parents' Perspectives on SBP Participation

To gain a deeper understanding of the factors contributing to SBP participation patterns, parent perspectives are useful. Parents whose children received a school breakfast less than three days per week offered reasons for why their child did not ever or usually did not eat school breakfasts. Eighty-two percent of respondents mentioned their child's preference to eat breakfast at home (with no further explanation), with parents of older students more likely to mention this (Table II.14). An inadequate amount of time was the second most common reason mentioned by parents, although parents of elementary school students cited this explanation less often than parents of middle and high school students (29 percent versus 43 and 46 percent, respectively). Approximately one-quarter of parents reported that their child did not like the food items in SBP meals, and 17 percent reported that their child preferred not to eat breakfast at all.

5. Parents' Knowledge of, and Views on, School Meal Programs

The extent to which parents know about the availability of the NSLP and SBP may affect whether their children participate. Information about the school meal programs may affect parents' attitudes and their views on whether their children should participate. In turn, parents may want an avenue to communicate their needs to the school foodservice.

Nearly three-quarters of parents (71 percent) strongly agreed or somewhat agreed that they had enough information from the school or district on the NSLP, while 29 percent disagreed

¹⁶ Moreover, 64 percent of children from lower-income households said that they would be more likely to eat school breakfasts if they were served in the classroom, as opposed to 56 percent of children from higher-income households (see Table B.5).

TABLE II.14

REASONS FOR NONPARTICIPATION OR INFREQUENT PARTICIPATION IN SBP AMONG PARENTS
WHOSE CHILD PARTICIPATES IN SBP LESS THAN THREE DAYS PER WEEK,
BY SCHOOL TYPE
(Percentage of Parents)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
Child prefers to eat at home	79.4	83.7	84.4	82.0
Not enough time to eat breakfast at school	28.9	43.1	46.2	37.6
Child does not like the food served	22.5	26.9	30.9	26.2
Child does not like to eat breakfast (in general)	13.7	21.1	19.0	17.0
Thought child could not participate in SBP	5.0	13.0	17.9	10.9
Friends don't eat school breakfasts	4.1	15.2	16.7	10.6
Parent prefers child to eat breakfast at home	9.5	5.5	2.7	6.4
Child thinks only needy kids eat school breakfast and doesn't want to be thought of that way	0.6	6.7	9.4	4.8
Doesn't want others to think can't provide breakfast	1.3	4.9	4.3	3.1
Other	6.0	7.5	7.2	6.7
Number of Parents	384	405	369	1,158

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 1,158. Sample is parents who reported that their child's school offered breakfast. Multiple answers allowed; list of possible answers was read out loud to respondents.

somewhat or strongly disagreed; those parents whose children were in lower grades were more likely to indicate having enough information (Table II.15). Indeed, among the 26 percent of parents whose children ate school lunches less than three days per week, 5 percent reported that lower levels of participation were due to believing that their child could not participate in the NSLP, and parents of older children were more likely to report this (refer back to Table II.9).¹⁷

Most parents were at least aware of whether their child’s school offered school breakfasts. Nearly all (91 percent) correctly reported that their child’s school offered (80 percent) or did not offer (11 percent) the SBP (Table II.16). Overall, four percent of parents did not think that the SBP was offered when it really was; they were more likely not to know of the school meal option if their child was in middle school (six percent) or high school (nine percent). As with the NSLP, lack of awareness may be one reason why some students do not participate in the SBP. In fact, among parents whose children never or infrequently ate school breakfasts, 11 percent noted that this was due to thinking that their child could not participate in the SBP; parents of older children were more likely to report this (refer back to Table II.14).¹⁸

Aside from knowing whether the SBP is an option, having adequate information on school breakfasts also may influence whether families participate. Parents who reported that the SBP was offered in their child’s school were asked if they received enough information on the program. About 65 percent of these parents strongly agreed or agreed somewhat with this statement, while 20 percent of parents somewhat disagreed and 15 percent strongly disagreed.

¹⁷ It is difficult to know how respondents interpreted the interview response option, “Thought child could not participate in the NSLP.” Some parents might have thought the barrier was eligibility (they assumed their child would not be eligible to get school lunches—although any student can get school lunches if they pay full price), while others might have thought the program was not available at their child’s school. In a few instances, parents indicated through open-ended responses that they did not realize that the NSLP was offered at their child’s school. Comparable evidence was discovered when analyzing SBP data, as discussed in the next section.

¹⁸ Again, it is difficult to know how parents interpreted the interview response option, “Thought child could not participate in the SBP.” The Parent Interview did not explore parents’ awareness of the NSLP.

TABLE II.15

PARENTS' KNOWLEDGE OF THE NSLP, BY SCHOOL TYPE
(Percentage of Parents)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
Receives Enough Information about the NSLP				
Strongly agree	50.1	35.8	27.8	40.7
Agree somewhat	32.2	30.4	28.0	30.6
Disagree somewhat	11.9	16.6	18.4	14.8
Strongly disagree	5.8	17.2	25.9	14.0
Number of Parents	732	787	795	2,314

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005.
Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 2,314 (three respondents did not answer the question about receiving information on the NSLP).

TABLE II.16

PARENTS' KNOWLEDGE OF THE SBP, BY SCHOOL TYPE
(Percentage of Parents)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
Awareness of the SBP ^a				
Parent said offered, SBP offered	80.4	84.7	75.0	79.9
Parent said not offered, SBP not offered	13.6	6.4	7.6	10.6
Parent said not offered, SBP offered	1.2	6.4	9.2	4.3
Parent said offered, SBP not offered	4.8	2.5	8.2	5.3
Number of Parents Reporting	722	731	674	2,127
Among Parents Whose Child <i>Never</i> Eats a School Breakfast, Receives Enough Information about the SBP ^b				
Strongly agree	40.9	33.0	27.0	35.7
Agree somewhat	29.9	30.8	27.9	29.6
Disagree somewhat	18.9	18.2	22.2	19.6
Strongly disagree	10.3	17.9	22.9	15.1
Number of Parents Reporting	636	639	563	1,838
Number of Parents	732	787	795	2,314

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 2,314 (187 respondents did not answer the question about awareness of the SBP).

^aCategories are defined according to whether or not parent reports that the school offers the SBP and whether or not the school actually offers the SBP.

^bN = 1,846 (eight respondents did not answer the question).

Parents of older students were more likely to think that they did not receive enough information on school breakfasts.

In addition, the degree to which parents viewed the NSLP and SBP as comprehensive nutrition programs for all students—regardless of personal circumstances such as household income—could offer additional insight into how likely they were to participate. Most parents strongly agreed (76 percent) or agreed somewhat (18 percent) that the NSLP gives all children an opportunity to eat lunch (Table II.17). A somewhat smaller portion (84 percent)—albeit still most respondents—disagreed somewhat or strongly disagreed that the NSLP is only for needy families. However, some parents may attach a stigma to participating in the NSLP, as 7 and 10 percent strongly agreed and somewhat agreed, respectively, that school lunches are only for needy children.

Patterns emerged for school breakfasts that were comparable to those observed for the NSLP. Almost all parents strongly agreed (68 percent) or agreed somewhat (24 percent) that the SBP gives all children an opportunity to eat breakfast. Likewise, most parents (77 percent) disagreed somewhat or strongly disagreed that the SBP is intended for needy families only. Nevertheless, some parents may have stigmatized school breakfasts, because 9 percent strongly agreed and 14 percent somewhat agreed that only needy students get them.

D. SATISFACTION WITH THE SCHOOL MEAL PROGRAMS

Gathering feedback from students and parents on how pleased they were with the NSLP and SBP may help policymakers gauge the degree to which school meal programs are accomplishing their goals. This section discusses student' and parents' satisfaction levels with school meals, both overall and according to particular aspects of meals, mealtime environments, and school meal policies. Parents also shared their views on allowing competitive foods in schools.

TABLE II.17

PARENTS' VIEWS ON SCHOOL MEAL PROGRAM, BY SCHOOL TYPE
(Percentage of Parents)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
NSLP Gives All Children an Opportunity to Eat Lunch				
Strongly agree	75.8	79.5	74.2	76.1
Agree somewhat	19.9	15.8	17.3	18.3
Disagree somewhat	2.8	2.2	4.8	3.2
Strongly disagree	1.6	2.5	3.7	2.4
Only Children from Needy Families Participate in the NSLP				
Strongly agree	3.3	9.7	10.2	6.6
Agree somewhat	6.7	11.0	13.9	9.7
Disagree somewhat	20.4	16.4	15.7	18.2
Strongly disagree	69.6	63.0	60.1	65.5
Number of Parents Reporting	732	784	795	2,311^a
Among Parents in School Offering the SBP				
SBP Gives All Children Opportunity to Eat Breakfast				
Strongly agree	68.4	70.6	65.5	68.1
Agree somewhat	24.1	21.4	24.6	23.7
Disagree somewhat	6.1	5.8	5.9	6.0
Strongly disagree	1.3	2.2	4.1	2.2
Only Children from Needy Families Participate in the SBP				
Strongly agree	6.0	11.3	12.1	8.6
Agree somewhat	10.6	17.6	19.8	14.4
Disagree somewhat	28.9	26.9	28.8	28.5
Strongly disagree	54.6	44.1	39.3	48.5
Number of Parents Reporting	636	639	563	1,838^b
Number of Parents	732	787	795	2,314

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aN = 2,314 (three respondents did not answer the question about giving all children an opportunity to eat lunch, and 40 did not answer the question about needy families).

^bN = 1,846 parents in schools with SBP (21 respondents did not answer the question about giving all children a chance to eat breakfast, and 70 did not answer the question about needy families).

1. Students' Opinions on School Lunches

During interviews, students who said they ever ate school lunches generally expressed positive opinions about the NSLP, with roughly half reporting that they liked the lunches (Table II.18). Opinions declined with students' grade level. Elementary school students were more likely than middle or high school students to say that they liked school lunches, as opposed to saying that lunches were only okay or unappealing. A small percentage of students who ever ate school lunches (four percent of elementary school students and five percent of middle and high school students) reported that they did not like school lunches.¹⁹

Aside from overall satisfaction levels, students gave their opinions on components of school lunches, including such factors as menu choice, quantity of food, appearance, and temperature (Table II.19). Overall, less than half of all students indicated that they always or often liked both the taste and the smell of food (44 percent). Similarly, less than half reported that the food always or often looked good (42 percent), the vegetables always or often looked good (45 percent), and the menu always or often served food they liked (45 percent). More than half of students thought that there were always or often enough food choices. They were more satisfied with the temperature of the milk (84 percent said it was about right) and portion sizes (75 percent).

Subgroup analyses illustrate that elementary school students were usually more likely to express positive opinions about the food itself (for example, to say the food always tasted and smelled good and that there were always adequate menu choices). They were also more likely to

¹⁹ Overall opinions of school lunches did not vary much by income subgroups, although students from low-income households were somewhat more likely than higher-income students to say that they did not like school lunches (6 versus 3 percent; see Table B.6).

TABLE II.18

STUDENTS' GENERAL VIEWS ON SCHOOL LUNCHESES, BY SCHOOL TYPE
(Percentage of Students Who Ever Ate a School Lunch)

	Elementary School Students	Middle School Students	High School Students	All Students
General Opinion of School Lunches				
Like them	56.1	34.7	31.9	47.0
Only okay	39.7	60.4	63.0	48.5
Doesn't like them	4.2	4.9	5.1	4.5
Number of Students Reporting	630	556	411	1,597

Source: School Nutrition Dietary Assessment-III, Student Interview, school year 2004-2005.
Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 1,597 (456 respondents did not give a general opinion of school lunches).
Response categories correspond to the wording on the instrument.

TABLE II.19

STUDENTS' VIEWS ON FOOD SERVED FOR LUNCH, BY SCHOOL TYPE
(Percentage of Students)

	Elementary School Students	Middle School Students	High School Students	All Students
Likes Taste of Food...				
Always	25.5	16.7	11.6	19.6
Often	22.6	22.7	27.0	23.9
Sometimes	48.3	55.8	55.8	52.0
Never	3.6	4.9	5.6	4.4
Likes Smell of Food...				
Always	29.4	19.5	14.6	23.1
Often	17.7	22.9	24.3	20.7
Sometimes	42.7	47.4	52.2	46.4
Never	10.3	10.1	8.9	9.8
Food Looks Good...				
Always	27.6	13.5	11.2	20.0
Often	18.2	24.7	25.8	21.8
Sometimes	45.3	52.6	52.5	48.9
Never	8.9	9.2	10.5	9.4
Vegetables in Serving Line Look Good... ^a				
Always	32.6	20.5	18.5	26.1
Often	16.9	22.0	21.8	19.3
Sometimes	35.1	37.3	40.2	37.0
Never	15.5	20.3	19.6	17.6
Amount of Food (Portions)				
Too much	4.3	1.3	1.4	2.8
Too little	16.5	26.6	28.4	22.0
About right	79.3	72.1	70.1	75.2
Temperature of Milk Served				
Too warm	5.5	9.2	10.4	7.6
Too cold	11.9	4.2	3.5	8.0
About right	82.6	86.6	86.1	84.4

TABLE II.19 (continued)

	Elementary School Students	Middle School Students	High School Students	All Students
How Often Lunch Menu Includes Foods They Like				
Always	22.9	22.2	17.1	21.1
Often	21.9	24.9	26.3	23.8
Sometimes	49.8	47.4	51.8	49.9
Never	5.4	5.4	4.9	5.2
How Often Enough Food Choices				
Always	34.0	26.6	24.6	29.7
Often	23.6	22.1	26.6	24.2
Sometimes	31.0	38.4	35.8	33.9
Never	11.5	13.0	13.0	12.2
Number of Students	732	787	795	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 2,314 (38 respondents did not answer the question about taste, 33 did not answer the question about smell, 25 did not answer the question about appearance, 60 did not answer the question about vegetables, 29 did not answer the question about food amounts, 103 did not answer the question about milk, 29 did not answer the question about the lunch menu, and 25 did not answer the question about choice).

^aThe question asked, "Do the vegetables on the serving line always, often, sometimes, or never look good?" Salad bars were not explicitly mentioned.

report that portion sizes were adequate. In addition, students from low-income households were more likely to say that they always liked the way the food tasted (24 versus 17 percent) (see Table B.7, Appendix B). Higher-income students were more likely than low-income students to think that there were always or often enough menu choices (59 versus 47 percent); one reason may be that students receiving free or reduced-price lunches may have had more limited options.

2. Parents' Opinions on School Lunches

Parents expressed relatively high levels of satisfaction with the NSLP and, in general, seemed to be pleased with the program. Twenty-one percent of parents characterized school lunches as very healthy, although most (68 percent) thought the food was somewhat healthy (Table II.20). More than half of parents said that the NSLP was a pretty good value, and 28 percent of parents said it was a good value. Parents were less likely to indicate that school lunches were very healthy or a good value if their children were older.

Overall, parents who reported their child had ever eaten a school lunch (86 percent of all parents) were reasonably satisfied with school lunches (Table II.20). Thirty-three percent said they were very satisfied with the NSLP, and 52 percent said they were somewhat satisfied with it; few parents (2 percent) were very dissatisfied. Moreover, 20 and 59 percent strongly agreed and agreed somewhat, respectively, that their child liked school lunches, and most parents (91 percent) strongly or somewhat agreed that school lunches were served at a convenient time and place. Parents of elementary school students and those from lower-income households were more likely to report high levels of satisfaction with school lunches (see Table B.8, Appendix B).

Those parents who expressed that they were somewhat or very dissatisfied with the NSLP (18 percent of all parents) offered reasons for their dissatisfaction (Table II.21). Nearly half said that school lunches were not healthy—this was the most common reason mentioned. Other

TABLE II.20
PARENTS' VIEWS ON SCHOOL LUNCHES, BY SCHOOL TYPE
(Percentage of Parents)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
Healthfulness of School Lunches				
Very healthy	23.7	20.2	16.9	21.0
Somewhat healthy	65.4	71.5	69.7	67.9
Not healthy	7.7	6.6	10.1	8.1
It depends	2.4	0.4	0.2	1.3
Don't know	0.9	1.3	3.2	1.6
Value of School Lunches				
A good value	30.4	25.7	24.0	27.6
A pretty good value	49.4	56.4	56.6	52.9
Not a good value	9.8	14.7	16.1	12.6
Gets lunch free (volunteered this information)	9.9	1.2	0.8	5.5
Don't know	0.6	2.1	2.5	1.4
Number of Parents Reporting	732	787	795	2,314
Among Parents Whose Child Ever Eats a School Lunch: ^a				
Satisfaction with School Lunches				
Very satisfied	37.6	29.3	27.4	33.4
Somewhat satisfied	48.2	56.8	55.3	51.8
Somewhat dissatisfied	11.7	10.7	14.7	12.2
Very dissatisfied	2.0	3.0	2.2	2.3
Don't know	0.5	0.2	0.5	0.4
Children Like School Lunches				
Strongly agree	21.7	20.7	15.7	20.0
Agree somewhat	61.0	54.7	57.5	58.8
Disagree somewhat	13.5	17.7	16.8	15.2
Strongly disagree	3.8	6.9	10.0	6.0
School Lunches Are Served at a Convenient Time and Place				
Strongly agree	61.7	62.3	56.3	60.4
Agree somewhat	31.3	27.3	30.8	30.4
Disagree somewhat	6.2	6.8	7.9	6.7
Strongly disagree	0.8	3.6	5.1	2.5
Number of Parents Reporting	678	703	609	1,987
Number of Parents	732	787	795	2,314

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 2,314 (eight respondents did not answer the question about children's satisfaction with school lunches, 33 did not answer the question about convenient time and place, 35 did not answer the question about their satisfaction with school lunches).

^aN = 1,995.

TABLE II.21

REASONS FOR DISSATISFACTION WITH SCHOOL LUNCHES, BY SCHOOL TYPE
(Percentage of Parents)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
Not healthy	47.9	40.8	50.5	47.5
Poor quality/taste	41.0	41.0	32.5	38.0
Not enough choices	30.2	21.1	25.6	27.0
Child won't eat it	27.0	13.6	8.5	18.1
Poor presentation (e.g., temperature)	11.2	11.7	12.7	11.8
Not enough food, small portions	0.0	13.7	6.9	7.3
Not good value/cost	8.2	4.8	4.7	6.4
Not enough time, schedule	5.2	0.2	7.0	2.5
Stigma/child gets teased	2.8	0.0	1.0	1.7
Other	7.2	7.9	4.6	6.5
Number of Parents	121	129	155	405

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 405 (one respondent did not give a reason). Multiple answers allowed; list of possible answers was read out loud to respondents.

prevalent reasons cited included poor quality or taste (38 percent), lack of choice (27 percent), and their child's refusal to eat school lunches (18 percent).

3. Students' Opinions on School Breakfasts

Overall, students offered favorable opinions on the SBP. Among students who reported that they ever ate school breakfasts, 54 percent said that they liked them, and 44 percent said they thought the breakfasts were okay (Table II.22). Just over one percent said they did not like school breakfasts. Opinions of school breakfasts generally declined with grade level. Among students who said they ever ate a school breakfast, 61 percent of elementary school students said they liked the breakfasts, compared with 49 percent of middle school students and 47 percent of high school students.

4. Parents' Opinions on School Breakfasts

Like their children, parents whose child ever ate school breakfasts gave positive feedback on the SBP overall. As with the NSLP, overall satisfaction levels were high, with 39 percent of parents reporting that they were very satisfied with the SBP, and 49 percent being somewhat satisfied with it (Table II.23). Similarly, 31 percent thought that breakfasts were very healthy, while most (63 percent) characterized them as somewhat healthy. Thirty-six percent of parents strongly agreed and 52 percent somewhat agreed that their child liked school breakfasts. Two-thirds strongly agreed that school breakfasts were served at a convenient time and place. Very few parents expressed decidedly negative opinions about the SBP. Parents' views on school breakfasts were generally consistent across grade levels, although parents of elementary school students were more likely to strongly agree that their child liked school breakfasts (40 percent) than were parents of middle and high school students (32 and 30 percent, respectively).

TABLE II.22

STUDENTS' GENERAL VIEWS ON SCHOOL BREAKFASTS, BY SCHOOL TYPE
 (Percentage of Students Who Ever Ate a School Breakfast)

	Elementary School Students	Middle School Students	High School Students	All Students
General Opinion of School Breakfasts				
Like them	60.5	49.0	47.4	54.4
Only okay	39.1	49.2	49.8	44.2
Don't like them	0.5	1.8	2.8	1.4
Number of Students	212	250	218	680

Source: School Nutrition Dietary Assessment-III, Student Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 680 (236 respondents did not give a general opinion of school breakfasts). Response categories correspond to the wording on the instrument.

TABLE II.23

PARENTS' VIEWS ON SCHOOL BREAKFASTS, BY SCHOOL TYPE
 (Percentage of Parents Whose Child Ever Ate a School Breakfast)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
Satisfaction with SBP				
Very satisfied	39.4	40.2	38.5	39.3
Somewhat satisfied	48.6	50.1	49.9	49.2
Somewhat dissatisfied	9.4	8.4	10.4	9.4
Very dissatisfied	2.1	1.4	0.8	1.7
Don't know	0.6	0.0	0.4	0.4
Healthfulness of School Breakfasts				
Very healthy	30.0	34.0	30.2	30.9
Somewhat healthy	62.0	62.7	64.6	62.7
Not healthy	5.1	3.1	5.2	4.7
It depends	2.8	0.2	0.0	1.7
Children Like School Breakfasts				
Strongly agree	40.0	31.5	29.6	36.0
Agree somewhat	47.9	57.3	58.5	52.1
Disagree somewhat	8.5	8.4	9.8	8.7
Strongly disagree	3.7	2.8	2.1	3.2
School Breakfasts Are Served at a Convenient Time and Place				
Strongly agree	63.8	68.7	70.8	66.3
Agree somewhat	29.4	23.7	21.9	26.7
Disagree somewhat	6.1	4.6	6.3	5.8
Strongly disagree	0.7	3.1	1.0	1.3
Number of Parents	359	344	265	968

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 968 parents in schools with SBP and who reported their child had ever eaten a school breakfast (24 respondents did not answer the question on information about if children like school breakfasts, 22 did not answer the question about convenience, and 16 did not answer the question about healthfulness).

When the data were analyzed according to household income, parents from lower-income households more frequently expressed strongly favorable opinions about the SBP (see Table B.9, Appendix B). For example, 40 percent of lower-income parents strongly agreed that their child liked school breakfasts, compared with 31 percent of higher-income parents. Moreover, lower-income parents were more likely to be very satisfied with the SBP (44 versus 32 percent). Lower-income parents were also more likely (35 percent) than higher-income parents (25 percent) to report that school breakfasts were very healthy.

5. Parents' Knowledge of, and Views on, Competitive Foods

In recent years, policymakers, child nutrition advocates, and health practitioners have paid increased attention to the effect that competitive foods in schools may have on childhood obesity and overweight. The degree to which parents were familiar with the competitive foods available to their children in school, as well as their opinions on the presence of competitive foods in school, is of interest to school nutrition officials and other stakeholders as they establish future regulations on such food items.

Parents were better informed about the presence of vending machines in school, as opposed to a la carte items or school stores/snack bars (Table II.24).²⁰ Parents were asked whether their child's school provided each of these competitive food venues, and their responses were categorized as correct or incorrect based on what the school actually provided. Eighty-six percent of parents correctly reported the presence or absence of vending machines. On the other hand, parents were less knowledgeable about the presence of a la carte items and school stores/snack bars (31 percent incorrectly reported for both). Across all three competitive food

²⁰ A la carte was described to parents as "...foods [sold by school cafeteria] that children can buy for lunch other than the school lunch meal, [which] might be foods like hamburgers, French fries, pizza, or ice cream."

TABLE II.24

PARENTS' KNOWLEDGE OF AVAILABLE COMPETITIVE FOODS, BY SCHOOL TYPE
(Percentage of Parents)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
Awareness of Vending Machine Availability^a				
Parent correctly reported vending machines available	15.9	74.4	90.7	48.4
Parent correctly reported no vending machines available	70.2	4.3	0.3	37.6
Parent incorrectly reported vending machines available	8.8	17.1	7.9	10.1
Parent incorrectly reported no vending machines available	5.2	4.2	1.1	3.8
Number of Parents Reporting	701	688	713	2,106
Awareness of A la Carte Foods Availability During Lunch^b				
Parent correctly reported a la carte foods available	37.7	76.5	85.0	59.0
Parent correctly reported no a la carte foods available	16.4	4.4	1.8	9.8
Parent incorrectly reported a la carte foods available	44.1	17.6	10.0	29.1
Parent incorrectly reported no a la carte foods available	1.8	1.4	3.2	2.1
Number of Parents Reporting	697	723	721	2,141
Awareness of School Store or Snack Bar Availability During Lunch				
Parent correctly reported school store or snack bar available	5.1	12.9	27.0	12.7
Parent correctly reported no school store or snack bar available	71.0	49.7	31.4	55.9
Parent incorrectly reported school store or snack bar available	20.4	25.0	31.2	24.3
Parent incorrectly reported no school store or snack bar available	3.4	12.3	10.4	7.1
Number of Parents Reporting	704	703	683	2,090
Number of Parents	732	787	795	2,314

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Note: N = 2,314 (208 respondents did not answer the question about the presence of vending machines in the schools, 173 did not answer the question about whether the school sells a la carte items, and 224 did not answer the question about the presence of snack bars or school stores).

^aCategories are defined according to whether or not parent reported that survey school provided vending machines, a la carte items, and snack bars/school stores, and whether or not school actually provided these venues.

^bThe question did not use the term "a la carte." It asked, "Does your child's school cafeteria sell foods that children can buy for lunch other than the regular school lunch? These might be foods like hamburgers, French fries, pizza, or ice cream, for example."

sources, incorrect beliefs that the school offered the items were more common than incorrect beliefs that the school did not offer these items.

Parents were also asked their opinions on the availability of competitive foods in schools. In asking about vending machines, the interviewer pointed out that schools sometimes receive revenue from companies when they allow machines to be placed on school grounds. More than half of parents thought that allowing national brands such as fast-food chain restaurants (58 percent) and vending machines (60 percent) in schools was a bad idea (Table II.25). In contrast, nearly one-third of parents thought that offering such items for sale was a good idea; about 10 percent said it depends, although the interview did not explore under what conditions the parent felt they should be permitted. Parents were more likely to condone the presence of national brands and vending machines in schools as grade level increased; however, even at the high school level, more than 40 percent thought that allowing vending machines or national brands in schools was a bad idea. Parents from lower-income households were more likely than those from higher-income ones to think that allowing national brands (37 versus 27 percent) and vending machines (35 versus 26 percent) was a good idea (see Table B.10, Appendix B).

E. SUGGESTIONS FROM PARENTS ON SCHOOL MEALS

Apart from examining customer satisfaction levels, policymakers may find feedback on the school meal programs to be useful for future program improvement. Parents were asked the following open-ended question: “Is there anything you would like to see changed regarding the school meals? If so, what would that be?” Responses were grouped and coded into 31 categories. This section summarizes these recommendations from parents (see Figure II.1); recommendations by school type and income subgroups are presented in Appendix B, Tables B.11 and B.12.

TABLE II.25

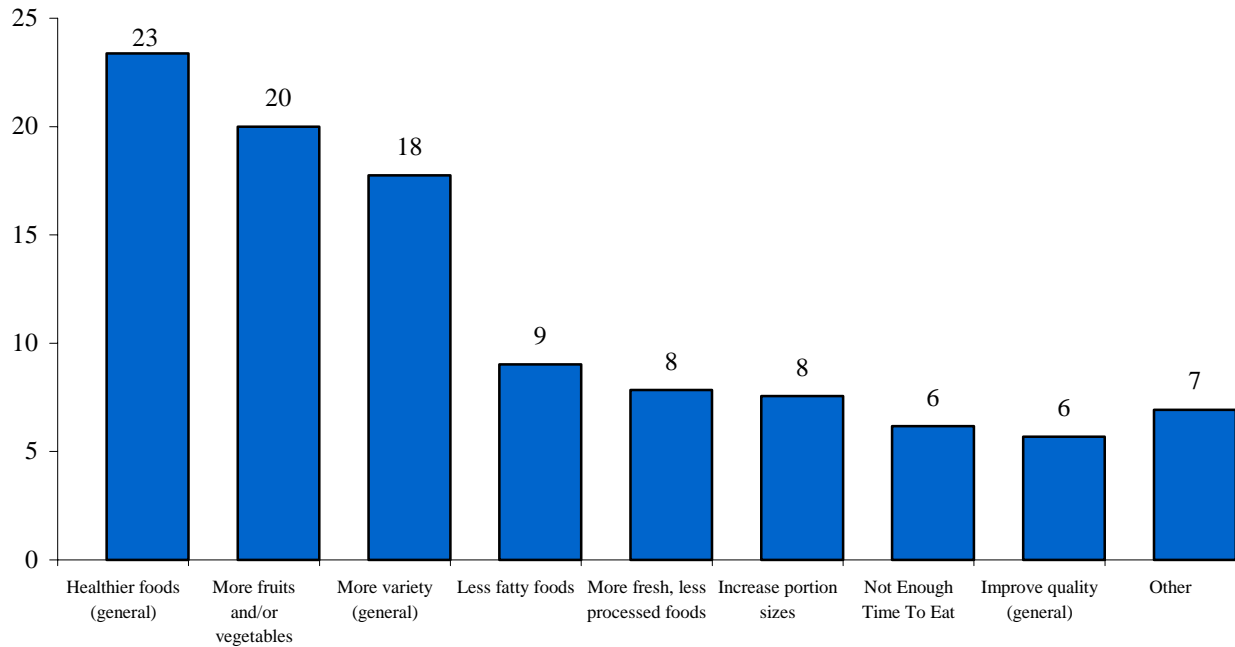
PARENTS' VIEWS ON COMPETITIVE FOODS, BY SCHOOL TYPE
(Percentage of Parents)

	Elementary School Parents	Middle School Parents	High School Parents	All Parents
Allowing National Brands (e.g., fast-food chains) in Schools				
Good idea	24.3	33.5	40.4	30.9
Bad idea	60.1	59.2	52.6	57.7
It depends	15.5	6.0	6.3	10.9
Don't know, no opinion	0.1	1.2	0.6	0.4
Allowing Vending Machines in Schools				
Good idea	16.8	35.8	48.0	29.8
Bad idea	71.1	53.7	43.7	59.6
It depends	12.0	9.9	8.1	10.4
Don't know, no opinion	0.1	0.5	0.1	0.2
Number of Parents	732	787	795	2,314

Source: School Nutrition Dietary Assessment-III, Parent Interview, school year 2004-2005.
Weighted tabulations prepared by Mathematica Policy Research, Inc.

FIGURE II.1

PARENTS' SUGGESTIONS FOR SCHOOL MEAL PROGRAMS
(Percentage of Parents)



Note: Figure only shows responses shared by at least five percent of parents; detailed breakdowns are presented in Appendix B, Table B.11.

1. Make Food More Healthy

Because of growing concerns nationwide about childhood obesity and overweight, it is not surprising that the number one suggestion raised by parents was to make meals more healthy (23 percent). Parents often spoke of making foods more “natural,” “balanced,” and “nutritious” to make them healthier. In addition to their general request for healthier meals, parents offered many specific recommendations on how to accomplish this goal; the most common one was to serve more fruits and/or vegetables (20 percent). Parents also identified changes to specific meal components, including serving fewer fatty or fried foods (nine percent), and less simple sugars

and carbohydrates (four percent).²¹ Eight percent said that they would like more fresh foods that were prepared from scratch on-site and fewer processed, refined foods.

2. Expand Variety and Menu Choices

Almost one-fifth of parents (18 percent) indicated a strong preference for enhancing the variety of offerings on the school menus.²² Several respondents simply stated that schools should offer “more variety” or “more choices.” Some added that their child or children in general were picky eaters and needed to have more food choices. As one parent noted, “If [the cafeteria] only has one thing and children don’t like it they go without [eating].” Several wanted to see more choices aside from ubiquitous dishes such as pizza.

A smaller number of parents gave more specific recommendations on how schools could enhance meal choices, such as offering more hot foods and being more attentive to children with dietary restrictions (for example, vegetarian menu items, religious considerations, allergies, or medical conditions). One percent of parents suggested offering more foods that reflect the student body’s cultural/ethnic heritages.

3. Improve Quantity and Quality of Foods

Some parents made recommendations related to the quantity and quality of school meals. Most feedback on quantity (eight percent) related to increasing portion sizes. Parents also described ways that schools could improve the quality of meals served. Almost six percent spoke about the need for better-quality foods, most of them characterizing quality in general

²¹ Respondents usually spoke in general terms, such as “sugar,” “starchy foods,” and “carbohydrates,” though occasionally they mentioned a specific item, like white bread, sweet breakfast rolls, and sweetened cereals. Some parents mentioned incorporating more whole-grain products.

²² Frequencies in this section are separate from suggestions that specifically identified adding more healthy menu choices, such as more fruits and vegetables, which are captured in the previous section.

terms (for example, “better quality of food” or “improve quality of meals”). Still, some parents gave more specific suggestions on ways to enhance quality. Recommendations usually addressed food preparation and presentation, such as ensuring that foods are adequately cooked and not served cold, not spoiled or served past the expiration date, not overcooked or burnt, and contain fewer artificial ingredients. Moreover, four percent of parents said that schools should improve the taste of the foods served by making the meals more appetizing and flavorful. If the meals were of better quality and tasted better, some parents suggested, then more students would eat them.

4. Adjust Mealtime Schedules

A few parents offered suggestions concerning when and how long it takes for students to get meals. The most common such suggestion was to increase the amount of time allotted to eat (six percent). Almost three percent suggested minimizing the length of time that students must stand in line to get their food. Two percent of parents thought meals should start later, and one percent thought they should start earlier.

5. Enhance Communication and Gather Feedback

Some parents suggested that schools improve communication regarding the school meal programs. Four percent of respondents thought they should be provided with better information as to which foods were served in school and what children were eating. For example, some in this group thought that menus should be sent home on a regular basis. A handful of parents worried that they could not monitor their child’s nutrition intake at school. They wanted to know what and if their child ate at school—for instance, whether they were eating a balanced meal, eating snack foods, or saving the money provided by their parents and not eating at all. In addition, two percent of parents thought that schools should gather opinions from students and

parents on the NSLP and SBP—for example, administering a survey to students at school to see what they would like served at mealtimes.

III. CHARACTERISTICS OF PARTICIPANTS AND NONPARTICIPANTS IN THE SCHOOL MEAL PROGRAMS

The National School Lunch Program (NSLP) and School Breakfast Program (SBP) are intended to improve the nutritional status of all schoolchildren, but their main benefits are targeted toward students from low-income families—those who qualify for free or reduced-price meals. The SBP also targets students who have long travel times to school, typically those in rural areas. Understanding the characteristics of those served by the two programs helps to assess how well they are reaching students in need, and where additional outreach efforts might best be targeted. This chapter describes the characteristics of NSLP and SBP participants in detail and contrasts them with the characteristics of each program’s respective nonparticipants.

In addition to helping researchers understand who the NSLP and SBP reached in school year 2004-2005, these contrasts also suggest hypotheses about factors that affect the decision to participate in the programs. Statistical tests are used to determine whether differences between participants and nonparticipants are large enough that they are not likely to be due to sampling variation. However, the contrasting profiles of NSLP and SBP participants versus nonparticipants presented here do not control for other factors, and do not represent causal effects of the school meal programs. Chapter IV explores these hypotheses in the context of a multivariate model, which enables us to examine the role of each factor, holding all others constant. This chapter focuses on participants on a typical school day (target day participants, as defined in Chapter II), as does Chapter IV.

Research questions addressed in this chapter include:

- What are the student and household characteristics of NSLP participants and nonparticipants? How do NSLP participants and nonparticipants differ across key demographic characteristics, weight status, and eating habits?

- What are the student and household characteristics of SBP participants and nonparticipants? How do SBP participants and nonparticipants differ across key demographic characteristics, weight status, and eating habits?

These questions are addressed primarily with data from the student and parent interviews, along with the observed height and weight measurements completed at the time of dietary recalls. Some background information on the SFAs and schools attended by participants and nonparticipants is also examined.

A. SUMMARY OF FINDINGS

- NSLP participants and nonparticipants in school year 2004-2005 differed markedly in age and gender and, to some extent, in race/ethnicity. Participating students were younger and more likely to be boys. Hispanics and non-Hispanic blacks were much more likely to participate than whites and others.
- Overall, NSLP participants were more disadvantaged than nonparticipants. Participants were more likely to live with a single parent and to attend school in rural districts and in low-income districts. On average, their parents had lower levels of education, and their families had lower incomes and were more likely to participate in other public assistance programs. However, the parents of participants and nonparticipants were equally likely to be employed (about 75 percent were working).
- Consistent with their differences in income, NSLP participants' families were more likely than nonparticipants' families to be food insecure.
- Weight status, physical activity, and reported health status were all similar for NSLP participants and nonparticipants; however, participants were less likely to take vitamins and other supplements, and participants' families reported serving higher-fat foods at home. Nonparticipants were more likely to be reported by their parents as "much more active" than participants.
- Differences between SBP participants and nonparticipants were generally similar to those observed between NSLP participants and nonparticipants, but they tended to be larger, as SBP participants were a smaller, more disadvantaged group than NSLP participants.

B. CHARACTERISTICS OF NSLP PARTICIPANTS AND NONPARTICIPANTS

About three in five schoolchildren participated in the NSLP on a typical school day, a rate that has not changed very much since at least the early 1990s (Burghardt et al. 1993a).¹ Participants included a wide range of students, but they were, on average, younger, more often male, and more disadvantaged than nonparticipants, findings that are consistent with those from the School Nutrition Dietary Assessment-I (SNDA-I) and other previous studies (Wemmerus et al. 1996; Gleason and Suitor 2001).

1. Student Demographic Characteristics

Participants in the NSLP were more likely than nonparticipants to be under 13, or in grades 1 through 6, and were less likely to be teenagers, or in grades 10 through 12 (Table III.1). This pattern of declining participation as children become older has been found in many previous studies. This pattern may reflect that teenagers have more freedom to choose the lunch they want (including the right to leave campus in some schools) and are more likely to have their own spending money. In addition, high schools tend to be larger and to offer more competitive food options (see Volume I). Furthermore, the results in Chapter II suggest that peer pressure may affect high school students' participation decisions.²

NSLP participants were also more likely than nonparticipants to be boys, to be black or Hispanic, to live in households with more children, and to live with only one adult (Table III.1). The difference in participation by gender was also observed in SNDA-I (Wemmerus et al. 1996) and in an analysis of school meal participation conducted by Gleason and Suitor (2001) using

¹ Nonparticipants and participants in this chapter include children attending school on the target day who skipped lunch (for NSLP) or breakfast (for SBP). Lunch participants could have skipped breakfast, and vice versa. Meal skipping is discussed further in Chapters VI and VII.

² For example, high school students were more likely than elementary school students to select, as a reason for nonparticipation, that "friends don't eat school lunches" (Table II.9).

TABLE III.1
 DEMOGRAPHIC CHARACTERISTICS OF NSLP PARTICIPANTS
 AND NONPARTICIPANTS
 (Percentage of Students)

	Participants	Nonparticipants	All Students
Grade Level			
1	9.6	6.2	8.3
2	13.3	7.0**	10.9
3	11.5	7.2*	9.8
4	11.2	7.0*	9.6
5	11.1	6.2**	9.2
6	6.5	5.5	6.1
7	8.5	8.8	8.6
8	7.1	10.1*	8.2
9	6.4	10.2**	7.8
10	5.9	11.1**	7.9
11	5.8	11.0**	7.8
12	3.2	9.8**	5.7
Age			
6	4.6	1.5**	3.4
7	11.0	8.0	9.9
8	11.8	6.8**	9.9
9	11.6	7.9	10.2
10	9.4	6.2	8.2
11	10.0	5.7**	8.4
12	7.7	6.3	7.2
13	7.8	8.7	8.1
14	7.7	11.0*	9.0
15	4.8	10.7**	7.1
16	7.0	11.3**	8.6
17	4.5	10.0**	6.7
18	2.0	5.9**	3.5
Gender			
Male	52.6	44.7**	49.6
Female	47.4	55.3**	50.4
Race/Ethnicity			
Hispanic	24.0	18.7	21.9
White, non-Hispanic	50.4	60.4**	54.2
Black, non-Hispanic	19.1	13.0*	16.8
Other (includes biracial)	6.5	8.0	7.0
Primary Language Spoken at Home			
Spanish	5.2	6.6*	10.0
Other than English or Spanish ^a	3.3	3.8	3.5

TABLE III.1 (continued)

	Participants	Nonparticipants	All Students
Household Size			
Less than or equal to 2	5.2	5.3	5.2
3	19.3	18.4	19
4	31.6	40.2**	34.9
5	22.6	20.7	21.9
Greater than 5	21.3	15.4**	19
Mean	4.5	4.3*	4.4
Number of Children Younger than 18			
1	24.3	28.7	26.0
2	35.1	41.7*	37.6
3	23.8	18.7*	21.9
4 or more	16.8	10.9**	14.5
Mean	2.4	2.1**	2.3
Number of Adults (Age 18 or Above)			
1	19.3	12.4**	16.7
2	59.9	63.9	61.4
3	15.7	18.5	16.8
4 or more	5.2	5.2	5.2
Mean	2.1	2.2	2.1
Sample Size	1,386	928	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aIncludes a few reports of “both English and Spanish.”

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

data from the 1994-1996 Continuing Survey of Food Intakes by Individuals. The other differences in the characteristics of participants and nonparticipants were consistent with participants being somewhat more disadvantaged than nonparticipants, on average. At the same time, most NSLP participants (81 percent) lived with two or more adults and half were white, non-Hispanic.

2. Characteristics of the School and Locality

As expected, given the age and grade distributions noted in Table III.1, most NSLP participants attended elementary schools (59 percent versus 36 percent of nonparticipants), while nonparticipants were more than twice as likely to be in high school as participants (43 percent versus 21 percent). The two groups were equally as likely to be in middle school (roughly 20 percent of both groups) (Table III.2). NSLP participants were less likely than nonparticipants to attend large schools (with more than 1,000 enrolled), perhaps partly reflecting the fact that large schools are more likely to be high schools.

A larger proportion of NSLP participants than nonparticipants attended schools in rural areas (24 versus 15 percent). Participants were also more likely than nonparticipants to live in the Southeastern region of the United States (26 percent of participants versus 16 percent of nonparticipants). In addition, students who participated in the NSLP were more likely to attend schools with a relatively high percentage of students (60 percent or more) certified for free or reduced-price meals and were less likely to attend schools with a low percentage (less than 20 percent) of students certified for free- or reduced-price meals.

TABLE III.2
CHARACTERISTICS OF SCHOOLS ATTENDED BY NSLP PARTICIPANTS
AND NONPARTICIPANTS
(Percentage of Students)

	Participants	Nonparticipants	All Students
School Type			
Elementary	59.4	36.0**	50.5
Middle	19.6	20.9	20.1
High	20.9	43.0**	29.4
School Size (Enrollment)			
Small	32.0	26.0	29.7
Medium	47.7	35.1**	42.9
Large	20.3	38.8**	27.4
Metropolitan Status^a			
Urban (central city of MSA)	36.0	39.6	37.4
Suburban (MSA but not central city)	39.7	45.8	42.0
Rural (not in MSA)	24.2	14.6**	20.5
FNS Region			
Northeast	7.1	11.1	8.6
Mid-Atlantic	10.4	10.9	10.6
Southeast	26.3	16.2**	22.4
Midwest	16.4	17.1	16.7
Southwest	16.5	14.5	15.7
Mountain/Plains	7.6	8.6	8.0
Western	15.7	21.7	18.0
Percentage of Students Certified for Free or Reduced-Price Meals^b			
Low (less than 20 percent)	17.0	35.0**	23.8
Medium (20 to < 60 percent)	50.1	50.6	50.3
High (60 percent or higher)	33.0	14.4**	25.9
School Participates in SBP	85.9	77.3	82.6
Sample Size	1,386	928	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aBased on 2002-2003 U.S. Department of Education Common Core of Data for district.

