United States
Department of
Agriculture

Food and
Nutrition
Service

**Office of
Analysis and
Evaluation**

The School Nutrition Dietary Assessment Study

Dietary Intakes of Program Participants and Nonparticipants

October 1993

Prepared by:
MATHEMATICA POLICY RESEARCH, INC.

Prepared for:
U.S. Department of Agriculture
Food and Nutrition Service
Office of Analysis and Evaluation

Contract No.: 53-3198-0-16
MPR Reference No.: 7937-140

THE SCHOOL NUTRITION DIETARY ASSESSMENT STUDY:

DIETARY INTAKES OF PROGRAM PARTICIPANTS AND NONPARTICIPANTS

October 1993

Authors:

Barbara Devaney
Anne Gordon
John Burghardt

Editor:

Laura Berenson

Submitted to:

U.S. Department of Agriculture
Food and Nutrition Service
Office of Analysis and Evaluation
Room 214
3101 Park Center Drive
Alexandria, VA 22302

Project Officers:
Leslie Christovich
Pat McKinney

Submitted by:

Mathematica Policy Research, Inc.
P.O. Box 2393
Princeton, NJ 08543-2393
(609) 799-3535

Co-Principal Investigators:
John Burghardt
Barbara Devaney

ACKNOWLEDGMENTS

Preliminary analyses of mean dietary intakes for previous drafts of this report were conducted by Philip Gleason and John Burghardt, with programming assistance from Yang Wang and Dexter Chu. The regression-adjusted and selection-bias-adjusted models of dietary intake were developed by Barbara Devaney, Anne Gordon, and John Burghardt. Dexter Chu was responsible for the programming to estimate the multivariate models, and to develop the tabulations for this report. Laura Berenson edited the report. Jill Miller, Doreen Ambrose, and Cindy Castro and Monica Capizzi produced it.

Given the analytical difficulties inherent in adjusting for possible unobserved differences between participants and nonparticipants that could affect their dietary intakes (self-selection), the analyses presented in this report received extensive review by the Food and Nutrition Service (FNS), Mathematica Policy Research, Inc. (MPR), and outside reviewers. At FNS, Leslie Christovich, Pat McKinney, Mike Fishman, Fran Zorn, Jeff Wilde, and Boyd Kowal reviewed the work and the report. At MPR, Charles Metcalf, Randall Brown, Thomas Fraker, Philip Gleason, David Myers, and Peter Schochet carefully reviewed our analyses and findings. In addition, FNS requested that two distinguished econometricians, Professor Robert Moffitt of Brown University and Professor Gary Solon of the University of Michigan review and offer comments on the analysis. The careful review and helpful comments of all of these individuals are gratefully acknowledged. However, the authors are responsible for the findings and interpretations presented in this report.

John Burghardt

Project Director

CONTENTS

Chapter		Page
	EXECUTIVE SUMMARY	xi
I	INTRODUCTION	1
	A. OVERVIEW OF THE SCHOOL NUTRITION DIETARY ASSESSMENT STUDY	2
	B. OBJECTIVES OF THIS REPORT	4
	C. METHODOLOGICAL ISSUES	5
II	THE DIETARY INTAKES OF STUDENTS IN THE UNITED STATES	7
	A. SUMMARY	7
	B. THE EATING PATTERNS OF STUDENTS ON A TYPICAL SCHOOL DAY	8
	C. DIETARY INTAKES	8
	1. 24-Hour Dietary Intake, by Age and Gender	10
	2. 24-Hour Dietary Intake, by Family Income	12
III	DIETARY INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS	15
	A. SUMMARY	15
	B. METHODOLOGICAL APPROACH	16
	C. DIETARY INTAKES AT LUNCH OF NSLP PARTICIPANTS AND NONPARTICIPANTS	19
	1. Dietary Intakes	19
	2. Types of Foods Consumed at Lunch	22
	3. Dietary Intakes of Subgroups of Students	26
	4. Dietary Intakes at Lunch of Students Eating Non-NSLP Lunches, by Source of Lunch	31
	D. 24-HOUR DIETARY INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS	34

CONTENTS *(continued)*

Chapter		Page
IV	DIETARY INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS	39
	A. SUMMARY	39
	B. DIETARY INTAKES AT BREAKFAST OF SBP PARTICIPANTS AND NONPARTICIPANTS	40
	1. Dietary Intakes	40
	2. Types of Foods Consumed at Breakfast	43
	3. Dietary Intakes at Breakfast of Students Eating Non-SBP Breakfasts, by Source of Breakfast	47
	C. 24-HOUR DIETARY INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS	49
	REFERENCES	53
	APPENDIX A: METHODOLOGY FOR ESTIMATING ADJUSTED DIFFERENCES IN DIETARY INTAKES	55
	APPENDIX B: MEANS AND STANDARD ERRORS OF DIETARY INTAKE DATA	69
	APPENDIX C: DETAILED RESULTS OF MULTIVARIATE MODELS OF SCHOOL NUTRITION PROGRAM PARTICIPATION AND DIETARY INTAKE	77
	APPENDIX D: FOOD SOURCES OF DIETARY COMPONENTS CONSUMED	103

TABLES

Table		Page
II.1	NUMBER AND TYPES OF EATING OCCASIONS, BY AGE AND GENDER	9
II.2	24-HOUR DIETARY INTAKES OF STUDENTS, BY AGE AND GENDER	11
II.3	24-HOUR DIETARY INTAKES OF STUDENTS, BY POVERTY STATUS OF FAMILY	13
III.1	DIETARY INTAKES AT LUNCH OF NSLP PARTICIPANTS AND NONPARTICIPANTS	20
III.2	NUTRIENT DENSITIES OF NSLP AND NON-NSLP LUNCHES	23
III.3	FOODS CONSUMED IN NSLP AND NON-NSLP LUNCHES	24
III.4	FOOD SOURCES OF KEY NUTRIENTS AT LUNCH, BY NSLP PARTICIPATION STATUS	25
III.5	DIFFERENCES IN DIETARY INTAKES AT LUNCH OF NSLP PARTICIPANTS AND NONPARTICIPANTS, BY AGE AND GENDER	28
III.6	DIFFERENCES IN DIETARY INTAKES AT LUNCH OF NSLP PARTICIPANTS AND NONPARTICIPANTS, BY FAMILY INCOME	30
III.7	DIETARY INTAKES AT LUNCH OF STUDENTS EATING NON-NSLP LUNCHES	32
III.8	24-HOUR DIETARY INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS	35
III.9	LUNCH-SPECIFIC AND 24-HOUR DIFFERENCES IN INTAKES BETWEEN NSLP PARTICIPANTS AND NONPARTICIPANTS	37
IV.1	DIETARY INTAKES AT BREAKFAST OF SBP PARTICIPANTS AND NONPARTICIPANTS	41
IV.2	NUTRIENT DENSITIES OF SBP AND NON-SBP BREAKFASTS	43
IV.3	FOODS CONSUMED IN SBP AND NON-SBP BREAKFASTS	45
IV.4	FOOD SOURCES OF KEY NUTRIENTS AT BREAKFAST, BY SBP PARTICIPATION STATUS	46