^bBased on SNDA-III Preliminary Survey.

MSA = metropolitan statistical area.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

3. Family Income, Program Participation, and Food Security

NSLP participants were more disadvantaged, on average, than nonparticipants—as expected, given the program’s targeting. Participants’ families had lower incomes, were more likely to participate in public and nutrition assistance programs, and were more likely to have *low food security* or *very low food security*.³

Family Income. Students who participated in the NSLP were more likely than other students to be from low-income families (Table III.3). In particular, participants were more likely to have family incomes of \$50,000 or less per year, and they were more likely to qualify for free or reduced-price meals. Among participants, 35 percent were from families with incomes at or below 130 percent of poverty (eligible for free meals), and 15 percent were from families with incomes between 130 and 185 percent of poverty (eligible for reduced-price meals)—thus, half were eligible for free or reduced-price meals, based on reported family income. Among nonparticipants, 18 percent were eligible for free meals, and 8 percent were eligible for reduced-price meals—thus, about a quarter could have received free or reduced-price meals. These findings reflect the fact that students certified for free or reduced-price meals participate at much higher rates than other students (Table II.1; Maurer 1984; Wemmerus et al. 1996; Gleason and Suitor 2001). NSLP participants were also less likely to be from families with incomes above 200 percent of the poverty level, but about one-third of them came from such families (versus 53 percent of nonparticipants).

³ In 2006, USDA revised the labels used to describe the ranges of food security in response to recommendations made by an expert panel convened by the Committee on National Statistics (Committee on National Statistics 2006; Nord et al. 2006). The new labels range from *high food security*, indicating no food-access problems, to *very low food security*, indicating multiple disrupted eating occasions and reduced food intake (Economic Research Service 2007).

TABLE III.3

HOUSEHOLD INCOME AND PUBLIC ASSISTANCE PROGRAM PARTICIPATION
OF NSLP PARTICIPANTS AND NONPARTICIPANTS
(Percentage of Students)

	Participants	Nonparticipants	All Students
Applied for Free/Reduced-Price Meals	56.5	30.0**	46.3
Certified for Free or Reduced-Price Lunch (yes/no)	53.6	23.3**	42.0
SBP Participant	25.6	5.0**	17.7
Family Receives Food Stamps	24.1	14.5**	21.0
Family Receives TANF or Other Cash Welfare	9.5	4.7*	8.0
Family Receives Medicaid or SCHIP ^a	39.1	21.9**	33.6
Family Receives WIC Benefits ^b	13.2	7.4*	11.3
Household Food Security			
Food secure	77.6	90.5**	82.5
Food insecure			
Low food security	16.6	6.0**	12.6
Very low food security	5.7	3.5*	4.9
Received Emergency Food in Past 30 Days (Food Pantry)	6.3	3.3*	5.5
Received Emergency Food in Past 30 Days (Kitchen)	1.4	0.6	1.1
Stayed in Shelter in Past 30 Days	0.3	0.2	0.2
Any Emergency Food in Past 30 Days ^c	7.4	3.3**	6.2
Household Income as a Percentage of Poverty			
0 to 130	35.0	18.4**	28.7
131 to 185	15.3	8.1**	12.6
186 to 200	17.7	20.4	18.7
201 to 300	12.0	19.5**	14.8
Greater than 300	20.1	33.6**	25.2
Annual Household Income (Dollars)			
Less than or equal to \$20,000	24.7	14.8**	21.0
\$20,001 to \$50,000	38.6	25.9**	33.8
\$50,001 to \$80,000	18.0	29.8**	22.5
\$80,001 to \$100,000	7.2	16.6**	10.7
More than \$100,000	11.5	12.9	12.0
Sample Size	1,386	928	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aSCHIP is the State Children's Health Insurance Program. Because in some States it is a part of Medicaid, the interview asked about them jointly. The income cutoffs for SCHIP are higher than for Medicaid, and exceed 185 percent of poverty in some States.

^bWIC is the Special Supplemental Nutrition Program for Women, Infants, and Children.

^cFrom a pantry, soup kitchen, or shelter.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

Program Participation. Participants' parents were more likely than nonparticipants' parents to have applied during school year 2004-2005 for certification for free or reduced-price meals (57 versus 30 percent), and their children were more likely to have received such meals in the 30 days prior to the interview (Table III.3). Participants were also more likely than nonparticipants to receive food stamps, Medicaid, or State Children's Health Insurance Program (SCHIP) coverage, or to live with someone receiving benefits from the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). About one-fourth of participants' families received food stamps, compared with 15 percent of nonparticipants' families. Participants were thus also more likely to be eligible for free or reduced-price meals on the basis of their family's participation in other assistance programs, even if their families did not submit an application. Through a process known as "direct certification," a list of students is matched against Food Stamp Program (FSP) records or those of other public assistance programs, and those who match are certified as eligible for free or reduced-price meals.

Food Security. More than three-quarters of NSLP participants' families reported being food secure, based on the 18-item food security scale (Table III.3). Nonetheless, participants' families were more likely to have *low food security* (previously called "food insecurity without hunger") than nonparticipants' families (17 percent of participants versus 6 percent of nonparticipants). Participants' families were also more likely to have *very low food security* (previously called "food insecurity with moderate or severe hunger") than nonparticipants' families (six versus four percent).⁴ This provides further evidence that the school meal programs are reaching those in need.

⁴ For reference, according to national data, in 2005, 16 percent of children were in households with low food security, and 1 percent were in households with very low food security (Nord et al. 2006). Their estimates of the percentage of children in households with low food security and very low food security combined (17 percent) are comparable for those for all students from the SNDA-III data (18 percent), although the estimated percentage of

Although only a small proportion of parents reported seeking emergency food, participants' families were more likely than nonparticipants' families to report seeking emergency food in the past 30 days (seven versus three percent), most often from food pantries.

4. Parent Characteristics

Parents of NSLP participants were more likely than parents of nonparticipants to be single, but more than 70 percent of parents of both groups of students lived with a spouse or partner (Table III.4).⁵ On average, NSLP participants also had less educated parents than nonparticipants. In particular, their parents were less likely to have completed high school and less likely to have a college degree. However, the parents of participants and nonparticipants were equally as likely to be employed (about 75 percent were working), and, among those who worked, more than 60 percent of both groups worked at least 35 hours per week.

5. Student Weight Status, Physical and Sedentary Activities, and Overall Health

SNDA-III measured students' height and weight and asked several questions about physical and sedentary activities in order to control for these factors when looking at the role of the NSLP and SBP in dietary intakes. In addition, this information can be used to describe students' body weight and the types of activities they engage in, because such information can inform strategies for preventing overweight and promoting healthy eating. NSLP participants and nonparticipants had significant differences in their parents' reports of their physical activity level, in the direction

(continued)

students in households with very low food security is higher in SNDA-III. One factor that may account for the difference is that the Nord et al. estimates are representative of all children, while the SNDA-III estimates are representative of children in public schools offering the NSLP.

⁵ Nearly all the parent interview respondents were the student's parent or the parent's partner (94 percent), and this did not differ between participants and nonparticipants. Further discussions will refer to parent interview respondents as "parents" in general, although about six percent may have been another relative, a foster parent, or some other individual caring for the student.

TABLE III.4
CHARACTERISTICS OF PARENT INTERVIEW RESPONDENTS, BY CHILD'S
NSLP PARTICIPATION STATUS
(Percentage of Students)

	Participants	Nonparticipants	All Students
Respondent Is Parent or Parent's Partner	93.4	94.5	93.8
Respondent Lives with Spouse or Partner	70.4	80.2**	74.2
Respondent Parent and Partner Status			
Parent/partner and lives with partner/spouse	65.9	76.4**	70
Parent/partner and does not live with partner/spouse	27.4	18.1**	23.8
Not parent/partner and lives with partner/spouse ^a	4.5	3.8	4.2
Not parent/partner and does not live with partner/spouse ^b	2.1	1.7	2
Respondent's Highest Education Level			
Less than high school	17.0	9.2**	14.0
High school or GED	30.1	24.5*	27.9
Some college or postsecondary	34.6	34.6	34.6
College graduate	18.3	31.7**	23.5
Respondent Is Employed	74.9	75.6	75.2
Respondent's Hours Worked per Week (Among Those Who Work)			
1 to 10	7.9	10.0	8.7
11 to 20	9.1	7.5	8.5
21 to 30	11.4	13.4	12.2
31 to 35	6.8	6.8	6.8
36 to 40	37.7	39.0	38.2
More than 40	27.0	23.3	25.6
Mean	36.4	35.5	36.1
Sample Size	1,386	928	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

^aFor example, married grandparents who have custody of their grandchildren.

^bFor example, an unmarried aunt who has custody of a niece or nephew.

of participants being less healthy than nonparticipants (Table III.5). They differed in the types of sedentary activities they engaged in, but not in the overall number of hours spent, on average. However, for both groups, the proportions overweight or at risk of overweight suggest some reason for concern.

Weight Status. Weight status for children was assessed on the basis of their body mass index (BMI), which is defined as weight (in kilograms) divided by the square of height (in meters). Standard growth charts provide percentiles of the BMI distribution for children of various ages (Centers for Disease Control and Prevention 2000). The convention widely accepted in assessment of children is to refer to children with BMI above the 95th percentile of this distribution as “overweight or obese” and to refer to children between the 85th and 95th percentile as “at risk for overweight.”

Estimates from SNDA-III of children’s weight status suggest that 22.5 percent of school-age children were overweight or obese, and 16.5 percent were at risk of overweight. Participants were somewhat more likely than nonparticipants to be overweight or obese (24 versus 20 percent), although this difference was not statistically significant (Table III.5). Participants were less likely than nonparticipants to be at risk of overweight (15 versus 19 percent), a difference that was statistically significant. In interpreting these differences, it is important to keep in mind that they do not adjust for differences in age, ethnicity, or other characteristics that are known to be correlated with BMI. So, for instance, nonparticipants may be more likely than participants to be at risk of overweight in part due to their older average age, since older children are less likely to participate but tend to have higher BMIs.

The overall estimates for overweight and risk of overweight are higher than those derived from the 2003-2004 National Health and Nutrition Examination Survey (NHANES), which also were directly measured (Ogden et al. 2006). Further research is needed to understand the

TABLE III.5

CHILD'S HEALTH AND PHYSICAL ACTIVITY, BY NSLP PARTICIPATION STATUS
(Percentage of Students)

	Participants	Nonparticipants	All Students
Body Mass Index (BMI)^a			
Underweight	1.9	2.1	2.0
Normal weight	58.9	59.1	59.0
At risk of overweight	14.9	19.0*	16.5
Overweight or obese	24.2	19.8	22.5
Physical Activities			
Taking physical education in school	82.5	72.2**	78.5
On a school sports team	21.6	27.1*	23.7
Participates in community sports	49.4	51.4	50.2
Walks or bikes to school	19.1	21.7	20.1
Physically active outside of school ^b	87.3	87.5	87.3
Number of Physical Activities^c			
None	1.0	1.5	1.2
1	10.9	14.3	12.2
2	33.7	31.3	32.8
3	38.3	32.6*	36.1
4	14.0	16.6	15.0
5	2.1	3.7	2.7
Mean	2.6	2.6	2.6
Activity Level Relative to Other Children (Parent Report)			
Less active	12.7	12.1	12.5
About as active	46.3	43.1	45.1
More active	26.0	24.1	25.2
Much more active	15.0	20.8*	17.2
Child's General Health (Parent Report)			
Excellent	48.3	52.8	50.0
Very good	33.4	31.4	32.6
Good	13.5	12.6	13.1
Fair	4.2	2.8	3.7
Poor	0.7	0.3	0.5
Smoked Cigarettes in Past Month	1.5	3.5*	2.3
Days per Month Smoked Cigarettes (among those who smoked in the past month; n = 68)			
1 to 2	12.1	18.7	16.0
3 to 5	14.0	15.8	15.0
6 to 19	17.0	7.1	11.2
20 to 29	7.0	6.3	6.6
30+	49.9	52.1	51.2
Hours Watching TV or Videos/DVDs^e			
None	6.8	9.7	7.9
Less than 1	9.8	9.2	9.6

TABLE III.5 (continued)

	Participants	Nonparticipants	All Students
1-<2	30.8	38.3*	33.7
2-<3	28.8	24.1*	27.0
3-<5	19.0	14.6*	17.3
5+	4.8	4.2	4.6
Mean	1.9	1.7*	1.8
Hours on Computer or Playing Video Games ^e			
None	33.4	29.8	32.0
Less than 1	22.8	17.4*	20.7
1-<2	24.3	30.3*	26.6
2-<3	11.9	12.0	11.9
3-<5	6.4	8.2	7.1
5+	1.2	2.3	1.6
Mean	0.9	1.1**	1.0
Sample Size	1,386	928	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aUnderweight = <5th percentile. Normal weight = \geq 5th percentile and <85th percentile. At risk of overweight = \geq 85th percentile, and overweight or obese = \geq 95th percentile.

^bFor younger students (less than age 12) the question is “Do you play outside after school?” For students age 12 and above, the question is “Outside of school, are you physically active, such as walking, running, biking, or working out with exercise equipment?”

^cThis variable counts how many of the five activities just described in which the student participated.

^dUsing a 1 to 5 scale, with excellent = 5, very good = 4, and so forth.

^eReported by parent for students younger than 12, by student for age 12 and up.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

sources of these differences. Possible explanations, for example, include that the SNDA-III population excludes students attending private schools and some special education students. In addition, the SNDA-III sampling methodology is school-based and omits children not attending school because of poor health or other reasons.

Activity Levels. Reports by students and their parents suggest that schoolchildren, on average, were moderately active, but that they also engaged in extensive sedentary “screen time,” which can be associated with overeating (Committee on the Prevention of Obesity in Children and Youth 2005). NSLP participants spent more time watching TV and less time playing computer or video games than nonparticipants, on average, but total “screen time” for both groups of students was similar. The different levels of computers or video game use versus TV watching may be yet another reflection of the differences in average incomes between participants and nonparticipants.

The physical activity measures used in SNDA-III were new and attempted to measure these behaviors in several ways. All of the children were asked five yes-or-no questions about the types of activities they engaged in, and they reported participating in 3.6 of the 5 activities, on average. Participants were slightly more likely than nonparticipants to report taking physical education classes in school. Parents were asked about their child’s activity level relative to other children the same age, and about 70 percent of both participants’ and nonparticipants’ parents reported their child was “as active” or “more active” than most children her or his age. However, parents of nonparticipants were significantly more likely to report that their child was “much more active” than other children (21 percent for nonparticipants versus 15 percent for NSLP participants).

Overall Health. No significant differences were found in parents' reports of their children's overall health. More than 80 percent of both participants' and nonparticipants' parents reported their child was in excellent or very good health.

Middle and high school students were asked whether they smoked cigarettes; NSLP participants were significantly less likely than nonparticipants to report smoking (two versus four percent), which is probably related to their differences in age.

6. Student and Family Eating Habits

To provide further insight into the diets of NSLP and SBP participants and nonparticipants, the student and parent interviews included a range of questions about the child's eating habits and those of his or her family. Questions covered dieting, use of dietary supplements, food allergies, the role of family in meals, and food preparation habits (Table III.6).

NSLP participants and nonparticipants were similar in whether they usually ate breakfast (91 percent said they did) and in whether they were trying to lose weight (about 30 percent of middle and high school students said they were). They differed in the use of dietary supplements—nonparticipants were more likely to take vitamins and minerals every day and overall. These differences may reflect the higher incomes and education levels of their parents.

Parents' views on their children's appetites were similar for NSLP participants and nonparticipants. There were no significant differences in the proportions of parents who reported that their child was a very or somewhat picky eater, or in the proportions reporting their child ate more (or less) than children the same age. Participants were more likely than nonparticipants to have their breakfast prepared for them by an adult, likely reflecting differences in the ages of participants versus nonparticipants. There were no significant differences in how often the family eats an evening meal together, as reported by students ages 12 and above.

TABLE III.6

CHILD AND FAMILY EATING HABITS, BY NSLP PARTICIPATION STATUS
(Percentage of Students)

	Participants	Nonparticipants	All Students
Usually Eats Breakfast	91.2	90.5	90.9
In Past 30 Days, Ate Less or Chose Foods Low in Fat or Carbohydrates to Lose Weight (age 12 and up only) ^a (n = 1,563)	29.5	29.7	29.6
Takes Vitamins ^b			
Every day or almost	23.2	29.6*	25.7
Every so often	27.8	29.0	28.3
Not at all	48.9	41.4**	46.0
Takes Minerals ^b			
Every day or almost	6.5	9.8*	7.8
Every so often	12.1	14.4	13.0
Not at all	81.4	75.9*	79.3
Takes Other Supplements ^b			
Every day or almost	1.1	2.1	1.5
Every so often	4.5	4.2	4.4
Not at all	94.4	93.8	94.2
Pickiness ^c			
Very picky eater	21.6	20.9	21.3
Somewhat picky eater	44.2	45.9	44.9
Not a picky eater	34.2	33.2	33.8
Amount Child Eats Compared with Other Children the Same Age ^c			
Larger amount	23.2	22.6	23.0
Same amount	60.5	62.6	61.3
Smaller amount	16.3	14.9	15.8
Any Food Allergies/Special Diet ^c	7.1	10.0	8.2
Someone Fixes Breakfast for Child ^c	79.1	69.1**	75.3
Nights per Week Family Eats Dinner Together (age 12 and up only) ^a (n = 1,574)			
Every night	35.6	33.6	34.6
5 or 6	12.3	15.0	13.7
3 or 4	25.6	23.0	24.3
1 or 2	15.5	18.5	17.0
None	11.0	9.8	10.4

TABLE III.6 (continued)

	Participants	Nonparticipants	All Students
In Food Prepared for Child			
Uses Skim or 1% Milk ^c			
Always	34.8	41.1*	37.2
Sometimes	11.5	10.7	11.2
Rarely	8.8	7.2	8.2
Never	43.7	39.6	42.1
Doesn't drink milk	1.2	1.4	1.3
Serves Chicken That Is Fried ^c			
Always	10.2	5.8**	8.5
Sometimes	39.1	31.1**	36.0
Rarely	34.1	39.5*	36.2
Never	15.6	21.8**	18.0
Doesn't eat chicken	1.0	1.8	1.3
Adds Fat to Potatoes (Baked or Mashed) ^c			
Always	57.2	56.8	57.1
Sometimes	19.7	19.7	19.7
Rarely	10.2	10.2	10.2
Never	10.6	8.6	9.8
Doesn't eat this	2.2	4.7*	3.2
Amount of Fat Spread on Bread ^c			
None	17.0	18.8	17.7
Light	46.3	43.8	45.3
Moderate	31.9	32.4	32.1
Generous	4.8	5.0	4.9
Sample Size	1,386	928	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aAs reported by the student.

^bAs reported by the student (age 12 and up) or the parent (if student's age is less than 12).

^cAs reported by the parent.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

Finally, parents were asked about their use of fat in cooking, through a series of questions adapted from the Diet and Health Knowledge Survey. The questions were chosen based on a study indicating that responses to these questions were associated with the fat content of one's diet (Capps 2000). However, the questions were revised to ask about foods prepared for the target child, rather than the family in general. According to their parents, NSLP participants were significantly less likely than nonparticipants to always consume skim or 1% low-fat milk at home, and they were more often fed fried chicken, when the family had chicken. However, there were no significant differences in whether parents added fat to their potatoes or in the amount of fat spread on their bread.

C. CHARACTERISTICS OF SBP PARTICIPANTS AND NONPARTICIPANTS

SBP participants are a smaller and more disadvantaged group than NSLP participants.⁶ In general, differences in the characteristics of SBP participants and nonparticipants follow patterns very similar to those of the differences between NSLP participants and nonparticipants, but they are proportionately larger, and suggest that SBP participants overall are a fairly disadvantaged group. For example, 67 percent of SBP participants had family incomes less than 185 percent of poverty, compared with 50 percent of NSLP participants. Fully 80 percent of SBP participants had applied for free or reduced-price meals during the school year, whereas 57 percent of NSLP participants had applied for them.

Demographic Characteristics. SBP participants were younger and more likely to be boys than SBP nonparticipants, and the differences were larger than for the respective NSLP populations (Table III.7). About 63 percent of SBP participants were in grades 1-5, versus

⁶ In this section, nonparticipants include students whose schools do not offer the SBP. In addition, as noted previously, meal skippers are included in the samples used in this chapter; breakfast skippers are SBP nonparticipants, while lunch skippers can be SBP participants.

TABLE III.7
 DEMOGRAPHIC CHARACTERISTICS OF SBP PARTICIPANTS
 AND NONPARTICIPANTS
 (Percentage of Students)

	Participants	Nonparticipants	All Students
Grade Level			
1	13.4	7.2	8.3
2	12.6	10.5	10.9
3	14.1	8.9*	9.8
4	11.7	9.2	9.6
5	11.3	8.8	9.2
6	7.4	5.8	6.1
7	6.5	9.1	8.6
8	6.2	8.7	8.2
9	3.0	8.9**	7.8
10	5.9	8.3	7.9
11	4.9	8.4*	7.8
12	2.9	6.3**	5.7
Age			
6	6.6	2.7*	3.4
7	10.2	9.8	9.9
8	15.7	8.6**	9.9
9	11.2	10.0	10.2
10	10.5	7.7	8.2
11	10.2	8.0	8.4
12	7.9	7.0	7.2
13	6.8	8.4	8.1
14	5.0	9.8**	9.0
15	4.2	7.7**	7.1
16	5.0	9.4**	8.6
17	5.0	7.0	6.7
18	1.7	3.9**	3.5
Gender			
Male	58.7	47.6**	49.6
Female	41.3	52.4**	50.4
Race/Ethnicity			
Hispanic	25.9	21.1	21.9
White, non-Hispanic	38.1	57.7**	54.2
Black, non-Hispanic	29.9	14.0**	16.8
Other (includes biracial)	6.1	7.2	7.0
Primary Language at Home			
Spanish	17.3	8.4	10.0
Other than English or Spanish	1.0	4.0**	3.5

TABLE III.7 (continued)

	Participants	Nonparticipants	All Students
Household Size			
Less than or equal to 2	6.2	5.0	5.2
3	17.4	19.3	19.0
4	27.4	36.5**	34.9
5	24.2	21.4	21.9
Greater than 5	24.8	17.8*	19.0
Mean	4.7	4.4*	4.4
Number of Children Younger than 18			
1	20.8	27.1*	26.0
2	31.3	39.0*	37.6
3	26.2	20.9	21.9
4 or more	21.7	13.0**	14.5
Mean	2.6	2.2**	2.3
Number of Adults (Age 18 or Above)			
1	27.2	14.4**	16.7
2	53.8	63.0*	61.4
3	14.6	17.2	16.8
4 or more	4.4	5.3	5.2
Mean	2.1	2.2	2.1
Sample Size	381	1,933	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005.
Weighted tabulations prepared by Mathematica Policy Research, Inc.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

45 percent of nonparticipants. Fully 59 percent of SBP participants were male, versus 48 percent of nonparticipants. SBP participants were more likely to be non-Hispanic blacks and were less likely to be non-Hispanic whites. Black non-Hispanic students were 30 percent of SBP participants and only 14 percent of SBP nonparticipants.

SFA and School Characteristics. SBP participants were significantly less likely to attend large schools and suburban schools, but they were more likely to attend rural schools (Table III.8). Fifty percent of SBP participants were in high-poverty districts and 7 percent were in low-poverty districts; in contrast, only 21 percent of nonparticipants were in high-poverty districts, and 27 percent were in low-poverty districts.

Family Income, Program Participation, and Food Security. Fully 68 percent of SBP participants' families had incomes at or below 185 percent of poverty, compared with 36 percent of nonparticipants (Table III.9). Participants were also much less likely to have incomes more than twice the poverty line (18 percent versus 45 percent for nonparticipants).

Three-quarters of SBP participants received free or reduced-price meals, according to their parents, but only 35 percent of nonparticipants did (Table III.9). Almost all SBP participants also participated in the NSLP (89 percent), while SBP nonparticipants participated at a much lower rate (56 percent). SBP participants' families were also more likely to participate in other food assistance or welfare programs.

Consistent with the relatively low incomes of their families, SBP participants were significantly more likely to be food insecure than nonparticipants' families. They were more likely to have *low food security* (23 versus 10 percent), as well as *very low food security* (8 versus 4 percent). Differences in use of emergency food follow a similar pattern, although they were not statistically significant.

TABLE III.8
CHARACTERISTICS OF SCHOOLS ATTENDED BY SBP PARTICIPANTS
AND NONPARTICIPANTS
(Percantage of Students)

	Participants	Nonparticipants	All Students
School Type			
Elementary	65.8	47.2**	50.5
Middle	17.4	20.7	20.1
High	16.8	32.1**	29.4
School Size (Enrollment)			
Small	32.6	29.1	29.7
Medium	54.0	40.5*	42.9
Large	13.4	30.4**	27.4
Metropolitan Status^a			
Urban (central city MSA)	44.2	35.9	37.4
Suburban (MSA but not central city)	25.4	45.6**	42.0
Rural (not in MSA)	30.4	18.4*	20.5
FNS Region			
Northeast	6.0	9.2	8.6
Mid-Atlantic	14.5	9.7	10.6
Southeast	25.8	21.7	22.4
Midwest	12.9	17.5	16.7
Southwest	19.2	14.9	15.7
Mountain/Plains	4.1	8.8	8.0
Western	17.5	18.1	18.0
Percentage of Students Certified for Free or Reduced-Price Meals^b			
Low (less than 20 percent)	7.4	27.4**	23.8
Medium (20 to 60 percent)	42.6	51.9	50.3
High (60 percent or higher)	50.0	20.7**	25.9
School Participates in SBP	100.0	78.9**	82.6
Sample Size	381	1,933	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aBased on 2002-2003 U.S. Department of Education Common Core of Data for district.

^bBased on SNDA-III Preliminary Survey.

MSA = metropolitan statistical area.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

TABLE III.9

HOUSEHOLD INCOME AND PUBLIC ASSISTANCE PROGRAM PARTICIPATION
OF SBP PARTICIPANTS AND NONPARTICIPANTS
(Percentage of Students)

	Participants	Nonparticipants	All Students
Applied for Free/Reduced-Price Meals	80.0	39.0**	46.3
Certified for Free or Reduced-Price Lunch	76.5	34.6**	42.0
NSLP Participant	89.1	55.8**	61.7
Family Receives Food Stamps	36.3	16.5**	21.0
Family Receives TANF or Other Cash Welfare	14.7	6.0**	8.0
Family Receives Medicaid or SCHIP ^a	50.0	28.7**	33.6
Family Receives WIC Benefits ^b	16.8	9.7	11.3
Household Food Security			
Food secure	68.9	85.5**	82.5
Food insecure			
Low food security	22.6	10.4**	12.6
Very low food security	8.4	4.1**	4.9
Received Emergency Food in Past 30 Days (Food Pantry)	8.1	4.6	5.5
Received Emergency Food in Past 30 Days (Kitchen)	2.6	0.7	1.1
Stayed in Shelter in Past 30 Days	0.4	0.2	0.2
Any Emergency Food in Past 30 Days ^c	10.3	4.8	6.2
Household Income as a Percentage of Poverty			
0 to 130	49.8	24.1**	28.7
131 to 185	17.6	11.5**	12.6
186 to 200	14.1	19.7	18.7
201 to 300	7.9	16.4**	14.8
Greater than 300	10.6	28.4**	25.2
Annual Household Income (Dollars)			
Less than or equal to \$20,000	38.0	17.2**	21.0
\$20,001 to \$50,000	41.6	32.1**	33.8
\$50,001 to \$80,000	12.0	24.8**	22.5
\$80,001 to \$100,000	3.3	12.4**	10.7
More than \$100,000	5.1	13.6**	12.0
Sample Size	381	1,933	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aSCHIP is the State Children's Health Insurance Program. Because in some States it is a part of Medicaid, the interview asked about them jointly. The income cutoffs for SCHIP are higher than for Medicaid, and exceed 185 percent of poverty in some States.

^bWIC is the Special Supplemental Nutrition Program for Women, Infants, and Children.

^cFrom pantry, soup kitchen, or shelter.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

Respondent Characteristics. SBP participants were more likely to live with a single parent than nonparticipants (Table III.10), and this difference was more pronounced than it was for NSLP participants and nonparticipants. Parents of SBP participants were nearly twice as likely not to have finished high school as nonparticipants' parents (22 and 12 percent, respectively), and were much less likely to have finished college (11 versus 26 percent). However, as with NSLP participants and nonparticipants, there were no significant differences in parents' employment rates or in the hours they worked.

Weight Status, Activity Levels, and Overall Health. SBP participants and nonparticipants did not significantly differ in weight status; they were also similar in physical activity levels (Table III.11). SBP participants, however, were more likely to be in fair health (six versus three percent of nonparticipants), and they watched more TV, on average, than nonparticipants—2.1 hours per day versus 1.8 hours. They were also more likely to have no access to computers or video games. These health and activity patterns are consistent with their economic disadvantage.

Child and Family Eating Habits. SBP participants and nonparticipants did not differ significantly in most of their eating habits (Table III.12). As with NSLP participants and nonparticipants, SBP participants were significantly less likely to take vitamins than nonparticipants; they were also less likely to take non-mineral supplements (such as echinacea or fish oil) than nonparticipants.

TABLE III.10
CHARACTERISTICS OF PARENT INTERVIEW RESPONDENTS, BY STUDENT'S
SBP PARTICIPATION STATUS
(Percentage of Students)

	Participants	Nonparticipants	All Students
Respondent Is Parent or Parent's Partner	92.1	94.2	93.8
Respondent Lives with Spouse or Partner	61.5	76.9**	74.2
Respondent Parent and Partner Status			
Parent/partner and lives with partner/spouse	56.2	72.9**	70.0
Parent/partner and does not live with partner/spouse	36.0	21.2**	23.8
Not parent/partner and lives with partner/spouse ^a	5.3	4.0	4.2
Not parent/partner and not living with partner/spouse ^b	2.6	1.9	2.0
Respondent's Highest Education Level			
Less than high school	22.2	12.3**	14.0
High school or GED	31.1	27.2	27.9
Some college or postsecondary	35.7	34.3	34.6
College graduate	11.0	26.2**	23.5
Respondent Is Employed	71.9	75.9	75.2
Respondent's Hours Worked per Week (Among Those Who Work)			
1 to 10	11.2	8.2	8.7
11 to 20	9.6	8.3	8.5
21 to 30	10.2	12.6	12.2
31 to 35	7.8	6.6	6.8
36 to 40	36.5	38.6	38.2
More than 40	24.8	25.7	25.6
Mean	35.6	36.2	36.1
Sample Size	381	1,933	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^a For example, married grandparents who have custody of their grandchildren.

^b For example, an unmarried aunt who has custody of a niece or nephew.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

TABLE III.11

CHILD'S HEALTH AND PHYSICAL ACTIVITY, BY SBP PARTICIPATION STATUS
(Percentage of Students)

	Participants	Nonparticipants	All Students
Body Mass Index (BMI)^a			
Underweight	2.7	1.8	2.0
Normal weight	57.1	59.4	59.0
At risk of overweight	15.4	16.7	16.5
Overweight or obese	24.8	22.1	22.5
Physical Activities			
Taking physical education in school	79.4	78.4	78.5
On a school sports team	24.5	23.5	23.7
Participates in community sports	46.7	50.9	50.2
Walks or bikes to school	19.0	20.3	20.1
Physically active outside of school ^b	86.0	87.6	87.3
Number of Physical Activities^c			
None	1.5	1.1	1.2
1	11.8	12.3	12.2
2	33.5	32.7	32.8
3	37.6	35.8	36.1
4	14.2	15.2	15.0
5	1.5	3.0	2.7
Mean	2.6	2.6	2.6
Activity Level Relative to Other Children (Parent Report)			
Less active	12.6	12.4	12.5
About as active	48.6	44.3	45.1
More active	23.1	25.7	25.2
Much more active	15.6	17.6	17.2
Child's General Health (Parent Report)			
Excellent	45.8	50.9	50.0
Very good	32.6	32.7	32.6
Good	14.8	12.8	13.1
Fair	6.1	3.1*	3.7
Poor	0.6	0.5	0.5
Smoked Cigarettes in Past Month	1.4	2.4	2.3
Days per Month Smoked Cigarettes (Among Those Who Smoked in the Past Month) (n=68)			
1 to 2	7.2	17.1	16.0
3 to 5	0.5	16.9	15.0
6 to 19	12.8	11.0	11.2
20 to 29	8.6	6.4	6.6
30+	70.9	48.7	51.2

TABLE III.11 (continued)

	Participants	Nonparticipants	All Students
Hours Watching TV or Videos/DVDs^c			
None	7.9	7.9	7.9
Less than 1	9.9	9.5	9.6
1 to <2	23.5	35.9**	33.7
2 to <3	30.5	26.2	27.0
3 to <5	20.8	16.6	17.3
5+	7.4	3.9	4.6
Means	2.1	1.8*	1.8
Hours on Computer or Playing Video Games^c			
None	37.9	30.8*	32.0
Less than 1	19.8	20.9	20.7
1 to <2	22.6	27.5	26.6
2 to <3	12.0	11.9	11.9
3 to <5	6.3	7.2	7.1
5+	1.3	1.7	1.6
Mean	0.9	1.0*	1.0
Sample Size	381	1,933	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aUnderweight = <5th percentile. Normal weight = \geq 5th percentile and <85th percentile. At risk of overweight = > 85th percentile, and overweight or obese = > 95th percentile.

^bFor younger students (less than age 12) the question is "Do you play outside after school?" For students age 12 and above, the question is "Outside of school, are you physically active, such as walking, running, biking, or working out with exercise equipment?"

^cThis variable counts how many of the five activities just described in which the student participated.

^eReported by parent for students younger than 12, by student for age 12 and up.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

TABLE III.12

CHILD AND FAMILY EATING HABITS, BY SBP PARTICIPATION STATUS
(Percentage of Students)

	Participants	Nonparticipants	All Students
Usually Eats Breakfast	92.7	90.6	90.9
In Past 30 Days, Ate Less or Chose Foods Low in Fat or Carbohydrates to Lose Weight (age 12 and up only) ^a (n = 1,563)	31.2	29.4	29.6
Takes Vitamins ^b			
Every day or almost	21.6	26.6	25.7
Every so often	25.3	28.9	28.3
Not at all	53.1	44.5**	46.0
Takes Minerals ^b			
Every day or almost	7.5	7.8	7.8
Every so often	9.4	13.7	13.0
Not at all	83.1	78.5	79.3
Takes Other Supplements ^b			
Every day or almost	0.2	1.7**	1.5
Every so often	2.0	4.9**	4.4
Not at all	97.8	93.4**	94.2
Pickiness ^c			
Very picky eater	22.5	21.0	21.3
Somewhat picky eater	44.7	44.9	44.9
Not a picky eater	32.8	34.0	33.8
Amount Child Eats Compared with Other Children the Same Age ^c			
Larger amount	25.3	22.5	23.0
Same amount	59.5	61.7	61.3
Smaller amount	15.2	15.9	15.8
Any Food Allergies/Special Diet ^c	8.2	8.3	8.2
Someone Fixes Breakfast for Child ^c	76.3	75.1	75.3
Nights per Week Family Eats Dinner Together (age 12 and up only) ^a (n = 1,574)			
Every night	31.0	35.1	34.6
5 or 6	9.3	14.2	13.7
3 or 4	28.1	23.8	24.3
1 or 2	18.0	16.9	17.0
Never	13.6	10.0	10.4
In Food Prepared for Child			
Uses Skim or 1% Milk ^c			
Always	33.0	38.1	37.2
Sometimes	10.3	11.4	11.2

TABLE III.12 (continued)

	Participants	Nonparticipants	All Students
Rarely	7.0	8.5	8.2
Never	47.1	41.1	42.1
Doesn't drink milk	2.6	1.0	1.3
Serves Chicken That Is Fried ^c			
Always	15.4	7.0**	8.5
Sometimes	38.5	35.4	36.0
Rarely	30.5	37.4	36.2
Never	14.0	18.8	18.0
Doesn't eat chicken	1.6	1.3	1.3
Adds Fat to Potatoes (Baked or Mashed) ^c			
Always	56.1	57.3	57.1
Sometimes	19.7	19.7	19.7
Rarely	11.0	10.0	10.2
Never	11.7	9.4	9.8
Doesn't eat this	1.6	3.6*	3.2
Amount of Fat Spread on Bread ^c			
None	18.8	17.5	17.7
Light	44.8	45.4	45.3
Moderate	29.8	32.6	32.1
Generous	6.6	4.5	4.9
Doesn't eat this			
Sample Size	381	1,933	2,314

Source: School Nutrition Dietary Assessment-III, Student Interview and Parent Interview, school year 2004-2005.
Weighted tabulations prepared by Mathematica Policy Research, Inc.

^aAs reported by the student.

^bAs reported by the student (age 12 and up) or the parent (if student's age is less than 12).

^cAs reported by the parent.

*Participants and nonparticipants are significantly different at the .05 level.

**Participants and nonparticipants are significantly different at the .01 level.

IV. FACTORS RELATED TO SCHOOL MEAL PROGRAM PARTICIPATION

A student's decision to participate in the National School Lunch Program (NSLP) or School Breakfast Program (SBP) is a complex one, influenced by personal and family characteristics and preferences, as well as by program features (such as meal price and menu planning system), characteristics of the school menus (for example, the specific foods offered and the number of choices), and alternative food sources available to the student. Chapter III of this report provides information on the characteristics of school meal program participants and nonparticipants, and Chapter II presents participation rates across various population subgroups. Building on that analysis, this chapter examines the factors associated with school meal participation in a multivariate context, simultaneously controlling for student characteristics, school foodservice program characteristics, and menu characteristics.

A. SUMMARY OF FINDINGS

- Among students who were not eligible for free or reduced-price meals, a higher lunch price was associated with lower probability of NSLP participation. All else equal, NSLP participation rates were higher in schools that used offer-versus-serve than in schools that did not.
- Characteristics of NSLP lunches offered, including percent of calories from fat, whether dessert or french fries were frequently offered, and average number of fresh fruits and vegetables offered per day, were generally not significantly associated with NSLP participation.
- Several personal and family characteristics were significantly associated with NSLP participation. All else equal, NSLP participation was significantly higher among elementary school students, male students, students who were eligible for free or reduced-price meals, and students whose parents did not attend college than among other students.
- Among students who were not eligible for free or reduced-price meals, a higher breakfast price was associated with lower probability of SBP participation. Other program variables, including use of offer-versus-serve, food-based versus nutrient-standard menu planning, and whether meals were prepared onsite, were not significantly associated with SBP participation.

- Percent of calories from fat in SBP breakfasts was not significantly associated with SBP participation.
- Several personal and family characteristics were significantly associated with SBP participation. All else equal, SBP participation was significantly higher among elementary school students, male students, students who were eligible for free or reduced-price meals, non-Hispanic black students, and students who spoke Spanish at home than among other students.

B. METHODS

To examine the factors associated with school meal program participation, this chapter presents the predicted probability of NSLP or SBP participation (or equivalently, predicted participation rates) for students with a particular characteristic, holding all other specified factors constant. The predicted probabilities are based on models that control for a variety of characteristics of students, the school meal programs, and the school meals; these factors are listed in Table IV.1. Appendix C describes the methodology in greater detail and presents the estimated marginal effects from the estimation model (known as a “probit” model) used to compute the predicted probabilities presented in this chapter.¹ In addition, Appendix C presents marginal effects from alternative model specifications, to examine the sensitivity of the results to the choice of covariates. In general, results were similar across a variety of model specifications.

The predicted probability of participation for a particular group (for example, girls) was computed as the average predicted probability of participation among members of that group, holding all other specified factors constant at their mean value for the full sample. In other words, the predicted probability for girls is the probability of eating a school meal for a girl who was like the “average sample member” in all other respects than her gender; the predicted probability for boys is the probability of eating a school meal for a boy who was like the average

¹ The marginal effect of a covariate is the estimated change in the outcome variable (in this case, the probability of school meal program participation) in response to a one-unit change in the value of the covariate.

TABLE IV.1

CHARACTERISTICS INCLUDED IN MAIN MODELS OF NSLP AND SBP PARTICIPATION

	NSLP	SBP
Key Program Variables		
Full price of USDA meal (NSLP or SBP) (among students not income-eligible for free or reduced-price meals)	x	x
Offer-versus-serve at meal (breakfast or lunch) (elementary and middle schools) ^a	x	x
Menu planning system	x	x
Meals prepared onsite	x	x
School participating in SBP	x	
Characteristics of Meals Offered		
Percent of calories from fat in meal (breakfast or lunch)	x	x
Dessert offered 4-5 times a week	x	
Average number of entrees offered per day	x	
Number of fresh fruits and vegetables offered per day	x	
French fries offered 4-5 times a week	x	
Alternatives to NSLP Lunch		
School has open-campus policy	x	
Competitive foods offered during mealtimes	x	x
Other School-Level Factors		
Competing activities scheduled during lunch	x	
School has recess (elementary and middle schools) ^b	x	
School has enough lines during lunch	x	
School has enough seats during lunch	x	
School size	x	x
Percent black in district	x	x
Percent Hispanic in district	x	x
Personal and Family Characteristics		
Grade level	x	x
Race/ethnicity	x	x
Gender	x	x
Picky eater	x	x
Physical activity relative to others	x	x
Student has food allergies or special dietary needs	x	x
Student on a diet (middle and high school students) ^c	x	x
Household structure/parental employment	x	x
Number of children in household	x	x
Income eligibility for free/reduced-price meals	x	x
Primary language spoken at home	x	x
Highest level of parental education	x	x
Family eats dinner together 5 nights a week or more (middle and high school students) ^c	x	x
Location, Region, and Day of Week		
Urbanicity	x	x
Region	x	x
Day of week	x	x
Other		
Indicators of imputed values of covariates	x	x

Note: See Appendix C for additional details on models of NSLP and SBP participation.

sample member in all other respects. Comparing the predicted probabilities for boys and girls indicates the relationship between a student's gender and the likelihood that he or she participated in the school meal program, holding constant other observable characteristics.

Of course, there are some factors that may affect school meal program participation that cannot be controlled for since they are not observed in the SNDA-III data. For instance, whether a student's friends participate in the program may influence his or her decision to participate. Therefore, although the participation models do control for many observable factors, the estimated relationship between a given factor and participation may not represent the causal effect of that factor on school meal program participation. Additionally, some true relationships between the various factors examined and school meal program participation may not be detected as statistically significant due to sample size limitations, as discussed in Chapter I.

C. FACTORS THAT PREDICT NSLP PARTICIPATION

More than 60 percent of students participated in the NSLP on a given day (Table IV.2). School meal program variables—such as meal price and whether the school used offer-versus-serve at lunch—and personal and family characteristics were generally more important predictors of NSLP participation than were the characteristics of NSLP meals offered, alternatives to NSLP lunches, or other school-level factors. Even among those subgroups with the lowest predicted participation rates, nearly half participated in the NSLP.

Key Program Variables. Some characteristics of the school meal programs were strong predictors of NSLP participation. All else equal, students who were not income-eligible for free or reduced-price meals were less likely to participate in the program when the full price of the meal was higher. For example, the predicted participation rate for these students was 50 percent in schools that charged \$2.00 for an NSLP lunch, compared to 56 percent in schools that charged \$1.50. This negative effect of meal price on the likelihood of participation (for those who must

TABLE IV.2

PREDICTED NSLP PARTICIPATION RATES UNDER ALTERNATIVE ASSUMPTIONS
ABOUT STUDENT AND PROGRAM CHARACTERISTICS

Characteristic	Category	Predicted Participation Rate	P-value Relative to Base Category	Percentage of Sample with Characteristic
All students		61.7	--	100.0
Key Program Variables				
Full price of NSLP lunch (among students not income-eligible for free or reduced-price meals) ^a	\$1.50	55.5	--	--
	\$1.75	52.8	0.006**	--
	\$2.00	50.0	0.006**	--
Offer-versus-serve at lunch (elementary and middle schools) ^b	No	44.1	--	5.1
	Yes	69.8	0.002**	94.9
Menu planning system	Food-based	60.0	--	68.3
	Nutrient-standard	66.3	0.162	31.7
Meals prepared onsite	No	56.7	--	28.9
	Yes	64.1	0.100	71.1
School participating in SBP	No	51.8	--	13.1
	Yes	63.5	0.096	86.9
Characteristics of Meals Offered				
Percent of calories from fat	<30%	60.7	--	24.8
	30-35%	60.5	0.966	43.9
	35+%	65.2	0.449	31.3
Dessert offered 4-5 times a week	No	62.5	--	87.7
	Yes	58.5	0.488	12.3
Average number of entrees offered per day	1-3	53.5	--	40.0
	4-6	66.1	0.012*	28.1
	7+	68.6	0.015*	31.9
Number of fresh fruits and vegetables offered per day	<2	65.0	--	30.7
	2-3	58.3	0.174	39.5
	4+	63.8	0.841	29.9
French fries offered 4-5 times a week	No	62.2	--	75.6
	Yes	61.6	0.896	24.4
Alternatives to NSLP Lunch				
School has open-campus policy	No	62.8	--	88.1
	Yes	56.0	0.202	11.9
Competitive foods offered during mealtimes	No	64.0	--	57.5
	Yes	59.4	0.205	42.5

TABLE IV.2 (continued)

Characteristic	Category	Predicted Participation Rate	P-value Relative to Base Category	Percentage of Sample with Characteristic
Other School-Level Factors				
Competing activities scheduled during lunch	No	62.6	--	87.2
	Yes	58.1	0.434	12.8
School has recess (elementary and middle schools) ^c	No	68.7	--	61.0
	Yes	68.5	0.973	39.0
School has enough lines during lunch	No	58.5	--	10.1
	Yes	62.4	0.502	89.9
School has enough seats during lunch	No	49.3	--	9.3
	Yes	63.3	0.153	90.7
School size	<500	56.2	--	33.6
	500-1000	66.5	0.087	41.3
	>1000	62.2	0.450	25.1
Personal and Family Characteristics				
Grade level	Elementary	77.6	--	31.6
	Middle	58.3	0.002**	34.0
	High	49.4	0.001**	34.4
Race/ethnicity	Hispanic	60.0	--	22.9
	White, non-Hisp.	59.4	0.886	51.1
	Black, non-Hisp.	70.5	0.103	19.0
	Other, non-Hisp.	63.8	0.491	7.0
Gender	Male	65.5	--	49.4
	Female	58.5	0.034*	50.6
Picky eater	Very picky	58.9	--	21.4
	Somewhat picky	61.8	0.351	43.6
	Not picky	64.3	0.140	34.9
Physical activity relative to others	Less active	63.2	--	15.2
	About as active	62.1	0.778	42.8
	More active	64.8	0.702	25.1
	Much more active	56.6	0.204	16.9
Student has food allergies or special dietary needs	No	62.4	--	91.4
	Yes	57.8	0.323	8.6
Student on a diet (middle and high school students) ^d	No	54.0	--	79.7
	Yes	53.3	0.827	20.3
Household structure/parental employment	Two parents, both employed full time	62.6	--	33.4
	Two parents, one employed full time	59.0	0.361	37.0
	Two parents, neither employed full time	63.8	0.852	5.1

TABLE IV.2 (continued)

Characteristic	Category	Predicted Participation Rate	P-value Relative to Base Category	Percentage of Sample with Characteristic
Number of children in household	One parent, employed full time	70.8	0.050*	15.3
	One parent, not employed full time	55.9	0.231	9.1
	One	63.6	--	26.3
	Two	58.3	0.166	37.3
Income eligibility for free/reduced-price meals	Three or more	64.6	0.764	36.4
	Free	71.0	--	32.1
	Reduced-price	72.2	0.793	13.1
Primary language spoken at home	Not income-eligible	53.7	0.000**	54.8
	English	61.6	--	85.7
	Spanish	66.1	0.402	10.7
Highest level of parental education	Other	59.5	0.801	3.5
	HS or less	65.4	--	37.2
	Some college	64.9	0.881	34.5
Family eats dinner together five nights a week or more (middle and high school students) ^d	College+	53.8	0.003**	28.3
	No	53.8	--	67.2
	Yes	54.1	0.902	32.8
Location, Region, and Day of Week				
Urbanicity	Urban	59.6	--	35.7
	Suburban	57.6	0.724	40.3
	Rural	72.4	0.019*	24.0
Region	Mid-Atlantic	52.6	--	10.5
	Midwest	69.6	0.086	16.0
	Mountain	66.1	0.155	7.8
	Northeast	62.9	0.214	8.6
	Southeast	70.4	0.020*	21.6
	Southwest	57.9	0.615	18.6
	Western	50.8	0.891	16.9
Day of week	Monday	59.1	--	26.1
	Tuesday	60.3	0.794	28.2
	Wednesday	62.1	0.544	20.6
	Thursday	72.5	0.023*	15.8
	Friday	56.1	0.615	9.2
Number of Students	2,314			

TABLE IV.2 (continued)

Source: School Nutrition Dietary Assessment-III, Initial Contact Form, Principal Survey, Foodservice Manager Survey, Menu Survey, Student Interview, and Parent Interview, school year 2004-2005. Weighted estimates prepared by Mathematica Policy Research, Inc.

Note: The predicted probabilities are based on the results from estimating a probit model. They represent the likelihood of the outcome for a student who has the specified characteristic but who otherwise has the average characteristics for all students. In addition to the characteristics listed in the table, the model also includes controls for percent black and percent Hispanic in the school district. The model also includes indicators for whether a specific covariate was imputed, if imputed for 1 percent or more of the sample.

Tests of statistical significance refer to the difference between the predicted probability for students with the particular characteristic and the predicted probability for those in the reference category in each group. For each characteristic, the reference category is the first category listed. For example, for the characteristic "grade level," the reference category is elementary school, and all significance tests compare the predicted probability for those in the specified grade level to those who are in elementary school.

^a Percentage with characteristic not shown for full price of NSLP lunch, since this is a continuous variable.

^b All high schools use offer-versus-serve at lunch, so the covariate equaled one for all high school students and predicted probabilities were computed only for elementary and middle school students.

^c This question was not asked of high schools, so the covariate was set to zero for all high school students and predicted probabilities were computed only for elementary and middle school students.

^d This question was not asked of elementary school students, so the covariate was set to zero for all elementary school students and the predicted probabilities were computed only for middle and high school students.

-- p-value not relevant for base category.

*Difference between specified group and reference group significantly different from zero at the .05 level.

**Difference between specified group and reference group significantly different from zero at the .01 level.

pay the full price) matches findings from previous studies of school meal participation (Maurer 1984; Barnes 1988; Gleason 1996). Predicted participation rates were significantly higher in elementary and middle schools that used offer-versus-serve (OVS) at lunch than in those that did not (70 percent, compared with 44 percent). In contrast, whether the school participated in SBP and the school's menu planning system were not significantly associated with students' NSLP participation.

Characteristics of Meals Offered. In contrast to program characteristics, most characteristics of NSLP lunches offered were not significantly associated with NSLP participation rates. All else equal, predicted participation rates were significantly higher in schools that offered four or more entrees a day on average than in schools that offered fewer entrees. However, other characteristics of meals offered (including the percent of calories from fat in the NSLP lunch, whether dessert was offered four or more days a week, the average number of fresh fruits and vegetables offered per day, and whether french fries were offered four or more days a week) were not significantly associated with NSLP participation rates. The finding of no significant relationship between percentage of calories from fat and NSLP participation contrasts with results from the School Nutrition Dietary Assessment (SNDA)-I, where students who were offered lunches that were low in fat (below 32 percent of calories) were less likely than other students to participate (Burghardt et al. 1993a).

Alternatives to NSLP Lunch and Other School-Level Factors. Alternatives to the NSLP lunch were not significantly associated with NSLP participation rates. Predicted participation rates were lower in schools that had an open-campus policy at lunch, but the difference in predicted participation rates between schools with open-campus policies and those without was not statistically significant. Similarly, the availability of competitive foods during mealtimes

was not significantly associated with NSLP participation. Of the other school-level factors examined, none was significantly associated with NSLP participation.

Personal and Family Characteristics. Some personal and family characteristics examined were significantly associated with NSLP participation. Holding other factors constant, elementary school students were more likely to participate than were middle and high school students (77 percent predicted participation rate for elementary school students versus 58 percent for middle school students and 49 percent for high school students). Predicted participation rates were also significantly lower among girls (59 percent) than among boys (66 percent). The estimated impacts of both school level and gender are consistent with findings from previous research on the factors associated with NSLP participation (Maurer et al. 1984; Barnes 1988; Gleason 1996). The student's physical activity level, whether the student was a picky eater, and whether the student had allergies or was on a diet were not significantly associated with NSLP participation.

Students in families that were income-eligible for free or reduced-price meals were significantly more likely to participate than students in families that were not income-eligible. Income eligibility measures not only a family's economic circumstances, but also the student's likely certification status and thus the lunch price they face. Gleason (1996) found that both certification status and income eligibility had independent effects on participation (both certified students and low-income students had higher participation rates, all else equal; in general, there were no differences between free and reduced-price certification status or income eligibility status). SNDA-III did not collect information on certification status, so only income eligibility could be examined.

Students whose parents had completed college were significantly less likely to participate in the NSLP than students whose parents had not attended college. Parental employment, number

of children in the household, primary language spoken at home, and whether the family ate dinner together five nights a week or more were not significantly associated with NSLP participation.

Location, Region, and Day of Week. Predicted participation rates among students in rural areas (72 percent) were significantly higher than those among students in urban areas (60 percent). Predicted participation rates also varied somewhat by geographic region, and by day of the week, with the highest predicted participation rate (73 percent) on Thursdays.

D. FACTORS THAT PREDICT SBP PARTICIPATION

SBP participation rates were much lower than NSLP participation rates, with only about one in five students participating in the program in schools that offered the SBP.² The factors associated with SBP participation suggest that participation rates are highest among low-income, minority students and students in large school districts or rural areas (Table IV.3).

Key Program Variables. All else equal, the full price of the SBP was negatively and significantly associated with SBP participation among students who were not income-eligible for free or reduced-price meals; predicted participation rates among these students were 13 percent in schools that charged \$0.70 for an SBP breakfast versus 9 percent in schools that charged \$1.00. The negative effect of the full price for breakfast was consistent with findings from previous studies (Maurer 1984; Barnes 1988; Gleason 1996). Whether the school used OVS at breakfast, whether meals were fully prepared on-site, and the school's menu-planning system were not significantly associated with SBP participation.

² Students in schools that did not participate in the SBP were excluded from this analysis.

TABLE IV.3

PREDICTED SBP PARTICIPATION RATES UNDER ALTERNATIVE ASSUMPTIONS
ABOUT STUDENT AND PROGRAM CHARACTERISTICS

Characteristic	Category	Predicted Value	P-value Relative to Base Category	Percentage with Characteristic
Overall		21.2	--	100.0
Key Program Variables				
Full price of SBP breakfast (among students not income-eligible for free or reduced-price meals) ^a	\$0.70	12.8	--	--
	\$0.85	10.8	0.000**	--
	\$1.00	9.1	0.000**	--
Offer-versus-serve at breakfast (elementary and middle schools) ^b	No	12.1	--	16.9
	Yes	17.0	0.191	83.1
Menu planning system	Food-based	13.8	--	71.5
	Nutrient-standard	18.7	0.067	28.5
Meals prepared onsite	No	12.6	--	26.0
	Yes	16.1	0.209	74.0
Characteristics of Meals Offered				
Percent of calories from fat	<20%	12.2	--	16.5
	20-25%	14.5	0.369	43.2
	25+%	17.2	0.124	40.3
Alternatives to SBP Breakfast				
Competitive foods offered during mealtimes	No	15.2	--	58.6
	Yes	14.9	0.903	41.4
Other School-Level Factors				
School size	<500	9.9	--	32.3
	500-1000	18.5	0.002**	42.8
	>1000	17.6	0.058	24.9
Personal and Family Characteristics				
Grade level	Elementary	20.9	--	31.4
	Middle	12.9	0.028*	35.5
	High	12.8	0.047*	33.1
Race/ethnicity	Hispanic	12.3	--	24.2
	White, non-Hisp.	13.7	0.704	48.2
	Black, non-Hisp.	21.1	0.040*	21.0
	Other, non-Hisp.	20.0	0.187	6.6
Gender	Male	19.4	--	48.4
	Female	11.7	0.001**	51.6

TABLE IV.3 (continued)

Characteristic	Category	Predicted Value	P-value Relative to Base Category	Percentage with Characteristic
Picky eater	Very picky	13.5	--	22.2
	Somewhat picky	15.0	0.560	43.3
	Not picky	16.4	0.314	34.6
Physical activity relative to others	Less active	14.5	--	15.6
	About as active	15.4	0.805	43.1
	More active	14.8	0.942	24.3
	Much more active	15.2	0.870	17.1
Student has food allergies or special dietary needs	No	14.7	--	91.3
	Yes	19.5	0.313	8.7
Student on a diet (middle and high school students) ^b	No	13.1	--	70.4
	Yes	11.9	0.632	29.6
Household structure/parental employment	Two parents, both employed full time	15.6	--	33.2
	Two parents, one employed full time	11.9	0.169	35.8
	Two parents, neither employed full time	21.5	0.288	5.1
	One parent, employed full time	17.5	0.643	16.0
	One parent, not employed full time	19.9	0.288	9.9
	Number of children in household	One	15.0	--
	Two	13.2	0.421	37.1
	Three or more	17.3	0.402	37.1
	Income eligibility for free/reduced-price meals	Free	21.0	--
Reduced-price		21.2	0.961	13.4
Not income-eligible		10.4	0.000**	50.9
Primary language spoken at home	English	14.6	--	84.5
	Spanish	25.1	0.025*	11.9
	Other	4.6	0.051	3.6
Highest level of parental education	HS or less	15.0	--	40.4
	Some college	17.6	0.334	34.7
	College+	12.1	0.345	24.9
Family eats dinner together five nights a week or more (middle and high school students) ^c	No	14.1	--	51.4
	Yes	10.6	0.087	48.6
Location, Region, and Day of Week				
Urbanicity	Urban	15.3	--	36.4
	Suburban	11.6	0.179	40.4
	Rural	22.3	0.048*	23.2

TABLE IV.3 (continued)

Characteristic	Category	Predicted Value	P-value Relative to Base Category	Percentage with Characteristic
Region	Mid-Atlantic	14.0	--	10.4
	Midwest	15.4	0.772	13.4
	Mountain	9.4	0.459	5.8
	Northeast	15.3	0.810	9.4
	Southeast	13.0	0.792	22.8
	Southwest	16.0	0.654	20.4
	Western	20.0	0.307	17.8
Day of week	Monday	13.6	--	26.2
	Tuesday	15.7	0.542	28.5
	Wednesday	15.5	0.553	20.6
	Thursday	18.0	0.302	14.5
	Friday	12.9	0.845	10.3
Number of Students	2,011			

Source: School Nutrition Dietary Assessment-III, Initial Contact Form, Principal Survey, Foodservice Manager Survey, Menu Survey, Student Interview, and Parent Interview, school year 2004-2005. Weighted estimates prepared by Mathematica Policy Research, Inc. Sample excludes students in schools that did not participate in the SBP.

Note: The predicted probabilities are based on the results from estimating a probit model. They represent the likelihood of the outcome for a student who has the specified characteristic but who otherwise has the average characteristics for all students. In addition to the characteristics listed in the table, the model also includes controls for percent black and percent Hispanic in the school district. The model also includes indicators for whether a specific covariate was imputed, if imputed for 1 percent or more of the sample.

Tests of statistical significance refer to the difference between the predicted probability for students with the particular characteristic and the predicted probability for those in the reference category in each group. For each characteristic, the reference category is the first category listed. For example, for the characteristic "grade level," the reference category is elementary school, and all significance tests compare the predicted probability for those in the specified grade level to those who are in elementary school.

^aPercentage with characteristic not shown for full price of SBP breakfast, since this is a continuous variable.

^bAll high schools use offer-versus-serve at breakfast, so the covariate equaled one for all high school students and predicted probabilities were computed only for elementary and middle school students.

^cThis question was not asked of elementary school students, so the covariate was set to zero for all elementary school students and the predicted probabilities were computed only for middle and high school students.

-- p-value not relevant for base category.

*Difference between specified group and reference group significantly different from zero at the .05 level.

**Difference between specified group and reference group significantly different from zero at the .01 level.

Characteristics of Meals Offered. All else equal, predicted participation rates were higher in schools that offered a greater percentage of calories from fat in the SBP breakfast; however, these differences were not statistically significant at conventional levels.

Alternatives to SBP Breakfast and Other School-Level Factors. All else equal, the availability of competitive foods during mealtimes was not significantly associated with SBP participation. Predicted SBP participation rates were significantly higher in larger schools. Predicted participation rates were 18 percent in schools with more than 1,000 students and 19 percent in schools with 500 to 1,000 students, compared with only 10 percent in schools with fewer than 500 students.

Personal and Family Characteristics. Some of the personal and family characteristics examined were significantly associated with SBP participation. All else equal, elementary schools students were more likely to participate than were middle and high school students. Black, non-Hispanic students were more likely to participate than Hispanic or white, non-Hispanic students, and boys were more likely to participate than girls. Students from Spanish-speaking homes were significantly more likely to participate than those from English-speaking homes.

Income eligibility for free or reduced-price meals was also a strong predictor of SBP participation. Income-eligible students had significantly higher predicted participation rates than students who were not income-eligible. As discussed above, income eligibility captures both family income and likely certification status; direct information on certification status was not available in SNDA-III. This finding is therefore generally consistent with Gleason (1996), who found that being certified for free meals was positively associated with SBP participation. However, Gleason (1996) found that once certification status was accounted for, income eligibility was not significantly related to participation status.

Location, Region, and Day of Week. Predicted participation rates in rural areas (22 percent) were significantly higher than those in urban areas (15 percent). Although there was some variation in predicted SBP participation rates across geographic regions, these differences were not statistically significant. Differences in predicted participation rates across days of the week also were not statistically significant at conventional levels.

V. METHODS USED TO ASSESS THE DIETARY INTAKES OF SCHOOL MEAL PARTICIPANTS AND NONPARTICIPANTS

The overarching goal of both the National School Lunch Program (NSLP) and the School Breakfast Program (SBP) is to support children's health and well-being by providing nutritious meals (U.S. Department of Agriculture 2000). The last nationally representative study of school meal programs that examined both what schools were offering and what children were eating was the first School Nutrition Dietary Assessment Study (SNDA-I), completed in school year 1991-1992. Since that time, substantial reforms have been instituted in both the NSLP and SBP. SNDA-II, conducted in school year 1998-1999, found that schools had made important improvements in the nutritional quality of meals offered and served to children through these programs (Fox et al. 2001). As discussed in Volume I of this report, analysis of menus from school year 2004-2005 showed that many of the positive changes in NSLP and SBP meals had been maintained, and that some additional improvements had been made.

Since SNDA-II, there have been major changes in nutrition recommendations and dietary reference standards for the U.S. population. In particular, Dietary Reference Intakes (DRIs) have replaced Recommended Dietary Allowances (RDAs). An important advantage of the DRIs is that, with appropriate data and application of specific statistical techniques, it is now possible to estimate the percentage of children whose usual diets provide inadequate or excessive amounts of key nutrients. For these reasons, it is critically important to update existing information about the dietary intakes of NSLP and SBP participants and nonparticipants.

Chapter VI of this report presents data on the dietary intakes of NSLP participants and nonparticipants in school year 2004-2005, and Chapter VII does the same for SBP participants and nonparticipants. Key research questions addressed in those chapters include:

- What are students' *mean energy and nutrient intakes* from NSLP and SBP meals? What contributions do NSLP and SBP meals make to participants' nutrient intakes over 24 hours?
- How do the *mean energy and nutrient intakes* of NSLP and SBP participants compare with those of nonparticipants?
- What proportion of NSLP/SBP participants and nonparticipants have *inadequate or excessive intakes* of specific nutrients?
- What *types of foods* do NSLP/SBP participants and nonparticipants consume at breakfast and lunch? Over 24 hours? What foods are the major sources of key nutrients?

This chapter describes the data used to address these questions and discusses several important methodological issues.

A. DIETARY INTAKE DATA

Collection and coding of data on dietary intakes was a complex, multistage process. Key features of the process are summarized here. More complete information is provided in Volume III of this report, *School Nutrition Dietary Assessment-III: Sampling and Data Collection Methods*.

1. Data Collection Methods

Dietary intake data were collected from children and their parents using 24-hour recalls. Data were collected using a modified version of the Automated Multiple Pass Method (AMPM) interview developed by the USDA's Agricultural Research Service (ARS) and used in the National Health and Nutrition Examination Survey (NHANES).¹ All 24-hour recalls for this study covered intakes on school days. Children in middle and high schools were interviewed in the morning and reported the previous day's intake (from midnight to midnight). Children in

¹ For more information on AMPM, see <http://www.ars.usda.gov/Services/docs.htm?docid=7710>.

elementary schools were interviewed during the school day, after lunch if possible, and were asked to report everything they had consumed that day since awakening. These children were interviewed a second time—usually the next day—to report intake for the rest of the 24-hour period. Parents attended the second in-person interview and were asked to help children recall and describe the foods and beverages consumed.

A subsample of twenty-nine percent of students completed a second 24-hour dietary recall. These second 24-hour recalls were used to estimate usual energy and nutrient intakes, following procedures recommended by the Institute of Medicine (IOM) (Institute of Medicine 2000). This process is discussed in more detail in Section C.

In addition to information on the types and quantities of food and beverages consumed, the dietary recalls collected information on the time each item was consumed, the reported eating occasion (breakfast, brunch, lunch, supper, dinner, snack), and where each item was obtained. For items obtained at school, students were asked to identify a specific location in the school (for example, reimbursable cafeteria line, vending machine, snack window or cart, canteen). The 24-hour recall protocol did not include collection of detailed data on intake of dietary supplements.²

2. Coding Procedures

Descriptive details provided by students and their parents were used to link each item reported in a 24-hour recall to USDA's Survey Net nutrient database. These links were used to generate estimates of the energy and nutrient content of every food and beverage reported by each child. Subsequently, foods and beverages obtained at school and from locations other than vending machines or strictly a la carte points of service were linked to data on items offered in

² Descriptive data about general use of dietary supplements were collected. These data are reported in Chapter III.

reimbursable school meals (see Volume I). For foods and beverages successfully linked to items offered in corresponding school menus, the energy and nutrient data initially obtained from Survey Net were replaced with data for the specific item offered in the school menu. This step ensured that NSLP and SBP foods were represented in the analysis as accurately as possible. For example, rather than hamburgers or cheese pizzas obtained at school being consistently represented by the “default” values available in the nutrient database, the nutrient value of the hamburgers and pizzas actually served in each child’s school were used. Thus, if a school purchased extra-lean hamburger patties or pizzas made with less or low-fat cheese, this was reflected in the dietary intake data.

To describe the types of foods consumed by NSLP and SBP participants and nonparticipants at mealtimes and over 24 hours, a food-grouping system was developed. The system, which built upon the food-grouping system developed for SNDA-II (Fox et al. 2001), was developed to support the needs of both menu- and student-level analyses. The system includes nine major food groups based on meal/menu component groups used in planning NSLP and SBP meals: milk, vegetables, fruits, combination entrees, meats/meat alternates, grains/breads, desserts, accompaniments (condiments and toppings), and other items (for example, snack items, candy, sodas, and fruit drinks). These nine major food groups were subdivided into 260 minor food groups that further classify foods on the basis of nutrient content and/or preparation method. Appendix D shows the complete food-grouping scheme.

3. Defining Breakfast and Lunch Foods

Foods considered to be part of breakfast and lunch meals were defined using rules developed in SNDA-I and used in Gleason and Suitor’s later FNS-sponsored analysis of data from the Continuing Survey of Food Intakes by Individuals (Gleason and Suitor 2001). Breakfast and lunch were defined primarily on the basis of the times of day foods were

consumed, but students' characterizations of the foods and beverages consumed at ambiguous times of day also were incorporated.

Specifically, all foods reported between 5:00 A.M. and 9:30 A.M. and foods reported between 9:30 A.M. and 10:30 A.M. and called "breakfast" by the student were counted as breakfast foods. A few breakfasts reported earlier in the day (3:00 to 4:00 A.M.) and later in the day (10:45 to 11:30 A.M.) were determined to be legitimate (that is, no other breakfast was reported, and students who

reported late breakfasts also reported a late lunch) and were counted as such. Lunch included all foods reported between 10:00 A.M. and 2:00 P.M., unless reported as breakfast; all foods reported between 9:30 A.M. and 10:00 A.M. that were reported as lunch, supper, or dinner; and all foods reported between 2:00 P.M. and 3:30 P.M. that students reported as being part of lunch.

B. DIETARY REFERENCE INTAKES

This section describes the DRIs used to assess usual dietary intakes of Americans (Institute of Medicine 2000, 2002). DRIs have been established both for vitamins and minerals (micronutrients) and for energy, fats, carbohydrates, and protein (macronutrients).

DRIs for vitamins and minerals include four reference standards: (1) Estimated Average Requirement (EAR), (2) Recommended Dietary Allowance (RDA), (3) Adequate Intake (AI), and (4) Tolerable Upper Intake Level (UL) (see box). When enough information was available

Dietary Reference Intakes for Micronutrients

Estimated Average Requirement (EAR): Usual intake level that is estimated to meet the requirement of half the healthy individuals in a life stage and gender group. At this level of intake, the other half of the healthy individuals in the specified group would not have their needs met.

Recommended Dietary Allowance (RDA): Usual intake level that is sufficient to meet the nutrient requirement of nearly all healthy individuals in a particular age and gender group (97.5 percent of the individuals in a group).

Adequate Intake (AI): Usual intake level based on experimentally derived intake levels or approximations of observed mean nutrient intakes by a group (or groups) of apparently healthy people who are maintaining a defined nutritional state or criterion of adequacy—used when an EAR and RDA cannot be determined.

Tolerable Upper Intake Level (UL): Highest level of usual nutrient intake that is likely to pose no risks of adverse health effects to individuals in the specified life stage group. As intake increases above the UL, the risk of adverse effects increases.

Source: Institute of Medicine 2000.

on the distribution of requirements of a particular nutrient at the time the DRIs were set, both an EAR and an RDA were defined. When there was not enough information to determine an EAR (and, thus, an RDA), an AI was defined. In addition, ULs were defined for many nutrients. In most cases, ULs consider contributions from food and beverages, water, and dietary supplements.³ The absence of a UL does not imply that consuming very large amounts of a nutrient is safe. Rather, it indicates that there was not enough evidence available at the time the DRIs were defined to set a UL.

For energy and macronutrients, a different set of DRIs was developed (Institute of Medicine 2002). For energy, dietary requirements are expressed in Estimated Energy Requirements (EERs). For fats, carbohydrate, and protein, the DRIs specify Acceptable Macronutrient Distribution Ranges (AMDRs). AMDRs are defined on the basis of percentage contribution to energy intake. As the term implies, AMDRs define *ranges of intake* that support daily nutritional needs while minimizing risk of chronic disease. The DRIs for carbohydrate and protein also include an EAR and an RDA, and the DRIs for linolenic acid and linoleic acid (essential polyunsaturated fatty acids) also include AIs. The DRI for fiber is expressed as an AI.

Table V.1 summarizes the nutrients included in the analysis of students' dietary intakes and the DRIs used in assessing those intakes. The DRIs used in the analysis are those that (1) are most appropriate for assessing intakes of populations (as opposed to individuals), and (2) can be adequately assessed with the available data (Institute of Medicine 2000). Specific DRI values are defined for different population groups based on age, gender, and life stage. Five of these population groups are relevant to the SNDA-III study: (1) children 4 to 8 years, (2) males 9 to 13 years, (3) females 9 to 13 years, (4) males 14 to 18 years, and (5) females 14 to 18 years. The

³ For some nutrients, the UL is based on contributions from dietary supplements and over-the-counter medications only (that is, not contributions from food and beverages or water).

TABLE V.1

DRIs USED IN ASSESSING USUAL DIETARY INTAKES

Nutrient	EAR	AI	EER	AMDR	UL
Energy			√		
Macronutrients ^a					
Total Fat				√ ^c	
Linolenic Acid		√ ^b		√ ^c	
Linoleic Acid		√ ^b		√ ^c	
Protein	√ ^b			√ ^c	
Carbohydrate	√ ^b			√ ^c	
Vitamins					
Vitamin A	√				
Vitamin C	√				
Vitamin E	√				
Vitamin B ₆	√				
Vitamin B ₁₂	√				
Folate	√				
Niacin	√				
Riboflavin	√				
Thiamin	√				
Minerals					
Calcium		√			
Iron	√				
Magnesium	√				
Phosphorus	√				
Potassium		√			
Sodium					√
Zinc	√				
Other Dietary Components ^d					
Fiber		√			

^aIntake of saturated fat, as a percentage of total energy intake, is also assessed, in comparison to recommendations in the 2005 edition of the *Dietary Guidelines for Americans*.

^bAssessed in total grams of intake.

^cAssessed as a percentage of total energy intake.

^dCholesterol intake is also assessed, in comparison to recommendations in the 2005 edition of the *Dietary Guidelines for Americans*.

sections that follow describe how the DRIs were applied to determine the prevalence of inadequate and excessive intakes.

The EAR Cut-Point Method. It is possible to estimate the proportion of individuals in a group whose usual intake of a particular nutrient does not meet their requirement if, for the specific group in question: (1) an EAR is available, and (2) a reliable estimate of the usual distribution of intakes of that nutrient is also available. Carriquiry (1999) showed that an approach known as the EAR cut-point method can produce a nearly unbiased estimate of the prevalence of inadequate intakes. The IOM has recommended that this approach be used to assess the prevalence of nutrient adequacy (or inadequacy) within groups when the following assumptions hold:

- The distribution of requirements in the group is symmetric around the EAR.
- The requirement for the nutrient and the usual intake of the nutrient are independent.
- The variance of the distribution of requirements is larger than the variance of the distribution of usual intakes (Institute of Medicine 2000).

Given the available information on the distribution of requirements for most nutrients, it appears that these assumptions hold for all of the nutrients examined in SNDA-III except iron. Therefore, except for iron, the EAR cut-point method was used to estimate the prevalence of inadequate intakes for nutrients with defined EARs.

Iron and the Probability Approach. It is well established that the distribution of iron requirements for some subgroups—most notably menstruating females—is skewed, with a long tail to the right. This skewed distribution precludes use of the EAR cut-point method to assess the adequacy of iron intakes. In keeping with IOM recommendations, an alternative method, known as the probability approach, was used to assess iron intakes (Institute of Medicine 2000). The probability approach, first developed by the National Research Council (National Research

Council, Subcommittee on Criteria for Dietary Evaluation 1986) uses estimates of the distribution of iron requirements to estimate the probability of inadequacy.

Nutrients with AIs. When an AI is defined instead of an EAR, it is not possible to estimate the prevalence of inadequate intakes (Institute of Medicine 2000). Consequently, assessment focuses on comparison of mean usual intakes with the AI. If the mean usual intake of a population subgroup is equal to or greater than the corresponding AI, it is likely that the prevalence of inadequacy is low. On the other hand, if the mean usual intake is less than the AI, no conclusion can be drawn about the prevalence of inadequacy. In this analysis, the key nutrients for which AIs are used are calcium, potassium, and fiber.

Energy. For food energy, requirements are expressed in terms of EERs. In children, the EER is defined as the sum of the energy intake predicted to maintain energy balance for an individual's age, weight, height, and activity level, plus an allowance for normal growth and development. EERs were computed for all sample members who had reliable data on height and weight. All children were assumed to have a "low active" level of physical activity.⁴ Because populations in balance should have roughly equivalent distributions for usual energy intake and EERs, assessment of energy intake focuses on comparing means and distributions of usual energy intakes and EERs.⁵

⁴ Other options included in the equations used to estimate EERs are: "sedentary," "active," and "very active." Physical activity was not directly measured in SNDA-III. However, data were collected on some relevant issues, such as participation on sports teams and physical education at school. These data could potentially be used to develop different assumptions about physical activity level for each child in the sample.

⁵ The IOM panel on energy and macronutrients recommended that energy intakes be assessed using data on Body Mass Index (BMI). However, EERs incorporate the information used to compute and interpret BMI (age, height, and weight) and may provide more information on how the distribution of intakes compares with the distribution of requirements.

AMDRs. For fats, carbohydrate, and protein, assessment focuses primarily on percentage contributions to energy intakes, which is evaluated with AMDRs.⁶ Usual distributions of intakes are examined to determine the proportions with usual intakes that (1) are within the AMDR, (2) fall below the lower bound of the AMDR, and (3) exceed the upper bound of the AMDR.

ULs. The only UL used in the SNDA-III analysis is the UL for sodium. Data on intakes of dietary supplements needed to apply other ULs appropriately were not collected in SNDA-III. To estimate the prevalence of excessive sodium intakes, usual distributions of sodium intake are used to determine the proportion of students with intakes that exceeded the UL.

Saturated Fat and Cholesterol—Special Cases. Saturated fat and cholesterol are nutrients of interest in any analysis of school meal programs. Specific goals for saturated fat are included in nutrient standards defined for school meals (see Volume I), and program regulations encourage reductions in levels of cholesterol. However, because the panels charged with establishing DRIs for macronutrients concluded that saturated fats and dietary cholesterol “have no known beneficial role in preventing chronic disease and are not required at any level in the diet,” DRIs have not been established for either of these nutrients (Institute of Medicine 2002). Therefore, recommendations from the 2005 edition of the *Dietary Guidelines for Americans* (DGA) were used to assess usual intakes of saturated fat and cholesterol (U.S. Department of Health and Human Services/U.S. Department of Agriculture 2005). Students with usual intakes that exceeded the DGA recommendations were deemed to have excessive intakes.

⁶ For protein and carbohydrate, EARs have also been defined. Data on the proportion with usual intakes below the respective EARs (rare for both nutrients), are presented in Appendices J and L. AIs have also been defined for linoleic acid and linolenic acid. AI values are presented in appendix tables.

C. ANALYSIS METHODS

Assessment of students' dietary intakes involved two different types of estimates: (1) estimates of students' *mean intakes* of energy and nutrients from breakfast/lunch and over 24 hours, and (2) estimates of the *proportion of students with inadequate or excessive nutrient intakes*. A distinct analytic approach was used for each set of estimates. In both cases, a major focus of the analysis was on comparing intakes of NSLP and SBP participants with those of nonparticipants. In interpreting results of these comparisons, it is important to keep in mind that differences observed between the two groups of students were not necessarily *caused* by the NSLP or SBP. Students who participate in the NSLP or SBP are likely to differ from nonparticipants in many ways, both observable and unobservable. For example, as shown in Chapter III, participants in both the NSLP and SBP are, on average, younger, lower income, and more likely to be male than nonparticipants. Participants may also differ from nonparticipants in ways that are not observable—for example, they may have different attitudes about healthy eating. Because of observed and unobserved differences between the two groups of students, their dietary intakes might differ even if the school meal programs were not available and participants obtained their meals from other sources.

A common approach to dealing with this issue is to use multivariate regression analysis to control for observable characteristics that might be correlated with both school meal participation and dietary intakes (Akin et al. 1983; Devaney et al. 1993; Gordon et al. 1995; Gleason and Sutor 2003). SNDA-III collected data on many characteristics not available in these other studies, so that estimates could control for characteristics that had not been observable in previous studies. Multivariate regression techniques were used in comparing mean energy and nutrient intakes of school meal participants and nonparticipants. However, for reasons discussed later in this section, it was not possible to use multivariate regression techniques in analyses that

compared the proportion of school meal participants and nonparticipants whose usual nutrient intakes were inadequate or excessive. Instead, a propensity score matching approach was used to adjust for differences in observable characteristics between participants and nonparticipants.

Although both the regression and propensity score matching adjustments account for differences between school meal participants and nonparticipants in a number of characteristics that may be associated with both participation in the school meal programs and dietary intakes, it is possible that important differences in unobservable characteristics remain. Therefore, the observed differences between participants and nonparticipants discussed in this report should *not* be interpreted as *causal effects* of the school meal programs.

1. Estimating Mean Intakes of Energy and Nutrients

Mean intakes of energy and nutrients at breakfast, lunch, and over 24 hours were generated for participants and nonparticipants, by school type, using the single 24-hour dietary recall collected from all students.⁷ These data were used to address the following research questions:

- What are students' *mean energy and nutrient intakes* from NSLP and SBP meals? What contributions do NSLP and SBP meals make to participants' nutrient intakes over 24 hours?
- How do the *mean energy and nutrient intakes* of NSLP and SBP participants compare with those of nonparticipants?

To adjust for some of the underlying differences between participants and nonparticipants, estimates of mean intakes were regression-adjusted for observable factors that may be correlated both with a student's decision to participate in the NSLP or SBP and with his or her dietary intakes. Regression models controlled for students' demographic characteristics, including age,

⁷ Mean intakes are primarily of descriptive interest and of interest in comparing results to previous studies.

gender, race, and ethnicity; and family characteristics, including income. They also controlled for the child's health and the child's and family's eating habits (not available in earlier studies). Other control variables included school characteristics—such as whether the school had an open-campus policy and whether competitive foods were available to students during mealtimes—and geographic location (region, urban/suburban/rural). Models also controlled for height to capture potential differences in students' nutrient requirements.⁸ Appendix E of this report describes the regression-adjustment procedure and covariates in greater detail.

The analysis of mean breakfast and lunch intakes does *not* compare these intakes to the USDA School Meals Initiative (SMI) nutrition goals for SBP and NSLP for several reasons.⁹ The SMI goals are based on meal-specific (breakfast or lunch) intakes rather than usual daily intakes, and are also based on RDAs, which represent amounts sufficient to meet the needs of nearly all healthy people. A comparison of students' mean meal-specific intakes to the RDAs would not permit conclusions to be drawn about the adequacy of students' intakes. In the new Dietary Reference Intake (DRI) framework (Institute of Medicine 2000, 2002), assessments of inadequacy and excess must be based on usual daily intakes rather than meal-specific intakes and on dietary standards other than the RDAs. Therefore, to assess students' nutrient inadequacy and excess using the most up-to-date standards and methods, the analysis focuses on usual daily intakes in comparison to the recommended dietary standards, as discussed below.

⁸ Height was preferred to body mass index (BMI) as a proxy for nutrient requirements. BMI may be influenced by school meal program participation, among many other factors. If this were the case, including BMI as a covariate would bias estimates of the relationship between school meal program participation and students' dietary intakes. For instance, if the school meal program caused students to eat more and increased their BMI, including BMI as a covariate would lead to an underestimate of the relationship between school meal program participation and students' dietary intakes. In contrast, height is less likely to be directly influenced by school meal program participation (Epstein et al. 1993).

2. Estimating the Prevalence of Inadequate and Excessive Intakes

To evaluate students' dietary intakes relative to the DRIs—the most up-to-date scientific standards for assessing the quality and adequacy of diets of individuals and population groups—the analysis also uses data and methods for assessing the distributions of usual dietary intakes. This analysis addresses the following research question:

- What proportion of participants and nonparticipants have *inadequate or excessive intakes* of specific nutrients?

An important feature of the DRIs is that they are defined in terms of an individual's *usual* daily intake, which is the long-run average of daily intakes of a particular nutrient for the individual. However, usual intakes can seldom, if ever, be directly observed. Although a single 24-hour recall provides information on an individual's observed *daily (24-hour)* intake, it provides an inaccurate estimate of the distribution of usual intake levels across a population group. This is because individuals' dietary intakes vary from day to day. This source of variation, known as *intra-individual* variation, is typically even larger than variation from one individual to the next within a population (*inter-individual variation*). If one daily intake per person is used to estimate intake distributions, the dispersion of the distribution will be larger than the dispersion of usual intakes, and estimates of the proportion of individuals whose usual intake of a particular nutrient is above or below a specific reference standard will be biased (Beaton et al. 1979).

(continued)

⁹ Volume I of this report compares nutrients offered and served in school meals (rather than students' mean meal-specific intakes) to the SMI standards. This is appropriate as the SMI standards remain the regulatory requirements for SBP and NSLP menus.

Thus, to apply the DRIs appropriately, it is necessary to have information about the *distribution of usual intakes* within population groups. The IOM has recommended use of a sophisticated empirical method for adjusting observed daily nutrient intakes to obtain unbiased estimates of the distribution of usual intakes for a group (Institute of Medicine 2000). The method was first developed by the National Research Council (National Research Council, Subcommittee on Criteria for Dietary Evaluation 1986) and later modified by Nusser et al. (1996), in a study sponsored by ARS. This method estimates the intra-individual variation in nutrient intake based on a subsample of individuals with two days of intake data, and removes this source of variation before estimating the distribution of usual nutrient intakes across a population. The personal computer version of a specialized software package, the Software for Intake Distribution Estimation (PC-SIDE), was used, in conjunction with the 24-hour recall collected from all sample members and the second 24-hour recall collected from 29 percent of the sample, to apply the IOM-recommended method in estimating usual intake distributions in the SNDA-III data.¹⁰ Appendix H of this report provides more detail on the PC-SIDE software and estimation procedures used in this analysis.

The IOM-recommended approach to estimating usual daily intakes relies on analysis at the group level. Thus, it is not possible to apply multivariate regression methods (which use data for each individual in a sample) to control for observable differences between school meal participants and nonparticipants when comparing proportions of students in each group who have

¹⁰ For more information on PC-SIDE, see <http://cssm.iastate.edu/software/side.html>. Development of PC-SIDE was sponsored by ARS. Since SNDA-III dietary recall data were collected for school days only, estimates are of usual intakes on school days rather than usual intakes across all days of the week.

inadequate or excessive intakes of specific nutrients.¹¹ Instead, a propensity score matching approach was used. School meal participants were “matched” to nonparticipants based on similarities in observable characteristics. Usual nutrient intake distributions were then estimated for participants and the matched sample of nonparticipants, using the IOM-recommended procedure. Differences between participants and the matched comparison group of nonparticipants are similar in spirit to those estimated using multivariate regression techniques because the matching approach controls for differences in observable characteristics, albeit with a different methodology. Appendix I of this report describes the propensity score matching approach in greater detail.