Table		Page
IV.5	DIETARY INTAKES AT BREAKFAST OF STUDENTS EATING A NON-SBP BREAKFAST	48
IV.6	24-HOUR DIETARY INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS	50
IV.7	BREAKFAST-SPECIFIC AND 24-HOUR DIFFERENCES IN INTAKES BETWEEN SBP PARTICIPANTS AND NONPARTICIPANTS	51
A.1	DEFINITIONS OF INDEPENDENT VARIABLES USED IN DIETARY INTAKE MODELS	59
A.2	ADDITIONAL VARIABLES USED TO PREDICT NSLP PARTICIPATION	63
A.3	ADDITIONAL VARIABLES USED TO PREDICT SBP PARTICIPATION	65
B.1	DIETARY INTAKES AT LUNCH, BY NSLP PARTICIPATION STATUS	71
B.2	DIETARY INTAKES AT BREAKFAST, BY SBP PARTICIPATION STATUS	72
B.3	24-HOUR DIETARY INTAKES, BY NSLP PARTICIPATION STATUS	73
B.4	24-HOUR DIETARY INTAKES, BY SBP PARTICIPATION STATUS	74
B.5	24-HOUR DIETARY INTAKES, BY PARTICIPATION IN EITHER THE SBP OR NSLP	75
C.1	PROBIT MODEL OF NSLP PARTICIPATION	79
C.2	RESULTS FROM REGRESSION MODELS OF DIETARY INTAKES AT LUNCH	81
C.3	PROBIT MODEL OF SBP PARTICIPATION	86
C.4	RESULTS FROM REGRESSION MODELS OF DIETARY INTAKES AT BREAKFAST	88

Table		Page
C.5	PROBIT MODEL OF NSLP PARTICIPATION	93
C.6	RESULTS FROM REGRESSION MODELS OF 24-HOUR DIETARY INTAKES	95
C.7	24-HOUR DIETARY INTAKES OF PARTICIPANTS IN BOTH THE SBP AND THE NSLP	100
C.8	24-HOUR DIETARY INTAKES OF PARTICIPANTS IN EITHER THE SBP AND/OR THE NSLP	101
D.1	FOOD SOURCES OF NUTRIENT INTAKE AT LUNCH, BY NSLP PARTICIPATION STATUS	105
D.2	FOOD SOURCES OF NUTRIENT INTAKE AT BREAKFAST, BY SBP PARTICIPATION STATUS	110

EXECUTIVE SUMMARY

The National School Lunch Program (NSLP) and the School Breakfast Program (SBP) are federally sponsored nutrition programs operating daily in our nation's schools. All public and private nonprofit elementary and secondary schools are eligible to participate. In fiscal year 1992, 24.5 million students participated in the lunch program each day, and nearly 5 million participated in the breakfast program. The two programs, which cost the federal government $5.5 billion in fiscal year 1992, make a substantial contribution to what our children eat and represent a large investment of federal dollars.

This report is one of four reports on the findings of the School Nutrition Dietary Assessment study. It describes the dietary intakes of the nation's students on a typical school day and compares the dietary intakes of school nutrition program participants and nonparticipants at breakfast, at lunch, and over 24 hours. The School Nutrition Dietary Assessment study collected information from a nationally representative sample of schools and a nationally representative sample of students attending those schools. A total of 545 schools provided information about all meals served during a one-week period between February and May 1992, as well as information about school food service operations. Approximately 3,350 students in grades 1 through 12 provided detailed information about the foods and beverages that they consumed during a 24-hour period that included a school day. Parents contributed to the interviews with students in grades 1 and 2; however, students in grades 3 through 12 reported their own food and beverage consumption.

A key objective of the School Nutrition Dietary Assessment study was to compare the dietary intakes of participants and nonparticipants in order to determine how much difference the school nutrition programs make in students' dietary intakes. To address this objective, statistical methods were used to adjust the estimated intakes of participants and nonparticipants. These methods are designed to take into account, to the extent permitted by the available data and statistical techniques, the effects that observed and unobserved differences in the characteristics of participants and nonparticipants might have on the average intakes of the two groups, so as to isolate differences associated with program participation.

STUDENTS' DIETARY INTAKES

Students eat many times during the day. Ninety-eight percent of all students reported eating at least three times per day, and more than one-half reported eating at least five. Across all age groups, a large percentage of students eat breakfast, lunch, and dinner; 88 percent of all students eat breakfast, 93 percent eat lunch, and 99 percent eat dinner.

On average, students' daily consumption of food energy exceeds the RDA. The average 24-hour intake of food energy is 111 percent of the RDA. Average intake of food energy varies little with family income, but does vary with age and gender. Although all age and gender subgroups consume more than the RDA for food energy, adolescent males consume about 17 percent more than the RDA, whereas adolescent females consume only 4 percent more. In contrast, the average intake of food energy is 109 percent of the RDA for students with family incomes less than the poverty level, 108 percent for students with family incomes between 100 and 185 percent of the poverty level, and 111 percent for students with family incomes greater than 185 percent of the poverty level.

The average daily intakes of most vitamins and minerals are at least the RDA. With the exception of intakes of adolescent females, vitamin and mineral intakes for all age and gender subgroups exceed the RDA. Adolescent females' intakes of most minerals are slightly below the RDA, and their intakes of calcium are relatively low; average intake of calcium relative to the RDA is 80 percent for females 15 to 18 years old and is 87 percent for females 11 to 14 years old.

Students' daily intakes of total fat, saturated fat, and sodium exceed dietary recommendations and their intakes of carbohydrate are less than recommended. Daily intakes average 34 percent of food energy from fat, compared with the Dietary Guideline goal of 30 percent or less; 13 percent from saturated fat, compared with the Dietary Guideline goal of less than 10 percent; and 53 percent from carbohydrate, compared with the National Research Council (NRC) recommendation of more than 55 percent. Average sodium intakes are roughly twice the NRC recommendation of no more than 2,400 milligrams per day and are especially high among adolescent males. Students from low-income families have higher fat and saturated fat intakes and lower carbohydrate intakes than do students from higher-income households.

DIETARY INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS

NSLP participation is associated with increased intakes at lunch of some, but not all, dietary components. Relative to nonparticipants who eat lunch, NSLP participants have higher lunch intakes of vitamin A, calcium, magnesium, and zinc, and have lower intakes of vitamin C (although their lunchtime intakes of vitamin C average 60 percent of the RDA). However, NSLP participants' lunches derive a higher percentage of food energy from fat and saturated fat, and a lower percentage from carbohydrate, than do nonparticipants' lunches.