¹¹ The IOM Subcommittee on the Interpretation and Uses of Dietary Reference Intakes proposed one approach for adjusting for observable differences between groups before assessing their usual intakes, but applying it has proved to be difficult, and it has not yet been successfully implemented (Institute of Medicine 2000).

VI. DIETARY INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS

This chapter presents data on the dietary intakes of National School Lunch Program (NSLP) participants and nonparticipants in the 2004-2005 school year. The analyses address the following key research questions:

- What are participants' *mean energy and nutrient intakes* from NSLP lunches? What contributions do NSLP lunches make to participants' nutrient intakes over 24 hours?
- How do the *mean lunch and 24-hour intakes* of NSLP participants compare with those of nonparticipants?
- What proportion of NSLP participants have *inadequate or excessive intakes* of specific nutrients, and how does this compare with the prevalence of inadequacy and excess among nonparticipants?
- What *types of foods* do NSLP participants and nonparticipants consume at lunch and over 24 hours?
- What are the *major food sources of energy and key nutrients* in the lunches consumed by NSLP participants and nonparticipants?
- What proportion of NSLP participants and nonparticipants consume *competitive foods*? What contributions do competitive foods make to students' lunch intakes?
- How do nutrient intakes of NSLP participants and nonparticipants in school year 2004-2005 compare with intakes in school year 1991-1992, when the first School Nutrition Dietary Assessment study (SNDA-I) was conducted? How do intakes compare with recent data for school-age children nationwide?

Section A provides a summary of key findings. Section B presents data on the proportions of students who did and did not eat lunch. Sections C through E describe the energy and nutrient intakes of NSLP participants and nonparticipants, including regression-adjusted estimates of mean lunch intakes of NSLP participants and nonparticipants (Section C), regression-adjusted estimates of mean 24-hour intakes of NSLP participants and nonparticipants (Section D), and estimates of the prevalence of inadequate and excessive usual daily intakes of participants compared with nonparticipants, adjusted using propensity score matching (Section E).

Sections F through H present data on the food intakes of NSLP participants and nonparticipants, including types of food consumed (Section F), the major food sources of energy and nutrients in lunches consumed (Section G), and the consumption of competitive foods (Section H). Section I compares SNDA-III data with data from SNDA-I and the most recently published data from the National Health and Nutrition Examination Survey (NHANES), and finally, Section J compares 24-hour intakes of students who participated in the NSLP (alone), students who participated both in the NSLP and the School Breakfast Program (SBP), and students who participated in neither program.

While differences in the dietary intakes of NSLP participants and nonparticipants are of great interest, these differences should not be interpreted as causal effects of the NSLP on students' dietary intakes. This is because there are likely to be many differences between participants and nonparticipants other than school meal participation that also influence their dietary intakes. For some of the estimates presented in this chapter, differences between participants and nonparticipants were adjusted for differences in observable characteristics between the two groups.¹ Even with these adjustments for observable characteristics, however, it is possible that important differences in unobservable characteristics remain.

Where possible, the statistical significance of differences between participants and nonparticipants was tested.² Unless otherwise noted, the differences discussed in the text are significant at least at the 0.05 level. While these test results provide an important gauge of true underlying population differences, they are not a definitive measure of true differences, as

¹ Multivariate regression methods were used to adjust estimates of mean intakes of energy and nutrients at lunch and over 24 hours (Sections C and D), and propensity score matching was used to adjust estimates of the proportions of students whose usual intakes were inadequate or excessive (Section E).

² Statistical significance was determined on the basis of two-tailed t-tests. These tests accounted for the complex sample design of the SNDA-III database, using Stata or SUDAAN statistical software.

discussed in Chapter I. Particularly among subgroups with small sample sizes, patterns of differences across groups, or a difference for a particular outcome that is substantive in magnitude, may be suggestive of differences between participants and nonparticipants even if these differences are not statistically significant at the 0.05 level. At the same time, a small number of significant differences would be expected to occur by chance, in a context when multiple comparisons are being tested.

A. SUMMARY OF KEY FINDINGS

1. Regression-Adjusted Mean Intakes of Energy and Nutrients at Lunch

- After controlling for characteristics that may be associated with both participation in the NSLP and dietary intakes, lunches consumed by NSLP participants generally provided amounts of energy similar to those consumed by nonparticipants. The one exception was among high school students; lunches consumed by high school NSLP participants were significantly higher in calories than those consumed by high school nonparticipants.
- At all grade levels (elementary school, middle school, and high school), lunches consumed by NSLP participants provided significantly greater amounts of vitamin A, vitamin B₁₂, riboflavin, calcium, phosphorus, and potassium than lunches consumed by nonparticipants.
- The average lunch consumed by all types of NSLP participants also provided a significantly larger percentage of energy from linolenic acid (a beneficial fatty acid) and from protein than the lunches consumed by nonparticipants, and a significantly smaller percentage of energy from carbohydrate.
- Among elementary school students, lunches consumed by NSLP participants were also lower in vitamins C and E than lunches consumed by nonparticipants. Among middle school students, lunches consumed by NSLP participants provided more total fat and saturated fat, as a percentage of total energy intake, and more cholesterol than lunches consumed by nonparticipants. Middle school NSLP participants also consumed more monounsaturated fat (as a percentage of energy intake) and more folate, iron, zinc, and fiber at lunch than nonparticipants. Finally, among high school students, NSLP participants also consumed more vitamin C, vitamin B₆, niacin, thiamin, iron, magnesium, and zinc at lunch than nonparticipants. High school NSLP participants also consumed more sodium at lunch than nonparticipants.
- Lunches consumed by NSLP participants provided a significantly greater share (relative to nonparticipants) of total 24-hour intakes of almost all vitamins and minerals examined, but did not provide a significantly greater share of 24-hour intakes of energy.

2. Regression-Adjusted Mean Intakes of Energy and Nutrients Over 24 Hours

- Students of different ages varied in the extent to which participant-nonparticipant differences in mean lunch intakes persisted over 24 hours.
 - Among elementary school students, only the differences in intakes of vitamin A, calcium, and percent of energy from linoleic acid (all higher among NSLP participants) were observed in mean 24-hour intakes. In addition, over 24 hours, elementary school NSLP participants had significantly lower mean intakes of niacin than nonparticipants.
 - Among middle school students, the significantly higher intakes of vitamins, minerals, and fiber noted at lunch persisted over 24 hours. In addition, over 24 hours, middle school NSLP participants had significantly greater mean intakes of vitamin B₆, niacin, and magnesium than nonparticipants. The same was true for 24-hour sodium intakes. Differences between middle school NSLP participants and nonparticipants in the percentage of energy derived from saturated fat and in total cholesterol intake persisted over 24 hours.
 - Among high school students, only the differences in the percentage of energy derived from protein and in mean potassium intakes persisted over 24 hours.

3. Percentage of Students with Excessive or Inadequate Usual Daily Intakes

- There were no significant differences between NSLP participants and matched nonparticipants in the extent to which *usual daily intakes* of macronutrients (total fat, saturated fat, carbohydrate, and protein) conformed with Dietary Reference Intakes (DRIs) and *Dietary Guidelines* recommendations (DGAs).
- There were a few significant differences between NSLP participants and matched nonparticipants in the proportion of children with inadequate usual intakes of certain vitamins and minerals, generally reflecting a decreased prevalence of nutrient inadequacy among NSLP participants relative to nonparticipants. Overall, inadequate intakes of magnesium and phosphorous were less common among participants than among matched nonparticipants. Among middle school students, magnesium inadequacy was lower among participants than matched nonparticipants. Among high school students, inadequate intakes of folate, thiamin, and phosphorous were less prevalent among participants than matched nonparticipants, while excessive sodium intakes were more common among participants than matched nonparticipants.

4. Food Intakes at Lunch and Over 24 Hours

- NSLP participants were four times more likely than nonparticipants to consume milk at lunch (75 versus 19 percent). Differences in the percent consuming milk persisted over 24 hours, although the disparity between the two groups was smaller (88 versus 69 percent). At lunch as well as over 24 hours, NSLP participants were significantly more likely than nonparticipants to consume flavored milk (almost always reduced-fat or nonfat).

- NSLP participants were significantly less likely than nonparticipants to consume beverages other than milk or 100% juice at lunch (18 versus 56 percent), including juice drinks, carbonated sodas, and bottled water. Over 24 hours, differences between NSLP participants and nonparticipants in the proportion of students who consumed fruit drinks and bottled water persisted, but the difference in the consumption of carbonated sodas disappeared.
- NSLP participants were more than twice as likely as nonparticipants to consume at least one vegetable (as a distinct food item) at lunch (51 versus 23 percent). These differences were driven primarily by differences in potato consumption. In middle and high schools, NSLP participants were significantly more likely than nonparticipants to consume French fries/tater tots at lunch, and NSLP participants at all three grade levels were significantly more likely than nonparticipants to consume other white potatoes at lunch. Over 24 hours, the significant difference between NSLP participants and nonparticipants in the proportion who consumed at least one vegetable persisted; however, the magnitude of the difference was smaller (72 versus 59 percent). These 24-hour differences were also driven primarily by differences in potato consumption.
- Among elementary school and middle school students, there was no difference between NSLP participants and nonparticipants in the percentage of students who consumed at least one type of fruit or 100% juice at lunch. Among high school students, NSLP participants were significantly more likely than nonparticipants to consume at least one type of fruit or 100% juice at lunch. This difference was attributable to differences in the proportion of students who consumed canned fruit and 100% juice. These patterns generally persisted over 24 hours.
- At lunch, NSLP participants were more likely to consume hot entrees such as pizza or hamburgers than nonparticipants, and were less likely to consume desserts or snack foods. However, NSLP participants were as likely to consume desserts or snack foods over 24 hours.

5. Food Sources of Nutrients

- NSLP participants obtained significantly more of their lunch energy than nonparticipants from milk, pizza, hamburgers, and cheeseburgers, condiments, and spreads, and significantly less of their lunch energy from juice drinks, carbonated sodas, peanut butter and plain meat/poultry sandwiches, chips, candy, crackers, and pretzels.
- NSLP participants generally obtained a significantly greater share of their saturated fat and carbohydrate intakes at lunch from pizza and milk than nonparticipants, while nonparticipants obtained significantly greater shares of their saturated fat and carbohydrate intakes at lunch from plain meat/poultry sandwiches, peanut butter sandwiches, corn/tortilla chips, candy, other snack chips, and crackers and pretzels.
- Milk and pizza products generally made significantly greater contributions to NSLP participants' lunch intakes of vitamin A, vitamin B₆, vitamin B₁₂, calcium, and iron

than to nonparticipants' intakes, while plain meat/poultry sandwiches, hamburgers and cheeseburgers, cheese, and juice drinks generally made significantly greater contributions to nonparticipants' lunch intakes of these nutrients.

- Relative to nonparticipants, NSLP participants obtained significantly greater shares of their sodium intakes at lunch from pizza and pizza products, condiments and spreads, 1% flavored milk, and salad dressings, and significantly smaller shares from plain meat/poultry sandwiches, peanut butter sandwiches, crackers and pretzels, and corn/tortilla chips.

6. Competitive Foods

- Overall, nonparticipants were more than twice as likely as NSLP participants to consume one or more competitive foods throughout the school day. Consumption of competitive foods was lowest among elementary school students and highest among high school students; however, at all three grade levels, participants were generally less likely than nonparticipants to consume competitive foods.
- Among elementary school students, the most common sources of competitive foods were classroom parties, rewards from teachers, bake sales, and other fundraisers. Among middle school students, the most common source of competitive foods for NSLP participants was vending machines, while the most common source for nonparticipants was a la carte points of sale. Among high school students, vending machines were the leading source of competitive foods for both participants and nonparticipants.
- Overall, among students who consumed competitive foods, NSLP participants obtained significantly fewer calories from these foods than did nonparticipants. Competitive foods consumed by nonparticipants were significantly higher in fat and saturated fat, as a percent of total energy, than the competitive foods consumed by NSLP participants, and also provided significantly larger amounts of most nutrients and sodium. In contrast, the competitive foods consumed by NSLP participants provided a significantly higher percentage of energy in the form of carbohydrate.

7. Comparison of SNDA-III Data with Data from Other Studies

- In comparing data from SNDA-I and SNDA-III on average intakes of energy and nutrients at lunch, several expected trends were borne out. For example, NSLP participants' intakes of protein (as a percent of energy), vitamin A, riboflavin, and calcium remained stable from SNDA-I to SNDA-III, while intakes of most other nutrients decreased significantly. In addition, the mean lunch intakes of total fat (as a percentage of energy) and cholesterol decreased significantly between SNDA-I and SNDA-III for NSLP participants but remained stable for nonparticipants. This is consistent with changes that have been observed in the nutrient content of NSLP lunches offered over time.

- Comparing SNDA-III data with the most recently published data from NHANES supports the representativeness of the SNDA-III estimates. Mean intakes and estimates of the prevalence of inadequate intakes are consistent for most nutrients and many subgroups. Where potentially noteworthy differences are apparent (for example, in mean intakes of vitamins A and C, calcium, and sodium for some or all subgroups), SNDA-III estimates tend to be higher. This is consistent with differences between NSLP participants and nonparticipants noted in the SNDA-III analysis of lunch intakes (students who consume NSLP lunches have higher intakes of these nutrients) and the fact that NHANES data likely include fewer NSLP participants because data were collected over the summer and on weekends and other nonschool days, regardless of public school attendance.

B. PROPORTIONS OF STUDENTS WHO DID AND DID NOT EAT LUNCH

By definition, NSLP participants consumed lunch. Among students who did not consume an NSLP lunch, most (94 percent) consumed some sort of lunch (Table VI.1).³ Lunch skipping was higher among middle and high school nonparticipants (nine and eight percent, respectively) than among elementary school nonparticipants (four percent).

Some students consumed lunch foods from more than one source. Overall, three percent of NSLP participants consumed, in addition to their NSLP lunch, lunch foods that were obtained and eaten in another location (for example, at home, at work, or from a store or restaurant). Among nonparticipants, six percent of students consumed lunch foods that were obtained at school as well as lunch foods that were obtained and consumed in another location.

³ Lunch included all foods reported between 10:00 A.M. and 2:00 P.M., unless reported as breakfast; all foods reported between 9:30 A.M. and 10:00 A.M. that were reported as lunch, supper, or dinner; and all foods reported between 2:00 P.M. and 3:30 P.M. that students reported as being part of lunch.

TABLE VI.1

LUNCH CONSUMPTION AND SKIPPING BEHAVIORS, BY SCHOOL TYPE

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
	Percent of Students		Percent of Students		Percent of Students		Percent of Students	
Consumed lunch	98	95	97	87	96	84	97	88
May have consumed two lunches ^a	2	1	4	4	4	9	3	6
Skipped lunch ^b	0	4	0	9	0	8	0	7
Number of Students	531	201	497	290	358	437	1,386	928

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample includes all children.

^aStudents who may have consumed two lunches consumed lunch foods that were obtained and eaten at school as well as lunch foods that were obtained and eaten in another location.

^bIncludes students who reported only water.

C. REGRESSION-ADJUSTED MEAN LUNCH INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS

Among NSLP participants and nonparticipants who consumed a lunch and were similar along a number of measured characteristics, several statistically significant differences in average nutrient intakes at lunch were observed.⁴

1. Energy and Macronutrients

Overall, lunches consumed by NSLP participants and nonparticipants provided a similar amount of food energy, an average of roughly 630 calories (Table VI.2). However, lunches consumed by NSLP participants provided a higher percentage of energy from saturated fat and protein and a lower percentage of energy from carbohydrate than lunches consumed by nonparticipants. Overall, lunches consumed by NSLP participants provided, on average, 12 percent of energy from saturated fat, 17 percent of energy from protein, and 51 percent of energy from carbohydrate. In comparison, lunches consumed by nonparticipants provided 11 percent of energy from saturated fat, 13 percent of energy from protein, and 55 percent of energy from carbohydrate. In addition, lunches consumed by NSLP participants provided greater amounts of linolenic acid in absolute terms and as a percentage of total energy.⁵ Lunches consumed by NSLP participants and nonparticipants were roughly equivalent in terms of the percentage of energy from total fat (33 to 34 percent).

⁴ Detailed results of regression models are presented in Appendix E. In addition, data on unadjusted mean lunch intakes are presented in Appendix F.

⁵ Linolenic acid is an essential polyunsaturated fatty acid that must be obtained from the diet.

TABLE VI.2

REGRESSION-ADJUSTED MEAN LUNCH INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS, BY SCHOOL TYPE

	Regression-Adjusted Mean Intake at Lunch									
	Elementary School Students		Middle School Students		High School Students		All Students			
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Food Energy (kcal)	587	628	620	582	733	661*	633	631		
Macronutrients: Total Amount (g)										
Total fat	21	25	24	23	29	27	24	25		
Saturated fat	7.4	7.6	8.3	7.1*	9.2	8.6	8.1	8.0		
Monounsaturated fat	8.2	10.1*	9.7	9.6	11.3	11.2	9.5	10.4		
Polyunsaturated fat	4.2	5.2	4.7	5.1	6.2	5.4	4.9	5.3		
Linoleic acid	3.7	4.7	4.2	4.5	5.4	4.7	4.3	4.6		
Linolenic acid	0.39	0.32	0.45	0.35*	0.59	0.41**	0.47	0.36**		
Carbohydrate	76	83	77	75	92	85	80	82		
Protein	25	21	24	20**	29	22**	25	21**		
Macronutrients: Percentage of Food Energy from (%)										
Total fat	31.7	32.1	34.9	31.4**	34.9	34.5	33.7	33.1		
Saturated fat	11.2	10.4	11.9	9.9**	11.3	11.1	11.5	10.6**		
Monounsaturated fat	12.3	13.0	13.8	12.9*	13.6	14.3	13.2	13.6		
Polyunsaturated fat	6.3	6.6	6.7	6.5	7.6	6.9	6.8	6.7		
Linoleic acid	5.6	5.8	5.9	5.8	6.5	6.1	5.9	5.9		
Linolenic acid	0.58	0.45**	0.65	0.49**	0.73	0.50**	0.65	0.49**		
Carbohydrate	52.4	56.1*	50.0	57.0**	49.4	54.6**	50.9	55.4**		
Protein	17.2	13.4**	16.1	12.9**	16.5	12.3**	16.5	12.9**		
Vitamins										
Vitamin A (mcg RAE)	212	91**	182	91**	173	97**	191	94**		
Vitamin C (mg)	20	28*	18	22	27	19*	20	22		
Vitamin E (mg)	1.6	2.1*	1.9	2.2	2.2	2.2	1.9	2.2		
Vitamin B ₆ (mg)	0.41	0.39	0.41	0.37	0.51	0.43**	0.44	0.40*		
Vitamin B ₁₂ (mcg)	1.5	0.9**	1.5	0.8**	1.5	1.0**	1.4	0.9**		
Folate (mcg DFE)	114	116	121	105*	137	122	123	117		
Niacin (mg)	5.6	5.9	5.5	5.7	7.2	6.2**	6	6.0		
Riboflavin (mg)	0.72	0.53**	0.67	0.47**	0.73	0.48**	0.70	0.49**		
Thiamin (mg)	0.40	0.41	0.42	0.40	0.51	0.40**	0.44	0.41		

TABLE VI.2 (continued)

	Regression-Adjusted Mean Intake at Lunch							
	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
	Minerals							
Calcium (mg)	422	256**	389	229**	401	246**	400	245**
Iron (mg)	3.6	3.5	3.7	3.1**	4.3	3.6**	3.8	3.5*
Magnesium (mg)	79	78	77	68	85	69**	79	72*
Phosphorus (mg)	464	359**	453	338**	502	362**	466	356**
Potassium (mg)	859	697**	810	593**	930	655**	852	650**
Sodium (mg)	1,069	961	1,057	960	1,332	1,076**	1,145	1,008**
Zinc (mg)	3.1	2.8	3.3	2.5**	3.5	3.0*	3.2	2.8**
	Other Dietary Components							
Fiber (g)	4.7	4.5	4.3	3.8*	4.7	4.1	4.5	4.2*
Fiber (g/1,000 kcal)	8.2	8.2	7.2	7.2	6.6	6.6	7.4	7.3
Cholesterol (mg)	55	62~	54	41**	66	59	56	57
Number of Students	531	189	497	259	358	394	1,386	842

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample excludes students who did not consume a lunch. Lunch intakes of both NSLP participants and nonparticipants include all foods and beverages consumed at lunch. For NSLP participants, this may include, in addition to foods/beverages obtained as part of the reimbursable lunch, foods/beverages that were obtained in school from non-reimbursable sources and/or foods that were brought from or consumed at home.

Note: All mean estimates have been regression-adjusted for differences in personal, family, and school characteristics between NSLP participants and nonparticipants, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics described in Appendix E.

~ Estimates may not be reliable due to inadequate cell size or a large coefficient of variation.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

These general patterns were noted for elementary, middle, and high school students alike, although the difference in the percentage of energy from saturated fat was statistically significant only for middle school students.⁶ Among middle school students, NSLP participants also consumed significantly more energy from total fat (35 versus 31 percent) and monounsaturated fat (14 versus 13 percent) than nonparticipants. In addition, among high school students, NSLP participants consumed significantly more energy at lunch than nonparticipants (733 versus 661 calories).

2. Vitamins and Minerals

NSLP participants consumed lunches that provided significantly greater amounts of several vitamins and minerals, on average, than lunches consumed by nonparticipants. Overall, NSLP participants consumed significantly greater amounts of vitamins A, B₆, B₁₂, and riboflavin, and significantly greater amounts of all of the minerals examined (calcium, iron, magnesium, phosphorous, potassium, and zinc) at lunch than nonparticipants (Table VI.2). At the same time, NSLP participants consumed significantly more sodium at lunch than did nonparticipants.

There was some variation across school levels in the pattern of differences in lunch intakes of vitamins and minerals. Differences between NSLP participants and nonparticipants in mean lunch intakes of vitamin A, vitamin B₁₂, riboflavin, calcium, phosphorus, and potassium were observed for all three groups of students (elementary, middle, and high school). However, differences in mean lunch intakes of other vitamins and minerals observed in the overall sample were concentrated among specific groups of students. Differences between NSLP participants and nonparticipants in mean lunch intakes of iron and zinc were concentrated among middle and high school students, and differences in mean intakes of vitamin B₆, magnesium, and sodium

⁶ Intakes for secondary school students (middle and high school combined) are presented in Appendix G.

were concentrated among high school students. In addition, several significant differences were observed only for specific groups of students (not for the overall sample). Among elementary school students, NSLP participants consumed significantly less vitamin C and vitamin E at lunch than nonparticipants. Among middle school students, NSLP participants consumed significantly more folate at lunch than nonparticipants. Finally, among high school students, NSLP participants had significantly higher lunch intakes of vitamin C, niacin, and thiamin than nonparticipants.

3. Fiber and Cholesterol

Except for middle school students, average lunch intakes of fiber and cholesterol were comparable for NSLP participants and nonparticipants. Among middle school students, NSLP participants had significantly higher mean lunch intakes of both fiber and cholesterol than nonparticipants (Table VI.2).

4. Mean Proportion of Total 24-Hour Intakes Provided by Lunch

Overall, both NSLP participants and nonparticipants obtained roughly 30 percent of their total energy intake from lunch (Table VI.3). However, the lunches consumed by NSLP participants made significantly greater contributions to total 24-hour intakes of many nutrients than the lunches consumed by nonparticipants. This was true for all vitamins and minerals examined except vitamins C and E and was also true for linolenic acid, protein, and fiber. These data indicate that NSLP participants were significantly less likely than nonparticipants to obtain these nutrients from other meals and snacks consumed throughout the day. NSLP participants

STABLE VI.3

MEAN PROPORTION OF 24-HOUR INTAKES CONTRIBUTED BY LUNCH: NSLP PARTICIPANTS AND NONPARTICIPANTS

	Mean Percentage of 24-Hour Intake											
	Elementary School Students		Middle School Students		High School Students		All Students					
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Food Energy (kcal)	31	30	32	30	33	30**	31	30	31	30	31	30
Macronutrients												
Total fat	32	32	35	33	37	32**	34	32	34	32	34	32
Saturated fat	32	30	34	30**	36	31**	33	30**	33	30**	33	30**
Monounsaturated fat	33	34	36	35	37	34*	35	34	35	34	35	34
Polyunsaturated fat	33	34	35	35	39	34*	35	34	35	34	35	34
Linoleic acid	33	33	35	35	38	34*	35	34	35	34	35	34
Linolenic acid	34	28*	37	31**	42	30**	37	30**	37	30**	37	30**
Carbohydrate	29	29	29	30	31	30	30	30	30	29	30	29
Protein	35	28**	35	29**	36	28**	35	28**	35	29**	35	29**
Vitamins												
Vitamin A	36	17**	33	21**	36	21**	36	21**	36	19**	36	19**
Vitamin C	28	30	27	27	33	27*	29	27*	29	28	29	28
Vitamin E	32	33	34	33	36	33	33	33	33	33	33	33
Vitamin B ₆	28	23**	28	25*	32	26**	29	26**	29	24**	29	24**
Vitamin B ₁₂	34	17**	33	20**	34	23**	34	23**	34	20**	34	20**
Folate	25	22	27	25	29	25*	27	25*	27	24**	27	24**
Niacin	30	26*	30	29	33	29**	31	29**	31	28*	31	28*
Riboflavin	33	24**	33	25**	35	24**	33	24**	33	24**	33	24**
Thiamin	28	25*	30	27*	32	26**	29	26**	29	26**	29	26**
Minerals												
Calcium	39	26**	38	27**	40	25**	39	25**	39	26**	39	26**
Iron	28	23**	29	25*	31	26**	29	26**	29	25**	29	25**
Magnesium	34	30*	33	30*	35	28**	33	28**	33	29**	33	29**
Phosphorus	36	27**	35	28**	37	27**	35	27**	35	28**	35	28**
Potassium	36	29**	35	28**	37	27**	35	27**	35	28**	35	28**
Sodium	34	30*	34	32	38	31**	35	31**	35	31**	35	31**
Zinc	31	25**	32	26**	33	26**	32	26**	32	26**	32	26**

TABLE VI.3 (continued)

	Mean Percentage of 24-Hour Intake							
	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Fiber	35	33	34	32	37	30**	35	31**
Cholesterol	32	21**	32	24**	35	26**	33	24**
Number of Students	531	189	497	259	358	394	1,386	842

Other Dietary Components

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample excludes students who did not consume a lunch. Lunch intakes of both NSLP participants and nonparticipants include all foods and beverages consumed at lunch. For NSLP participants, this may include, in addition to foods/beverages obtained as part of the reimbursable lunch, foods/beverages that were obtained in school from non-reimbursable sources and/or foods that were brought from or consumed at home.

Note: All mean estimates have been regression-adjusted for differences in personal, family, and school characteristics between NSLP participants and nonparticipants, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics described in Appendix E.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

also obtained significantly larger shares of their 24-hour intakes of saturated fat, sodium, and cholesterol from lunch than did nonparticipants.⁷

Results for students in all three types of schools followed these general patterns. Among high school students, however, NSLP participants consumed more energy at lunch (Table VI.2) and obtained a greater share of their 24-hour energy intakes from lunch (Table VI.3). High school NSLP participants also obtained a larger percentage of their total intakes of most vitamins and minerals from lunch than nonparticipants.

D. REGRESSION-ADJUSTED MEAN 24-HOUR INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS

Some or all of the significant differences observed in the mean lunch intakes of NSLP participants and nonparticipants could be offset by what students consumed at other times throughout the day. Therefore, to obtain a more accurate assessment of how NSLP lunch intakes may influence students' overall diets, it is important to examine 24-hour intakes of energy and nutrients. Analysis of 24-hour intakes revealed that, while several of the significant differences observed in lunch intakes dissipated over 24 hours, many meaningful differences persisted.⁸ Moreover, there were noteworthy differences across age groups in the pattern of significant differences in the 24-hour intakes of NSLP participants and nonparticipants.

⁷ The fact that NSLP participants obtained significantly greater shares of total 24-hour intakes of specific nutrients at lunch, relative to nonparticipants, does not necessarily mean that NSLP participants consumed significantly greater amounts of these nutrients than nonparticipants over 24 hours. Results of analyses that examined mean 24-hour intakes are presented in the next section.

⁸ Detailed results of regression models are presented in Appendix E. In addition, data on unadjusted mean 24-hour intakes are presented in Appendix F.

1. Energy and Macronutrients

Overall, mean 24-hour energy intakes were comparable for NSLP participants and nonparticipants. The same was true for the relative contribution of most macronutrients to energy intakes. Significant differences in the percentage of energy from saturated fat and carbohydrate observed at lunch were balanced out during the day so that, over 24 hours, the relative contribution of these macronutrients to total energy intake were comparable for NSLP participants and nonparticipants (Table V1.4). Differences in the percentage of energy from linolenic acid and protein persisted over 24 hours, with NSLP participants obtaining significantly greater shares of total energy intakes from these macronutrients than nonparticipants.

There was some variation across school types in findings related to energy and macronutrient intakes over 24 hours. Among elementary school students, there were no meaningful significant differences between NSLP participants and nonparticipants in mean 24-hour intakes of energy or macronutrients. Among middle school students, NSLP participants consumed significantly more energy over 24 hours (2,119 versus 1,944 calories) and obtained a significantly greater share of their 24-hour energy intakes from saturated fat (11.3 versus 10.7 percent). NSLP participants obtained a greater percentage of 24-hour energy intakes from protein than nonparticipants.

2. Vitamins and Minerals

There was substantial variation across school types in the extent to which differences observed between NSLP participants and nonparticipants in mean lunch intakes of vitamins and minerals persisted over 24 hours. Among elementary school students, most of the differences in mean intakes of NSLP participants and nonparticipants observed at lunch dissipated over 24

TABLE VI.4

REGRESSION-ADJUSTED MEAN 24-HOUR INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS, BY SCHOOL TYPE

	Regression-Adjusted Mean 24-Hour Intake									
	Elementary School Students		Middle School Students		High School Students		All Students			
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Food Energy (kcal)	2,018	2,077	2,119	1,944*	2,336	2,204	2,149	2,081		
Macronutrients: Total Amount (g)										
Total fat	71	74	77	70*	86	83	78	76		
Saturated fat	25.4	25.5	26.8	23.9**	28.9	28.5	27.1	26.1		
Monounsaturated fat	27.0	28.6	29.7	27.1*	33.4	32.3	29.9	29.5		
Polyunsaturated fat	13.7	14.6	15.1	13.8	17.3	15.9	15.2	15.0		
Linoleic acid	12.1	13.0	13.3	12.3	15.2	13.9	13.3	13.2		
Linolenic acid	1.2	1.1	1.3	1.1*	1.5	1.3	1.3	1.2**		
Carbohydrate	276	285	285	266	309	293	289	282		
Protein	74	74	77	68**	87	78*	79	73*		
Macronutrients: Percentage of Food Energy from (%)										
Total fat	31.3	31.9	32.4	31.6	32.7	32.6	32.1	32.1		
Saturated fat	11.2	11.0	11.3	10.7*	10.9	11.2	11.2	11.0		
Monounsaturated fat	11.9	12.3	12.5	12.3	12.7	12.6	12.3	12.5		
Polyunsaturated fat	6.0	6.3	6.3	6.2	6.6	6.4	6.2	6.3		
Linoleic acid	5.3	5.5	5.5	5.5	5.8	5.6	5.5	5.6		
Linolenic acid	0.53	0.49*	0.54	0.50	0.57	0.54	0.55	0.51**		
Carbohydrate	55.0	54.9	54.0	55.4	53.1	54.4	54.1	54.8		
Protein	14.8	14.3	14.7	14.2	15.1	14.2*	14.8	14.2*		
Vitamins										
Vitamin A (mcg RAE)	681	594*	641	519**	604	543	641	560**		
Vitamin C (mg)	94	90	85	89	96	92	91	91		
Vitamin E (mg)	5.7	6.2	6.2	6.0	6.8	6.8	6.1	6.5		
Vitamin B ₆ (mg)	1.7	1.8	1.8	1.6*	1.9	1.9	1.8	1.8		
Vitamin B ₁₂ (mcg)	5.3	5.3	5.6	4.7**	5.4	5.3	5.3	5.2		
Folate (mcg DFE)	574	616	588	500*	609	597	581	579		
Niacin (mg)	20.3	22.6*	21.6	19.5**	24.4	23.6	21.9	22.1		
Riboflavin (mg)	2.4	2.3	2.4	2.0**	2.4	2.2	2.3	2.2*		
Thiamin (mg)	1.6	1.7	1.6	1.5	1.8	1.7	1.7	1.6		

TABLE VI.4 (continued)

	Regression-Adjusted Mean 24-Hour Intake							
	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Minerals								
Calcium (mg)	1,179	1,032*	1,137	906**	1,088	987	1,134	976**
Iron (mg)	15.0	15.9	15.5	13.6*	16.1	16.3	15.4	15.4
Magnesium (mg)	250	253	251	226*	269	249	256	243*
Phosphorus (mg)	1,377	1,319	1,393	1,200**	1,475	1,340	1,411	1,286**
Potassium (mg)	2,560	2,396	2,499	2,177**	2,702	2,440*	2,587	2,345**
Sodium (mg)	3,287	3,252	3,378	3,084*	3,788	3,549	3,492	3,304*
Zinc (mg)	11.2	11.5	12.1	10.5**	12.6	12.3	11.8	11.5
Other Dietary Components								
Fiber (g)	14.3	14.1	13.8	12.3*	14.3	13.7	14.2	13.5
Fiber (g/1,000 kcal)	7.2	6.8	6.7	6.4	6.3	6.5	6.7	6.6
Cholesterol (mg)	202	214	207	188*	238	233	215	214
Number of Students	531	201	497	290	358	437	1,386	928

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample includes all students, including those who did not consume a lunch.

Note: All mean estimates have been regression-adjusted for differences in personal, family, and school characteristics between NSLP participants and nonparticipants, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics described in Appendix E.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

hours (vitamin C, vitamin E, vitamin B₁₂, riboflavin, phosphorus, and potassium) (compare Tables VI.2 and VI.4). Only the differences in mean intakes of vitamin A and calcium persisted. In addition, NSLP participants in elementary schools consumed significantly less niacin over 24 hours, on average, than nonparticipants.

Among middle school students, all the significant differences noted between NSLP participants and nonparticipants in mean lunch intakes of vitamins and minerals persisted over 24 hours (vitamin A, vitamin B₁₂, folate, riboflavin, calcium, iron, phosphorus, potassium, and zinc), and three new significant differences emerged—in mean 24-hour intakes of vitamin B₆, niacin, and magnesium. For all of these nutrients, middle school NSLP participants had higher 24-hour intakes, on average, than middle school nonparticipants. Middle school NSLP participants also had higher mean sodium intakes over 24 hours than middle school nonparticipants.

Finally, among high school students, significant differences in mean intakes of potassium persisted over 24 hours, while all other differences in vitamin and mineral intakes (all minerals examined and all vitamins examined except for vitamin E and folate) dissipated.

3. Fiber and Cholesterol

Consistent with findings from the analysis of mean lunch intakes, NSLP participants' and nonparticipants' average intakes of fiber and cholesterol over 24 hours were largely comparable (Table VI.4). The only significant differences noted were for total fiber and cholesterol intake among middle school students, with NSLP participants consuming significantly more fiber and cholesterol over 24 hours, on average, than nonparticipants.

E. PREVALENCE OF INADEQUATE AND EXCESSIVE USUAL DAILY INTAKES AMONG NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS

The data presented in this section are based on usual intake distributions that were estimated using methods recommended by the Institute of Medicine (IOM) (see Chapter V). Tables VI.5 and VI.6 show the percentage of NSLP participants and nonparticipants whose usual daily intakes were acceptable, inadequate or excessive, relative to DRIs or DGAs. As noted previously, these comparisons were made using propensity score matching techniques to control for differences between NSLP participants and nonparticipants in a number of characteristics that may be associated with both NSLP participation and dietary intakes (see Chapter V and Appendix I).

Individual point estimates in these analyses may be statistically unreliable because of small sample size or a large coefficient of variation. Rather than reporting point estimates of the percentage of students with usual daily intakes that fell above or below a dietary standard, “less than 3 percent” is reported for rare occurrences (less than 3 percent of students had usual intakes in this range, but the specific point estimate was statistically unreliable), and “more than 97 percent” is reported for common occurrences (more than 97 percent of students had usual intakes in this range, but the specific point estimate was statistically unreliable).

Appendix J provides data on unadjusted means and full distributions of usual intakes (5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles) for five subgroups of NSLP participants and nonparticipants that correspond to the age and gender subgroups used in the DRIs (children 6 to 8 years, males 9 to 13 years, females 9 to 13 years, males 14 to 18 years, and females 14 to 18 years), as well as for groups defined by school level (elementary, middle, high, and secondary) and for all students combined.

TABLE VI.5
 MEAN USUAL DAILY ENERGY INTAKES AND ESTIMATED ENERGY REQUIREMENTS OF NSLP PARTICIPANTS
 AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

	Elementary School Students		Middle School Students		High School Students		All Students	
	Matched		Matched		Matched		Matched	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Mean Intake	2,051	1,952 **	2,102	2,037	2,386	2,121 **	2,131	2,003 **
Mean EER ^a	1,758	1,762	2,270	2,275	2,501	2,452	2,013	2,007
Number of Students	531	142	496	176	358	188	1,385	506

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first and second 24-hour recalls prepared by Mathematica Policy Research, Inc. Usual intake distributions were determined for each subgroup using the PC version of the Software for Intake Distribution Estimation (PC-SIDE). Sample includes all students, including those who did not consume a lunch.

Note: Matched sample constructed using propensity score matching to adjust for differences in personal, family, and school characteristics between NSLP participants and nonparticipants, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics, as described in text. Estimates weighted to account for sample design and the fact that students in the comparison group may be matched to multiple participants.

^aEER = Estimated Energy Requirement. EERs were estimated based on age, gender, height, and weight, and assumed, for all children, a “low active” physical activity level (Institute of Medicine, 2002/2005). EER estimates exclude children who did not have valid data for height and/or weight.

**Difference between participants and matched nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and matched nonparticipants is significantly different from zero at the .01 level.

TABLE VI.6

PERCENT OF NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS WITH ACCEPTABLE, INADEQUATE,
OR EXCESSIVE INTAKES, BY SCHOOL TYPE

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Matched Nonparticipants	Participants	Matched Nonparticipants	Participants	Matched Nonparticipants	Participants	Matched Nonparticipants
Macronutrients								
Total fat								
% within AMDR	77.4	87.0	78.8	95.1	68.4	63.5	76.8	94.2
% > AMDR	17.6 ~	10.1 ~	19.8 ~	4.2 ~	30.5	30.0 ~	20.2	5.5 ~
% < AMDR	4.9 ~	2.9 ~	<3 ~	<3 ~	<3 ~	6.5 ~	<3 ~	<3 ~
Saturated fat								
% > DGA	77.5	62.1 ~	87.7	44.7 ~	74.9	67.9	80.5	79.7 ~
Linoleic acid								
% within AMDR	63.4	65.1	67.4	70.1	75.4	76.3	67.6	69.1
% > AMDR	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~
% < AMDR	36.6	34.7	32.6 ~	29.9 ~	24.0 ~	23.0 ~	32.4	30.6
Alpha-linolenic acid								
% within AMDR	20.6	22.0	<3	7.4	40.1	38.8	24.5	17.8
% > AMDR	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~
% < AMDR	79.4	78.0	>97 ~	92.6 ~	59.2	61.2 ~	75.6	82.2
Carbohydrate								
% < EAR	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	3.1 ~	<3 ~	<3 ~
% within AMDR	93.5	>97	>97	>97	95.7	84.8	96.6	>97
% > AMDR	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	5.5 ~	<3 ~	<3 ~
% < AMDR	4.2 ~	<3 ~	<3 ~	<3 ~	4.3 ~	9.7 ~	<3 ~	<3 ~
Protein								
% < EAR	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~
% within AMDR	>97	>97	>97	93.4	96.7	89.4	>97	94.1
% > AMDR	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~
% < AMDR	<3 ~	<3 ~	<3 ~	6.6 ~	3.3 ~	10.6 ~	<3 ~	6.0 ~
Vitamins and Minerals with EARs (Percent < EAR)								
Vitamin A	7.4 ~	<3 ~	28.8	44.2 *	48.8	63.8 *	20.0	27.6
Vitamin C ^a	5.7 ~	<3 ~	14.2 ~	25.6	31.8	47.9 *	12.2	12.5 ~
Vitamin E	84.6	88.9 ~	94.2	92.3 ~	95.0	89.7	87.7	85.9
Vitamin B ₆	<3 ~	<3 ~	6.1 ~	5.4 ~	<3 ~	20.1 **	<3 ~	3.4 ~
Vitamin B ₁₂	<3 ~	<3 ~	<3 ~	6.2 ~	<3 ~	10.8 ~	<3 ~	5.2 ~
Folate	<3 ~	<3 ~	6.2 ~	12.0 ~	4.3 ~	28.8 **	<3 ~	7.9 ~

TABLE VI.6 (continued)

	Elementary School Students		Middle School Students		High School Students		All Students	
	Matched		Matched		Matched		Matched	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Niacin ^b	<3 ~	<3 ~	<3 ~	<3 ~	<3 ~	10.9 ~	<3 ~	<3 ~
Riboflavin	<3 ~	<3 ~	<3 ~	4.1 ~	<3 ~	11.9 ~	<3 ~	<3 ~
Thiamin	<3 ~	<3 ~	3.7 ~	6.4 ~	4.4 ~	22.1 **	<3 ~	5.2 ~
Iron ^c	<3 ~	<3 ~	<3 ~	3.2 ~	8.8 ~	9.5 ~	<3 ~	<3 ~
Magnesium	8.1	6.1 ~	43.2	62.0 **	77.8	83.8	27.4	37.6 **
Phosphorus	6.5	13.0 ~	23.0	34.9	15.5 ~	39.3 **	11.7	21.1 **
Zinc	<3 ~	9.2 ~	7.6 ~	14.9 ~	3.6 ~	25.4 ~	4.0 ~	13.3 ~
Calcium, Potassium, and Sodium								
Calcium (Mean % AI)	114.4 ~	100.4 ~	87.6	63.8 **	86.6	70.7 *	103.3 ~	87.0 *
Potassium (Mean % AI)	61.5	58.1	55.0	48.3 *	58.2	47.4 **	59.5	53.9
Sodium (Mean % AI)	246.9 ~	224.6 ~	224.7 ~	217.5 ~	258.4 ~	219.5 *~	245.0 ~	222.1 *~
Sodium (% > UL)	95.6	94.3 ~	90.7	88.8	96.0 ~	77.9 *	95.0	88.1
Other Dietary Components								
Fiber (Mean % AI)	53.7	48.7 *	46.5	40.0 *	45.1	39.3 *	50.5	45.0 **
Fiber (g/1,000 kcal) (Mean % AI)	50.9	48.7	47.6	43.1 *	44.2	42.3	48.9	46.3
Cholesterol (% > DGA)	7.3 ~	5.8 ~	6.9 ~	7.4 ~	21.4 ~	15.7 ~	9.1 ~	7.6 ~
Number of Students	531	142	496	176	358	188	1,385	506

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first and second 24-hour recalls prepared by Mathematica Policy Research, Inc. Usual intake distributions were determined for each subgroup using the PC version of the Software for Intake Distribution Estimation (PC-SIDE). Sample includes all students, including those who did not consume a lunch.