Differences in the consumption of specific foods explain differences in the nutrient intakes of NSLP participants and nonparticipants. NSLP participants are more than twice as likely as nonparticipants to consume milk and milk products at lunch, which largely explains their higher intakes of calcium and vitamin A. NSLP participants also consume more meat, poultry, fish, and meat mixtures than do nonparticipants. NSLP participants' greater consumption of foods from these two food groups contributes to their higher percentage of food energy derived from fat and saturated fat.

Food energy and nutrients consumed by students who eat non-NSLP lunches vary according to the source of the lunch. Students who obtain a *non-NSLP lunch at school* (food purchased from a vending machine, school store, or a la carte from the cafeteria) consume just 23 percent of the RDA for food energy at lunch. These students also consume less than 20 percent of the RDA for several nutrients (vitamin A, vitamin B6, calcium, iron, and zinc), and less than one-third of the RDA for many others. Students who obtain *lunch from home* consume 31 percent of the RDA for food energy, and students who obtain *lunch off campus* consume 34 percent of the RDA for food energy. Both groups consume less than one-third of the RDA for several vitamins and minerals--vitamin A, vitamin B6, calcium, and zinc.

Non-NSLP lunches from home and from school have less fat, saturated fat, sodium, and cholesterol than do those obtained off campus. Students who eat non-NSLP lunches either brought from home or obtained at school derive less of their lunchtime intake of food energy from fat and more from carbohydrate than do students who obtain off-campus meals. The sodium and fat content of off-campus lunches and of NSLP lunches are quite similar, although off-campus lunches provide lower levels of vitamins and minerals.

Some, but not all, of the differences between the intakes of NSLP participants and nonparticipants at lunch persist over 24 hours. NSLP participation is associated with increases in the percentage of food energy from fat and saturated fat and with decreases in the percentage of food energy from carbohydrate both at lunch and over 24 hours. NSLP participation is also associated with higher intakes of vitamin A and lower intakes of vitamin C both at lunch and over 24 hours. The relationship between NSLP participation and higher calcium intake at lunch diminishes over 24 hours.

DIETARY INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS

SBP participation increases intakes at breakfast of some, but not all, dietary components. Compared with nonparticipants who eat breakfast, SBP participants have higher average breakfast intakes of food energy, protein, calcium, and magnesium, and derive a greater proportion of food energy from fat and saturated fat. SBP participants consume the target of one-fourth of the RDA for food energy at breakfast; nonparticipants consume less than one-fourth of the RDA.

Differences in the breakfast consumption of specific types of foods by SBP participants and nonparticipants are consistent with differences in dietary intakes. Although only one-half of SBP breakfasts include a meat or meat alternate, SBP participants are three times more likely than nonparticipants to consume meat, poultry, fish, or meat mixtures at breakfast. SBP participants are also more likely than nonparticipants to consume milk or milk products at breakfast. The higher proportion of SBP participants consuming foods from these two groups largely explains their higher breakfast intakes of food energy, protein, calcium, fat, and saturated fat.

Meals consumed by students at home conform to the dietary targets for breakfast, except for food energy and zinc. Most non-SBP breakfasts are eaten at home. Home breakfasts provide one-fourth of the RDA for all vitamins and for all minerals except zinc. However, breakfasts consumed at home provide only 18 percent of the RDA for food energy. The average levels of fat, saturated fat, cholesterol, and sodium in home breakfasts are at or below the recommended levels, and the protein and carbohydrate levels are within the targeted range.

SBP participant-nonparticipant differences in breakfast intakes persist over 24 hours, except for differences in the percentage of food energy from fat, saturated fat, and carbohydrate. SBP participation is associated with increases in the intake of food energy over 24 hours. The difference between the SBP participants' and nonparticipants' 24-hour intakes of food energy is about the same as the difference in their breakfast intakes. The effects of SBP participation on the percentage of food energy from fat, saturated fat, and carbohydrate at breakfast disappear over 24 hours. The SBP contributes to higher intakes of protein and calcium, both at breakfast and over 24 hours.

I. INTRODUCTION

Congress authorized the National School Lunch Program (NSLP) in 1946 "to safeguard the health and well-being of the Nation's children and to encourage the domestic consumption of nutritious agricultural commodities and other foods." In the Child Nutrition Act of 1966, Congress established the School Breakfast Program (SBP) as a pilot program to provide funding for breakfasts to children in low-income areas and in areas in which children travel long distances to school. The 1975 amendments to the Child Nutrition Act authorized the SBP as a permanent program, and subsequent legislation has expanded its coverage.

The Food and Nutrition Service of the U.S. Department of Agriculture (USDA) sponsored the School Nutrition Dietary Assessment study to provide information on the dietary intakes of children, the nutrient content of school lunches and school breakfasts ***as offered*** to students, the nutrient content of school lunches and school breakfasts ***as consumed*** by students, and differences in the dietary intakes of program participants and nonparticipants.

This report on findings of the School Nutrition Dietary Assessment study describes the dietary intakes of all American schoolchildren and compares the dietary intakes of participants and nonparticipants in school nutrition programs. A companion report (Burghardt, Gordon, Chapman et al. 1993) presents study findings on the characteristics of school meal service, foods and nutrients offered in SBP breakfasts and NSLP lunches, program participation, and dietary intakes of NSLP and SBP participants. A third study report (Burghardt, Ensor, Hutchinson et al. 1993) describes the sampling and data collection operations. Burghardt and Devaney (1993) summarize study findings from the three technical reports.

This report is organized into four chapters and several appendices. The remainder of this chapter describes the study design, the research questions addressed and the methodology for comparing dietary intakes of school nutrition program participants and nonparticipants. Chapter II presents data on the dietary status of students in the United States. Chapter III compares the lunch and 24-hour dietary intakes of NSLP participants and nonparticipants. Chapter IV presents analogous findings for SBP participants and nonparticipants. Appendix A provides a technical description of the statistical models used to obtain the estimates; Appendices B, C, and D contain supplementary tables.

A. OVERVIEW OF THE SCHOOL NUTRITION DIETARY ASSESSMENT STUDY

The School Nutrition Dietary Assessment study draws on information from two levels: (1) schools; and (2) students. School food service personnel at a nationally representative sample of 545 schools provided descriptions and amounts of foods offered as part of SBP breakfasts and NSLP lunches during a one-week period. These data have been converted into estimates of average nutrients offered per meal. In addition, staff from all 545 schools provided descriptive information on enrollment levels and school nutrition program participation, and school food service personnel provided data on food service characteristics and meal-preparation practices. (A full analysis of meals offered and school food service characteristics is presented in the companion report by Burghardt, Gordon, Chapman et al. (1993), "The School Nutrition Dietary Assessment Study: School Food Service, Meals Offered, and Dietary Intakes.") In this report, school-level variables serve as control variables in the statistical models used to analyze students' dietary intakes.