Note: Matched sample constructed using propensity score matching to adjust for differences in personal, family, and school characteristics between NSLP participants and nonparticipants, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics, as described in text. Estimates weighted to account for sample design and the fact that students in the comparison group may be matched to multiple participants.

AI = Adequate Intake

AMDR = Acceptable Macronutrient Distribution Range

DGA = Dietary Guidelines for Americans recommendation

EAR = Estimated Average Requirement

UL = Tolerable Upper Intake Level

^aThe EAR for vitamin C is 35mg greater for smokers than nonsmokers. These tabulations used EARs for nonsmokers.

^bNiacin intakes include preformed niacin only. EARs for niacin are expressed as niacin equivalents, including contributions from tryptophan. Therefore, prevalence of inadequate niacin intakes may be overestimated.

^cComparison to EAR was done using the probability approach. The significance of differences between participants and nonparticipants was not tested.

~ Estimates may not be reliable due to inadequate cell size or a large coefficient of variation.

*Difference between participants and matched nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and matched nonparticipants is significantly different from zero at the .01 level.

1. Energy

Assessment of self-reported energy intakes is difficult. In theory, populations that are in energy balance (not gaining or losing weight) should have average usual energy intakes that are roughly equivalent to corresponding Estimated Energy Requirements (EERs). However, it is well recognized that individuals tend to misreport food intake in dietary surveys (Institute of Medicine 2005). Underreporting tends to be greatest among females, people who are overweight or obese, and people who are low income. There is some evidence that underreporting is associated with omission of foods perceived to be “bad,” such as foods high in fat and/or sugar. Among young children, the opposite problem (overreporting) may occur (Devaney et al. 2005).

In addition, it is difficult to accurately estimate EERs without accurate information about customary levels of physical activity. This analysis assumes a “low active” level of physical activity for all children.⁹ Despite these limitations, it is instructive to examine reported energy intakes to gain some perspective on the potential for over- and underreporting in general, and on differences in this regard among participants and nonparticipants.

Estimated mean energy intakes and EERs suggest that food intakes of elementary school students may have been overreported (by children themselves and/or by their parents/primary caregivers). In this group of children, the estimated mean usual energy intake was greater than the estimated mean EER by roughly 200 to 300 calories (Table VI.5). Excess daily energy

⁹ The choice to use a “low active” level of physical activity for all children was based on data from the Centers for Disease Control and Prevention’s Youth Media Campaign Longitudinal Survey, which indicated that 61.5 percent of children ages 9 to 13 years do not participate in any organized physical activity during their nonschool hours and that 22.6 percent do not engage in any free-time physical activity (Centers for Disease Control and Prevention 2003). Other possible physical activity levels for the equations used to estimate EERs are: “sedentary,” “active,” and “very active.” “Sedentary” would underestimate EERs for the 77.2 percent of students who engage in some form of free-time physical activity, and “active” or “very active” might overestimate EERs for these students. Physical activity was not explicitly measured in SNDA-III, and there is no accepted method for using the related data that were collected (for example, information about participation on sports teams and physical education at school) to develop group-level assumptions about physical activity or to assign different levels of physical activity to each child in the sample.

intakes in this range would lead to an annual weight gain of about 20 to 30 pounds.¹⁰ While the prevalence of overweight has been increasing among children in all age groups, this discrepancy is so large that it is likely that at least some of it must be associated with overreporting. This pattern was noted for both NSLP participants and nonparticipants and could have included reporting of foods that were not actually consumed and/or overestimation of portion sizes for foods that were consumed. The potential for overreporting is most notable among children 6 to 8 years old, among whom the difference between mean usual energy intakes and mean EERs ranged from 377 to 441 calories (see Tables J.1A and J.1B in Appendix J). To the extent that the discrepancy between estimated energy intakes and estimated EERs is due to overreporting, the major implication is that the prevalence of inadequate nutrient intakes discussed in subsequent sections of this chapter may be underestimated for elementary school students. An alternative explanation for the discrepancy between mean usual energy intakes and mean EERs in this age group is that EERs are underestimated because a “low active” level of physical activity was assumed for all children.

Among middle and high school students, the relationship between mean usual energy intakes and mean EERs is reversed, with mean intakes falling below mean EERs. This may indicate a tendency for adolescents to underreport food intakes. To the extent that this is true, estimates of the prevalence of inadequate nutrient intakes discussed later in this chapter may be overstated.

There were no statistically significant differences between NSLP participants and matched nonparticipants in mean estimated EERs. However, NSLP participants, overall and in elementary schools and high schools, had significantly higher mean usual energy intakes than

¹⁰ One pound of body fat is equivalent to 3,500 kilocalories.

nonparticipants. At least part of this difference may be attributable to the fact that NSLP participants, by definition, consumed a lunch. As discussed previously, seven percent of nonparticipants (four percent of elementary school nonparticipants and eight percent of high school nonparticipants) did not consume a lunch or consumed only water at lunch.

2. Macronutrients

Table VI.6 presents data comparing usual macronutrient intakes of NSLP participants and nonparticipants to dietary standards. For total fat, linoleic acid, and linolenic acid, carbohydrate, and protein, data are presented on the proportion of participants and nonparticipants whose usual intakes were within the respective Acceptable Macronutrient Distribution Range (AMDR), as well as the proportion with usual intakes that exceeded or fell below the AMDR. For saturated fat, usual intakes are compared to the DGA that less than 10 percent of energy come from saturated fat. Carbohydrate and protein intakes are also compared to Estimated Average Requirements (EARs).

Overall, there were no statistically significant differences between NSLP participants and matched nonparticipants in the extent to which macronutrient intakes conformed to dietary standards. This is generally consistent with findings from the regression-adjusted 24-hour intakes (Table VI.4). For 70 percent or more of both NSLP participants and matched nonparticipants, usual daily fat intakes fell within the AMDR of 25 to 35 percent of total energy. For both participants and matched nonparticipants, the usual daily fat intakes of students whose intakes were not within the AMDR were much more likely to exceed the recommended range (consume more fat [as a percentage of energy] than recommended) than to fall below it.

Roughly 80 percent of both NSLP participants and matched nonparticipants had usual daily intakes of saturated fat that exceeded the DGA recommendation of less than 10 percent of total energy. In keeping with the comparatively high intakes of saturated fat, sizable proportions of

both NSLP participants and nonparticipants had usual daily intakes of the essential polyunsaturated fatty acids linoleic acid and linolenic acid that fell below the lower end of their respective AMDRs. This was particularly true for linolenic acid, for which the percentage of students with usual intakes that were less than the lower bound of the AMDR ranged from 59 to 97 percent. Usual daily carbohydrate and protein intakes of both NSLP participants and nonparticipants were generally consistent with the respective AMDRs, and inadequate intakes (usual intakes less than the EAR) of these two macronutrients were rare.

3. Vitamins and Minerals with Estimated Average Requirements

EARs have been defined for all of the vitamins examined in this study and for four of the eight minerals examined (iron, magnesium, phosphorus, and zinc) (see Chapter V). Table VI.6 shows the percentage of NSLP participants and matched nonparticipants whose usual daily intakes of these nutrients were inadequate (less than the EAR).¹¹ Findings from this analysis, with respect to differences between NSLP participants and matched nonparticipants, would not necessarily be consistent with findings from the preceding analysis of mean 24-hour intakes, even if both sets of estimates were regression-adjusted. Differences in mean intakes on one day do not necessarily translate into differences in adequacy, which is assessed by taking into consideration the distribution of *usual* nutrient intakes and the distribution of nutrient requirements.¹²

¹¹ The prevalence of inadequate intakes of iron was estimated using the probability approach (see Appendix H). It was not possible to test the significance of differences between participants and nonparticipants using this approach.

¹² For example, even if both groups have similar mean intakes, the percent with inadequate intakes (usual daily intakes below the relevant standard) may differ if the variance of usual intakes differs between the two groups. Conversely, the two groups may have similar levels of nutrient inadequacy even if there are significant differences in mean daily intakes.

Except for vitamin E, for which the prevalence of inadequacy was high for all groups of students, inadequate intakes of vitamins and minerals were rare among elementary school students, and there were no significant differences between elementary school NSLP participants and nonparticipants in the prevalence of inadequacy. Given the apparent tendency for food intakes of children in this age group to be overreported, it is possible that the prevalence of inadequacy was underestimated.

Among middle school students, the prevalence of inadequate intakes of several vitamins and minerals was notably greater, relative to elementary school students. This was true for vitamin A, vitamin C, magnesium, phosphorus, and zinc. Data broken down by gender indicate that the prevalence of inadequate intakes of all of these nutrients was notably higher for females than for males (see Appendix J). The nutrients for which the prevalence of inadequacy was greatest were vitamin A, vitamin E, magnesium, and phosphorus. For vitamin A and magnesium, middle school NSLP participants were significantly less likely than middle school matched nonparticipants to have inadequate intakes (29 versus 44 percent for vitamin A and 43 versus 62 percent for magnesium).

High school students—who have the highest nutrient requirements, relative to the other age groups considered in this study—had the greatest prevalence of inadequate intakes. This was particularly true for high school females (see Appendix J). Nutrients that were problematic for high school students included vitamin A, vitamin C, vitamin E, magnesium, phosphorus, and zinc. It is possible that these results are at least partially associated with underreported food intakes.

High school NSLP participants were significantly less likely than matched nonparticipants to have inadequate usual daily intakes of vitamin A (49 versus 64 percent), vitamin C (32 versus 48 percent), vitamin B₆ (less than 3 versus 20 percent), folate (4 versus 29 percent), thiamin (4

versus 22 percent), and phosphorus (16 versus 39 percent). Except for vitamin A, the differences between participants and nonparticipants are largely attributable to differences among females (see Appendix J).

As noted previously, the prevalence of inadequate intakes of vitamin E was high for students at all grade levels and for both NSLP participants and matched nonparticipants. This is consistent with most recent studies of vitamin E intake (Devaney et al. 2007). Devaney and colleagues considered a range of possible reasons for these findings (Devaney et al. 2007). They pointed out that the diets of most of the U.S. population do not meet the EAR for vitamin E, yet vitamin E deficiency is rare. They noted limitations of both the data used to establish the EAR and the data used to assess vitamin E intakes.

4. Calcium, Potassium, and Sodium

EARs have not been defined for calcium, potassium, or sodium (see Chapter V). For calcium and potassium, Adequate Intake levels (AIs) have been defined and for sodium, both an AI and a Tolerable Upper Intake Level (UL) have been defined. Assessment of students' usual intakes of calcium and potassium is limited to a comparison of mean usual intakes to the relevant AI. Usual mean intakes of calcium, sodium, and potassium are reported in Table VI.6 as the mean percentage of the relevant AI. If the usual mean intake is equivalent to 100 percent or more of the AI, the prevalence of inadequacy is likely to be low. If the usual mean intake falls below 100 percent of the AI, no firm conclusions can be drawn about the adequacy of usual intakes. Because public health concerns about sodium center around the problems associated with excessive sodium intake, the discussion focuses on the sodium UL (rather than the AI) and the proportions of children with usual intakes that exceed this benchmark.

a. Calcium

Among elementary school students, mean usual intakes of calcium of both NSLP participants and matched nonparticipants were more than 100 percent of the AI (Table VI.6). This indicates that the prevalence of inadequate calcium intakes in this age group is likely to be low. Among middle and high school students, mean usual calcium intakes were less than 100 percent of the AI. In both cases, mean usual calcium intakes of NSLP participants were significantly higher than mean usual calcium intakes of nonparticipants. Given the limitation of the AI standard, however, we cannot conclude that (1) mean usual intakes below 100 percent of the AI indicate that a high proportion of middle and high school students have inadequate usual calcium intakes, or (2) that the significant differences observed in the usual calcium intakes of NSLP participants and matched nonparticipants mean that NSLP participants are less likely than matched nonparticipants to have inadequate calcium intakes.

b. Potassium

Mean usual potassium intakes of students at all three school levels fell short of 100 percent of their respective AIs. Among middle school and high school students, NSLP participants had significantly greater mean usual intakes of potassium than matched nonparticipants. Interpretation of data on usual potassium intakes relative to the AI faces the same constraints as that for usual calcium intakes discussed above.

c. Sodium

More than three-quarters of NSLP participants and matched nonparticipants at all three school levels had usual sodium intakes that exceeded the UL. Among high school students, NSLP participants were significantly more likely than matched nonparticipants to have usual sodium intakes that exceeded the UL (96 versus 78 percent).

5. Fiber and Cholesterol

a. Fiber

On average, usual fiber intakes of all groups of students fell well below 100 percent of both age-and-gender specific AIs and the 14 grams per 1,000 kilocalorie benchmark on which the fiber AIs are based (Table VI.6). The AIs are defined for total fiber (dietary fiber and functional fiber), while the Survey Net nutrient database used in this study includes values only for dietary fiber.¹³ Thus, fiber intakes are underestimated, but not to an extent that would alleviate the marked disparities between recommendations and usual intakes apparent in these data.¹⁴ Mean usual fiber intakes were significantly greater for NSLP participants than for matched nonparticipants; however, mean intakes for both groups were still considerably below 100 percent of the AI. Differences in fiber intakes could be driven by consumption of more food or by consumption of foods higher in fiber. When examined on a gram-per-1,000 kilocalorie basis, differences between fiber intakes of participants and matched nonparticipants fell and were statistically significant only among middle school students. This suggests that much of the difference in overall fiber intakes can be explained by the fact that participants consumed more food (that is, more total grams of food) over the course of the day than matched nonparticipants, rather than more fiber-dense foods.

b. Cholesterol

In general, less than 10 percent of children had usual daily intakes of cholesterol that exceeded the DGA recommendation of less than 300 mg. The one exception was for high school

¹³ Dietary fiber consists of nondigestible carbohydrates and lignin that are intrinsic and intact in plants. Functional fiber consists of isolated, nondigestible carbohydrates that have beneficial physiological effects in humans. Total fiber is the sum of dietary fiber and functional fiber (Institute of Medicine 2002).

¹⁴ The IOM estimates that total fiber intakes are, on average, 5.1 grams higher than dietary fiber intakes (Institute of Medicine 2002).

students, among whom 21 percent of participants had intakes that exceeded the DGA. This finding was largely driven by a high prevalence of excessive cholesterol intakes among 14- to 18-year-old males (see Table J.37 in Appendix J). In this age-and-gender subgroup, 28 to 37 percent of students had cholesterol intakes that exceeded the DGA. There were no significant differences between NSLP participants and matched nonparticipants in the proportion of students with usual cholesterol intakes that exceeded the DGA recommendation.

F. TYPES OF FOOD CONSUMED BY NSLP PARTICIPANTS AND NONPARTICIPANTS

This section presents data on the types of food consumed at lunch and over 24 hours by NSLP participants and nonparticipants. Tables report the proportions of NSLP participants and nonparticipants who consumed at least one food within specific food groups (in any amount) at lunch and over 24 hours. All tabulations are based on the single 24-hour recall collected from all sample members.

1. Foods Consumed at Lunch

NSLP participants were about four times more likely than nonparticipants to consume milk at lunch (75 versus 19 percent) (Table VI.7). This pattern was noted for students in elementary, middle, and high schools alike and is consistent with differences observed in mean lunch intakes of protein (as a percentage of energy intake), vitamin A, vitamin B₁₂, riboflavin, calcium, and phosphorus.

For both participants and nonparticipants, the percentage of students consuming milk decreased from elementary school to middle school and from middle school to high school. The decline from elementary school to high school was notably more dramatic for nonparticipants (from 30 to 9 percent; a 70 percent decrease) than for participants (from 83 to 60 percent;

TABLE VI.7

MOST COMMONLY CONSUMED FOODS AT LUNCH BY NSLP PARTICIPANTS AND NONPARTICIPANTS, BY SCHOOL TYPE

	Percentage of Students Consuming at Least Once at Lunch													
	Elementary School Students				Middle School Students				High School Students				All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants		
Milk	83	30**	65	18**	60	9**	75	19**						
1%	48	14**	32	11**	29	4**	41	9**						
Skim or nonfat	21	4**	16	2**	14	1**	19	3**						
2%	13	10	14	3**	13	3**	13	6**						
Flavored ^a	57	14**	41	9**	38	4**	50	9**						
Vegetables	51	24**	45	22**	54	24**	51	23**						
French fries/similar potato products	20	11	24	14**	34	17**	24	14**						
White potatoes	8	1*	4	1*	8	1*	7	1**						
Green salads (non-entree)	8	5	4	4	2	2	6	4						
Corn	8	6	4	1	4	1*	6	3						
Deep yellow/dark green	8	5	4	4	2	2	6	4						
Other vegetables ^b	7	3*	5	1*	3	1*	6	2**						
Fruits and Juices	55	45	26	29	32	18**	45	30**						
Canned fruit ^c	25	9**	11	5*	14	2**	20	6**						
Fresh fruit	22	28	7	17**	8	12	16	19						
Fruit juice, 100%	11	14	8	8	15	4**	11	8						
Combination Entrees	64	67	78	59**	80	59**	70	62**						
Pizza with meat	8	3	18	8**	12	8*	11	6*						
Pizza without meat	11	2**	7	1*	7	1**	10	2**						
Mexican style entrees	7	7	13	4*	6	8	8	7						
Sandwiches with plain meat, poultry, or fish	5	19**	4	18**	16	15	7	17**						
Sandwiches with breaded/fried meat, poultry, or fish	4	0	6	1**	10	5*	5	2*						
Hamburgers and similar beef/pork sandwiches	8	1*	5	0*	3	1*	6	1**						

TABLE VI.7 (continued)

	Percentage of Students Consuming at Least Once at Lunch											
	Elementary School Students			Middle School Students			High School Students			All Students		
	Participants	Nonparticipants		Participants	Nonparticipants		Participants	Nonparticipants		Participants	Nonparticipants	
Hot dog, corn dog, similar sausage sandwiches	6	1*	3	3	3	4	4	1	5*	2*		
Cheeseburgers and similar beef/pork sandwiches	3	2	8	3*	3	9	4	4	5	3		
Peanut butter sandwiches	5	24**	2	13**	1	1	8**	4	4	15**		
Mixtures with a pasta or noodle base ^d	1	2	5	2	2	6	2	2	3	2		
Meat/Meat Alternates ^e	37	35	18	20	20	20	19	19	29	25		
Breaded/fried chicken nuggets, patties, similar products	22	11	9	8	10	10	8	8	17	9*		
Meat (beef, pork, lamb, veal)	3	3	4	2*	4	4	1	1	4	2		
Other (cheese, eggs, nuts)	5	8	3	7	3	3	6	6	4	7		
Grains/Breads ^e	35	38	31	35	32	32	27	27	34	33		
White breads, rolls, bagels, and other plain breads	15	7	11	5*	7	7	4	4	12	5**		
Corn/tortilla chips	8	13	11	17*	10	10	10	10	9	13**		
Crackers and pretzels	9	20	5	13**	5	5	7	7	7	13*		
Other Desserts and Snacks	40	62**	38	49	33	33	44*	44*	38	52**		
Cookies, cakes, brownies	19	25	20	20	16	16	15	15	18	20		
Candy	5	17**	8	12	13	13	18	18	7	16**		
Dairy-based desserts (ice cream, pudding)	10	12	5	3	3	3	3	3	7	6		
Snack chips (popcorn, potato chips)	4	13**	5	12**	4	4	11**	11**	4	12**		
Dessert items that contain fruit or juice ^f	4	12**	2	5	1	1	2	2	3	6*		
Grain and fruit cereal bars, granola bars	1	6	0	4*	1	1	7**	7**	1	6**		

TABLE VI.7 (continued)

	Percentage of Students Consuming at Least Once at Lunch									
	Elementary School Students		Middle School Students		High School Students		All Students			
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Other beverages	8	46**	28	56**	35	64**	18	56**		
Juice drinks (not 100% juice)	4	31**	15	32**	16	21	9	27**		
Carbonated soda	1	8**	4	11*	8	25**	3	16**		
Bottled water	3	7*	4	10**	9	16*	4	11**		
Tea/coffee	1	1	6	5	7	8	3	5		
Number of Students	531	189	497	259	358	394	1,386	842		

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample excludes students who did not consume a lunch. Lunch intakes of both NSLP participants and nonparticipants include all foods and beverages consumed at lunch. For NSLP participants, this may include, in addition to foods/beverages obtained as part of the reimbursable lunch, foods/beverages that were obtained in school from non-reimbursable sources and/or foods that were brought from or consumed at home.

Note: Table is limited to minor food groups consumed by at least five percent of participants for one or more school type.

^aIncludes all flavored skim, 1%, 2%, and whole milk.

^bIncludes other cooked and raw vegetables.

^cIncludes sweetened and unsweetened canned fruit.

^dIncludes spaghetti with meat sauce, macaroni and cheese, lasagna, etc.

^eFood items not included as part of a combination entree.

^fIncludes fruit juice bars and fruited gelatin.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

a 28 percent decrease). Nearly all the milk consumed by both participants and nonparticipants at lunch was reduced-fat (1% or 2%) or nonfat. NSLP participants were more likely than nonparticipants to consume flavored milk at lunch (50 versus 9 percent).¹⁵

There were also substantial differences between NSLP participants and nonparticipants in the consumption of vegetables at lunch. Roughly one-half of all NSLP participants consumed at least one vegetable (as a distinct food item) at lunch, compared with 23 percent of nonparticipants. This pattern was noted in all three school levels and was driven primarily by differences in potato consumption. In middle and high schools, NSLP participants were significantly more likely than nonparticipants to consume French fries/tater tots at lunch, and across all three grade levels, participants were significantly more likely than nonparticipants to consume white potatoes at lunch. Differences in potato consumption are consistent with observed differences in mean lunch intakes of potassium.¹⁶

Among high school students, NSLP participants were significantly more likely than nonparticipants to consume fruit or 100% juice at lunch (32 versus 18 percent). Most of this difference was attributable to differences in the percentage of students who consumed canned fruit and 100% juice; there was no significant difference in the percentage of high school participants and nonparticipants who consumed fresh fruit.

Among elementary and middle school students, there were no differences between NSLP participants and nonparticipants in the percentage who consumed at least one type of fruit or 100% juice at lunch. However, among elementary and middle school students, NSLP

¹⁵ Nearly all flavored milk was reduced-fat or nonfat.

¹⁶ One medium serving of oven-baked French fries (114 gm) provides 474 mg of potassium. This is more potassium than is provided by one medium banana (422 mg)—a food that is frequently cited as being high in potassium.

participants were more likely than nonparticipants to consume canned fruit (25 versus 9 percent and 11 versus 5 percent). Middle school NSLP participants were also *less* likely than nonparticipants to consume fresh fruit (7 versus 17 percent).

With regard to entrees, NSLP participants were more likely to consume pizza; sandwiches with breaded chicken, fish or meat; hamburgers; hot dogs; and breaded chicken products (such as nuggets, patties, poppers, and tenders), while nonparticipants were more likely to consume plain meat sandwiches (such as turkey or ham) or peanut butter sandwiches. Although equally likely to consume a separate grain/bread item at lunch, NSLP participants were more likely to consume a slice of bread, a roll, or a similar bread product. Nonparticipants were more likely to consume corn/tortilla chips, crackers, and pretzels. These patterns were noted at all three school levels, but differences were not consistently significant.

NSLP participants were significantly *less* likely than nonparticipants to consume desserts and other snack foods at lunch (38 versus 52 percent). Among elementary school students, NSLP participants were less likely than nonparticipants to consume candy, snack chips, and dessert items containing fruit (such as fruit juice bars and fruited gelatin). Among middle and high school students, NSLP participants were less likely than nonparticipants to consume snack chips and cereal/granola bars.

Finally, NSLP participants were significantly less likely than nonparticipants to consume beverages other than milk or 100% juice at lunch (18 versus 56 percent). The two most common alternative beverages were juice drinks and carbonated sodas. Consumption of carbonated sodas was highest among high school students. One-quarter of high school nonparticipants consumed a carbonated soda at lunch (compared with eight percent of participants).

2. Foods Consumed Over 24 Hours

Analysis of foods consumed over the full 24-hour period indicates that some of the differences observed between NSLP participants and nonparticipants at lunch persisted over the course of the day, and some were counterbalanced by foods consumed at other meals and snacks. Over 24 hours, NSLP participants were still significantly more likely than nonparticipants to consume milk (88 versus 69 percent) (Table VI.8). Whole milk was consumed more often than it was at lunch by both NSLP participants and nonparticipants, and NSLP participants were significantly more likely than nonparticipants to consume whole milk (19 versus 12 percent). This difference was concentrated among elementary school students and, given the results observed at lunch (Table VI.7), was associated with differences in the type of milk consumed at eating occasions other than lunch.

NSLP participants were also more likely than nonparticipants to consume at least one vegetable (as a discrete food item) over the course of the day (72 versus 59 percent). French fries/tater tots continued to be the most commonly consumed vegetable for both participants and nonparticipants. In addition, for students in all three types of schools, NSLP participants were significantly more likely than nonparticipants to consume French fries at least once in a day, and participants at the elementary and high school levels were significantly more likely than nonparticipants to consume other white potatoes at least once a day.

With regard to fruit and 100% juice, the general patterns observed in food intakes at lunch persisted over 24 hours, but the statistical significance of differences was not always consistent. Among middle school students, the difference between NSLP participants and nonparticipants in the proportion of students who consumed fresh fruit was no longer significant, but the difference in the proportion who consumed canned fruit (higher for NSLP participants) was significant.

TABLE VI.8

MOST COMMONLY CONSUMED FOODS OVER 24 HOURS BY NSLP PARTICIPANTS AND NONPARTICIPANTS, BY SCHOOL TYPE

	Percentage of Students Consuming at Least Once in a Day											
	Elementary School Students		Middle School Students		High School Students		All Students					
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants				
Milk	93	80**	83	66**	78	61**	88	69**				
1%	56	29**	38	22**	34	14**	48	21**				
2%	46	54	38	26**	35	29	42	37				
Skim or nonfat	25	10**	21	10**	17	8*	23	9**				
Whole	22	13**	15	14	16	11	19	12**				
Flavored ^a	61	19**	44	11**	40	6**	53	12**				
Vegetables	73	63*	64	56*	75	56**	72	59**				
French fries/similar potato products	31	20*	31	23*	43	27**	33	24**				
White potatoes	18	9*	11	14	22	11**	18	11**				
Other vegetables ^b	18	20	12	11	11	7	16	13				
Corn	14	15	9	5	8	5	12	8				
Deep yellow/dark green	14	16	10	12	7	8	12	11				
Green salads (non-entree)	11	9	12	6*	12	11	11	9				
Legumes	8	5	4	2	6	3*	7	4*				
Fruits and Juices	82	72	61	62	63	57	74	63**				
Fruit juice, 100%	50	41	35	32	40	33	45	36**				
Fresh fruit	43	47	31	38	27	35*	37	40				
Canned fruit ^c	28	13**	13	6*	16	5**	23	8**				
Combination Entrees	87	83	93	87*	93	82**	89	83*				
Mixtures with a pasta or noodle base ^d	23	21	21	17	22	19	22	19				
Pizza with meat	16	6*	24	15*	20	13*	18	11**				
Mexican style entrees	18	13	20	15	19	19	19	16				
Sandwiches with plain meat, poultry, or fish	12	21*	14	23*	22	23	14	22**				
Pizza without meat	16	6**	9	5	9	4*	13	5**				

TABLE VI.8 (continued)

	Percentage of Students Consuming at Least Once in a Day									
	Elementary School Students		Middle School Students		High School Students		All Students			
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Cheeseburgers and similar beef/pork sandwiches	8	3*	12	7*	14	10	10	10	7*	7*
Hot dog, corn dog, similar sausage sandwiches	12	3**	8	7	6	5	10	10	5**	5**
Other mixtures ^e	7	9	9	12	12	9	9	9	9	9
Hamburgers and similar beef/pork sandwiches	11	3*	7	3	6	3	9	9	3**	3**
Peanut butter sandwiches	10	25**	5	15**	4	9*	8	8	16**	16**
Sandwiches with breaded/fried meat, poultry, or fish	4	1	8	1**	12	5*	6	6	3*	3*
Entree salads	5	3	5	3	8	4	5	5	4	4
Breakfast sandwiches ^f	1	2	3	1	5	5	2	2	3	3
Meat/Meat Alternates ^g	72	74	55	64*	60	59	66	66	66	66
Breaded/fried chicken nuggets, patties, similar products	34	25	21	17	24	20	29	29	21*	21*
Meat (beef, pork, lamb, veal)	19	13*	17	15	20	16	19	19	15*	15*
Other protein (cheese, eggs, nuts)	20	25	20	25	17	21	19	19	23	23
Plain (not breaded/fried) chicken or turkey	9	18**	6	9	7	7	8	8	12*	12*
Grains/Breads ^g	94	93	88	85	84	78*	90	90	85**	85**
Cold cereal	40	52*	39	34	30	33	38	38	40	40
White breads, rolls, bagels, and other plain breads	29	19*	26	22	24	16**	28	28	18**	18**
Whole-grain breads and rolls	6	3*	5	6	7	8	6	6	6	6
Corn/tortilla chips	21	22	24	27	23	18*	22	22	21	21
Crackers and pretzels	27	35	18	24	11	18**	22	22	26	26
Sweet rolls, doughnuts, toaster pastries, fruit turnovers, coffee cake	18	13	12	9	16	11	17	17	11**	11**
Rice	12	18	14	11	10	10	12	12	13	13

TABLE VI.8 (continued)

	Percentage of Students Consuming at Least Once in a Day									
	Elementary School Students		Middle School Students		High School Students		All Students			
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Pancakes, waffles, French toast	16	17	7	10	8	3**	12	9		
Biscuits, croissants, cornbread	6	5	6	6	11	6*	7	5		
Buttered toast, bagels with cream cheese	6	3	7	2*	4	5	5	4*		
Muffins, sweet/quick Breads	5	5	4	4	2	2	4	4		
Other Desserts and Snacks	83	87	78	79	80	77	81	81		
Cookies, cakes, brownies	43	52	41	38	39	37	42	43		
Candy	28	39	31	38	43	39	32	39*		
Dairy-based desserts (ice cream, pudding)	24	30	19	13	16	15	22	20		
Gelatin (non-fruited), ice pops	10	7	8	4	5	4	8	5*		
Snack chips (popcorn, potato chips)	21	26	23	23	18	21	21	23		
Dessert items that contain fruit or juice ^h	9	17**	6	8	3	3	7	9		
Grain and fruit cereal bars, granola bars	6	9	5	10	7	15**	6	12**		
Other beverages	71	75	85	90*	84	92**	77	86**		
Carbonated soda	39	30*	54	51	52	56	45	46		
Juice drinks (not 100% juice)	36	52**	41	57**	38	41	37	49**		
Bottled water	17	16	21	29*	27	37	20	28*		
Tea/coffee	9	8	17	16	25	21	14	15		
Number of Students	531	201	497	290	358	437	1,386	928		

TABLE VI.8 (continued)

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample includes all students, including those who did not consume a lunch.

Note: Table is limited to minor food groups consumed by at least five percent of participants for one or more school type.

^aIncludes all flavored skim, 1%, 2%, and whole milk.

^bIncludes other cooked and raw vegetables.

^cIncludes sweetened and unsweetened canned fruit.

^dIncludes spaghetti with meat sauce, macaroni and cheese, lasagna, etc.

^eIncludes chili, beef stew, egg rolls, frozen meals.

^fIncludes sandwiches with sausage, egg, cheese, ham or other types of meat on a biscuit, English muffin, bagel, or croissant.

^gFood items not included as part of a combination entree.

^hIncludes fruit juice bars and fruited gelatin.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

Among high school students, NSLP participants continued to be more likely than nonparticipants to consume 100% juice and canned fruit. Over 24 hours, high school NSLP participants were less likely than nonparticipants to consume fresh fruit.

Over 24 hours, NSLP participants continued to be more likely than nonparticipants to consume pizza; hot dogs; hamburgers; sandwiches with breaded chicken, fish or meat; and breaded chicken products. Nonparticipants continued to be more likely to consume plain meat sandwiches and peanut butter sandwiches. In addition, NSLP participants were more likely than nonparticipants to consume cheeseburgers (this difference was also noted for middle school students at lunch) and red meat, while nonparticipants were more likely than participants to consume plain (not breaded) chicken or turkey and other protein sources (cheese, eggs, or nuts).

Many of the differences noted at lunch in the proportion of NSLP participants and nonparticipants who consumed desserts and snack foods dissipated over the course of the day, indicating that NSLP participants who did not consume these foods at lunch obtained them from other sources. Over 24 hours, there was no difference between NSLP participants and nonparticipants in the percentage of students who consumed one or more snack or dessert items (8 out of 10 students, overall) or in the percentage who consumed snack chips (roughly 1 out of 5, overall). The percentage of NSLP participants who consumed candy remained significantly lower than the percentage of nonparticipants, but the magnitude of the proportional difference was smaller over 24 hours than at lunch: 7 versus 16 percent at lunch (Table VI.7), compared with 32 versus 39 percent over 24 hours (Table VI.8). The difference between NSLP participants and nonparticipants in the percentage of students who consumed dessert items containing fruit remained significant for elementary school students, but was not significant overall. Similarly, while the difference between participants and nonparticipants in the

percentage who consumed cereal/granola bars remained significant overall, the difference was concentrated among high school students.

The difference between NSLP participants and nonparticipants in the proportion of students who consumed carbonated sodas dissipated over 24 hours. Over the course of the day, the proportions of participants and nonparticipants who consumed carbonated soda at least once were identical. Moreover, among elementary school students, the proportion who consumed carbonated soda was significantly *higher* for NSLP participants than for nonparticipants (39 versus 30 percent). Nonparticipants continued to be more likely than NSLP participants to consume fruit drinks and bottled water.

G. FOOD SOURCES OF ENERGY AND KEY NUTRIENTS IN LUNCHESES CONSUMED BY NSLP PARTICIPANTS AND NONPARTICIPANTS

The relative importance of a food as a source of a particular nutrient is influenced by both the concentration of the nutrient in the food and the frequency of its consumption. For example, pizza is not a concentrated source of zinc, but, because it was so frequently consumed, it may have made an important contribution to students' zinc intakes at lunch. Conversely, even though very few children consumed carrots at lunch (see Table VI.7; only two to eight percent of students in any participant/school level subgroup consumed any type of deep yellow or dark green vegetable), carrots, which are a concentrated source of vitamin A, may have contributed a high percentage of students' vitamin A intakes at lunch.

Information about the relative contributions of various foods and food groups to lunch intakes of energy and nutrients can provide insights about foods that are making major contributions to intakes of specific nutrients and foods that may be driving differences observed in the nutrient intakes of NSLP participants and nonparticipants. The approach used in this analysis was adapted from methods developed by Krebs-Smith (1992) and later expanded by

Subar and colleagues (1998). An important difference is that this analysis considered foods as they were offered to and consumed by students rather than breaking combination foods down into their constituent ingredients. So, for example, pizza was considered as a whole food rather than as cheese, bread, tomato sauce, and, where appropriate, meat.

The analysis used data from the single 24-hour recall completed by all students. All reported foods were further divided into 103 minor food source groups.¹⁷ Population proportions were calculated to estimate the contribution of each food source group to lunch intakes of energy and nutrients. This was done by summing the weighted amount of a given nutrient provided by a given food group for all individuals in the sample and dividing by the total weighted amount of that nutrient consumed by all individuals. Differences between NSLP participants and nonparticipants were tested for statistical significance on the basis of two-tailed t-tests, using SUDAAN statistical software.

Major findings are summarized in the sections that follow, focusing on selected nutrients for which significant differences were observed between NSLP participants and nonparticipants in regression-adjusted mean lunch intakes (see Section C). Detailed tabulations are presented in Appendix K; these tabulations show, for energy and all nutrients and dietary components examined in this study, the food source groups that contributed two percent or more to lunch intakes of NSLP participants or nonparticipants. Data are presented for the overall sample (Tables K.1 through K.7) and by school level (Tables K.8 through K.28).

¹⁷ The food source groups are comparable but not identical to the minor food groups used to describe food choices of NSLP participants and nonparticipants (see Appendix D, Table D.1).

1. Energy

There were numerous significant differences between NSLP participants and nonparticipants in the relative contributions of beverages, entrees, and extras to lunch energy intakes. With regard to beverages, NSLP participants obtained significantly more lunch energy than nonparticipants from 1% flavored milk and skim or nonfat unflavored milk, and significantly less lunch energy from juice drinks and carbonated sodas (Table K.1). Relative to nonparticipants, NSLP participants also obtained significantly more of their lunch energy from pizza and pizza products and from hamburgers/cheeseburgers and significantly less of their lunch energy from peanut butter sandwiches and plain meat/poultry sandwiches.¹⁸ Condiments and spreads and bread, rolls, and bagels consumed as extras (not as part of a combination entree) made significantly greater contributions to the lunch energy intakes of NSLP participants, relative to nonparticipants. On the other hand, corn/tortilla chips, other snack chips, candy, and crackers and pretzels made significantly smaller contributions to the lunch energy intakes of NSLP participants than to those of nonparticipants.

2. Saturated Fat

NSLP participants obtained a significantly greater share of their saturated fat intakes at lunch from pizza and pizza products, milk (1% flavored, 2% flavored, 2% unflavored), and salad dressings than nonparticipants (Table K.1). In contrast, nonparticipants obtained significantly greater shares of their saturated fat intakes at lunch from plain meat/poultry sandwiches, peanut butter sandwiches, corn/tortilla chips, candy, other snack chips, and crackers and pretzels.

¹⁸ Plain meat/poultry sandwiches included sandwiches with ham, sliced chicken or turkey, roast beef, or other plain meats. Hamburgers/cheeseburgers and a number of other types of sandwiches were considered separately. See Appendix D, Table D.1 for a list of the subgroups of sandwiches used.

3. Carbohydrate

NSLP participants obtained a significantly greater share of their carbohydrate intakes at lunch from pizza and pizza products, hamburgers and cheeseburgers, flavored milks (1% and skim/nonfat), extra bread and rolls, and condiments and spreads than nonparticipants (Table K.2). Nonparticipants obtained significantly greater shares of their carbohydrate intakes at lunch from juice drinks, carbonated sodas, plain meat/poultry sandwiches, peanut butter sandwiches, corn/tortilla chips, candy, other snack chips, and crackers and pretzels.

4. Vitamin A

Milk (1% flavored and skim/nonfat) and pizza and pizza products made significantly greater contributions to NSLP participants' lunch intakes of vitamin A than to nonparticipants' intakes (Table K.3). The reverse was true for plain meat/poultry sandwiches, hamburgers and cheeseburgers, cheese, juice drinks, and granola/cereal bars.

5. Vitamin B₆

Findings for vitamin B₆ mirror findings for other nutrients, with pizza and pizza products, hamburgers and cheeseburgers, and milk (1% flavored, skim/nonfat flavored, and 1% unflavored) accounting for a greater share of NSLP participants' lunch intakes than nonparticipants' and plain meat/poultry sandwiches, peanut butter sandwiches, corn/tortilla chips, other snack chips, crackers and pretzels, and granola/cereal bars accounting for a greater share of nonparticipants' lunch intakes than participants' (Table K.4). In addition, white potatoes (other than French fries) contributed a significantly greater share of NSLP participants' lunch intakes of vitamin B₆ than nonparticipants'.

6. Vitamin B₁₂

Milk (1% flavored, skim/nonfat flavored, and 1% unflavored) made more significant contributions to lunch intakes of vitamin B₁₂ for NSLP participants than for nonparticipants (Table K.4). Plain meat/poultry sandwiches, yogurt, and cheese made significantly larger contributions to lunch intakes of vitamin B₁₂ for nonparticipants than for participants.

7. Calcium

NSLP participants obtained significantly greater shares of their lunch calcium intakes from milk (1% flavored and skim/nonfat flavored) and pizza and pizza products than nonparticipants (Table K.5). Nonparticipants, on the other hand, obtained significantly greater shares of their calcium intakes at lunch from various types of sandwiches (which may have included cheese), cheese, yogurt, and juice drinks than NSLP participants.

8. Iron

Pizza and pizza products, hamburgers and cheeseburgers, breaded/fried chicken products, and milk (1% flavored and skim/nonfat flavored) accounted for significantly larger shares of participants' lunch intakes of iron than nonparticipants' (Table K.5). Peanut butter sandwiches, crackers and pretzels, corn/tortilla chips, juice drinks, and granola/cereal bars provided significantly greater shares of nonparticipants' lunch intakes of iron than participants'.

9. Sodium

Relative to nonparticipants, NSLP participants obtained significantly greater shares of their sodium intakes at lunch from pizza and pizza products, condiments and spreads, 1% flavored milk, and salad dressings, and significantly smaller shares from plain meat/poultry sandwiches, peanut butter sandwiches, crackers and pretzels, and corn/tortilla chips (Table K.6).

H. COMPETITIVE FOODS CONSUMED BY NSLP PARTICIPANTS AND NONPARTICIPANTS AND THEIR ENERGY/NUTRIENT CONTRIBUTIONS

In recent years, interest in the healthfulness of foods offered in school meal programs has expanded to include competitive foods—foods and beverages sold on an a la carte basis in school cafeterias or through vending machines, snack bars, school stores, or other venues that may be operated by departments or groups other than the school foodservice program (Weschler 2001; French and Stables 2003; French 2003; Samuels & Associates 2006; U.S. General Accounting Office 2005). Chapter IV in Volume 1 of this report provides information about the availability of competitive foods in schools and the types of foods available in different competitive food venues. In this section, we present data on the prevalence of competitive food consumption among NSLP participants and nonparticipants, the sources of competitive foods, the times of day competitive foods were consumed, the types of foods consumed, and the contribution of competitive foods to students' energy and nutrient intakes at lunch and over the course of the school day. All data are based on the single 24-hour recall completed by all respondents. The findings presented are strictly descriptive and have not been adjusted for differences in observed characteristics of participants and nonparticipants. The statistical significance of differences between participants and nonparticipants was tested using two-tailed t-tests, adjusted for the complex sample design with the SUDAAN software.

Competitive food sources in each school were identified by dietary interviewers prior to interviewing students, and specific codes were assigned to each source so they could be identified in the dietary recall data. Vending machines were differentiated by location: in the cafeteria, within 20 feet of the cafeteria, or some other location. School stores and snack bars were identified separately, as were food carts and other points of sale where all foods and beverages were sold on a strictly a la carte basis. Foods that students reported obtaining from

class parties, school fundraisers, or from teachers as rewards were also coded as competitive foods. Dietary recalls, however, did not distinguish foods that might have been purchased a la carte from points of sale that offered both reimbursable and a la carte items, regardless of whether that item appeared on the school menu. For this reason, the data presented here should be considered a *lower-bound estimate* of the prevalence of and energy and nutrient contributions of competitive foods.

1. Consumption of Competitive Foods Among NSLP Participants and Nonparticipants

At all school levels, NSLP participants were less likely than nonparticipants to consume competitive foods (Table VI.9). Overall, nonparticipants were almost twice as likely as NSLP participants to consume one or more competitive foods throughout the school day (37 versus 19 percent). Consumption of competitive foods increased for both participants and nonparticipants from elementary schools to middle schools and from middle schools to high schools. Among high school students, more than about a third (34 percent) of NSLP participants and 46 percent of nonparticipants consumed one or more competitive foods.

a. Sources of Competitive Foods

Among elementary school students, the most common source of competitive foods was classroom parties, rewards from teachers, bake sales, and other fundraisers. Eleven percent of elementary school NSLP participants and 16 percent of nonparticipants reported consuming one or more items from such sources (Table IV.9). The next most common source of competitive foods among elementary school students was vending machines. Nonparticipants were more likely than NSLP participants to consume foods or beverages from a vending machine (13 versus 2 percent). Most vending machine items were obtained from vending machines that were

TABLE VI.9

PERCENTAGE OF NSLP PARTICIPANTS AND NONPARTICIPANTS WHO CONSUMED ONE OR MORE COMPETITIVE FOODS,
BY SOURCE AND TIME OF DAY

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
	Percent of Students		Percent of Students		Percent of Students		Percent of Students	
Where Competitive Food Was Obtained								
Any source	14	25	18	37**	34	46**	19	37**
Vending machine	2	13*	8	14	16	25**	6	19**
In cafeteria	1	13*	2	6	5	6	2	8*
Within 20 feet of cafeteria	0	0	2	1	4	7	2	3
Other location	0	0	4	7	8	14	3	7**
Sources other than vending	12	21	11	32**	24	33*	14	29**
School store	1	2	2	2	4	6	2	4
Snack bar	0	0	2	9*	6	6	2	4*
A la carte-only points of sale	0	4	3	18**	6	19**	2	13**
Fundraisers, class parties, rewards, other	11	16	5	7	9	6	10	10
When Competitive Food Was Consumed								
As part of breakfast	2	5	1	3	11	11	4	7*
As part of lunch	6	17*	12	33**	23	38**	11	29**
Other time, at school	6	11	5	7	8	9	6	9
Other time, outside of school	1	5	1	1	3	1	2	2
Number of Students	531	201	497	290	358	437	1,386	928

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample includes all children, including those who did not consume a lunch.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

located in school cafeterias. School stores, snack bars, and strictly a la carte points of sale were not common in elementary schools, and consumption of foods from these sources was reported by less than one percent of NSLP participants and less than five percent of nonparticipants.

Among middle school students, the most common source of competitive foods for NSLP participants was vending machines (8 percent), while the most common source for nonparticipants was strictly a la carte points of sale (other than snack bars and school stores) (18 percent). NSLP participants were less likely than nonparticipants to consume foods from snack bars (2 versus 9 percent) and from other strictly a la carte points of sale (3 versus 18 percent).

Among high school students, vending machines were the leading source of competitive foods for both NSLP participants and nonparticipants. Nonetheless, NSLP participants were less likely than nonparticipants to consume foods and beverages from vending machines (16 versus 25 percent). NSLP participants were also less likely than nonparticipants to consume foods obtained from strictly a la carte points of sale (other than snack bars and school stores) (6 versus 19 percent).

b. When Competitive Foods Are Consumed

Overall, competitive foods were most commonly consumed at lunch (Table VI.9). In all three types of schools, nonparticipants were more likely than NSLP participants to consume a competitive food at lunch (29 versus 11 percent, overall).¹⁹ Consumption of competitive foods at breakfast was uncommon (reported by five percent of students or less) in elementary and middle schools. However, among high school students, 11 percent of both NSLP participants and nonparticipants consumed one or more competitive foods at breakfast. There were no significant

¹⁹ The breakfast and lunch meals used in this analysis are the same as those used in the main analysis of lunch and breakfast intakes and are defined based on time of day and the name the student used to describe the eating occasion. See Section A.3 in Chapter V.

differences between NSLP participants and nonparticipants in the proportion who consumed competitive foods at school but at a time other than breakfast or lunch, or in the proportion of students who consumed competitive foods outside of school at a time other than breakfast or lunch.

c. Types of Foods and Beverages Consumed as Competitive Foods

Table VI.10 presents data on the types of competitive foods consumed by students. The table is limited to students who consumed one or more competitive foods at any time during the day. There were some differences between NSLP participants and nonparticipants in the types of competitive foods that were most commonly consumed, with nonparticipants being more likely than participants to consume most types of competitive foods. However, several findings were quite similar for the two groups of students.

Overall, among NSLP participants, the most common competitive foods were desserts and snacks (consumed by 53 percent of students who consumed one or more competitive foods), beverages other than milk (consumed by 37 percent of these students), and grain/bread products (consumed by 26 percent of these students). Within these categories, the specific foods most commonly consumed included candy (28 percent), cookies, cakes, and brownies (18 percent), carbonated sodas (16 percent), crackers and pretzels (14 percent), and juice drinks (13 percent). Among nonparticipants overall, desserts and snacks, beverages other than milk, and grain/bread products were also the three most commonly consumed types of competitive foods (50, 47, and 27 percent of students, respectively). In addition, 24 percent of nonparticipants consumed combination entrees that were sold as competitive foods, 17 percent consumed milk as a competitive food, and about 11 percent each obtained a meat/meat alternate, fruit, or a vegetable

TABLE VI.10

MOST COMMONLY CONSUMED COMPETITIVE FOODS BY NSLP PARTICIPANTS AND NONPARTICIPANTS,
BY SCHOOL TYPE

	Elementary School Students			Middle School Students			High School Students			All Students		
	Participants	Nonparticipants	Percent of Students	Participants	Nonparticipants	Percent of Students	Participants	Nonparticipants	Percent of Students	Participants	Nonparticipants	Percent of Students
Milk	1	37**		2	19*		2	7*		1	17**	
Flavored	0	17**		2	9		1	5*		1	9**	
Unflavored	1	22**		0	9**		1	3		1	9*	
Skim and 1%		29*		2	15		0	3**		0	12*	
Whole and 2%	1	8		0	2.		0	4		1	4.	
Vegetables	0	10		0	20**		3	9		1	12**	
French fries ^a	0	5		0	17**		3	4		1	7**	
Fruits and Juices	13	19		1	10**		6	8		8	11	
Fruit juice, 100%	11	0*		1	4		6	6		7	4	
Combination Entrees	5	10		4	34**		2	26**		3	24**	
Pizza	4	4		3	16*		2	11**		3	10**	
Mexican Entrees	1	4		0	4		0	9**		0	7**	
Sandwiches	0	1		0	13*		0	4*		0	5**	
Meat/Meat Alternates	0	12		3	15		0	9**		1	11**	
Breaded chicken patties and nuggets	0	5		0	11		0	4*		0	5**	
Grains/Breads	32	36		13	20		25	25		26	27	
Corn/tortilla chips ^a	0	5		8	14		14	12		7	11	
Crackers and pretzels	26	13		5	2		5	6		14	7*	
Breads, rolls, and other breads	3	10		0	2		5	4		3	5	
Muffins, doughnuts, sweet rolls, toaster pastries ^a	1	5		0	3		3	4		2	4	
Desserts and Snacks ^a	61	61		42	47		51	45		53	50	
Ice cream and pudding	4	22		7	3		4	1		5	7	
Cookies, cakes, brownies	17	22		13	19		22	17		18	19	
Candy	38	38		14	18		25	20		28	24	
Potato chips and popcorn	7	10		10	7		5	10		7	9	
Beverages other than milk	12	12		50	52		58	60		37	47	
Carbonated soda ^a	4	4		30	15		22	25		16	17	
Juice drinks (not 100% juice) ^a	5	6		15	30*		22	17		13	17	
Bottled water	3	2		3	6		11	20		6	12*	
Number of Students	74	43		92	107		119	196		285	346	

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample includes only children who consumed one or more competitive foods.

^a Considered a low-nutrient/energy-dense food in the analyses presented in Tables VI.11 to VI.13.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

(mainly French fries) from a competitive food source. The leading specific competitive food choices among nonparticipants, as among participants, were candy, cakes, cookies, and brownies, carbonated soda, and juice drinks. NSLP participants were less likely than nonparticipants to consume competitive foods that were comparable to NSLP meal components: combination entrees, meats/meat alternates, milk, and vegetables (French fries). This pattern is noted for nonparticipants in both middle and high schools and reflects the fact that many of the nonparticipants at these school levels who consumed competitive foods relied on competitive food sources for their lunch meal.

Roughly 60 percent of elementary school participants and nonparticipants who consumed competitive foods consumed desserts and snacks. The most common selections within this category were candy and cakes, cookies, and brownies. Among both middle school and high school students, beverages other than milk were the most common competitive foods for both participants and nonparticipants. Among students who consumed one or more competitive foods, about 50 percent of middle school students and roughly 60 percent of high schools students consumed a beverage other than milk. Across almost all groups of students examined, carbonated sodas and fruit drinks were the most common beverages other than milk consumed from competitive food sources, while consumption of bottled water was less prevalent. However, among NSLP nonparticipants in high school who consumed competitive foods, bottled water was about as popular as fruit drinks.

2. Energy/Nutrient Contributions of Competitive Foods

Overall, NSLP participants who consumed competitive foods obtained an average of 218 calories from these foods (Table VI.11). Nonparticipants who consumed competitive foods

TABLE VI.11

NUTRIENT CONTENT OF COMPETITIVE FOODS CONSUMED BY NSLP PARTICIPANTS AND NONPARTICIPANTS

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
All Competitive Foods Consumed at School								
Food Energy (kcal)	177.7	350.6**	181.5	465.8**	282.8	417.4**	218.3	411.3**
Percentage of Food Energy from:								
Total fat	19.2	28.8 *	21.8	29.2	21.0	27.2**	20.4	28.0**
Saturated fat	6.3	9.9 *	7.6	9.2	6.4	8.8**	6.6	9.2**
Carbohydrate	74.4	61.1**	73.2	61.5 *	71.3	60.3**	73.0	60.8**
Vitamin A (mg RAE)	31.5	100.0 *	18.6	78.3**	25.4	58.4**	26.8	72.8**
Vitamin C (mg)	12.4	10.8	9.8	15.3	14.7	12.3	12.8	12.6
Calcium (mg)	43.6	191.4**	41.1	174.7**	45.4	153.2**	43.8	167.1**
Iron (mg)	1.3	2.1	0.7	2.1**	1.1	2.1**	1.1	2.1**
Fiber (g)	0.9	2.3**	0.7	2.3**	1.1	2.1**	0.9	2.2**
Sodium (mg)	198.9	365.7	166.5	683.8**	216.7	555.2**	199.7	536.0**
Competitive Foods Consumed at Lunch								
Food Energy (kcal)	64.2	166.8	135.5	406.4**	151.3	324.1**	110.5	303.0**
Percentage of Food Energy from:								
Total fat	9.8	16.7	17.0	27.1 *	14.8	23.1**	13.0	22.4**
Saturated fat	3.6	7.1 *	5.8	8.6	4.9	7.7**	4.5	7.7**
Carbohydrate	30.4	44.0	48.0	51.2	47.7	46.2	40.2	46.7
Vitamin A (mg RAE)	20.0	45.1	14.8	70.4**	13.6	45.1**	16.6	50.5**
Vitamin C (mg)	3.4	7.6	7.9	14.1	13.5	7.9	8.1	9.1
Calcium (mg)	25.7	86.3	31.3	155.8**	25.4	125.7**	26.6	122.4**
Iron (mg)	0.3	0.9	0.6	1.9**	0.6	1.6**	0.5	1.5**
Fiber (g)	0.4	1.1	0.6	2.0**	0.6	1.7**	0.5	1.6**
Sodium (mg)	73.9	202.7	122.2	628.9**	108.8	461.0**	96.1	433.3**
Competitive Foods Consumed at Other Times of the Day								
Food Energy (kcal)	113.4	183.8	46.0	59.4	131.5	93.3	107.8	108.3
Percentage of Food Energy from:								
Total fat	10.8	21.3	5.1	5.6	9.4	8.7	9.2	11.1
Saturated fat	2.9	7.1	2.1	1.7	2.6	2.7	2.6	3.6
Carbohydrate	48.1	38.4	28.3	19.2	35.8	25.9	39.8	27.6 *
Vitamin A (mg RAE)	11.5	55.0	3.8	7.8	11.8	13.3	10.2	22.3
Vitamin C (mg)	9.0	3.3	1.9	1.2	1.3	4.4	4.7	3.5
Calcium (mg)	17.8	105.1	9.8	18.8	20.1	27.5	17.2	44.7
Iron (mg)	1.0	1.2	0.1	0.2 *	0.5	0.5	0.6	0.6
Fiber (g)	0.5	1.2	0.1	0.3	0.5	0.4	0.4	0.6
Sodium (mg)	125.0	163.0	44.2	54.9	107.9	94.2	103.6	102.8
Low-Nutrient/Energy-Dense Competitive Foods								
Food Energy (kcal)	93.9	184.5	150.1	201.1	238.4	224.3	159.1	209.6 *
Percentage of Food Energy from:								
Total fat	13.9	19.4	16.7	19.1	20.6	18.6	17.0	18.9
Saturated fat	4.8	7.3	6.2	5.4	6.3	5.2	5.6	5.7
Carbohydrate	52.5	50.8	68.8	60.2	66.1	60.3	60.7	58.0
Vitamin A (mg RAE)	6.0	32.0	10.1	16.3	17.5	14.4	11.1	19.1
Vitamin C (mg)	0.8	3.3	9.0	7.9	5.0	5.7	3.9	5.6

TABLE VI.11 (continued)

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Calcium (mg)	9.5	52.4	18.0	21.5	29.7	27.1	18.7	32.1
Iron (mg)	0.3	0.8 *	0.4	0.6	0.7	0.7	0.5	0.7 *
Fiber (g)	0.4	0.9	0.4	0.9 *	0.9	0.8	0.6	0.9 *
Sodium (mg)	52.4	113.6	84.0	161.2 *	151.1	141.7	95.7	138.9**
Number of Students	74	43	92	107	119	196	285	346

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations of single 24-hour recalls prepared by Mathematica Policy Research, Inc. Sample includes only children who consumed one or more competitive foods.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

obtained significantly more calories from these foods—an average of 411 calories. Competitive foods consumed by nonparticipants were significantly higher in fat and saturated fat, as a percentage of total energy, than the competitive foods consumed by NSLP participants, and also provided significantly larger amounts of most nutrients and sodium. In contrast, the competitive foods consumed by NSLP participants provided a significantly higher percentage of energy in the form of carbohydrate. This pattern is consistent with the fact that nonparticipants were more likely than participants to purchase items like combination entrees, meat/meat alternates, milk and French fries from competitive food sources.

Slightly more than 50 percent of the calories elementary school students obtained from competitive foods were consumed outside of the lunch meal, while 75 percent or more of the calories middle school students obtained from competitive foods were consumed at lunch. Among high school students, the pattern differed for participants and nonparticipants. NSLP participants who consumed competitive foods consumed about half of their competitive food calories at lunch. Their nonparticipant counterparts, who more often relied on competitive foods for major meal components, consumed more than three-quarters of their competitive food calories at lunch.

For the full sample of NSLP participants who consumed competitive foods, the majority of calories were contributed by foods that were low in nutrients and/or high in energy (159 of 218 calories, or 73 percent). This includes all desserts and snacks, all beverages other than milk and 100% juice, French fries, corn/tortilla chips, and muffins, doughnuts, sweet rolls, and toaster pastries (see Table VI.10). Among nonparticipants who consumed competitive foods, low-nutrient/energy-dense foods contributed a smaller proportion of competitive food calories (51 percent). This pattern was noted for middle school and high school students, but not for elementary school students. In middle and high schools, more than 80 percent of the competitive

food calories consumed by NSLP participants who consumed competitive foods came from low-nutrient/energy-dense foods. Among elementary school students, roughly 50 percent of the competitive food calories consumed by both NSLP participants and nonparticipants came from low-nutrient/energy-dense foods, although total food energy consumed from these foods was significantly higher for nonparticipants than participants.

Tables VI.12 and VI.13 show the percentage contribution of competitive foods and low-nutrient/energy-dense foods to lunch and 24-hour intakes for students who consumed competitive foods (Table VI.12) and for all students (Table VI.13). Among students who consumed competitive foods, these foods made significantly greater contributions to nonparticipants' lunch intakes of calories and most nutrients than to participants' (Table VI.12). Middle and high school nonparticipants who consumed competitive foods obtained 42 to 67 percent of their lunch energy and nutrient intakes from competitive foods, compared with 8 to 38 percent for NSLP participants who consumed competitive foods. These differences remained over 24 hours (see third panel in Table VI.12). This reflects the fact that nonparticipants more often obtained their lunch meal from competitive food sources.

Among elementary school students who consumed competitive foods, differences in the percentage contribution to lunch intakes were significant only for energy, carbohydrate, vitamin A, calcium, and fiber (relative contributions were consistently higher for nonparticipants).

Overall, low-nutrient/energy-dense competitive foods accounted for a significantly smaller share of lunch intakes of energy, carbohydrate, vitamin A, and fiber among NSLP participants who consumed competitive foods, relative to nonparticipants who consumed competitive foods. These findings are attributable to differences among high school students. At the elementary and middle school levels, there were no significant participant-nonparticipant differences in the

TABLE VI.12

CONTRIBUTION OF COMPETITIVE FOODS TO LUNCH AND 24-HOUR INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS, AMONG STUDENTS WHO CONSUMED COMPETITIVE FOODS

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
	Percentage of Lunch Intakes Contributed by Competitive Foods							
Food Energy (kcal)	17.2	31.9*	25.3	56.8**	20.6	47.4**	20.4	46.5**
Total fat	14.7	25.8	23.2	56.2**	15.6	44.4**	16.7	44.5**
Saturated fat	13.9	29.3	21.3	56.0**	15.4	45.4**	16.0	45.3**
Carbohydrate	20.9	36.1*	30.0	59.0**	26.1	50.7**	25.3	49.4**
Vitamin A (mg RAE)	14.5	38.5*	13.7	62.8**	9.4	50.5**	12.3	50.0**
Vitamin C (mg)	22.5	23.7	36.9	67.3**	38.0	55.5	33.5	45.6
Calcium (mg)	11.8	33.3*	12.6	59.3**	7.9	49.3**	10.1	47.5**
Iron (mg)	14.1	33.3	19.5	53.4**	15.9	43.7**	16.0	43.8**
Fiber (g)	13.6	34.7*	19.3	52.3**	13.9	43.9**	14.7	43.8**
Sodium (mg)	12.2	26.4	17.4	54.4**	10.2	41.7**	12.0	41.9**
Percentage of Lunch Intakes Contributed by Low-Nutrient/Energy-Dense Competitive Foods								
Food Energy (kcal)	10.3	11.6	20.3	21.6	16.8	23.2**	15.5	20.5*
Total fat	8.4	8.1	15.8	15.1	13.4	15.6	12.3	14.2
Saturated fat	7.1	11.1	14.7	14.1	13.5	12.5	11.7	12.6
Carbohydrate	13.7	16.2	26.5	32.0	21.3	32.7**	20.0	29.1**
Vitamin A (mg RAE)	2.9	8.9	8.1	13.2	5.2	9.4	4.6	10.2*
Vitamin C (mg)	3.1	2.3	34.3	33.1	10.7	29.3**	12.5	19.6
Calcium (mg)	2.5	5.0	5.3	6.5	4.9	6.6	4.1	6.2
Iron (mg)	4.9	5.7	12.6	13.6	9.3	10.8	8.4	10.4
Fiber (g)	6.2	6.7	12.6	18.7	10.5	14.6	9.4	13.8*
Sodium (mg)	4.1	5.3	8.8	10.9	6.2	8.2	5.9	8.3
Number of Students	34	31	68	91	80	159	182	281
Percentage of 24-Hour Intakes Contributed by Competitive Foods								
Food Energy (kcal)	8.1	17.5**	8.4	23.3**	11.1	18.6**	9.4	19.3**
Total fat	5.4	16.2**	6.8	25.5**	8.0	16.9**	6.7	18.5**
Saturated fat	4.4	18.6**	6.3	22.8**	7.2	16.3**	5.8	18.1**
Carbohydrate	10.9	19.5*	10.9	23.1**	15.0	21.3**	12.6	21.3**
Vitamin A (mg RAE)	4.9	18.5**	3.3	17.5**	4.7	12.2**	4.6	15.0**
Vitamin C (mg)	13.0	12.6	11.6	20.6	14.0	12.8	13.2	14.2
Calcium (mg)	3.7	18.6**	3.9	20.3**	4.2	15.2**	3.9	17.0**
Iron (mg)	9.4	17.3*	5.2	20.0**	7.3	15.2**	7.8	16.6**
Fiber (g)	6.3	16.9**	5.4	20.4**	7.3	16.2**	6.6	17.2**
Sodium (mg)	5.7	12.2*	5.4	23.0**	5.6	15.4**	5.6	16.1**
Percentage of 24-Hour Intakes Contributed by Low-Nutrient/Energy-Dense Competitive Foods								
Food Energy (kcal)	4.3	9.2	6.9	10.1*	9.3	10.0	6.8	9.8**
Total fat	3.2	8.8	4.8	8.0*	7.2	7.1	5.2	7.7*
Saturated fat	2.5	11.5	4.6	6.4	6.4	5.7	4.4	7.1
Carbohydrate	5.9	11.3	9.8	13.7	12.6	14.2	9.3	13.4**
Vitamin A (mg RAE)	0.9	5.9	1.8	3.6	3.3	3.0	1.9	3.9
Vitamin C (mg)	0.9	3.8	10.6	10.7	4.7	6.0	4.0	6.3
Calcium (mg)	0.8	5.1	1.7	2.5	2.8	2.7	1.7	3.3*

TABLE VI.12 (continued)

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Iron (mg)	2.0	6.7*	3.4	5.6*	4.5	4.9	3.3	5.5**
Fiber (g)	2.6	6.8	3.4	8.3**	5.6	6.4	4.0	6.9**
Sodium (mg)	1.5	3.8	2.7	5.4*	3.9	3.9	2.7	4.2**
Number of Students	74	43	92	107	119	196	285	346

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations of single 24-hour recalls prepared by Mathematica Policy Research, Inc. Sample includes only children who consumed one or more competitive foods.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

TABLE VI.13

CONTRIBUTION OF COMPETITIVE FOODS TO LUNCH AND 24-HOUR INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS, AMONG ALL STUDENTS

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Percentage of Lunch Intakes Contributed by Competitive Foods								
Food Energy (kcal)	1.1	5.0	2.9	21.6**	5.4	17.8**	2.5	13.7**
Total fat	0.8	3.2	2.2	22.8**	3.5	15.5**	1.8	12.3**
Saturated fat	0.8	3.9	2.0	22.5**	3.5	16.4**	1.7	13.0**
Carbohydrate	1.6	6.3*	4.2	21.5**	8.5	21.1**	3.7	15.6**
Vitamin A (mg RAE)	1.2	9.5*	1.2	25.6**	2.1	18.6**	1.4	16.5**
Vitamin C (mg)	2.1	6.7	6.9	24.9*	17.0	17.8	6.6	14.4
Calcium (mg)	0.7	6.7*	1.1	21.3**	1.7	18.0**	1.0	14.4**
Iron (mg)	0.8	4.6	1.9	17.5**	3.3	14.5**	1.6	11.3**
Fiber (g)	0.8	4.9	1.8	16.7**	3.5	14.6**	1.6	11.2**
Sodium (mg)	0.7	3.6	1.5	18.7**	2.1	14.5**	1.2	11.4**
Percentage of Lunch Intakes Contributed by Low-Nutrient/Energy-Dense Competitive Foods								
Food Energy (kcal)	0.7	1.8	2.3	8.2**	4.4	8.7**	1.9	6.0**
Total fat	0.5	1.0	1.5	6.1**	3.0	5.4*	1.3	3.9**
Saturated fat	0.4	1.5	1.4	5.7**	3.0	4.5	1.3	3.6**
Carbohydrate	1.0	2.8	3.7	11.7**	6.9	13.6**	2.9	9.2**
Vitamin A (mg RAE)	0.2	2.2	0.7	5.4	1.2	3.5*	0.5	3.3**
Vitamin C (mg)	0.3	0.7	6.4	12.2	4.8	9.4	2.5	6.2**
Calcium (mg)	0.1	1.0	0.5	2.4**	1.1	2.4**	0.4	1.9**
Iron (mg)	0.3	0.8	1.2	4.5**	1.9	3.6*	0.8	2.7**
Fiber (g)	0.4	0.9	1.2	5.9**	2.6	4.8*	1.0	3.5**
Sodium (mg)	0.2	0.7	0.7	3.8**	1.3	2.9**	0.6	2.3**
Number of Students	531	189	497	260	358	399	1,386	848
Percentage of 24-Hour Intakes Contributed by Competitive Foods								
Food Energy (kcal)	1.2	4.2	1.5	9.1**	4.1	8.9**	1.9	7.3**
Total fat	0.8	3.9	1.2	10.7**	2.9	8.3**	1.4	7.2**
Saturated fat	0.7	4.5	1.1	9.6**	2.6	8.1**	1.2	7.1**
Carbohydrate	1.6	4.6	2.1	8.6**	5.7	10.1**	2.6	7.8**
Vitamin A (mg RAE)	0.7	3.8	0.5	5.7**	1.4	4.9**	0.8	4.6**
Vitamin C (mg)	1.9	2.9	2.0	6.5*	5.5	6.1	2.7	5.0
Calcium (mg)	0.5	4.5*	0.6	7.4**	1.4	7.1**	0.7	6.2**
Iron (mg)	1.2	3.1	0.8	6.0**	2.3	5.9**	1.4	4.8**
Fiber (g)	0.9	4.0	0.9	7.1**	2.6	7.0**	1.2	5.9**
Sodium (mg)	0.8	2.8	0.9	8.4**	1.9	7.3**	1.1	5.9**
Percentage of 24-Hour Intakes Contributed by Low-Nutrient/Energy-Dense Competitive Foods								
Food Energy (kcal)	0.6	2.2	1.3	3.9**	3.4	4.8*	1.4	3.7**
Total fat	0.5	2.1	0.8	3.4**	2.6	3.5	1.1	3.0**
Saturated fat	0.4	2.8	0.8	2.7**	2.3	2.8	0.9	2.8*
Carbohydrate	0.9	2.7	1.9	5.1**	4.8	6.7*	1.9	4.9**
Vitamin A (mg RAE)	0.1	1.2	0.3	1.2	1.0	1.2	0.3	1.2
Vitamin C (mg)	0.1	0.9	1.9	3.3	1.9	2.8	0.8	2.2**
Calcium (mg)	0.1	1.2	0.3	0.9**	0.9	1.3	0.3	1.2*

TABLE VI.13 (continued)

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Iron (mg)	0.3	1.2	0.5	1.7**	1.4	1.9	0.6	1.6**
Fiber (g)	0.4	1.6	0.6	2.9**	2.0	2.7	0.8	2.3**
Sodium (mg)	0.2	0.9	0.4	2.0**	1.3	1.9	0.5	1.5**
Number of Students	531	201	497	290	358	437	1,386	928

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations of single 24-hour recalls prepared by Mathematica Policy Research, Inc. Sample for lunch intakes excludes children who did not consume a lunch. Sample for 24-hour intakes includes all children, including those who did not consume a lunch.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

relative contribution of low-nutrient/energy-dense competitive foods to lunch intakes. Such foods accounted for about 11 percent of the lunch calories for elementary school students and about 21 percent of lunch calories for middle school students.

I. COMPARING SNDA-III DATA WITH DATA FROM OTHER STUDIES

Comparing SNDA-III data on the nutrient intakes of NSLP participants and nonparticipants with data from previous studies can provide information on how students' dietary intakes have changed over time. However, such comparisons must be made with caution. Differences in measured dietary intakes can be caused by factors other than actual changes in dietary intakes. Major factors include (1) methodological differences in data collection techniques, including the use of automated data collection systems and different portion size estimation tools; (2) improvements in food composition databases; and (3) differences in analysis techniques, including the use of one versus two 24-hour recalls. In studies that present regression-adjusted estimates, difference in covariates and multivariate regression techniques may lead to differences in estimated intakes. Finally, differences in the standards used to assess intakes affect the interpretation of results.

Given the above limitations, the following comparisons seem most appropriate:

- ***SNDA-III Versus SNDA-I:*** Non-regression-adjusted mean intakes at lunch and over 24 hours (based on a single 24-hour recall)
- ***SNDA-III Versus NHANES 2001-2002:*** Usual mean daily intakes and the proportions of children with inadequate and excessive intakes (based on PC-SIDE analysis using a second dietary recall for a subsample and application of the DRIs), not adjusted for differences in observed characteristics

While the latter comparison does not provide insight into how nutrient intakes may have changed over time, it does provide information on how SNDA-III estimates compare with the most recent national estimates. SNDA-III and NHANES used the same system to collect 24-

hour recalls and the same nutrient database (Survey Net) and analysis software (PC-SIDE) to analyze data.²⁰

1. SNDA-III Versus SNDA-I: Mean Lunch Intakes

Table VI.14 presents data from SNDA-I and SNDA-III on mean lunch intakes of NSLP participants and nonparticipants. Data are for all students in grades 1-12.²¹ For NSLP participants, differences between SNDA-I and SNDA-III are statistically significant for energy and all nutrients except protein (as a percentage of energy intake), vitamin A, riboflavin, and calcium. For nonparticipants, significant differences between SNDA-I and SNDA-III are limited to macronutrients other than total fat (generally in terms of absolute intake as well as percentage contribution to energy intake), vitamin C, thiamin, and sodium.

Some key trends observed in differences between SNDA-I and SNDA-III lunch intakes of NSLP participants and nonparticipants are consistent with what one would expect based on findings from the two studies and changes observed in the nutrient content of NSLP lunches offered to students. For example, the fact that average lunch intakes of total fat (as a percentage of energy) and cholesterol changed significantly for NSLP participants but remained stable for nonparticipants is consistent with changes that have been observed in the nutrient content of NSLP lunches offered to students (see Fox et al. 2001 and Chapter VIII in Volume I of this report).

²⁰ The data collection software was modified slightly for SNDA-III (to collect more detailed information on sources of food obtained at school), and nutrient data from the analysis of school menus ultimately replaced Survey Net nutrient data for foods that were obtained at school and included in reimbursable menus.

²¹ These are the only unadjusted estimates available in the SNDA-I report.

TABLE VI.14

MEAN LUNCH INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS:
SNDA-I VERSUS SNDA-III

	SNDA-I (1991-1992)		SNDA-III (2004-2005)	
	Participants	Nonparticipants	Participants	Nonparticipants
Food Energy (kcal)	762	679	626*	641
Total Fat (g)	32	26	24*	26
Saturated Fat (g)	12	9	8*	8*
Carbohydrate (g)	90	92	80*	84*
Protein (g)	31	21	25*	22
Total Fat (% kcal)	37	33	33*	33
Saturated Fat (% kcal)	14	12	11*	11*
Carbohydrate (% kcal)	48	57	51*	55
Protein (% kcal)	17	12	17	13*
Vitamin A (mg RE)	260	143	262	139
Vitamin C (mg)	30	39	21*	22*
Vitamin B ₆ (mg)	0.5	0.4	0.4*	0.4
Vitamin B ₁₂ (mcg)	1.8	0.9	1.5*	0.9
Niacin (mg)	7	6	6*	6
Riboflavin (mg)	0.7	0.5	0.7	0.5
Thiamin (mg)	0.5	0.5	0.4*	0.4*
Calcium (mg)	423	251	406	246
Iron (mg)	4.3	3.6	4*	4
Magnesium (mg)	92	73	80*	73
Phosphorus (mg)	526	366	468*	360
Sodium (mg)	1,501	1,146	1,121*	1,035*
Zinc (mg)	4.1	2.7	3.3*	2.8
Cholesterol (mg)	85	54	59*	60
Number of Students	1,744	1,608	1,386	842

Sources: SNDA-I data: Table B.1 (p. 71) in Devaney et al. 1993.

SNDA-III data: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005.

Both data sets based on weighted tabulations of data from a single 24-hour recall. Samples exclude children who did not consume a lunch. Intakes of NSLP participants include all foods consumed, including those that may have been brought from home or obtained in school from sources other than the reimbursable meal.

Notes: SNDA-I and SNDA-III also assessed folate intake, but data from the two studies cannot be compared because of differences in units of measure (mcg folate in SNDA-I and mcg Dietary Folate Equivalents in SNDA-III) and substantial changes in food fortification practices. Nutrients assessed in SNDA-III but not in SNDA-I are not shown.

RE = Retinol Equivalent.

*Difference between SNDA-I and SNDA-III is significantly different from zero at the .05 level or less.

2. SNDA-III Versus SNDA-I: Mean 24-Hour Intakes

As shown in Table VI.15, most of the differences between SNDA-I and SNDA-III estimates of mean 24-hour intakes were statistically significant for both NSLP participants and nonparticipants. The fact that the mean percentages of energy from fat and saturated fat are significantly lower in SNDA-III than in SNDA-I, for both NSLP participants and nonparticipants, is consistent with secular trends in dietary intake observed in NHANES data (Briefel and Johnson 2004) and, for participants, with changes over time in the fat content of NSLP lunches (Fox et al. 2001 and Volume I, Chapter VIII). The same is true for lower mean intakes of calcium and zinc. However, the finding that mean 24-hour energy intakes are lower in SNDA-III than in SNDA-I is not consistent with the trends observed in NHANES. These differences may be accounted for by differences in the sample (NHANES included a sample of all U.S. children, not just public school children), and study design (NHANES dietary intake estimates included weekends, holidays, and summertime when school was out of session, whereas SNDA-III included intakes on school days only).

3. SNDA-III Versus NHANES 2001-2002: Mean Usual Intakes and Prevalence of Inadequate and Excessive Intakes

Table VI.16 summarizes data on mean usual daily intakes and the prevalence of inadequate and excessive intakes from SNDA-III and NHANES 2001-2002. The age groups for the youngest children are not directly comparable because the NHANES sample includes younger children (4 to 5 years old). Overall, the data presented in this table lend considerable confidence to the SNDA-III estimates. Mean intakes and estimates of the prevalence of inadequate intakes are consistent for most nutrients and many subgroups. Where potentially noteworthy differences

TABLE VI.15

MEAN 24-HOUR INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS:
SNDA-I VERSUS SNDA-III

	SNDA-I (1991-1992)		SNDA-III (2004-2005)	
	Participants	Nonparticipants	Participants	Nonparticipants
Food Energy (kcal)	2,556	2,509	2,130*	2,076*
Total Fat (g)	101	95	77*	75*
Saturated Fat (g)	38	35	27*	26*
Carbohydrate (g)	325	335	288*	283*
Protein (g)	97	89	78*	73*
Total Fat (% kcal)	35	33	32*	32*
Saturated Fat (% kcal)	13	12	11*	11*
Carbohydrate (% kcal)	51	54	54*	55*
Protein (% kcal)	15	14	15	14
Vitamin A (mg RE)	1,058	1,046	891*	817*
Vitamin C (mg)	135	152	91*	92*
Vitamin B ₆ (mg)	2.1	2	1.7*	1.9
Vitamin B ₁₂ (mcg)	6.1	5.3	5.3*	5.2
Niacin (mg)	25	25	21*	23*
Riboflavin (mg)	2.6	2.5	2.4*	2.2*
Thiamin (mg)	2.1	2.1	1.6*	1.7*
Calcium (mg)	1,228	1,108	1,153*	992*
Iron (mg)	16.9	17.2	15*	16*
Magnesium (mg)	309	299	255*	247*
Phosphorus (mg)	1,643	1,527	1,412*	1,294*
Sodium (mg)	4,819	4,501	3,461*	3,307*
Zinc (mg)	13.8	12.7	11.6*	11.5*
Cholesterol (mg)	316	280	211*	216*
Number of Students	1,744	1,608	1,386	928

Sources: SNDA-I data: Table B.3 (p. 73) in Devaney et al. 1993.

SNDA-III data: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005.

Both data sets based on weighted tabulations of data from a single 24-hour recall. Samples include all children, including those who did not consume a lunch.

Notes: SNDA-I and SNDA-III also assessed folate intake, but data from the two studies cannot be compared because of differences in units of measure (mcg folate in SNDA-I and mcg Dietary Folate Equivalents in SNDA-III) and substantial changes in food fortification practices. Nutrients assessed in SNDA-III but not in SNDA-I are not shown.

RE = Retinol Equivalent.

*Difference between SNDA-I and SNDA-III is significantly different from zero at the .05 level or less.

TABLE VI.16

MEAN USUAL NUTRIENT INTAKES OF SCHOOL-AGE CHILDREN AND COMPARISON TO DRI STANDARDS:
ESTIMATES FROM SNDA-III AND NHANES 2001-2002

	4/6-8 Years ^a		9-13, Male		9-13, Female		14-18, Male		14-18, Female	
	SNDA-III	NHANES	SNDA-III	NHANES	SNDA-III	NHANES	SNDA-III	NHANES	SNDA-III	NHANES
Macronutrients										
Carbohydrate										
Mean intake (g)	269	257	309	309	269	262	343	364	248	263
% < EAR	<3	<3	<3	<3	<3	<3	<3	<3	2~	<3
Linoleic Acid										
Mean intake (g)	12.1	11.0	13.8	12.8	12.2	12.0	16.5	16.4	12.0	12.1
Linolenic Acid										
Mean intake (g)	1.1	1.1	1.2	1.3	1.2	1.1	1.6	1.6	1.2	1.2
Vitamins										
Vitamin A										
Mean intake (mcg RAE)	630	573	700	670	613	536	680	638	478	513
% < EAR	<3~	4	13~	13	22	34	49	55	58	54
Vitamin C										
Mean intake (mg)	87.9	80.7	98.0	80.2	92.4	81.0	101.1	100.0	80.0	75.6
% < EAR	<3~	<3	4~	8	13~	9	27	26	40	42
Vitamin E										
Mean intake (mg AT)	5.7	5.0	6.7	6.0	5.7	5.6	7.5	7.3	5.8	5.6
% < EAR	64	80	87	97	91	95	95	>97	>97~	>97
Vitamin B ₆										
Mean intake (mg)	1.6	1.50	1.9	1.81	1.7	1.52	2.2	2.17	1.5	1.48
% < EAR	<3~	<3	<3~	<3	<3~	<3	<3~	<3	20	16
Vitamin B ₁₂										
Mean intake (mcg)	5.03	4.75	5.80	6.00	4.88	4.40	6.39	6.69	4.23	4.16
% < EAR	<3~	<3	<3~	<3	<3~	<3	<3~	<3	13~	8
Folate										
Mean intake (mcg DFE)	552	528	674	644	564	512	699	683	495	500
% < EAR	<3~	<3	<3~	<3	<3~	<3	<3~	4	24	19
Niacin (mg)										
Mean intake (mg)	20.1	18.2	22.7	22.5	20.7	18.5	27.9	27.0	18.8	18.6
% < EAR	<3~	<3	<3~	<3	<3~	<3	<3~	<3	9~	6

TABLE VI.16 (continued)

	4/6-8 Years ^a		9-13, Male		9-13, Female		14-18, Male		14-18, Female	
	SNDA-III	NHANES	SNDA-III	NHANES	SNDA-III	NHANES	SNDA-III	NHANES	SNDA-III	NHANES
Riboflavin (mg)										
Mean intake (mg)	2.30	2.10	2.59	2.51	2.16	1.94	2.74	2.57	1.83	1.80
% < EAR	<3~	<3	<3~	<3	<3~	<3	<3	<3	7~	6
Thiamin (mg)										
Mean intake (mg)	1.57	1.45	1.79	1.78	1.56	1.44	2.07	1.96	1.38	1.40
% < EAR	<3~	<3	<3~	<3	<3~	<3	3~	<3	17	17
Minerals										
Calcium										
Mean intake (mg)	1,093	960	1,213	1,139	1,050	865	1,248	1,142	847	804
Iron										
Mean intake (mg)	14.5	13.7	16.7	17.0	14.6	13.7	19.0	19.1	12.9	13.3
% < EAR	<3~	<3	<3~	<3	<3~	<3	<3~	<3	16	16
Magnesium										
Mean intake (mg)	245	212	269	250	236	215	300	284	216	206
% < EAR	<3~	<3	12~	14	29	44	72	78	87	91
Phosphorus										
Mean intake (mg)	1,314	1,172	1,472	1,431	1,278	1,141	1,669	1,575	1,130	1,099
% < EAR	<3~	<3	6~	9	28	42	9~	9	46	49
Potassium										
Mean intake (mg)	2,415	2,136	2,662	2,472	2,370	2,125	3,004	2,774	2,084	2,020
Sodium										
Mean intake (mg)	3,125	2,831	3,561	3,549	3,259	2,806	4,293	4,086	2,922	2,799
% > UL	97~	94	>97~	>97	90	88	>97~	>97	75	74
Zinc										
Mean intake (mg)	10.9	10.0	12.4	13.0	10.5	9.8	14.9	15.1	9.6	9.5
% < EAR	<3~	<3	<3~	<3	12~	10	7~	4	28	26
Other Dietary Components										
Fiber										
Mean intake (g)	13.9	11.6	15.0	14.2	13.3	12.3	16.2	15.3	12.0	11.7
Sample Size	343	920	469	574	484	597	506	727	512	677

Sources: SNDA-III data: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

NHANES data: Moshfegh et al. 2005.

TABLE VI.16 (continued)

Notes: In both data sets, usual intake distributions were estimated using two days of intake data for a portion of the sample and the Software for Intake Distribution Estimation, developed by Iowa State University (1996).

*SND A-III sample includes children 6 to 8 years old, and NHANES sample includes children 4 to 8 years old.

AT = Alpha-tocopherol

DFE = Dietary Folate Equivalents

EAR = Estimated Average Requirement

RAE = Retinol Activity Equivalents

UL = Tolerable Upper Intake Level

~ Estimate may not be reliable due to inadequate cell size or a large coefficient of variation.

are apparent (for example, in mean intakes of vitamins A, vitamin C, calcium, and sodium for some or all subgroups), SNDA-III estimates tend to be higher. This is consistent with the differences noted between NSLP participants and nonparticipants in the SNDA-III analysis of lunch intakes (students who consume NSLP lunches have higher intakes of these nutrients; for vitamin C this is limited to middle school students) and the fact that NHANES data likely include fewer NSLP participants because data were sometimes collected over the summer and on weekends and other nonschool days, and regardless of public school attendance. However, differences may also be due to other methodological differences between the two studies.

J. REGRESSION-ADJUSTED 24-HOUR INTAKES OF STUDENTS WHO PARTICIPATED IN ONE, TWO, OR NO SCHOOL MEAL PROGRAMS

On any given day, roughly 25 percent of NSLP participants also participated in the SBP (see Chapter III, Table III.3). Table VI.17 presents regression-adjusted mean 24-hour nutrient intakes of students who participated in the NSLP (alone), students who participated in both the NSLP and the SBP (joint participants), and students who participated in neither program (nonparticipants). Nutrient intakes for students who participated in the SBP but not the NSLP are not examined due to small sample sizes.²²

In general, almost all differences observed between NSLP participants and nonparticipants in the regression-adjusted mean 24-intakes of vitamins and minerals (as reported previously and shown in Table VI.4) were also observed in comparisons of both joint participants and NSLP-only participants to nonparticipants. On average, 24-hour intakes of both joint participants and NSLP-only participants were significantly higher in vitamin A, riboflavin, calcium, magnesium, phosphorus, and potassium than those of nonparticipants.

²² Only 58 sample members (and two percent of students nationally) participated in the SBP but not the NSLP on the target day. Analyses for the other three groups (NSLP and SBP participants, NSLP-only participants, and nonparticipants) were not conducted by grade level due to sample size limitations.