The analysis of the dietary intake of students presented in this report relies on information provided by a nationally representative sample of 3,350 students in 329 of the schools in the national sample. Information was collected on:

- Dietary intakes over a 24-hour period
- Students' personal and family characteristics
- Whether the student was certified to be eligible for free or reduced-price school meals

The students' grade level determined the method used to collect this information. ***Students in the 3rd through 12th grades*** were administered a three-part, in-person interview during the school day:

- The first part, a 24-hour dietary recall, elicited descriptions and estimated quantities of all foods and beverages consumed during the immediately preceding 24 hours, as well as the location of the eating occasion and, for foods eaten in school, the source of the food.
- The second part asked about foods eaten in school that the student may have selected or been served, but that he or she did not consume completely. Data from the questionnaire were used to determine participation in the SBP and NSLP.
- The third part elicited perceptions about the SBP and NSLP and information on personal characteristics (age) and family characteristics (household size and whether the child resides with his or her mother). In addition, the race and gender of students were noted and coded by interviewers.

A short questionnaire was also mailed to the parents of students who completed the in-person interview, requesting information on family income, household size, ethnicity of the student, and the parent's knowledge and perceptions of the SBP and NSLP. If a parent did not return the questionnaire within two weeks after the completion date of the dietary intake interview, study staff attempted to complete the mail questionnaire by telephone, if the parent was willing.

A different strategy was used to collect data from ***students in the 1st and 2nd grades***, given that these students generally are less able to recall what they eat during a 24-hour period, to describe the foods precisely, and to estimate accurately the amount of food consumed. Researchers have found that dietary recalls conducted jointly with parents and children elicit the most accurate dietary intake information for children in this younger age group. Nevertheless, based on the judgment that the students would be the best source of information on the foods eaten in school on the day of the interview, and that more accurate information on food waste would be elicited if the child's parent were not present, the study design included a *brief* interview with each 1st- and 2nd-grade sample member during the school day. The students were asked to report only the foods and beverages that they had consumed in school on the day of the interview. The interviewers requested a description of each food reported and the estimated quantity of that item consumed. The children also were asked to estimate the amount of each food that they might have selected or have been served, but did not eat.

A second interview was conducted later that day (or, occasionally, at the time of the first interview) with both the child and his or her parent or guardian. This interview requested dietary intake information on all foods eaten during the immediately preceding 24 hours, excluding the period covered by the first interview with the student. At the conclusion of the second interview, the parent (or guardian) was asked to provide the same information on personal and family characteristics that had been requested of the parents of the 3rd- through 12th-grade students.

Finally, school officials or cafeteria personnel were asked to provide information on the meal-price eligibility status (free, reduced price, or full price) of all students in the sample. Meal-price eligibility status was obtained for approximately 90 percent of the students who completed a 24-hour dietary recall interview.

B. OBJECTIVES OF THIS REPORT

The analysis of the dietary intakes of school nutrition program participants and nonparticipants addresses four main questions:

- What are the dietary intakes of students on a typical school day, and how do these intakes compare with dietary targets?
- What are the differences in meal-specific dietary intakes between school nutrition program participants at each meal and nonparticipants?
- Do differences in dietary intakes between school nutrition program participants and nonparticipants vary by age and gender, and by family income?
- What are the differences in the 24-hour dietary intakes between school nutrition program participants and nonparticipants?

The School Nutrition Dietary Assessment study uses several reference standards for purposes of assessing students' dietary intakes, which are all referred to as "dietary targets" in this report.

- Intakes of food energy, protein, vitamins, and minerals are compared with targets defined in terms of the RDA--one-third of the RDA for lunch intakes, one-fourth of the RDA for breakfast intakes, and the full RDA for 24-hour intakes. Average intakes of food energy are expected to be approximately equal to the RDA standard. Average intakes of the other nutrients are expected to equal or exceed the corresponding RDA standard.

- Intake of total fat as a percentage of food energy should be 30 percent or less, and intake of saturated fat as a percentage of food energy should be less than 10 percent.

- Daily intake of cholesterol should be 300 mg or less, and daily intake of sodium should be 2,400 mg or less (lunch targets are one-third of these amounts; breakfast targets are one-fourth of these amounts). Intakes of carbohydrate as a percentage of food energy should be more than 55 percent.

As discussed in detail in Burghardt, Gordon, Chapman et al. (1993), targets in the first group are related to program goals of the NSLP and SBP; targets in the second group are based on recommendations in the *Dietary Guidelines for Americans*; targets in the third group are based on recommendations of the National Research Council, published in *Diet and Health* (1989).

C. METHODOLOGICAL ISSUES

Three issues are important for assessing the data from this study according to the various standards for dietary quality. First, with the exception of food energy, the RDA for most dietary components are set such that the recommended amount is sufficient to meet the needs of most healthy individuals. However, nutritional requirements of individuals vary greatly, and many persons are perfectly healthy even if they consume an amount of a nutrient that is much less than the RDA. Thus, a usual intake below the RDA does not necessarily signal a nutrient deficiency.

Second, most standards of dietary adequacy are defined in terms of usual intake. However, the dietary intake data for this study are taken from just a single, 24-hour dietary recall interview, covering a school day. The intake of particular nutrients by an individual may vary considerably from one day to the next--being high one day and low another--and still constitute an adequate intake over a period of time. In view of this limitation, the analysis focuses on the *mean* intake of each dietary component--usually, the mean intake relative to the RDA for the individual student's age and gender.

Third, the analysis of the dietary intake data is based on a comparison-group design, in which students who ate an NSLP or SBP meal are compared with those who did not. However, students who choose to participate in the school nutrition programs may differ from nonparticipants in observed or unobserved characteristics that affect their dietary intakes. For example, program participants may differ from nonparticipants in their level of family income or in such unmeasurable ways as food preferences or appetites. In particular, unobserved differences between program participants and nonparticipants may lead to estimates of program effects that suffer from "selection bias." As discussed in detail in Chapter III and in Appendix A, statistical procedures are used to estimate differences in dietary intakes between program participants and nonparticipants that attempt to control for differences in both observed and unobserved characteristics of students. However, the complexity of the models estimated and the set of statistical assumptions on which the models are based both suggest caution in interpreting the differences in dietary intakes as "effects" of the school nutrition programs. In short, the comparison-group design of the SNDA study does not allow definitive analysis of the impacts of the NSLP and SBP on dietary intakes.

II. THE DIETARY INTAKES OF STUDENTS IN THE UNITED STATES

This chapter provides a snapshot of the diets of all American schoolchildren that serves as background to the comparisons of intakes of participants and nonparticipants in the National School Lunch Program and School Breakfast Program, described in subsequent chapters. The chapter addresses the following questions about the dietary intake of students during a typical, 24-hour school day:

- How many times and what meals do students eat during a typical school day?
- What are students' average intakes of food energy, other macronutrients, vitamins and minerals, sodium, and cholesterol during a typical school day?
- How do the dietary intakes of students differ by age and gender?
- Do the dietary intakes of students differ by family income?

A. SUMMARY

Most students eat at least five times during the day, and nearly all eat at least three times per day. The average daily intake of vitamins and minerals at least meets the Recommended Dietary Allowances (RDA). Overall, American students consume more food energy on average than recommended, suggesting that some may be at risk of consuming more food energy than is optimal. American students also consume more protein, total fat, saturated fat, and sodium than is recommended for good health, although their cholesterol intake is within recommended limits. Adolescent females have generally lower intakes relative to their RDA than do either adolescent males or younger children. Regardless of income level, on average, students consume more than the RDA for all vitamins and minerals, and more than the recommended amounts of food energy, protein, fat, saturated fat, and sodium. However, low-income students consume diets that are higher in fat and lower in several key vitamins and minerals than higher-income students.

B. THE EATING PATTERNS OF STUDENTS ON A TYPICAL SCHOOL DAY (Table II.1)

Students eat many times during a typical school day.[1] The vast majority (98 percent) reported at least three eating occasions, and more than one-half reported five or more. A large percentage of students from all age groups eat breakfast, lunch, and dinner. Slightly less than 90 percent of all students eat breakfast, 93 percent eat lunch, and 99 percent eat dinner. Two-thirds of students eat an afternoon snack, and almost 60 percent eat an evening snack. However, only 15 percent of students eat a morning snack.

The incidence of various types of eating occasions differs somewhat by age and gender. Younger students are more likely than older students to eat breakfast. For example, 94 percent of 6- to 10-year-old students eat breakfast, compared with 78 percent of 15- to 18-year-old female students and 82 percent of 15- to 18-year-old male students. Younger students are also more likely to eat lunch and an afternoon snack. Ninety-six percent of 6- to 10-year-old students eat lunch, compared with 91 percent of 15- to 18-year-old male students and 88 percent of 15- to 18-year-old female students; 68 percent of 6- to 10-year-old students eat an afternoon snack, compared with 61 and 62 percent of the oldest female and male students, respectively. Interestingly, the eating patterns of 11- to 14-year-old students fall between those of the oldest and the youngest students in nearly every respect.

C. DIETARY INTAKES

This section describes the mean dietary intakes of schoolchildren on a typical school day, by age and gender group, and by family income (measured relative to the poverty level).

---

[1]Eating occasions are defined as periods of eating that are separated by at least 30 minutes. The various eating occasions are defined as follows: ***breakfast*** includes all foods eaten from the time that a student wakes up in the morning until 45 minutes after the start of school; ***lunch*** includes all foods eaten during the period when lunch is served in the student's school; ***dinner*** includes all foods eaten on the occasion after school at which the student consumed the largest number of calories; a ***morning snack*** includes all foods eaten between breakfast and lunch; an ***afternoon snack*** includes all foods eaten between lunch and dinner; and an ***evening snack*** includes all foods eaten after dinner.

TABLE II.1

NUMBER AND TYPES OF EATING OCCASIONS, BY AGE AND GENDER
(Percentage of Students)

	6- to 10-Year-Old Students	11- to 14-Year-Old Students		15- to 18-Year-Old Students		All Students
		Females	Males	Females	Males	
Number of Eating Occasions						
1	0	0	0	1	<1	0
2	1	1	1	4	3	2
3	11	10	10	11	8	10
4	30	31	31	28	29	30
5 or more	58	59	58	56	59	58
Type of Eating Occasion						
Breakfast	94	87	90	78	82	88
Lunch	96	94	94	88	91	93
Dinner	99	99	100	99	99	99
Morning Snack	15	16	12	18	17	15
Afternoon Snack	68	68	71	61	62	67
Evening Snack	53	58	61	61	65	58
Sample Size (Unweighted)	**1,383**	**552**	**579**	**413**	**425**	**3,352**

SOURCE: Weighted tabulations of data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: Table entries show the percentage of the age/gender subgroup that has the indicated number of eating periods or type of eating occasion.

1. 24-Hour Dietary Intake, by Age and Gender (Table II.2)

On average, American students consume more food energy than recommended--11 percent above the RDA. Adolescent males consume 16 percent to 18 percent more food energy than the RDA, whereas adolescent females consume 4 percent more; the average intake of 6- to 10-year-old students falls between these amounts. For most nutrients, intake that exceeds the RDA is not cause for concern; however, the RDA for food energy are set to reflect *average* needs. Thus, a pattern of average energy intakes of a population significantly above the RDA might indicate that some individuals are consuming more food energy than necessary.

Students consume an average of nearly 2.5 times the RDA for protein. The National Research Council (NRC) recommends reducing protein consumption to less than twice the RDA. Consumption of protein relative to the RDA varies by age and gender group. Children 6- to 10-years old consume especially high levels of protein relative to the RDA--nearly three times the RDA, on average. Adolescent males consume between 2 and 2.5 times the RDA. Adolescent females meet the goal of consuming less than twice the RDA.

Students consume at least the RDA for all vitamins and minerals measured. Furthermore, all age/gender subgroups, with the exception of adolescent females, have average intakes above the RDA for all vitamins and minerals. Adolescent females consume most minerals at levels slightly below the RDA and, in particular, consume relatively low levels of calcium; 11- to 14-year-old females consume 87 percent of the RDA for calcium; 15- to 18-year-old females consume only 80 percent. As noted in Chapter I, however, average consumption of a dietary component that is somewhat less than the RDA does not necessarily indicate an inadequate intake of that component, because RDA are set at levels adequate to meet the needs of nearly all healthy persons.

American students also consume more fat and saturated fat than the Dietary Guidelines recommend, and less carbohydrate than the NRC recommends. Students' diets average 34 percent of food energy from fat, compared with the Dietary Guideline of 30 percent or less, and average 13