TABLE VI.17

REGRESSION-ADJUSTED MEAN 24-HOUR INTAKES BY SCHOOL MEAL PROGRAM PARTICIPATION,
ALL STUDENTS

	Regression-Adjusted Mean 24-Hour Intakes		
	Participants in NSLP and SBP	Participants in NSLP Only	Participants in Neither Program
Food Energy (kcal)	2,259**†	2,128	2,060
Macronutrients: Total Amount (g)			
Total fat	83*†	77	76
Saturated fat	28.8*	26.7	25.9
Monounsaturated fat	31.9†	29.5	29.3
Polyunsaturated fat	16.3†	14.9	14.9
Linoleic acid	14.4†	13.1	13.1
Linolenic acid	1.4**	1.3**	1.2
Carbohydrate	300*	287	278
Protein	84**††	77*	73
Macronutrients: Percentage of Food Energy from (%)			
Total fat	32.3	32.1	32.2
Saturated fat	11.2	11.2	11.0
Monounsaturated fat	12.4	12.3	12.5
Polyunsaturated fat	6.4	6.2	6.4
Linoleic acid	5.6	5.5	5.6
Linolenic acid	0.6*	0.5*	0.5
Carbohydrate	53.7	54.3	54.6
Protein	15.0	14.8	14.3
Vitamins			
Vitamin A (mcg RAE)	657**	639**	555
Vitamin C (mg)	91	91	89
Vitamin E (mg)	6.5	6.0	6.4
Vitamin B ₆ (mg)	1.8	1.8	1.8
Vitamin B ₁₂ (mcg)	5.8*†	5.2	5.1
Folate (mcg DFE)	569	583	578
Niacin (mg)	22.2	21.8	22.2
Riboflavin (mg)	2.5**†	2.3*	2.2
Thiamin (mg)	1.7	1.6	1.6
Minerals			
Calcium (mg)	1,218**†	1,119**	955
Iron (mg)	15.9	15.3	15.4
Magnesium (mg)	269**	253*	240
Phosphorus (mg)	1,521**††	1,389**	1,267
Potassium (mg)	2,770**††	2,552**	2,304
Sodium (mg)	3,752**†	3,437	3,272
Zinc (mg)	12.5*	11.7	11.4
Other Dietary Components			
Fiber (g)	14.8**	14.0	13.3
Fiber (g/1,000 kcal)	6.7	6.8	6.6
Cholesterol (mg)	214	214	218
Number of Students	323	1,063	870

TABLE VI.17 (continued)

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on single 24-hour recall prepared by Mathematica Policy Research, Inc. Sample includes all students, including those who did not consume a lunch.

Note: All mean estimates have been regression-adjusted for differences in personal, family, and school characteristics between participation status groups, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics described in Appendix E. Participants in SBP only are included in the analysis sample used for the regression-adjustment, but means for this group are not reported since estimates may be unreliable due to small sample sizes (only 58 students in the sample participated in the SBP but not the NSLP).

* Mean for participants in specified program(s) is significantly different from mean for participants in neither program at the .05 level.

** Mean for participants in specified program(s) is significantly different from mean for participants in neither program at the .01 level.

† Mean for participants in NSLP and SBP is significantly different from mean for participants in NSLP only at the .05 level.

†† Mean for participants in NSLP and SBP is significantly different from mean for participants in NSLP only at the .01 level.

Nonetheless, some differences between joint participants and NSLP-only participants were found. Overall, joint participants consumed significantly more energy, total fat, and protein over 24 hours than either NSLP-only participants or nonparticipants. (NSLP-only participants also consumed significantly more protein over 24 hours than nonparticipants.) In addition, joint participants had significantly higher 24-hour intakes of vitamin B₁₂ than either NSLP-only participants or nonparticipants. Joint participants also had significantly higher 24-hour intakes of riboflavin, calcium, phosphorus, potassium, and sodium, relative to NSLP-only participants and significantly higher 24-hour intakes of zinc, sodium, and dietary fiber, relative to nonparticipants.

VII. DIETARY INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS

This chapter presents data on the dietary intakes of SBP participants and nonparticipants in the 2004-2005 school year, in parallel with the data on intakes of NSLP participants and nonparticipants presented in Chapter VI. The following key research questions are addressed:

- What are participants' *mean energy and nutrient intakes* from SBP breakfasts? What contributions do SBP breakfasts make to participants' overall dietary intakes?
- How do *mean breakfast and 24-hour intakes* of SBP participants compare with those of nonparticipants?
- What proportion of SBP participants have *inadequate or excessive intakes* of specific nutrients, and how does this compare with the prevalence of inadequacy and excess among nonparticipants?
- What *types of foods* do SBP participants and nonparticipants consume at breakfast and over 24 hours?
 - What are the *major food sources of energy and key nutrients* in the lunches consumed by SBP participants and nonparticipants?
 - What proportion of SBP participants and nonparticipants consume *competitive foods*?
- How do nutrient intakes of SBP participants and nonparticipants in school year 2004-2005 compare with intakes in school year 1991-1992, when the first School Nutrition Dietary Assessment study (SNDA-I) was conducted?

The chapter begins with a summary of key findings (Section A). Section B presents data on the proportions of students who did and did not eat breakfast. Sections C through E describe the energy and nutrient intakes of SBP participants and nonparticipants, including regression-adjusted estimates of mean breakfast intakes of SBP participants and nonparticipants (Section C), regression-adjusted estimates of mean 24-hour intakes of SBP participants and nonparticipants (Section D), and estimates of the prevalence of inadequate and excessive usual daily intakes of participants compared with nonparticipants, adjusted using propensity score matching (Section E).

Sections F through H present data on the food intakes of SBP participants and nonparticipants, including types of food consumed (Section F), the major food sources of energy and nutrients in breakfasts consumed (Section G), and the consumption of competitive foods (Section H). Section I compares SNDA-III data with data from SNDA-I.

While differences in the dietary intakes of SBP participants and nonparticipants are of great interest, these differences should not be interpreted as causal effects of the SBP on students' dietary intakes. This is because there are likely to be many differences between participants and nonparticipants other than school meal participation that also influence their dietary intakes. For some of the estimates presented in this chapter, differences between participants and nonparticipants were adjusted for differences in observable characteristics between the two groups.¹ Even with these adjustments for observable characteristics, however, it is possible that important differences in unobservable characteristics remain.

Where possible, the statistical significance of differences between participants and nonparticipants was tested.² Unless otherwise noted, the differences discussed in the text are significant at least at the 0.05 level. While these test results provide an important gauge of true underlying population differences, they are not a definitive measure of true differences, as discussed in Chapter I. Particularly among subgroups with small sample sizes, patterns of differences across groups, or a difference for a particular outcome that is substantive in magnitude, may be suggestive of differences between participants and nonparticipants even if these differences are not statistically significant at the 0.05 level. Small sample sizes are

¹ Multivariate regression methods were used to adjust estimates of mean intakes of energy and nutrients at breakfast and over 24 hours (Sections C and D), and propensity score matching was used to adjust estimates of the proportions of students whose usual intakes were inadequate or excessive (Section E).

² Statistical significance was determined on the basis of two-tailed t-tests, assuming independent samples. These tests accounted for the complex sample design of the SNDA-III database, using Stata or SUDAAN statistical software.

particularly likely to be an issue in the propensity score matched analysis of nutrient inadequacy and excess of SBP participants and nonparticipants by grade level. This is because the matched analysis compares the intakes of SBP participants (already somewhat small in number) to a subsample of nonparticipants with similar characteristics, leading to an overall sample size of 683 for this analysis, and samples as small as 179 when broken down by grade level.³ For this analysis in particular, observed differences may therefore not be statistically significant even if there are true underlying differences in the population.

A. SUMMARY OF KEY FINDINGS

1. Regression-Adjusted Mean Intakes of Energy and Nutrients at Breakfast

- After controlling for a number of characteristics that may be associated with both participation in the SBP and with dietary intakes, relatively few significant differences were observed in the mean breakfast intakes of SBP participants and nonparticipants. Breakfasts consumed by SBP participants in high schools and middle schools provided a significantly greater percentage of energy from monounsaturated fat, polyunsaturated fat, and linolenic acid (an essential polyunsaturated fatty acid) than breakfasts consumed by nonparticipants in these schools.
- Among middle school students, breakfasts consumed by SBP participants provided significantly less vitamin A, vitamin B₆, vitamin B₁₂, folate, niacin, riboflavin, iron, and zinc than breakfasts consumed by nonparticipants. Scattered differences were observed for other nutrients among elementary and/or high school students.
- SBP participants in both elementary schools and middle schools had significantly lower intakes of cholesterol at breakfast than nonparticipants. Among high school students, SBP participants had a significantly lower average intake of fiber at breakfast—on a gram per calorie basis—than nonparticipants.
- There were few consistent patterns across school types in the relative contribution of breakfast intakes of SBP participants and nonparticipants to 24-hour intakes. In general, however, breakfasts consumed by SBP participants provided significantly larger shares of 24-hour intakes of calcium, phosphorus, and potassium.

³ This stands in contrast to the matched analysis for NSLP participants, which had an overall sample of 1,891 and grade-level samples of 546 or more.

2. Regression-Adjusted Mean Intakes of Energy and Nutrients Over 24 Hours

- Few of the differences observed in the breakfast intakes of SBP participants and nonparticipants remained significant over 24 hours. Differences observed in the relative contribution of various types of fat to overall energy intake dissipated over the course of the day. All differences observed for middle school students (SBP participants had lower mean intakes iron, zinc, and most vitamins at breakfast) dissipated over the course of the day.

3. Prevalence of Inadequate or Excessive Usual Daily Intakes

- Estimated energy requirements for SBP participants and matched nonparticipants were similar. Although mean energy intakes of SBP participants exceeded those of matched nonparticipants by about 50 to 150 calories, these differences were not statistically significant at the 0.05 level.
- There were no significant differences between SBP participants and matched nonparticipants in the extent to which *usual daily intakes* of macronutrients (total fat, saturated fat, carbohydrate, and protein) conformed with Dietary Reference Intakes (DRIs) and *Dietary Guidelines* recommendations (DGAs).
- Overall, estimated inadequacy of vitamin A and phosphorous were significantly lower for SBP participants than matched nonparticipants. Among elementary school students, phosphorous inadequacy was significantly lower among participants than matched nonparticipants, and among middle school students, magnesium inadequacy was lower among participants than matched nonparticipants.
- Overall and among middle school students, excessive sodium intakes were significantly more common among participants than matched nonparticipants.

4. Food Intakes at Breakfast and Over 24 Hours

- Overall, SBP participants were more likely than nonparticipants to consume milk, both at breakfast and over 24 hours.
- SBP participants were more likely than nonparticipants to consume 100% fruit juice both at breakfast and over 24 hours.
- Ready-to-eat breakfast cereal was the grain/bread product consumed most often at breakfast by both SBP participants and nonparticipants. Among high school students, SBP participants were less likely than nonparticipants to consume cereal that was unsweetened. Overall, breakfasts consumed by SBP participants were more likely than breakfasts consumed by nonparticipants to include sweet rolls, doughnuts, biscuits and other higher-fat grain products. These differences persisted over 24 hours.
- Among middle school students, SBP participants were less likely than nonparticipants to consume juice drinks or bottled water, both at breakfast and over 24 hours.

5. Food Sources of Nutrients

- SBP participants obtained a significantly smaller share of their carbohydrate intakes at breakfast from cold cereal than nonparticipants, and a significantly greater share of their breakfast carbohydrate intakes from cakes, cookies, and brownies than nonparticipants.
- Flavored milks and pizza products accounted for significantly greater shares of SBP participants' breakfast intakes of protein, relative to nonparticipants, and cold cereal and unflavored skim/nonfat milk accounted for significantly smaller shares.
- The overall contribution of cold cereals to intakes of vitamin B₆, folate, phosphorus, and potassium was generally greater for nonparticipants than for participants, while fruit juices and sweet rolls, doughnuts, and toaster pastries made significantly greater contributions to SBP participants' breakfast intakes of these nutrients than to nonparticipants'.
- Relative to nonparticipants, SBP participants obtained significantly greater shares of their sodium intakes at breakfast from pizza products and cookies, cakes, and brownies and a significantly smaller share from cold cereals. Cakes, cookies, and brownies also made a significantly larger contribution to SBP participants' breakfast intakes of cholesterol than to nonparticipants' breakfast intakes.

6. Competitive Foods

- Overall, SBP participants were less likely than nonparticipants to consume one or more competitive foods throughout the school day. Consumption of competitive foods was lowest among elementary school students and highest among high school students; however, the difference between SBP participants and nonparticipants was most pronounced among middle school students.
- Among elementary school students, the most common sources of competitive foods were classroom parties, rewards from teachers, bake sales, and other fundraisers. Among middle and high school students, the most common source of competitive foods was vending machines.
- Overall, competitive foods were most commonly consumed at lunch; SBP participants were less likely than nonparticipants to consume a competitive food at lunch. Consumption of competitive foods at breakfast was uncommon among elementary school students; however, among high school students, 20 percent of SBP participants and 10 percent of nonparticipants consumed one or more competitive foods at breakfast.

7. Comparison of SNDA-III Data with Data from Other Studies

- The significance and direction of changes in mean breakfast intakes between SNDA-I and SNDA-III are comparable for SBP participants and nonparticipants for all estimates except energy, the proportion of energy derived from total fat, and vitamin A. The fact

that total intake of energy at breakfast and the proportion of energy derived from fat decreased between SNDA-I and SNDA-III for SBP participants but not for nonparticipants is consistent with changes observed in the energy and relative fat content of breakfasts offered to SBP participants.

B. PROPORTIONS OF STUDENTS WHO DID AND DID NOT EAT BREAKFAST

By definition, SBP participants consumed breakfast. Among students who did not consume a reimbursable SBP breakfast, most (85 percent) consumed something other than plain water for breakfast (Table VII.1).⁴ Breakfast skipping was highest among middle school students—23 percent of middle school nonparticipants consumed nothing for breakfast. The prevalence of breakfast skipping was somewhat lower among high school nonparticipants (17 percent) and was lowest among elementary school nonparticipants. However, even at the elementary school level, one in ten nonparticipants consumed nothing for breakfast.

About a quarter of SBP participants consumed breakfast foods both at school and at some other location, mainly at home. This behavior was most common among elementary school and high school participants (26 and 23 percent, respectively). Nonparticipants at all school levels were substantially less likely than participants to consume breakfast foods from school and from other sources (statistical significance of difference not tested). The consumption of breakfasts from more than one source has been observed by other SBP researchers. In a study of a universal-free breakfast program in elementary schools, McLaughlin and colleagues (2002)

⁴ All foods reported between 5:00 A.M. and 9:30 A.M. and foods reported between 9:30 A.M. and 10:30 A.M. and called “breakfast” by the student were counted as breakfast foods. A few breakfasts reported earlier in the day (3:00 to 4:00 A.M.) and later in the day (10:45 to 11:30 A.M.) were determined to be legitimate (that is, no other breakfast was reported, and students who reported late breakfasts also reported a late lunch) and were also included.

TABLE VII.1
 BREAKFAST CONSUMPTION AND SKIPPING BEHAVIORS, BY SCHOOL TYPE

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
	Percent of Students		Percent of Students		Percent of Students		Percent of Students	
Consumed breakfast	74	86	85	76	77	77	77	81
May have consumed two breakfasts ^a	26	5	15	3	23	7	24	5
Skipped breakfast ^b	0	10	0	23	0	17	0	15
Number of Students	160	572	127	660	94	701	381	1,933

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations of single 24-hour recalls prepared by Mathematica Policy Research, Inc. Sample includes all children.

^aStudents who may have consumed two breakfasts consumed breakfast foods that were obtained and eaten at school as well as breakfast foods that were obtained and eaten in another location.

^bIncludes students who reported only water.

found that 11 percent of students in control SBP schools and 21 percent of students in universal-free breakfast program schools consumed breakfast foods from both the SBP and from home.

C. REGRESSION-ADJUSTED MEAN BREAKFAST INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS

After controlling for measured differences between SBP participants and nonparticipants, several statistically significant differences in mean breakfast intakes were observed.⁵ There was substantial variation in findings for elementary, middle, and high school students, however. None of the differences in mean intakes was observed for all three groups of students.⁶

1. Energy and Macronutrients

Overall, breakfasts consumed by SBP participants and nonparticipants were comparable in energy content, providing an average of roughly 420 to 450 calories (Table VII.2). On average, breakfasts consumed by SBP participants provided a higher percentage of energy from monounsaturated fat, polyunsaturated fat, linoleic acid, and protein than the breakfasts consumed by nonparticipants, and a lower percentage of energy from carbohydrate.⁷ There were no significant differences, overall, in the average percentage of energy from total fat or saturated fat in breakfasts consumed by participants and nonparticipants.

None of the above differences in relative macronutrient intakes was observed among elementary school students. Differences in the average percentage of energy derived from monounsaturated fat, polyunsaturated fat, and linoleic acid were observed for both middle school and high school students. However, differences between SBP participants and nonparticipants in

⁵ Detailed results of regression models are presented in Appendix E. In addition, data on unadjusted mean breakfast intakes are presented in Appendix F.

⁶ Intakes for secondary school students (middle and high school combined) are presented in Appendix G.

⁷ Linoleic acid is an essential polyunsaturated fatty acid that must be obtained from the diet.

TABLE VII.2

REGRESSION-ADJUSTED MEAN BREAKFAST INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS, BY SCHOOL TYPE

	Regression-Adjusted Mean Breakfast Intake											
	Elementary School Students		Middle School Students		High School Students		All Students					
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants				
Food Energy (kcal)	436	412	408	415	510	424	451	417				
Macronutrients: Total Amount (g)												
Total fat	11	12	13	12	16	12*	13	12				
Saturated fat	4.3	4.4	4.4	4.5	5.3	4.5	4.5	4.5				
Monounsaturated fat	4.2	4.1	5.2	4.1	6.4	4.3**	5	4.2*				
Polyunsaturated fat	2.3	2.2	2.6	2.0*	3.1	2.1*	2.6	2.1*				
Linoleic acid	2.1	1.9	2.4	1.8*	2.8	1.9*	2.4	1.9*				
Linolenic acid	0.18	0.19	0.19	0.17	0.23	0.17*	0.20	0.18				
Carbohydrate	71	66	62	67	77	68	71	67				
Protein	14	12	13	12	16	13	14	12*				
Macronutrients: Percentage of Food Energy from (%)												
Total fat	23.0	23.8	26.1	23.4	26.8	22.1**	24.4	23.1				
Saturated fat	8.6	9.4	9.1	9.4	9.2	8.5	8.7	9.1				
Monounsaturated fat	8.5	8.4	10.0	8.2*	10.6	7.6**	9.3	8.1**				
Polyunsaturated fat	4.5	4.3	5.1	4.0**	5.2	3.8**	4.9	4.1**				
Linoleic acid	4.2	3.8	4.7	3.5**	4.8	3.5**	4.5	3.7**				
Linolenic acid	0.34	0.39	0.41	0.35	0.39	0.31*	0.37	0.36				
Carbohydrate	65.4	65.4	63.2	66.5	60.8	69.8**	64.4	67.4*				
Protein	12.8	11.8	12.4	11.6	12.6	11.2*	12.6	11.4*				
Vitamins												
Vitamin A (mcg RAE)	217	229	193	247*	228	227	216	232				
Vitamin C (mg)	28	26	28	28	38	26*	29	27				
Vitamin E (mg)	1.1	1.0	1.0	0.9	1.3	1.2	1.2	1				
Vitamin B ₆ (mg)	0.49	0.59	0.38	0.66**	0.55	0.61	0.49	0.61**				
Vitamin B ₁₂ (mcg)	1.8	1.8	1.5	2.1**	1.6	1.8	1.7	1.9				
Folate (mcg DFE)	200	233	147	281**	216	243	201	245*				
Niacin (mg)	5.1	5.6	4.1	6.2**	6.0	5.8	5.2	5.8				
Riboflavin (mg)	0.78	0.77	0.68	0.85**	0.78	0.79	0.77	0.79				
Thiamin (mg)	0.48	0.52	0.43	0.57	0.59	0.55	0.51	0.54				

TABLE VII.2 (continued)

	Regression-Adjusted Mean Breakfast Intake							
	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Minerals								
Calcium (mg)	353	311	346	321	332	285	340	301
Iron (mg)	4.7	5.3	3.8	6.0**	5.7	5.6	5	5.4
Magnesium (mg)	58	54	52	54	60	59	59	55
Phosphorus (mg)	352	313	337	320	374	319	358	314*
Potassium (mg)	612	520*	570	530	625	537	613	527*
Sodium (mg)	585	545	559	535	825	541**	640	539*
Zinc (mg)	3.1	3.1	2.7	3.4*	3.2	3.0	3.1	3.1
Other Dietary Components								
Fiber (g)	2.6	2.6	2.1	2.4	2.9	2.8	2.7	2.6
Fiber (g/1,000 kcal)	6.2	6.1	5.2	5.8	5.6	7.3*	6.2	6.5
Cholesterol (mg)	27	46**	30	50*	50	45	32	47**
Number of Students	160	510	127	495	94	550	381	1,555

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample excludes students who did not consume a breakfast. Intakes of both SBP participants and nonparticipants include all foods and beverages consumed at breakfast. For SBP participants, this may include, in addition to foods/beverages obtained as part of the reimbursable breakfast, foods/beverages that were obtained in school from non-reimbursable sources and/or foods that were brought from or consumed at home.

Note: All mean estimates have been regression-adjusted for differences in personal, family, and school characteristics between SBP participants and nonparticipants, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics described in Appendix E.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

the relative contributions of carbohydrate and protein to breakfast energy intakes were limited to high school students. In addition, SBP participants in high schools consumed breakfasts that provided a significantly greater amount of energy from total fat than the breakfasts consumed by their nonparticipant counterparts (27 versus 22 percent).

2. Vitamins and Minerals

Significant differences between SBP participants and nonparticipants in average vitamin and mineral intakes at breakfast were largely limited to middle school students. In this subgroup, breakfasts consumed by SBP participants provided, on average, significantly *less* iron, zinc, and nearly all vitamins examined in this analysis than breakfasts consumed by nonparticipants (Table VII.2). However, the only significant difference in breakfasts intakes of vitamins and minerals observed among elementary school students was a higher intake of potassium among SBP participants, relative to nonparticipants. Among high school students, significant differences between SBP participants and nonparticipants were limited to vitamin C and sodium. In both cases, mean intakes of participants were significantly higher than mean intakes of nonparticipants. The difference in average sodium intake was substantial; SBP participants consumed 52 percent more sodium at breakfast than nonparticipants (825 versus 541 mg).

Overall, SBP participants had significantly higher mean breakfast intakes of phosphorus than nonparticipants. Although phosphorous intake was higher for SBP participants than nonparticipants across all three types of schools, the differences were not significant in any of the school-level comparisons.

3. Fiber and Cholesterol

SBP participants in both elementary and middle schools had significantly lower intakes of cholesterol at breakfast than their nonparticipant counterparts (Table VII.2). Among high school

students, SBP participants had a significantly lower average intake of fiber—on a gram per calorie basis—than nonparticipants (5.6 g/1,000 calories versus 7.3 g/1,000 calories).

4. Mean Proportion of Total 24-Hour Intakes Provided by Breakfast

SBP participants and nonparticipants in elementary and middle schools obtained roughly 20 percent of their total energy intakes from breakfast (Table VII.3). However, the breakfasts consumed by elementary and middle school SBP participants made significantly greater contributions to total 24-hour intakes of several nutrients than the breakfasts consumed by their nonparticipant counterparts. This was true for protein, calcium, phosphorus, and potassium and indicates that SBP participants were significantly less likely than nonparticipants to obtain these nutrients from other meals and snacks consumed throughout the day. It also suggests that SBP meals were particularly rich in these nutrients.⁸ Comparable patterns were observed for carbohydrate and magnesium among elementary school students and for all macronutrients except saturated fat and carbohydrate among middle school students. One divergent result was noted among middle school students. In this group of students, the relative contribution of breakfasts to total 24-hour intakes of vitamin B₆ was significantly *lower* for SBP participants, compared with nonparticipants. SBP participants in high schools obtained a significantly greater share of their total 24-hour energy intakes from breakfast than did nonparticipants (23 versus 19 percent). At the same time, the breakfasts consumed by high school SBP participants provided a significantly greater share of total 24-hour intakes of vitamin C, vitamin E, thiamin, calcium, magnesium, phosphorus, and potassium than the breakfasts consumed by

⁸ The fact that SBP participants obtained significantly greater shares of total 24-hour intakes of specific nutrients at breakfast, relative to nonparticipants, does not necessarily mean that SBP participants consumed greater amounts of these nutrients than nonparticipants over 24 hours. Results of analyses that examined mean 24-hour intakes are presented in the next section.

TABLE VII.3

MEAN PROPORTION OF TOTAL 24-HOUR INTAKES CONTRIBUTED BY BREAKFAST: SBP PARTICIPANTS AND NONPARTICIPANTS

	Mean Percentage of Total 24-Hour Intake											
	Elementary School Students		Middle School Students		High School Students		All Students					
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Food Energy (kcal)	21	20	21	19	23	19*	22	19**				
Macronutrients												
Total fat	16	16	18	15*	20	14**	18	15**				
Saturated fat	17	17	18	18	21	15*	18	17				
Monounsaturated fat	16	15	18	14**	20	13**	18	14**				
Polyunsaturated fat	17	16	19	15**	21	13**	19	15**				
Linoleic acid	18	16	20	15**	21	14**	19	15**				
Linolenic acid	16	16	19	15*	19	13**	17	15				
Carbohydrate	25	23*	23	23	25	23	25	23**				
Protein	19	16*	19	16*	21	15**	19	16**				
Vitamins												
Vitamin A	34	32	35	36	38	33	36	33				
Vitamin C	30	24	30	25	36	23**	31	24**				
Vitamin E	17	15	16	16	20	16*	18	15*				
Vitamin B ₆	28	29	25	31*	28	27	28	29				
Vitamin B ₁₂	32	30	32	33	33	28	32	30				
Folate	32	32	30	35	36	31	33	32				
Niacin	25	24	23	26	26	22	25	23				
Riboflavin	31	29	31	32	34	30	32	30				
Thiamin	29	29	31	31	33	28*	30	29				
Minerals												
Calcium	29	25*	32	28**	32	25**	30	26**				
Iron	30	29	28	30	32	28	30	29				
Magnesium	23	20*	22	20	24	21*	23	20**				
Phosphorus	25	22*	25	22*	27	21**	26	22**				
Potassium	23	20**	24	21*	25	20**	24	20**				
Sodium	18	16	18	16	21	15**	19	16**				
Zinc	26	24	24	24	25	21	25	23				

TABLE VII.3 (continued)

	Mean Percentage of Total 24-Hour Intake							
	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Fiber	19	18	18	17	21	18	19	18
Cholesterol	15	18	17	18	23	15**	17	17
Number of Students	160	510	127	495	94	550	381	1,555
Other Dietary Components								

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample excludes students who did not consume a breakfast. Breakfast intakes of both SBP participants and nonparticipants include all foods and beverages consumed at breakfast. For SBP participants, this may include, in addition to foods/beverages obtained as part of the reimbursable breakfast, foods/beverages that were obtained in school from non-reimbursable sources and/or foods that were brought from or consumed at home.

Note: All mean estimates have been regression-adjusted for differences in personal, family, and school characteristics between SBP participants and nonparticipants, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics described in Appendix E.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

nonparticipants. Breakfasts consumed by SBP participants in high schools also provided significantly greater shares of 24-hour intakes of sodium, cholesterol, and all macronutrients except carbohydrate.

D. REGRESSION-ADJUSTED 24-HOUR INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS

Some or all of the significant differences observed in the mean breakfast intakes of SBP participants and nonparticipants could be offset by the foods and beverages students consume at other times throughout the day. Therefore, to obtain a more accurate assessment of how SBP breakfast intakes may influence students' dietary intakes, it is important to examine 24-hour intakes of energy and nutrients. Analysis of 24-hour intakes revealed that most of the significant differences observed in the breakfast intakes of SBP participants and nonparticipants dissipated over 24 hours.⁹ In addition, several differences that were not observed in breakfast intakes emerged.

1. Energy and Macronutrients

Although mean energy intakes at breakfast were comparable for SBP participants and nonparticipants (Table VII.2), SBP participants, overall, had significantly higher intakes of energy over 24 hours than nonparticipants (2,229 versus 2,102 calories) (Table VII.4). In addition, the differences observed between SBP participants and nonparticipants in the relative contributions of different macronutrients to energy intakes were not significant over 24 hours. SBP participants had higher total intakes of carbohydrate and protein than nonparticipants, but, overall, there were no significant differences between participants and

⁹ Detailed results of regression models are presented in Appendix E. In addition, data on unadjusted mean 24-hour intakes are presented in Appendix F.

TABLE VII.4

REGRESSION-ADJUSTED MEAN 24-HOUR INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS, BY SCHOOL TYPE

	Regression-Adjusted Mean 24-Hour Intake									
	Elementary School Students		Middle School Students		High School Students		All Students			
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Food Energy (kcal)	2,117	2,012	2,184	2,029	2,494	2,234	2,229	2,102*		
Macronutrients: Total Amount (g)										
Total fat	76	71	81	73	90	84	81	76		
Saturated fat	27.0	25.0	27.5	25.4	29.9	28.5	28.1	26.4		
Monounsaturated fat	28.9	27.1	31.5	28.2	36.0	32.4	31.5	29.4		
Polyunsaturated fat	14.8	13.7	16.2	14.3	17.8	16.3	16.0	14.9		
Linoleic acid	13.1	12.1	14.3	12.6	15.8	14.3	14.2	13.1		
Linolenic acid	1.3	1.2	1.3	1.2	1.5	1.4	1.3	1.3		
Carbohydrate	286	277	296	274	339	296*	300	284*		
Protein	78	72*	75	73	88	81	81	76*		
Macronutrients: Percentage of Food Energy from (%)										
Total fat	31.7	31.4	33.2	31.9	31.6	32.8	32.1	32.1		
Saturated fat	11.3	11.1	11.3	11.1	10.4	11.1*	11.0	11.1		
Monounsaturated fat	12.1	12.0	12.9	12.3	12.5	12.7	12.4	12.4		
Polyunsaturated fat	6.2	6.0	6.6	6.2	6.4	6.5	6.4	6.3		
Linoleic acid	5.4	5.3	5.9	5.4	5.7	5.7	5.6	5.5		
Linolenic acid	0.53	0.52	0.55	0.52	0.54	0.56	0.54	0.54		
Carbohydrate	54.7	55.1	54.1	54.5	54.8	53.7	54.4	54.4		
Protein	14.7	14.7	14.0	14.6	14.5	14.6	14.6	14.6		
Vitamins										
Vitamin A (mcg RAE)	663	656	604	594	638	561	626	605		
Vitamin C (mg)	94	92	84	87	115	91	94	90		
Vitamin E (mg)	6.1	5.7	6.7	6.0	7.1	6.8	6.6	6.2		
Vitamin B ₆ (mg)	1.7	1.7	1.6	1.7	2.0	1.9	1.8	1.8		
Vitamin B ₁₂ (mcg)	5.9	5.1*	5.2	5.3	5.4	5.3	5.7	5.2		
Folate (mcg DFE)	558	593	503	566	682	593	574	582		
Niacin (mg)	20.9	21.0	20.2	21.0	25.1	23.8	22.0	22.0		
Riboflavin (mg)	2.5	2.3	2.3	2.2	2.5	2.3	2.4	2.3**		
Thiamin (mg)	1.7	1.6	1.6	1.6	1.9	1.7	1.7	1.6		

TABLE VII.4 (continued)

	Regression-Adjusted Mean 24-Hour Intake							
	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Minerals								
Calcium (mg)	1,234	1,112*	1,116	1,039	1,114	1,022	1,161	1,053*
Iron (mg)	15.3	15.2	14.0	14.9	18.3	16.0	15.9	15.3
Magnesium (mg)	263	248	258	239	275	256	265	248*
Phosphorus (mg)	1,463	1,333*	1,414	1,303	1,493	1,388	1,465	1,340**
Potassium (mg)	2,700	2,464**	2,548	2,347	2,761	2,533	2,683	2,452**
Sodium (mg)	3,390	3,247	3,445	3,234	4,324	3,564**	3,645	3,372*
Zinc (mg)	11.9	11.2	11.1	11.6	13.6	12.3	12.3	11.6
Other Dietary Components								
Fiber (g)	14.6	14.2	14.1	13.1	15.5	13.8	14.6	13.8
Fiber (g/1,000 kcal)	6.9	7.1	6.6	6.6	6.4	6.4	6.6	6.7
Cholesterol (mg)	196	208	197	201	246	234	207	216
Number of Students	160	572	127	660	94	701	381	1,933

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample includes all students, including those who did not consume a breakfast.

Note: All mean estimates have been regression-adjusted for differences in personal, family, and school characteristics between SBP participants and nonparticipants, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics described in Appendix E.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

nonparticipants in the relative contribution of these (or any other) macronutrients to total energy intakes.

The only significant difference observed in the 24-hour macronutrient intakes of SBP participants and nonparticipants was a lower percentage of energy from saturated fat among participants in high schools, compared with nonparticipants (10.4 versus 11.1 percent). This difference was not observed in high school students' mean breakfast intakes.

2. Vitamins and Minerals

Nearly all of the differences observed between SBP participants and nonparticipants in mean breakfast intakes of vitamins and minerals did not persist over 24 hours. The only differences that were observed at both breakfast and over 24 hours were a significantly higher intake of phosphorus among SBP participants overall, a significantly higher intake of potassium among SBP participants overall and in elementary schools, and a significantly higher intake of sodium among SBP participants overall and in high schools.

Several significant differences observed in the mean 24-hour intakes of SBP participants and nonparticipants were not observed in mean breakfast intakes. These include significantly higher mean 24-hour intakes of vitamin B₁₂, calcium, and phosphorus among SBP participants in elementary schools, and significantly higher mean intakes of riboflavin, calcium, and magnesium for SBP participants overall. The differences in mean 24-hour intakes of calcium, magnesium, and phosphorus (elementary students only) are consistent with general patterns observed in mean breakfast intakes—that is, mean breakfast intakes for SBP participants were higher, but the difference between participants and nonparticipants was not statistically significant.

3. Fiber and Cholesterol

There were no significant differences between SBP participants and nonparticipants in mean 24-hour intakes of cholesterol or fiber. All of the significant differences observed in breakfast intakes (lower mean intakes of cholesterol among SBP participants in elementary and middle schools and a lower mean intake of fiber [grams per 1,000 calories] among SBP participants in high schools [Table VII.2]) dissipated over 24 hours.

E. PREVALENCE OF INADEQUATE AND EXCESSIVE USUAL DAILY INTAKES AMONG SBP PARTICIPANTS AND MATCHED NONPARTICIPANTS

The data presented in this section are based on usual intake distributions that were estimated using methods recommended by the Institute of Medicine (see Chapter V). Tables VII.5 and VII.6 show the percentage of SBP participants and nonparticipants whose usual daily intakes were acceptable, inadequate, or excessive, relative to the DRIs or DGAs. As noted previously, these comparisons were made using propensity score matching techniques to control for differences between SBP participants and nonparticipants in a number of characteristics that may be associated with both SBP participation and dietary intakes (see Chapter V and Appendix I).

Individual point estimates in these analyses may be statistically unreliable because of small sample size or a large coefficient of variation. Rather than reporting point estimates of the percentage of students with usual daily intakes that fell above or below a dietary standard, “less than 3 percent” is reported for rare occurrences (less than 3 percent of students had usual intakes in this range, but the specific point estimate was statistically unreliable), and “more than 97 percent” is reported for common occurrences (more than 97 percent of students had usual intakes in this range, but the specific point estimate was statistically unreliable).

TABLE VII.5
MEAN USUAL DAILY ENERGY INTAKES AND ESTIMATED ENERGY REQUIREMENTS OF SBP PARTICIPANTS
AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Matched Nonparticipants	Participants	Matched Nonparticipants	Participants	Matched Nonparticipants	Participants	Matched Nonparticipants
Mean Intake	2,153	2,094	2,177	2,034	2,569	2,515	2,230	2,153
Mean EER ^a	1,769	1,784	2,256	2,284	2,519	2,511	1,978	1,992
Number of Students	160	118	127	99	94	85	381	302

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first and second 24-hour recalls prepared by Mathematica Policy Research, Inc. Usual intake distributions were determined for each subgroup using the PC version of the Software for Intake Distribution Estimation (PC-SIDE). Sample includes all students, including those who did not consume a breakfast.

Note: Matched sample constructed using propensity score matching to adjust for differences in personal, family, and school characteristics between SBP participants and nonparticipants, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics, as described in text. Estimates weighted to account for sample design and the fact that students in the comparison group may be matched to multiple participants.

^aEER = Estimated Energy Requirement. EERs were estimated based on age, gender, height, and weight, and assumed, for all children, a “low active” physical activity level (Institute of Medicine 2002/2005). EER estimates exclude children who did not have valid data for height and/or weight.

*Difference between participants and matched nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and matched nonparticipants is significantly different from zero at the .01 level.

TABLE VII.6

PERCENT OF SBP PARTICIPANTS AND MATCHED NONPARTICIPANTS WITH ACCEPTABLE, INADEQUATE,
OR EXCESSIVE INTAKES, BY SCHOOL TYPE

	Elementary School Students		Middle School Students		High School Students		All Students	
	Matched		Matched		Matched		Matched	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Macronutrients								
Total fat								
% within AMDR	70.6	79.4	63.5	69.1	78.9	48.2	77.3	83.5
% > AMDR	22.6	13.5 ~	34.2	30.9 ~	21.1 ~	38.4	20.3 ~	14.4 ~
% < AMDR	6.9 ~	7.1 ~	<3	<3	5.0 ~	13.5 ~	<3	<3
Saturated fat								
% > DGA	75.6	64.6	71.1	86.3 ~	59.8	70.3	71.5	70.4
Linoleic acid								
% within AMDR	57.3	60.8	79.0	65.2	96.0	63.7	69.5	62.9
% > AMDR	<3	<3	<3	<3	<3	3.2 ~	<3	<3
% < AMDR	41.6	38.9	20.9 ~	34.6 ~	4.0 ~	33.1 ~	30.2	36.4
Alpha-linolenic acid								
% within AMDR	25.7	16.5	29.8	25.8	36.2	41.6	27.1	24.2
% > AMDR	<3	<3	<3	<3	<3	<3	<3	<3
% < AMDR	74.3	83.5	70.2 ~	74.0	63.6	56.6	72.9	75.6
Carbohydrate								
% < EAR	<3	<3	<3	<3	<3	<3	<3	<3
% within AMDR	89.2	>97	95.2	86.3	>97	79.0	96.9	97.0
% > AMDR	3.3 ~	<3	<3	<3	<3	3.2 ~	<3	<3
% < AMDR	7.5 ~	<3	3.5 ~	13.5 ~	<3	17.9 ~	<3	<3
Protein								
% < EAR	<3	<3	<3	<3	<3	<3	<3	<3
% within AMDR	>97	>97	>97	>97	93.7	>97	>97	>97
% > AMDR	<3	<3	<3	<3	<3	<3	<3	<3
% < AMDR	<3	<3	<3	<3	5.9 ~	<3	<3	<3
Vitamins and Minerals with EARs (Percent < EAR)								
Vitamin A	5.9 ~	13.9 ~	27.3 ~	44.8	34.2 ~	53.6	13.4 ~	26.6 *
Vitamin C ^a	6.4 ~	<3	<3	18.0 ~	10.2 ~	36.1	5.4 ~	<3
Vitamin E	75.9	76.2	88.1 ~	91.0 ~	>97	93.6 ~	82.4	82.5
Vitamin B ₆	<3	<3	<3	5.0 ~	<3	<3	<3	<3
Vitamin B ₁₂	<3	<3	<3	3.1 ~	<3	3.5 ~	<3	<3
Folate	<3	<3	<3	17.8 ~	6.6 ~	6.6 ~	<3	<3
Niacin ^b	<3	<3	<3	<3	3.3 ~	<3	<3	<3
Riboflavin	<3	<3	<3	7.7 ~	<3	5.4	<3	<3

TABLE VII.6 (continued)

	Elementary School Students		Middle School Students		High School Students		All Students	
	Matched		Matched		Matched		Matched	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Thiamin	<3 ~	<3 ~	<3 ~	11.4 ~	4.3 ~	5.5 ~	<3 ~	<3 ~
Iron ^c	<3 ~	<3 ~	<3 ~	3.6 ~	7.7 ~	8.5 ~	<3 ~	<3 ~
Magnesium	6.0 ~	11.1 ~	40.8 ~	57.1 *	75.3 ~	72.9 ~	20.6 ~	29.0 ~
Phosphorus	3.9 ~	15.5 *	19.6 ~	36.7 ~	<3 ~	25.4 ~	7.4 ~	18.0 *
Zinc	<3 ~	5.0 ~	7.6 ~	25.5 ~	8.7 ~	9.7 ~	<3 ~	9.1 ~
Calcium, Potassium, and Sodium								
Calcium (Mean % AI)	121.6 ~	109.6 ~	81.5 ~	69.8 ~	91.1 ~	89.7 ~	109.5 ~	99.3 ~
Potassium (Mean % AI)	65.7 ~	59.3 ~	55.7 ~	48.5 ~	61.9 ~	57.5 ~	63.3 ~	57.1 ~
Sodium (Mean % AI)	258.1 ~	240.0 ~	228.3 ~	216.1 ~	292.1 ~	276.4 ~	258.6 ~	242.0 ~
Sodium (% > UL)	>97 ~	87.1 ~	>97 ~	74.8 **	>97 ~	94.6 ~	>97 ~	86.8 *
Other Dietary Components								
Fiber (Mean % AI)	55.4 ~	54.0 ~	46.7 ~	44.9 ~	47.8 ~	44.2 ~	52.6 ~	50.8 ~
Fiber (g/1,000 kcal) (Mean % AI)	49.3 ~	51.2 ~	46.4 ~	44.2 ~	45.1 ~	44.8 ~	48.1 ~	48.9 ~
Cholesterol (% > DGA)	8.6 ~	13.8 ~	6.2 ~	15.3 ~	27.4 ~	45.5 ~	12.9 ~	18.6 ~
Number of Students	160	118	127	99	94	85	381	302

Source: School Nutrition Dietary Assessment-III, 24-Hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first and second 24-hour recalls prepared by Mathematica Policy Research, Inc. Usual intake distributions were determined for each subgroup using the PC version of the Software for Intake Distribution Estimation (PC-SIDE). Sample includes all students, including those who did not consume a breakfast.

Note: Matched sample constructed using propensity score matching to adjust for differences in personal, family, and school characteristics between SBP participants and nonparticipants, including age, sex, race and ethnicity, height, household income relative to poverty, region, and several other characteristics, as described in text. Estimates weighted to account for sample design and the fact that students in the comparison group may be matched to multiple participants.

AI = Adequate Intake

AMDR = Acceptable Macronutrient Distribution Range

DGA = Dietary Guidelines for Americans recommendation

EAR = Estimated Average Requirement

UL = Tolerable Upper Intake Level

^aThe EAR for vitamin C is 35mg greater for smokers than nonsmokers. These tabulations used EARs for nonsmokers.

^bNiacin intakes include preformed niacin only. EARs for niacin are expressed as niacin equivalents, including contributions from tryptophan. Therefore, prevalence of inadequate niacin intakes may be overestimated.

^cComparison to EAR was done using the probability approach. The significance of differences between participants and nonparticipants was not tested.

~ Estimates may not be reliable due to inadequate cell size or a large coefficient of variation.

* Difference between participants and matched nonparticipants is significantly different from zero at the .05 level.