TABLE II.2

24-HOUR DIETARY INTAKES OF STUDENTS, BY AGE AND GENDER

Dietary Component	Target Over 24 Hours	6- to 10-Year-Old Students	11- to 14-Year-Old Students		15- to 18-Year-Old Students		All Students
			Female	Male	Female	Male	
Macronutrients							
Food Energy (Percentage of the RDA)	100	111	104	118	104	116	111
Protein (Percentage of the RDA)	100	298	178	246	186	221	247
Percentage of Food Energy from:							
Fat	≤ 30 percent	34	34	34	33	35	34
Saturated Fat	< 10 percent	13	13	13	12	13	13
Carbohydrate	> 55 percent	53	54	52	53	51	53
Vitamins (Percentage of the RDA)							
Vitamin A	100	141	110	134	108	132	130
Vitamin C	100	288	271	313	222	309	284
Thiamin	100	184	162	188	156	190	179
Riboflavin	100	195	169	203	156	189	187
Niacin	100	172	146	174	142	178	165
Vitamin B6	100	133	127	143	115	143	133
Folate	100	294	182	244	140	214	239
Vitamin B12	100	369	240	379	222	388	335
Minerals (Percentage of the RDA)							
Calcium	100	134	87	115	80	126	116
Iron	100	152	98	168	93	200	145
Phosphorus	100	177	118	157	114	178	157
Magnesium	100	166	97	134	87	100	132
Zinc	100	117	96	106	95	126	110
Other Dietary Components (Intake)							
Cholesterol (mg)	≤ 300 mg	270	258	356	257	415	299
Sodium (mg)	≤ 2,400 mg	4,076	4,091	5,462	4,223	6,573	4,633
Sample Size (Unweighted)		**1,383**	**552**	**579**	**413**	**425**	**3,352**

SOURCE: Weighted tabulations of data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

mg = milligrams.

percent of food energy from saturated fat, compared with the Dietary Guideline of less than 10 percent. Moreover, students obtain 53 percent of food energy from carbohydrate, although the recommended level is more than 55 percent. Consumption of fat, saturated fat, and carbohydrate as a proportion of food energy is very similar across all age/gender subgroups.

Finally, students consume an average amount of cholesterol equal to the maximum recommended by the NRC (which is 300 mg per day), but they consume sodium at levels of nearly twice the NRC recommended maximum of 2,400 mg per day. Average consumption of sodium and cholesterol is especially high among adolescent males. Male students 15- to 18-years old, for example, consume 38 percent more cholesterol than the NRC recommended maximum, and nearly three times the recommended maximum level of sodium.

2. 24-Hour Dietary Intake, by Family Income (Table II.3)

Regardless of income level, students' average consumption of vitamins and minerals is more than the RDA, and average consumption of food energy, protein, fat, saturated fat, and sodium is higher than the recommended amounts. However, relative to low-income students, higher-income students (students with family incomes above 185 percent of the poverty level) consume significantly less fat and saturated fat and significantly more carbohydrate as a percentage of food energy than do students with family incomes below the poverty level or between 100 percent and 185 percent of the poverty level. In addition, higher-income students consume slightly (but significantly) higher levels of several key vitamins and minerals--such as vitamin C and vitamin B6--than do students in each of the two low-income groups. Students in the highest-income group also consume significantly more riboflavin, niacin, folate, and iron than do students below the poverty level.

TABLE II.3

24 HOUR DIETARY INTAKES OF STUDENTS, BY POVERTY STATUS OF FAMILY

		Family Income			
Dietary Component	Target Over 24 Hours	Below Poverty Level	100 to 185 Percent of Poverty Level	More than 185 Percent of Poverty Level	All Students
Macronutrients					
Food Energy (Percentage of the RDA)	100	109	108	111	111
Protein (Percentage of the RDA)	100	256	244	245	247
Percentage of Food Energy from:					
Fat	≤ 30 percent	35 [a]	34 [c]	33	34
Saturated Fat	< 10 percent	13 [a]	13 [c]	12	13
Carbohydrate	> 55 percent	51 [a,b]	52 [c]	53	53
Vitamins (Percentage of the RDA)					
Vitamin A	100	127	121 [c]	133	130
Vitamin C	100	264 [a]	252 [c]	299	284
Thiamin	100	172	173	181	179
Riboflavin	100	179 [a]	184	189	187
Niacin	100	157 [a]	162	169	165
Vitamin B6	100	124 [a]	129 [c]	136	133
Folate	100	231 [a]	235	246	239
Vitamin B12	100	354	334	326	335
Minerals (Percentage of the RDA)					
Calcium	100	113	112	118	116
Iron	100	134 [a]	142	149	145
Phosphorus	100	154	152	158	157
Magnesium	100	133	129	134	132
Zinc	100	108	109	110	110
Other Dietary Components (Intake)					
Cholesterol (mg)	≤ 300 mg	305	313 [c]	286	299
Sodium (mg)	≤ 2,400 mg	4,500	4,510	4,596	4,633
Sample Size (Unweighted)		**632**	**511**	**1,629**	**3,352**

SOURCE: Weighted tabulations of data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

[a]Significantly different from intakes of students with family incomes above 185 percent of poverty at the 95 percent level of confidence.

[b]Significantly different from intakes of students with family incomes between 100 and 185 percent of poverty at the 95 percent level of confidence.

[c]Significantly different from intakes of students with family incomes over 185 percent of poverty at the 95 percent level of confidence.

mg = milligrams.

III. DIETARY INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS

This chapter presents findings on the dietary intakes of participants and nonparticipants in the National School Lunch Program (NSLP) and examines the sources of differences in mean intakes. The following questions are addressed:

- How do the lunch intakes of NSLP participants compare with those of nonparticipants and with standards derived from the Recommended Dietary Allowances (RDA), Dietary Guidelines, and National Research Council *Diet and Health* recommendations?
- What are the sources of the differences in dietary intake of NSLP participants and nonparticipants?
  - To what extent are differences in nutrient intakes associated with differences in the nutrient density of foods consumed?
  - Do NSLP participants and nonparticipants consume different types of food at lunch?
  - Do the differences in dietary intakes vary by age and gender, or by family income level?
  - How does the intake of nutrients of students who eat non-NSLP lunches vary according to the source of those lunches?
- Do the dietary intakes of NSLP participants and nonparticipants differ over 24 hours?

Section A summarizes our findings on the dietary intakes of NSLP participants and nonparticipants. Section B discusses the methodological approach underlying the analysis of dietary intakes. (Appendix A provides technical details of the approach.) Sections C and D present the findings on dietary intakes at lunch and over 24 hours, respectively.

A. SUMMARY

NSLP participants consume lunches that provide 33 percent of the RDA for food energy and for all vitamins and minerals, whereas nonparticipants consume less than 33 percent of the RDA for food energy, vitamin A, vitamin B6, calcium, iron, and zinc. However, NSLP participants' lunches are higher than nonparticipants' lunches in fat, saturated fat, and sodium and are lower in carbohydrate, although both groups fail to meet dietary recommendations for these components.

After adjusting for both observed and unobserved differences in characteristics between participants and nonparticipants, participation in the NSLP is associated with higher intakes at lunch of vitamin A, calcium, and magnesium, and with a lower intake of vitamin C. Furthermore, NSLP participation is associated with consuming a higher percentage of food energy from fat and saturated fat, and with consuming a lower percentage from carbohydrate. The NSLP leads to higher intakes of specific nutrients because NSLP lunches contain more of these nutrients per kilocalorie of food energy than do non-NSLP lunches. The adjusted differences in dietary intakes largely occur because NSLP participants are much more likely than nonparticipants to consume fluid milk and meat.

Over 24 hours, NSLP participation is associated with significantly higher intake of vitamin A and lower intake of vitamin C. In addition, relative to nonparticipants, NSLP participants consume a higher percentage of food energy from fat and saturated fat and consume a lower percentage of food energy from carbohydrate. There are no other significant differences in 24-hour intakes.

B. METHODOLOGICAL APPROACH

Comparing the intakes of NSLP participants with those of nonparticipants indicates whether the NSLP affects the dietary intakes of students. The ideal research design to determine how much difference the NSLP makes in students' dietary intakes would be to use a random process to establish two groups, and then to allow one group to obtain the NSLP lunch while denying this opportunity to the other group. If such a random process were used to create the two groups, they would, on average, have the same tastes, appetites, and personal characteristics. The two groups would differ only in their access to the NSLP. Consequently, any differences in nutrient intakes of the two groups could be attributed to the NSLP with a known degree of statistical confidence.

The current study of the NSLP cannot use this ideal research design, as determining participation in the NSLP by random assignment for evaluation purposes simply is not practical. Instead, the evaluation compares dietary intakes of NSLP participants with intakes of students who chose not to participate in that program, using statistical methods to adjust for other observed and unobserved differences in the characteristics of the two groups that may lead to differences in dietary intakes. Thus, it is important to note that the study design does not allow definitive analysis of the effects of the NSLP on dietary intakes, and any conclusions from this study about the effects of the NSLP necessarily rely on statistical assumptions that are subject to debate.

Because NSLP participants (or their parents) decide to participate in the NSLP, and nonparticipants decide not to participate (a small minority do not participate because their schools do not offer the program), NSLP participants and nonparticipants might differ in terms of characteristics that affect what and how much they eat for lunch. For example, boys eat more than girls. They are also more likely to eat an NSLP lunch. Comparing participants and nonparticipants without taking into account the greater proportion of boys in the participant group could lead to erroneous conclusions about how much difference the NSLP makes in students' dietary intakes. Fortunately, well-accepted statistical procedures are available to control for the effects of such observed, measurable characteristics as gender, age, or income level on group differences. Using these procedures permits comparisons between participants and nonparticipants that avoid confounding intake differences due to the program with the effects of observed student characteristics. The analysis presented in this chapter controls for several student and family characteristics that could affect dietary intakes, as well as characteristics of the schools' meal service and the community.

A more difficult problem arises if the participant and nonparticipant groups differ in some important characteristic that the analyst cannot observe or measure directly. Suppose, for example, that girls who are limiting their food intake in order to lose weight decide not to participate in the NSLP because they wish to eat only an apple or a package of crackers for lunch, rather than the full meal. Suppose, as another example, that students who like only certain foods decide to bring lunch from home. Dieters and students who like a narrow range of foods might eat less than other students. If these characteristics are more prevalent in the nonparticipant group than in the NSLP participant group, direct comparisons of participants and nonparticipants will not portray accurately the difference that NSLP participation makes to students' intakes. (In technical terms, such estimates would be said to suffer from "selection bias.") Instead, the larger intakes of participants would be due in part to the inclination of nonparticipants to eat less food.

The findings presented here are based on both simple regression models that control for the influence of observed characteristics on intakes and on more complex statistical models that adjust for both observed and unobserved characteristics. The simple regression models control for observed characteristics of the student (age group, gender, race or ethnicity, whether the student reported the day's intake was unusually low or unusually high), observed characteristics of the student's family (whether family income is less than 185 percent of the poverty level, family size, whether the student's mother is in the household, whether the student's mother works), and observed characteristics of the school and community (availability of a la carte lunches in the cafeteria, availability of vending machines or a school store, urban or suburban location, region of the country).[1]

The more complex statistical models adjust for both observed and unobserved differences between the characteristics of participants and nonparticipants. Specifically, a joint model of NSLP participation and dietary intake is estimated.[2] The model recognizes that the participation decision of students (or their parents) might reflect important differences in food preferences, needs, or appetites that cannot be observed directly.

The following sections present both simple regression-adjusted estimates and selection-bias-adjusted estimates of the differences in the dietary intakes of NSLP participants and nonparticipants.

---

[1]Mean intakes of NSLP participants and nonparticipants (with standard errors) are reported in Appendix B. Full regression results are reported in Appendix C.

[2]Detailed technical descriptions of the joint model of NSLP participation and dietary intake, and of the procedures used to estimate the model, are presented in Appendix A.

The selection-bias-adjusted estimates of participant-nonparticipant differences in dietary intakes are derived from the joint model of NSLP participation and dietary intakes. These estimates are net of the observed and unobserved differences in characteristics between NSLP participants and nonparticipants that also influence dietary intakes, to the extent possible given the available data and the statistical assumptions of the model. Estimates of participant-nonparticipant differences in 24-hour intakes also control for the relation between SBP participation and dietary intakes, which is considered in Chapter IV. Although the results from selection-bias-adjustment models are sometimes quite sensitive to minor changes in model assumptions, extensive sensitivity tests support the selection-bias-adjusted findings reported here.[3]

C. DIETARY INTAKES AT LUNCH OF NSLP PARTICIPANTS AND NONPARTICIPANTS

1. Dietary Intakes

The lunches of NSLP participants are richer in most vitamins and minerals than are those of nonparticipants, but are also higher in food energy, fat, saturated fat, cholesterol, and sodium (Table III.1).[4] NSLP participants consume lunches that provide 33 percent of the RDA for food energy and all vitamins and minerals, whereas nonparticipants consume less than 33 percent of the RDA for food energy, vitamin A, vitamin B6, calcium, iron, and zinc. Furthermore, with the exception of vitamin C, NSLP participants consume higher levels of all vitamins and minerals than do nonparticipants. However, NSLP participants' lunches are high in the percentage of food energy from fat and saturated fat, high in sodium, and low in the percentage of food energy from carbohydrate relative to dietary recommendations. Nonparticipants' intakes also exceed dietary

[3]The sensitivity of the results to key assumptions is discussed in Appendix A.

[4]The intakes presented in the first two columns of Table III.1 are adjusted for observed characteristics of students, but are very close to simple mean intakes.