** Difference between participants and matched nonparticipants is significantly different from zero at the .01 level.

Appendix L provides data on unadjusted means and full distributions of usual intakes (5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles) for five subgroups of SBP participants and nonparticipants that correspond to the age and gender subgroups used in the DRIs (children 6 to 8 years, males 9 to 13 years, females 9 to 13 years, males 14 to 18 years, and females 14 to 18 years), as well as for groups defined by school level (elementary, middle, high, and secondary) and for all students combined.

1. Energy

Assessment of self-reported energy intakes is difficult. In theory, populations that are in energy balance (not gaining or losing weight) should have average usual energy intakes that are roughly equivalent to corresponding Estimated Energy Requirements (EERs). However, it is well recognized that individuals tend to misreport food intake in dietary surveys (Institute of Medicine 2005). Underreporting tends to be greatest among females, people who are overweight or obese, and people who are low income. There is some evidence that underreporting is associated with omission of foods perceived to be “bad,” such as foods high in fat and/or sugar. Among young children, the opposite problem (overreporting) may occur (Devaney et al. 2005).

In addition, it is difficult to accurately estimate EERs without accurate information about customary levels of physical activity. This analysis assumes a “low active” level of physical activity for all children.¹⁰ Despite these limitations, it is instructive to examine reported energy

¹⁰ The choice to use a “low active” level of physical activity for all children was based on data from the Centers for Disease Control and Prevention’s Youth Media Campaign Longitudinal Survey, which indicated that 61.5 percent of children aged 9 to 13 years do not participate in any organized physical activity during their nonschool hours and that 22.6 percent do not engage in any free-time physical activity (Centers for Disease Control and Prevention 2003). Other possible physical activity levels for the equations used to estimate EERs are: “sedentary,” “active,” and “very active.” “Sedentary” would underestimate EERs for the 77.2 percent of students who engage in some form of free-time physical activity, and “active” or “very active” might overestimate EERs for these students. Physical activity was not explicitly measured in SNDA-III, and there is no accepted method for using the related data that were collected (for example, information about participation on sports teams and physical education at school) to develop group-level assumptions about physical activity or to assign different levels of physical activity to each child in the sample.

intakes to gain some perspective on the potential for over- and underreporting in general, and on differences in this regard among participants and nonparticipants.

Estimated mean energy intakes and EERs suggest that food intakes of elementary school students may have been overreported (by children themselves and/or by their parents/primary caregivers). In this group of children, the estimated mean usual energy intake was greater than the estimated mean EER by 310 to 380 calories (Table VII.5). Excess daily energy intakes in this range would lead to an annual weight gain of 32 to 40 pounds.¹¹ While the prevalence of overweight has been increasing among children in all age groups, this discrepancy is so large that it is likely that at least some of it must be associated with overreporting. This pattern was noted for both SBP participants and nonparticipants and could have included reporting of foods that were not actually consumed and/or overestimation of portion sizes for foods that were consumed. The potential for overreporting is most notable among children 6 to 8 years old, among whom the difference between mean usual energy intakes and mean EERs ranged from 376 to 442 calories (see Tables L.1A and L.1B in Appendix L). To the extent that the discrepancy between estimated energy intakes and estimated EERs is due to overreporting, the major implication is that the prevalence of inadequate nutrient intakes discussed in subsequent sections of this chapter may be underestimated for elementary school students. An alternative explanation for the discrepancy between mean usual energy intakes and mean EERs in this age group is that EERs are underestimated because a “low active” level of physical activity was assumed for all children.

Among middle school students, the relationship between mean usual energy intakes and mean EERs is reversed, with mean intakes falling below mean EERs (Table VII.5). This may

¹¹ One pound of body fat is equivalent to 3,500 kilocalories.

indicate a tendency for adolescents to underreport food intakes. To the extent that this is true, estimates of the prevalence of inadequate nutrient intakes for middle school students discussed later in this chapter may be overstated. Among high school students, mean usual energy intakes and mean EERs were roughly equivalent.

Estimated energy requirements for SBP participants and matched nonparticipants were similar within each of the three grade levels. Although mean energy intakes of SBP participants exceeded those of matched nonparticipants by about 50 to 150 calories, these differences were not statistically significant at the 0.05 level.

2. Macronutrients

Table VII.6 presents data comparing usual macronutrient intakes of SBP participants and nonparticipants to dietary standards. For total fat, linoleic acid, linolenic acid, carbohydrate, and protein, data are presented on the proportion of participants and matched nonparticipants whose usual daily intakes were within the respective Acceptable Macronutrient Distribution Range (AMDR), as well as the proportion with usual intakes that exceeded or fell below the AMDR. For saturated fat, usual intakes are compared to the DGA that less than 10 percent of energy come from saturated fat. Carbohydrate and protein intakes are also compared to Estimated Average Requirements (EARs).

Overall, there were no statistically significant differences between SBP participants and matched nonparticipants in the extent to which macronutrient intakes conformed to dietary standards. This is generally consistent with findings from the regression-adjusted 24-hour intakes (Table VII.4). More than three-quarters of both SBP participants and matched nonparticipants had usual daily fat intakes that fell within the AMDR of 25 to 35 percent of total energy (Table VII.6). For both participants and matched nonparticipants, the usual daily fat intakes of students whose intakes were not within the AMDR were much more likely to exceed

the recommended range (include more fat [as a percentage of energy] than recommended) than to fall below it.

Roughly 70 percent of both SBP participants and matched nonparticipants had usual daily intakes of saturated fat that exceeded the DGA recommendation of less than 10 percent of total energy. In keeping with the comparatively high intakes of saturated fat, sizable proportions of both SBP participants and matched nonparticipants had usual daily intakes of the essential polyunsaturated fatty acids linoleic acid and linolenic acid that fell below the lower end of their respective AMDRs. This was particularly true for linolenic acid, for which the percentage of students with usual intakes that were less than the lower bound of the AMDR ranged from 57 to 84 percent. Usual carbohydrate and protein intakes of both SBP participants and matched nonparticipants were generally consistent with the respective AMDRs, and inadequate intakes (usual intakes less than the EAR) of these two macronutrients were rare. For carbohydrate, students whose usual intake did not fall within the AMDR most often obtained too little energy from carbohydrate rather than too much. This problem was largely concentrated among female middle and high school students (see Table L.15 in Appendix L).

3. Vitamins and Minerals with Estimated Average Requirements

EARs have been defined for all of the vitamins examined in this study and for four of the eight minerals examined (iron, magnesium, phosphorus, and zinc) (see Chapter V). Table VII.6 shows the percentage of SBP participants and matched nonparticipants whose usual daily intakes of these nutrients were inadequate (less than the EAR).¹² Findings from this analysis, with respect to differences between SBP participants and matched nonparticipants, would not

¹² The prevalence of inadequate intakes of iron was estimated using the probability approach (see Appendix H). It was not possible to test the significance of differences between participants and nonparticipants using this approach.

necessarily be consistent with findings from the preceding analysis of mean 24-hour intakes, even if both sets of estimates were regression-adjusted. Differences in mean intakes on one day do not necessarily translate into differences in adequacy, which is assessed by taking into consideration the distribution of *usual* nutrient intakes and the distribution of nutrient requirements.

For the full sample, prevalence of inadequacy was relatively high for vitamin A, vitamin E, magnesium, and phosphorus. For vitamin A and phosphorus, however, the prevalence of inadequate intakes among SBP participants was 50 to 60 percent lower than the prevalence among matched nonparticipants—13 versus 27 percent for vitamin A and 7 versus 18 percent for phosphorus. SBP participants and matched nonparticipants had comparable levels of inadequacy for vitamin E and magnesium.

Compared to middle and high school students, the prevalence of inadequate intakes of vitamins and minerals was low among elementary school students, except for vitamin E. Given the possibility that food intakes of children in this age group may be overreported, it is possible that the prevalence of inadequate intakes was underestimated. An estimated 4 to 16 percent of elementary school SBP participants and/or matched nonparticipants had inadequate usual intakes of vitamin A, vitamin C, magnesium, phosphorus, or zinc. The prevalence of inadequacy was generally lower for SBP participants than for matched nonparticipants; however, the difference between the two groups was statistically significant only for phosphorus. The prevalence of inadequate phosphorus intakes among SBP participants was significantly lower—by 75 percent—than the prevalence among matched nonparticipants (4 versus 16 percent).

Among middle school students, the prevalence of inadequate intakes of several vitamins and minerals was notably higher, relative to elementary school students. This was true for vitamin A, vitamin E, magnesium, phosphorus, and zinc for both SBP participants and matched

nonparticipants and for vitamin C, vitamin B₆, folate, riboflavin, and thiamin for matched nonparticipants. Data broken down by gender indicate that the prevalence of inadequate intakes of all of these nutrients was notably higher for females than for males (see Appendix L). The prevalence of inadequacy for all of these nutrients was generally lower among SBP middle school participants than among the matched nonparticipants. However, differences were statistically significant only for magnesium intakes, with 41 percent of middle school SBP participants consuming less than the EAR, compared with 57 percent of middle school matched nonparticipants.

Nutrients that were problematic for high school students included vitamin A, vitamin C, vitamin E, and magnesium. The prevalence of inadequate intakes of these nutrients was generally higher for high school females than for males (see Appendix L). It is possible that these results are at least partially associated with underreported food intakes. Although the prevalence of inadequacy of these nutrients tended to be lower among high school SBP participants than matched nonparticipants, differences between the two groups were not statistically significant.

4. Calcium, Potassium, and Sodium

EARs have not been defined for calcium, potassium, or sodium (see Chapter V). For calcium and potassium, Adequate Intake levels (AIs) have been defined and for sodium, both an AI and a Tolerable Upper Intake Level (UL) have been defined. Assessment of students' usual intakes of calcium and potassium is limited to a comparison of mean usual intakes to the relevant AI. Usual mean intakes of calcium, sodium, and potassium are reported in Table VI.6 as the mean percentage of the relevant AI. If the usual mean intake is equivalent to 100 percent or more of the AI, the prevalence of inadequacy is likely to be low. If the usual mean intake falls below 100 percent of the AI, no firm conclusions can be drawn about the adequacy of usual

intakes. Because public health concerns about sodium center around the problems associated with excessive sodium intake, the discussion focuses on the sodium UL (rather than the AI) and the proportions of children with usual intakes that exceed this benchmark.

a. Calcium

Among elementary school students, mean usual calcium intakes of both SBP participants and matched nonparticipants were more than 100 percent of the AI (Table VII.5). This indicates that the prevalence of inadequate calcium intakes among elementary school students is likely to be low. Among middle and high school students, mean usual calcium intakes were less than 100 percent of the AI. There were no significant differences between SBP participants and matched participants in mean usual calcium intakes, overall or for any of the three school levels.

Given the limitation of the AI standard, we cannot conclude that (1) mean usual intakes below 100 percent of the AI mean than high proportions of middle and high school students have inadequate usual calcium intakes, or (2) that the lack of significant differences observed in the usual calcium intakes of SBP participants and matched nonparticipants means that SBP participants and matched nonparticipants have a similar prevalence of inadequate calcium intakes.

b. Potassium

Mean usual potassium intakes of students at all three school levels fell short of 100 percent of their respective AIs. Among elementary school students, SBP participants had significantly greater mean usual intakes of potassium (66 percent of AI) than matched nonparticipants (59 percent of AI). Similarly, for the full sample, SBP participants had significantly greater mean usual intakes of potassium (63 percent of AI) than matched nonparticipants (57 percent of

AI). Interpretation of data on usual potassium intakes relative to the AI faces the same constraints as that for usual calcium intakes discussed above.

c. Sodium

The majority of SBP participants and matched nonparticipants at all three school levels had usual sodium intakes that exceeded the UL. Among middle school students, SBP participants were significantly more likely than matched nonparticipants to have usual sodium intakes that exceeded the UL (>97 versus 75 percent). Similarly, for the full sample, SBP participants were significantly more likely than matched nonparticipants to have usual sodium intakes that exceeded the UL (>97 versus 87 percent).

5. Fiber and Cholesterol

a. Fiber

Mean usual fiber intakes of all groups of students fell well below 100 percent of both age- and-gender specific AIs and the 14 grams per 1,000 kilocalorie benchmark on which the fiber AIs are based (Table VII.6). The AIs are defined for total fiber (dietary fiber and functional fiber), while the Survey Net nutrient database used in this study includes values only for dietary fiber.¹³ Thus, fiber intakes are underestimated, but not to an extent that would alleviate the marked disparities between recommendations and usual intakes apparent in these data.

Overall and for each of the three school levels, mean usual fiber intakes were 55 percent or less of the AI when assessed in total grams of intake and 51 percent or less of the AI when assessed on a grams-per-1,000 calorie basis. Mean usual fiber intakes were similarly low for

¹³ Dietary fiber consists of nondigestible carbohydrates and lignin that are intrinsic and intact in plants. Functional fiber consists of isolated, nondigestible carbohydrates that have beneficial physiological effects in humans. Total fiber is the sum of dietary fiber and functional fiber, and total fiber intakes are, on average, 5.1 grams higher than dietary fiber intakes (Institute of Medicine 2005).

SBP participants and matched nonparticipants, and differences between the two groups were not statistically significant.

b. Cholesterol

The prevalence of excessive usual cholesterol intakes was lowest among the elementary and middle school SBP participants (9 and 6 percent, respectively) and highest among the matched high school nonparticipants (46 percent). The greater prevalence of excessive cholesterol intakes among matched high school nonparticipants is largely driven by a high prevalence of excessive usual cholesterol intakes among 14- to 18-year-old males (see Table L.37 in Appendix L). In this age-and-gender subgroup, 28 to 37 percent of students had usual cholesterol intakes that exceeded the DGA.

Overall, 13 percent of SBP participants and 19 percent of matched nonparticipants had usual intakes of cholesterol that exceeded the DGA recommendation of less than 300 mg. The difference in prevalence was not statistically significant. For students in all three school levels, the prevalence of excessive cholesterol intakes was greater for the matched comparison groups than for SBP participants. However, these differences were not statistically significant at the 0.05 level.

F. TYPES OF FOOD CONSUMED BY SBP PARTICIPANTS AND NONPARTICIPANTS

This section presents data on the types of food consumed at breakfast and over 24 hours by SBP participants and nonparticipants. All tabulations are based on the single 24-hour recall collected from all sample members.

1. Foods Consumed at Breakfast

Overall, SBP participants were more likely than nonparticipants to consume milk at breakfast (75 versus 53 percent) (Table VII.7). This pattern was noted for students in elementary and middle schools but not high schools. Nearly all of the milk consumed by both participants and nonparticipants was reduced-fat (1% or 2%) or nonfat.¹⁴ While the percentage of students who consumed whole milk at breakfast was low for both groups of students, SBP participants were significantly less likely than nonparticipants to consume this type of milk (7 versus 11 percent). SBP participants were also significantly more likely than nonparticipants to consume flavored milk at breakfast (22 versus 3 percent).

Almost two-thirds of SBP participants consumed 100% juice or some type of fruit at breakfast, compared with less than one-third of nonparticipants. Most of this difference, which was observed in all three types of schools, was due to a difference in the proportion of students who consumed 100% juice (56 versus 22 percent). In addition, while the percentage of students who consumed fresh fruit at breakfast was low for both groups, SBP participants were less likely than nonparticipants to consume fresh fruit (five versus nine percent).

Grain and bread products were consumed by roughly three-quarters of both SBP participants and nonparticipants. For both groups, cold cereals were the specific type of grain/bread product consumed most frequently. Among high school students, SBP participants were significantly less likely than nonparticipants to consume unsweetened breakfast cereal, but there were no significant differences in consumption of sweetened breakfast cereal. The breakfasts consumed by SBP participants were more likely than those consumed by nonparticipants to include (1) sweet rolls, doughnuts, and similar items; and (2) biscuits, croissants, or cornbread. In

¹⁴ Nearly all flavored milks were reduced-fat or nonfat.

TABLE VII.7

MOST COMMONLY CONSUMED FOODS AT BREAKFAST BY SBP PARTICIPANTS AND NONPARTICIPANTS, BY SCHOOL TYPE

	Percentage of Students Consuming at Least Once at Breakfast									
	Elementary School Students		Middle School Students		High School Students		All Students			
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Milk	81	56**	71	56*	55	46	75	53**		
1%	42	8**	27	9**	16	6*	35	7**		
2%	31	34	24	25	24	26	29	30		
Whole	8	12	8	13*	5	10	7	11*		
Skim or nonfat	4	3	14	6	11	4	7	4		
Flavored ^a	23	5**	24	1**	18	1**	22	3**		
Fruits and Juices	66	33**	53	28**	62	26**	63	30**		
Fruit juice, 100%	57	24**	51	22**	59	19**	56	22**		
Canned fruit ^b	8	0	1	0	1	1	6	1		
Fresh fruit	7	11	3	7	3	8*	5	9*		
Grains/Breads ^c	79	79	78	73	67	63	77	73		
Cold cereal	38	39	29	40*	22	31	34	37		
Sweetened	32	32	24	33	21	21	29	29		
Unsweetened	6	7	5	8	2	10**	5	8		
Sweet rolls, doughnuts, toaster pastries, fruit turnovers, coffee cake	16	13	16	8	22	8	17	10*		
Pancakes, waffles, French toast	16	14	4	10*	3	5	12	10		
Biscuits, croissants, cornbread	6	1	16	2*	20	2**	10	2**		
Crackers (mainly graham)	11	4	3	2	2	2	8	3		
White breads, rolls, bagels, and other plain breads	5	10*	7	7	8	8	6	9		
Muffins, sweet/quick breads	9	2	6	3	2	2	7	2		
Whole-grain breads and rolls	3	3	1	4**	1	5**	2	4		
Combination Entrees ^d	23	6**	19	7*	28	8**	23	7**		

TABLE VII.7 (continued)

	Percentage of Students Consuming at Least Once at Breakfast							
	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Meat/Meat Alternates ^c	20	11	13	13	18	11	19	11
Sausage	12	2	9	2*	4	1	10	1*
Breaded chicken patty/nuggets	0	0	1	0	7	1	2	1
Eggs	1	5**	2	7*	2	3	1	5**
Other desserts and snacks	16	20	10	15	27	22	17	20
Candy	7	6	7	7	16	12	8	8
Cookies, pastries, cakes	7	9	2	4	6	5	6	7
Grain and fruit cereal bars, granola bars	1	4*	1	5**	5	5	1	4**
Other beverages	11	19*	7	25**	14	34**	11	24**
Juice drinks (not 100% juice)	4	8	3	10**	5	8	4	8**
Bottled water	4	4	2	8**	1	12**	3	8*
Tea/coffee	2	4	2	3	6	8	3	5
Carbonated soda	2	4	1	5*	2	8**	2	6**
Number of Students	160	510	127	495	94	550	381	1,555

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample excludes students who did not consume a breakfast. Breakfast intakes of both SBP participants and nonparticipants include all foods and beverages consumed at breakfast. For SBP participants, this may include, in addition to foods/beverages obtained as part of the reimbursable breakfast, foods/beverages that were obtained in school from non-reimbursable sources and/or foods that were brought from or consumed at home.

Note: Table is limited to minor food groups consumed by at least five percent of participants for one or more school type.

^aIncludes all flavored skim, 1%, 2%, and whole milk.

^bIncludes sweetened and unsweetened canned fruit.

^cFood items not included as part of a combination entree.

^dIncludes breakfast sandwiches, pizza with meat, sausage with pancake, and Mexican-style entrees (mainly burritos).

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

addition, while the percentage of students who consumed whole-grain breads or rolls at breakfast was low for both groups, SBP participants in middle and high schools were less likely than their nonparticipant counterparts to consume these items.

SBP participants were more likely than nonparticipants to consume combination entree items such as breakfast sandwiches and pizza. SBP participants were also more likely to consume sausage and less likely to consume eggs, as separate items, than nonparticipants. There were no significant differences in the percentage of SBP participants and nonparticipants who consumed candy or cookies and cakes at breakfast. However, SBP participants were less likely than nonparticipants to consume cereal/granola bars.

Finally, SBP participants were significantly less likely than nonparticipants to consume beverages other than milk or 100% juice at breakfast (11 versus 24 percent). This difference was concentrated among students in middle and high schools. In middle schools, SBP participants were less likely than nonparticipants to consume juice drinks, bottled water, and carbonated soda at breakfast. In high schools, consumption of juice drinks was comparable for SBP participants and nonparticipants, but participants were significantly less likely than nonparticipants to consume both bottled water and carbonated sodas.

2. Foods Consumed Over 24 Hours

Analysis of foods consumed over the full 24-hour period indicates that some of the differences observed between SBP participants and nonparticipants at breakfast persisted over the course of the day, and some were counterbalanced by foods consumed at other meals and snacks. Over 24 hours, SBP participants were still significantly more likely than nonparticipants to consume milk (92 versus 79 percent) (Table VII.8). The modest but significant difference observed at breakfast in the proportion of participants and nonparticipants who consumed whole milk dissipated over the course of the day. However, the difference in the percentage of

TABLE VII.8

MOST COMMONLY CONSUMED FOODS OVER 24 HOURS BY SBP PARTICIPANTS AND NONPARTICIPANTS, BY SCHOOL TYPE

	Percentage of Students Consuming at Least Once in a Day									
	Elementary School Students		Middle School Students		High School Students		All Students			
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Milk	96	88**	84	76	83	67*	92	79**		
1%	59	46	42	29*	36	21**	52	34**		
2%	50	47	37	32	34	32	45	39		
Skim or nonfat	22	21	22	16	17	11	21	17		
Whole	21	19	12	15	9	13	18	16		
Flavored ^a	61	46**	47	28**	31	20*	53	34**		
Fruits and Juices	88	76**	69	60	81	57**	84	67**		
Fruit juice, 100%	68	41**	59	29**	68	32**	67	36**		
Fresh fruit	40	45	25	36*	32	31	36	39		
Canned fruit ^b	33	21*	9	11	17	9	26	15**		
Grains/Breads ^c	98	92**	93	86*	84	80	94	87**		
Cold cereal	45	43	38	37	29	32	41	38		
Sweetened	38	34	35	30	25	22	35	29		
Unsweetened	9	10	7	7	4	10*	8	10		
White breads, rolls, bagels, and other plain breads	23	27	27	24	19	20	23	24		
Crackers (including graham)	24	31	15	22	10	15	20	24		
Sweet rolls, doughnuts, toaster pastries, fruit turnovers, coffee cake	22	15	20	9*	25	12	22	13**		
Pancakes, waffles, French toast	16	16	6	9	6	5	13	11		
Biscuits, croissants, cornbread	9	5	19	4*	24	6*	13	5**		
Muffins, sweet/quick breads	10	4	8	3	2	2	9	3		
Whole-grain breads and rolls	6	5	1	6**	7	8	5	6		
Combination Entrees ^d	96	82**	92	90	88	87	94	85**		
Meat/Meat Alternates ^c	74	72	54	59	65	59	69	65		
Sausage	14	5	10	3*	8	3	13	4*		
Eggs	3	6*	5	7	5	4	3	6*		

TABLE VII.8 (continued)

	Percentage of Students Consuming at Least Once in a Day							
	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
Other desserts and snacks	79	85	78	79	81	78	79	81
Cookies, pastries, cakes	47	45	38	40	41	37	44	41
Candy	31	31	34	34	46	40	34	35
Grain and fruit cereal bars, granola bars	1	9**	1	8**	9	11	2	10**
Other beverages	69	73	84	88	82	89	74	81*
Carbonated soda	36	37	59	52	52	54	43	45
Juice drinks (not 100% juice)	35	42	34	50**	41	40	36	43
Bottled water	19	16	12	26**	27	33	19	24
Tea/coffee	8	9	17	17	15	24	11	15*
Number of Students	160	572	127	660	94	701	381	1,933

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations based on first 24-hour recall prepared by Mathematica Policy Research, Inc. Sample includes all students, including those who did not consume a breakfast.

Note: Table is limited to minor food groups consumed by at least five percent of participants for one or more school type.

*Includes all flavored skim, 1%, 2%, and whole milk.

^bIncludes sweetened and unsweetened canned fruit.

^cFood items not included as part of a combination entree.

^dIncludes breakfast sandwiches, pizza with meat, sausage with pancake, and Mexican-style entrees (mainly burritos).

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

participants and nonparticipants who consumed flavored milk persisted over 24 hours. This difference may also have been influenced by participation in the NSLP (see Chapter VI).

The significant difference between SBP participants and nonparticipants in the proportion of students who consumed 100% juice persisted over the course of the day (67 versus 36 percent). The difference in the percentage of participants and nonparticipants consuming fresh fruit at breakfast (SBP participants were less likely to consume fresh fruit) dissipated for students overall and for high school students. Among middle school students, however, SBP participants were less likely than nonparticipants to have consumed fresh fruit at least once in a 24-hour period (25 versus 36 percent). In addition, SBP participants were significantly more likely than nonparticipants to have consumed canned fruits in a day (26 versus 15 percent). The difference between SBP participants and nonparticipants in fruit consumption over 24 hours may have been influenced by NSLP participation (see Chapter VI).

Over 24 hours, SBP participants continued to be more likely than nonparticipants to consume combination entrees. However, the difference over 24 hours, which may have been influenced by NSLP participation (see Chapter VI), was limited to elementary school students. The significant differences in the proportion of SBP participants and nonparticipants consuming sausage or eggs (as separate items) persisted over 24 hours. Relative to nonparticipants, SBP participants were more likely to consume sausage over the course of a day and less likely to consume eggs.

Over 24 hours, significant differences between SBP participants and nonparticipants in the proportion of students who consumed sweet rolls, doughnuts, and pastries, as well croissants and cornbread, persisted (SBP participants were more likely to consume these items than nonparticipants). Cold cereal remained the most frequently consumed grain/bread product over 24 hours for both SBP participants and nonparticipants. The difference in the percentage of high

school participants and nonparticipants consuming unsweetened cereal persisted (SBP participants were less likely to consume unsweetened cereal).

Over 24 hours, differences between SBP participants and nonparticipants in the proportion of students who consumed beverages other than milk or 100% juice largely persisted for middle school students but not for high school students. Among middle school students, SBP participants were significantly less likely than nonparticipants to consume either juice drinks (34 versus 50 percent) or bottled water (12 versus 26 percent) over 24 hours. Overall, SBP participants were less likely than nonparticipants to consume coffee or tea.

G. FOOD SOURCES OF ENERGY AND KEY NUTRIENTS IN BREAKFASTS CONSUMED BY SBP PARTICIPANTS AND NONPARTICIPANTS

The relative importance of a food, as a source of a particular nutrient, is influenced by both the concentration of the nutrient in the food and the frequency of its consumption. For example, cold cereals are not a particularly concentrated source of energy, but because they were so frequently consumed, they could have made an important contribution to students' energy intakes at breakfast. Conversely, even though very few children consumed eggs (as a distinct food item) for breakfast (see Table VII.7; only one to seven percent of students in any participant/school level subgroup consumed eggs for breakfast), eggs, which are a concentrated source of cholesterol, may have contributed a high percentage of students' cholesterol intakes at breakfast.

Information about the relative contributions of various foods and food groups to breakfast intakes of energy and nutrients can provide insights about foods that are making major contributions to intakes of specific nutrients and foods that may be driving differences observed in the nutrient intakes of SBP participants and nonparticipants. The approach used in this analysis was adapted from methods developed by Krebs-Smith (1992) and later expanded by

Subar and colleagues (1998). An important difference is that this analysis considered foods as they were offered to and consumed by students rather than breaking combination foods down into their constituent ingredients. So, for example, breakfast sandwiches (such as egg, sausage, and cheese on an English muffin) were considered as a whole food rather than as egg, meat, cheese, and bread.

The analysis used data from the single 24-hour recall completed by all students. All reported foods were further divided into 103 minor food source groups.¹⁵ Population proportions were calculated to estimate the contribution of each food source group to breakfast intakes of energy and nutrients. This was done by summing the weighted amount of a given nutrient provided by a given food group for all individuals in the sample and dividing by the total weighted amount of that nutrient consumed by all individuals. Differences between SBP participants and nonparticipants were tested for statistical significance on the basis of two-tailed t-tests, using the SUDAAN statistical software.

Major findings are summarized in the sections that follow, focusing on selected nutrients for which significant differences were observed between SBP participants and nonparticipants, for the full sample or for one or more school-level samples, in regression-adjusted mean breakfast intakes (see Section C). Detailed tabulations are presented in Appendix M; these tabulations show, for energy and all nutrients and dietary components examined in this study, the food source groups that contributed two percent or more to breakfast intakes of SBP participants or nonparticipants. Data are presented for the overall sample (Tables M.1 through M.7) and by school level (Tables M.8 through M.28).

¹⁵ The food source groups are comparable but not identical to the minor food groups used to describe food choices of NSLP participants and nonparticipants (see Appendix D, Table D.1).

1. Carbohydrate

SBP participants obtained a significantly smaller share of their carbohydrate intakes at breakfast from cold cereal than did nonparticipants (Table M.2). SBP participants obtained a significantly greater share of their breakfast carbohydrate intakes from cakes, cookies, and brownies than nonparticipants.

2. Protein

Flavored milks (1% and 2%) and pizza and pizza products accounted for significantly greater shares of SBP participants' breakfast intakes of protein, relative to nonparticipants, and cold cereal and unflavored skim/nonfat milk accounted for significantly smaller shares (Table M.2).

3. Vitamin B₆

Cold cereals were the single most important source of vitamin B₆ in the breakfasts consumed by both SBP participants and nonparticipants (Table M.4). However, the overall contribution of cold cereals was significantly greater for nonparticipants than for participants. Fruit juices and sweet rolls, doughnuts, and toaster pastries made significantly greater contributions to SBP participants' breakfast intakes of vitamin B₆ than to nonparticipants' breakfast intakes.

4. Folate

SBP participants obtained a significantly smaller share of their breakfast intakes of folate from cold cereals than nonparticipants and a significantly greater share from sweet rolls, doughnuts, and toaster pastries (Table M.4).

5. Phosphorus

Flavored milks (1% and 2%) contributed significantly larger shares of SBP participants' breakfast intakes of phosphorus, relative to nonparticipants, and cold cereals and unflavored skim/nonfat milk contributed significantly smaller shares (Table M.6).

6. Potassium

SBP participants obtained significantly greater shares of their breakfast intakes of potassium from flavored milks (1% and 2%) than nonparticipants, and significantly smaller shares from cold cereals and unflavored skim/nonfat milk (Table M.6).

7. Sodium

Relative to nonparticipants, SBP participants obtained significantly greater shares of their sodium intakes at breakfast from pizza and pizza products and cookies, cakes, and brownies and a significantly smaller share from cold cereals (Table M.6).

8. Cholesterol

Cakes, cookies, and brownies made a significantly larger contribution to SBP participants' breakfast intakes of cholesterol than to nonparticipants' breakfast intakes (Table M.7).

H. FREQUENCY AND SOURCES OF COMPETITIVE FOODS CONSUMED BY SBP PARTICIPANTS AND NONPARTICIPANTS

In recent years, interest in the healthfulness of foods offered in school meal programs has expanded to include competitive foods—foods and beverages sold on an a la carte basis in school cafeterias or through vending machines, snack bars, school stores, or other venues that may be operated by departments or groups other than the school foodservice program (Weschler 2001; French and Stables 2003; French 2003; Samuels & Associates 2006; U.S. General Accounting Office 2005). Chapter IV in Volume 1 of this report provides information about the

availability of competitive foods in schools and the types of foods available in different competitive food venues. In this section, we present data on the prevalence of competitive food consumption among SBP participants and nonparticipants, the source of competitive foods, and the times of day competitive foods were consumed. Sample sizes are too small to allow for detailed analysis of the types of competitive foods consumed or the contribution of competitive foods to students' energy and nutrient intakes at breakfast and over the course of the school day. These data are presented for NSLP participants and nonparticipants in Chapter VI.

Competitive food sources in each school were identified by dietary interviewers prior to interviewing students, and specific codes were assigned to each source so they could be identified in the dietary recall data. Vending machines were differentiated by location: in the cafeteria, within 20 feet of the cafeteria, and other location. School stores and snack bars were identified separately, as were food carts and other points of sale where all foods and beverages were sold on a strictly a la carte basis. Foods that students reported obtaining from class parties, school fundraisers, or from teachers as rewards were also coded as competitive foods. Dietary recalls did not, however, distinguish between foods that might have been purchased a la carte from a point of sale that offered both reimbursable and a la carte items regardless of whether that item appeared on the school menu. For this reason, the data presented here should be considered a *lower-bound estimate* of the prevalence of competitive foods in the dietary intakes of SBP participants and nonparticipants.

Consumption of competitive foods increased for both SBP participants and nonparticipants from elementary schools to middle schools and from middle schools to high schools (Table VII.9). Among high school students, a third or more of both SBP participants and nonparticipants consumed one or more competitive foods throughout the day. Overall, SBP participants were less likely than nonparticipants to consume competitive foods. This difference

TABLE VII.9

PERCENTAGE OF SBP PARTICIPANTS AND NONPARTICIPANTS WHO CONSUMED ONE OR MORE COMPETITIVE FOODS, BY SOURCE AND TIME OF DAY

	Elementary School Students		Middle School Students		High School Students		All Students	
	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants	Participants	Nonparticipants
	Percent of Students		Percent of Students		Percent of Students		Percent of Students	
Where Competitive Food Was Obtained								
Any source	12	19	16	27**	33	42	16	28**
Vending machine	1	6	7	11	18	21	5	12**
In cafeteria	0	5*	4	4	5	6	2	5*
Within 20 feet of cafeteria	0	0	2	2	5	6	1	2*
Other location	1	0	1	6**	11	11	3	5*
School store	2	1	4	1	6	5	3	2
Snack bar	0	0	4	5	3	6	1	3*
A la carte-only points of sale	0	2	4	9	13	14	3	7**
Fundraisers, class parties, rewards, other	9	14	3	6	9	7	8	10
When Competitive Food Was Consumed								
As part of breakfast	3	3	4	2	20	10	6	5
As part of lunch	4	11	8	23**	20	33*	8	20**
Other time, at school	4	9	6	6	11	8	6	8
Other time, outside of school	0	3	2	1	4	2	1	2
Number of Students	160	572	127	660	94	701	381	1933

Source: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations of single 24-hour recalls prepared by Mathematica Policy Research, Inc. Sample includes all children, including those who did not consume a breakfast.

*Difference between participants and nonparticipants is significantly different from zero at the .05 level.

**Difference between participants and nonparticipants is significantly different from zero at the .01 level.

was concentrated in middle schools, where 16 percent of SBP participants consumed one or more competitive foods, compared with 27 percent of nonparticipants.

Among elementary school students, the most common source of competitive foods was classroom parties, rewards from teachers, bake sales, and other fundraisers. Fourteen percent of elementary school SBP participants and 9 percent of nonparticipants reported consuming one or more items from such sources. The next most common source of competitive foods among elementary school students was vending machines. Nonparticipants were more likely to consume foods or beverages from a vending machine located in the cafeteria than SBP participants (five versus two percent).

For both middle and high school students, the most common source of competitive foods for both SBP participants and nonparticipants was vending machines. Among middle school students, SBP participants were less likely than nonparticipants to consume foods from vending machines that were not located in or near the cafeteria (one versus six percent).

Overall, competitive foods were most commonly consumed at lunch (Table VII.9). SBP participants were less likely than nonparticipants to consume a competitive food at lunch (8 versus 20 percent). Consumption of competitive foods at breakfast was not common (reported by four percent of students or less) in elementary and middle schools.¹⁶ However, among high school students, 20 percent of SBP participants and 10 percent of nonparticipants consumed one or more competitive foods at breakfast. There were no significant differences between SBP participants and nonparticipants in the proportion of students who consumed competitive foods at school but at a time other than breakfast or lunch or who consumed competitive foods obtained at school later in the day at some other location.

¹⁶ The breakfast and lunch meals used in this analysis are the same as those used in the main analysis of lunch and breakfast intakes and are defined based on time of day and the name the student used to describe the eating occasion. See section A.3 in Chapter V.

I. COMPARING SNDA-III DATA WITH DATA FROM OTHER STUDIES

Comparing SNDA-III data on the nutrient intakes of SBP participants and nonparticipants with data from previous studies can provide information about how students' dietary intakes have changed over time. However, such comparisons must be made with caution. Differences in measured dietary intakes can be caused by factors other than actual changes in the dietary intakes. Major factors include (1) methodological differences in data collection techniques, including the use of automated data collection systems and different portion size estimation tools; (2) improvements in food composition databases; and (3) differences in analysis techniques, including the use of one versus two 24-hour recalls. In studies that present regression-adjusted estimates, difference in covariates and multivariate regression techniques may lead to differences in estimated intakes. Finally, differences in the standards used to assess intakes affect the interpretation of results.

Given the above limitations, the following comparisons seem most appropriate:

- ***SNDA-III Versus SNDA-I:*** Non-regression-adjusted mean intakes of SBP participants and nonparticipants, at breakfast and over 24 hours (based on a single 24-hour recall)

In addition, Chapter VI presents estimates of mean daily intakes and the prevalence of nutrient inadequacy and excess among all students and compares these estimates from SNDA-III to those from the National Health and Nutrition Examination Survey (NHANES) 2001–2002.

1. SNDA-III Versus SNDA-I: Mean Breakfast Intakes

Table VII.10 presents data from SNDA-I and SNDA-III on mean breakfast intakes of SBP participants and nonparticipants. Data are for all students in grades 1–12.¹⁷ The significance and

¹⁷ These are the only unadjusted estimates available in the SNDA-I report.

direction of changes between SNDA-I and SNDA-III are comparable for SBP participants and nonparticipants for all estimates except energy, the proportion of energy derived from total fat, vitamin A, vitamin B₆, riboflavin, and iron. The fact that total intake of energy at breakfast and the proportion of energy derived from fat decreased between SNDA-I and SNDA-III for SBP participants but not for nonparticipants is consistent with changes observed in the energy and relative fat content of breakfasts offered to SBP participants (see Fox et al. 2001 and Chapter VIII in Volume I of this report).

2. SNDA-III Versus SNDA-I: Mean 24-Hour Intakes

As shown in Table VII.11, the significance and direction of changes between SNDA-I and SNDA-III are comparable for SBP participants and nonparticipants for most nutrient estimates. The fact that percentages of energy from fat and saturated fat were significantly lower in SNDA-III than in SNDA-I, for both SBP participants and nonparticipants, is consistent with secular trends in dietary intake observed in NHANES data (Briefel and Johnson 2004). However, the finding that mean energy intakes are lower in SNDA-III than in SNDA-I is not consistent with the trends observed in NHANES. These differences may be accounted for by differences in the sample (NHANES included a sample of all U.S. children, not just public school children), and study design (NHANES dietary intake estimates included weekends, holidays, and summertime when school was out of session, whereas SNDA-III included intakes on school days only). However, differences may also be due to other methodological differences between the two studies.

TABLE VII.10

MEAN BREAKFAST INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS:
SNDA-I VERSUS SNDA-III

	SNDA-I (1991-1992)		SNDA-III (2004-2005)	
	Participants	Nonparticipants	Participants	Nonparticipants
Food Energy (kcal)	555	419	464*	415
Total fat (g)	20	13	14*	11*
Saturated fat (g)	8	5	5*	4*
Carbohydrate (g)	77	65	72	68
Protein (g)	18	13	14*	12*
Total fat (% kcal)	31	24	25*	23
Saturated fat (% kcal)	13	10	9*	9*
Carbohydrate (% kcal)	57	65	64*	67*
Protein (% kcal)	13	13	12*	11*
Vitamin A (mg RE)	278	335	272	297*
Vitamin C (mg)	42	42	31*	28*
Vitamin B ₆ (mg)	0.5	0.6	0.4*	0.6
Vitamin B ₁₂ (mcg)	1.3	1.3	1.5*	1.9*
Niacin (mg)	5	6	5	6
Riboflavin (mg)	0.8	0.8	0.7*	0.8
Thiamin (mg)	0.6	0.6	0.5*	0.5*
Calcium (mg)	362	288	338	309
Iron (mg)	4.2	5.0	4.0	6.0*
Magnesium (mg)	69	62	57*	56*
Phosphorus (mg)	402	319	356	315
Sodium (mg)	840	584	644*	537*
Zinc (mg)	2.4	2.3	2.8*	3.1*
Cholesterol (mg)	97	61	36*	45*
Number of Students	319	3,033	381	1,555

Sources: SNDA-I data: Table B.2 (p. 72) in Devaney et al. 1993.

SNDA-III data: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Both data sets based on weighted tabulations of data from a single 24-hour recall. Samples exclude children who did not consume a breakfast. Intakes of SBP participants include all foods consumed, including those that may have been brought from home or obtained in school from sources other than the reimbursable meal.

Notes: SNDA-I and SNDA-III also assessed folate intake, but data from the two studies cannot be compared because of differences in units of measure (mcg folate in SNDA-I and mcg Dietary Folate Equivalents in SNDA-III) and substantial changes in food fortification practices. Nutrients assessed in SNDA-III but not in SNDA-I are not shown.

RE = Retinol Equivalents.

*Difference between SNDA-I and SNDA-III is significantly different from zero at the .05 level or less.

TABLE VII.11

MEAN 24-HOUR INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS:
SNDA-I VERSUS SNDA-III

	SNDA-I (1991-1992)		SNDA-III (2004-2005)	
	Participants	Nonparticipants	Participants	Nonparticipants
Food Energy (kcal)	2,481	2,558	2,230*	2,083*
Total fat (g)	100	98	81*	75*
Saturated fat (g)	37	37	28*	26*
Carbohydrate (g)	310	335	300	283*
Protein (g)	94	94	81*	75*
Total fat (% kcal)	36	34	32*	32*
Saturated fat (% kcal)	13	13	11*	11*
Carbohydrate (% kcal)	51	53	54*	55*
Protein (% kcal)	15	15	15	15
Vitamin A (mg RE)	866	1,103	892	857*
Vitamin C (mg)	137	147	99*	90*
Vitamin B ₆ (mg)	1.9	2.1	1.7*	1.8*
Vitamin B ₁₂ (mcg)	5.7	5.9	5.6	5.2*
Niacin (mg)	24	26	22	22*
Riboflavin (mg)	2.5	2.6	2.4	2.3*
Thiamin (mg)	2	2.1	1.7*	1.7*
Calcium (mg)	1,163	1,193	1,195	1,069*
Iron (mg)	15.6	17.5	16	15*
Magnesium (mg)	295	310	264*	250*
Phosphorus (mg)	1,578	1,611	1,472	1,344*
Sodium (mg)	4,700	4,689	3,623*	3,355*
Zinc (mg)	13.5	13.5	12.1	11.5*
Cholesterol (mg)	334	303	211*	214*
Number of Students	319	3,033	381	1,933

Sources: SNDA-I data: Table B.3 (p. 73) in Devaney et al. 1993.

SNDA-III data: School Nutrition Dietary Assessment-III, 24-hour Dietary Recalls, school year 2004-2005. Weighted tabulations prepared by Mathematica Policy Research, Inc.

Both data sets based on weighted tabulations of data from a single 24-hour recall. Samples include all children, including those who did not consume a breakfast.

Notes: SNDA-I and SNDA-III also assessed folate intake, but data from the two studies cannot be compared because of differences in units of measure (mcg folate in SNDA-I and mcg Dietary Folate Equivalents in SNDA-III) and substantial changes in food fortification practices. Nutrients assessed in SNDA-III but not in SNDA-I are not shown.

RE = Retinol Equivalents.

* Difference between SNDA-I and SNDA-III is significantly different from zero at the .05 level or less.

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