TABLE III.1

DIETARY INTAKES AT LUNCH OF NSLP PARTICIPANTS AND NONPARTICIPANTS

	Regression-Adjusted Dietary Intakes			
Dietary Component	NSLP Participants	Nonparticipants	Difference	Selection-Bias Adjusted Difference
Macronutrients				
Food Energy (Percentage of the RDA)	34	30	4 **	-2
Protein (Percentage of the RDA)	84	57	27 **	12
Percentage of Food Energy from:				
Fat	37	33	4 **	4 **
Saturated Fat	14	11	3 **	3 **
Carbohydrate	48	57	-9 **	-7 **
Vitamins (Percentage of the RDA)				
Vitamin A	33	17	16 **	19 **
Vitamin C	59	78	-19 **	-42 **
Thiamin	46	42	4 **	-8
Riboflavin	55	38	17 **	9 *
Niacin	47	38	9 **	-4
Vitamin B6	34	26	8 **	0
Folate	53	45	8 **	-2
Vitamin B12	107	57	50 **	44 **
Minerals (Percentage of the RDA)				
Calcium	43	25	18 **	11 **
Iron	37	31	6 **	0
Phosphorus	53	36	17 **	9 **
Magnesium	41	33	8 **	6 *
Zinc	35	23	12 **	8 **
Other Components (Intake)				
Cholesterol (mg)	85	52	33 **	15
Sodium (mg)	1,524	1,113	411 **	126

SOURCE: Weighted regression results based on data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the NSLP and students at schools not offering the NSLP. The sample size is 3,015; students who do not eat lunch are excluded. Intakes and differences in the intakes of NSLP participants and nonparticipants are based on multiple regression models of students' dietary intakes. Selection-bias adjusted differences in estimated intakes of NSLP participants and nonparticipants are based on models of NSLP participation and students' dietary intakes. See Appendix Table C.2 for detailed regression results.

mg = milligrams.

*/** indicates the difference is statistically significant at the 95/99 percent confidence level with a two-tailed test.

recommendations for fat, saturated fat, and sodium, but to a lesser extent, and derive a proportion of food energy from carbohydrate within the recommended range.[5]

These differences in intakes reflect either program effects or underlying differences in the unobserved characteristics of participants and nonparticipants. Estimates that adjust for the effects of both observed and unobserved characteristics (in the column in Table III.1 marked "Selection-Bias Adjusted Difference") indicate that NSLP participation is directly associated with differences in the intakes of some, but not all, dietary components. Specifically, participation by students in the NSLP leads to:

- Higher average lunch intakes of vitamin A, riboflavin, vitamin B12, calcium, phosphorus, magnesium, and zinc, and a lower intake of vitamin C
- Higher percentages of food energy from fat and saturated fat, and a lower percentage from carbohydrate
- No significant differences in the lunch intakes of food energy, protein, thiamin, niacin, vitamin B6, iron, folate, sodium or cholesterol

Contrasting the selection-bias adjusted differences in participant-nonparticipant dietary intakes with the regression-adjusted differences in dietary intakes suggests that, for some nutrients, differences in the unobserved characteristics account for a substantial portion of observed differences in lunchtime dietary intakes. In particular, the significantly higher mean intakes of food energy, protein, thiamin, niacin, vitamin B6, folate, iron, cholesterol, and sodium by NSLP participants relative to nonparticipants may be due primarily to differences in unobserved characteristics (for example, larger appetites, food preferences, or food energy needs), rather than to the NSLP.

Nutrient density is one measure of dietary quality. It is a ratio that is constructed by dividing the intake of a nutrient relative to its RDA by the intake of food energy relative to the RDA for food energy. Data on the nutrient densities of NSLP lunches and non-NSLP lunches confirm that, after

[5]Dietary intakes of NSLP participants are analyzed in more detail Chapter VIII of the companion report, by Burghardt, Gordon, Chapman et al. (1993).

adjusting for the unobserved characteristics of NSLP participants that lead to higher food energy consumption, the NSLP increases the dietary intake of selected nutrients by providing lunches that are relatively dense in those nutrients, rather than by providing more food (Table III.2). In general, the dietary components of NSLP lunches having high relative nutrient densities (relative to those of non-NSLP lunches) are the same dietary components having statistically significant adjusted participant-nonparticipant differences in dietary intakes. In particular, the selection-bias adjusted differences in intakes are largest for vitamin A, vitamin B12, and calcium, and the relative nutrient density of NSLP lunches is highest for these three nutrients. This pattern holds to a lesser extent for riboflavin, zinc, phosphorus, and magnesium. The nutrient density of protein in NSLP lunches is also relatively high, as is the selection-bias adjusted difference in intakes. NSLP participation is associated with significantly less consumption of vitamin C, and NSLP lunches are relatively less nutrient dense in this nutrient than are non-NSLP lunches.

2. Types of Foods Consumed at Lunch (Tables III.3 and III.4)

Differences in the lunchtime consumption of foods from major food groups by NSLP participants and nonparticipants also shed light on the sources of the selection-bias adjusted differences in intakes of specific nutrients discussed in the previous section.[6] NSLP participants are more than twice as likely as nonparticipants to consume ***milk and milk products*** at lunch, because of participants' more frequent consumption of fluid milk (Table III.3). The more frequent consumption of fluid milk by NSLP participants largely explains their higher estimated lunchtime intakes of vitamin A and calcium (Table III.4). The more frequent consumption of ***milk*** and ***meat, poultry, fish, and meat mixtures*** by NSLP participants largely explains why participants derive significantly more of their total lunchtime intake of food energy from fat than do nonparticipants.

---

[6]Table D.1 in Appendix D contains detailed tabulations of the average amounts of nutrients provided by each food group in the lunches consumed by NSLP participants and nonparticipants.

TABLE III.2

NUTRIENT DENSITIES OF NSLP AND NON-NSLP LUNCHES

Nutrient	Nutrient Density of NSLP Lunches	Nutrient Density of Non-NSLP Lunches	Relative Nutrient Density of NSLP Lunches
Food Energy	NA	NA	--
Protein	2.5	1.8	+39
Vitamin A	0.97	0.60	+62
Vitamin C	1.74	2.62	-34
Thiamin	1.38	1.38	+0
Riboflavin	1.62	1.25	+30
Niacin	1.39	1.27	+9
Vitamin B6	0.99	0.87	+14
Folate	1.62	1.43	+13
Vitamin B12	3.20	1.82	+76
Calcium	1.26	0.82	+54
Iron	1.09	1.01	+8
Phosphorus	1.56	1.20	+30
Magnesium	1.24	1.04	+19
Zinc	1.02	0.76	+34

SOURCE: Weighted tabulations of data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the NSLP and students at schools not offering the NSLP. Nutrient density of a given nutrient is intake of the nutrient relative to the RDA for that nutrient divided by intake of food energy relative to the RDA for food energy. The relative nutrient density of NSLP lunches is the percentage by which the nutrient density of NSLP lunches for a particular nutrient exceeds (+) or is less than (-) the nutrient density of non-NSLP lunches.

NA = not applicable.

TABLE III.3

FOODS CONSUMED IN NSLP AND NON-NSLP LUNCHES
(Percentage of Students Eating Foods)

Food Group	NSLP Participants	Nonparticipants	Difference
Milk and Milk Products	88	42	46 **
White milk	35	11	24 **
Flavored milk	50	12	38 **
Cheese	17	17	0
Other milk products	9	9	0
Meat, Poultry, Fish, and Meat Mixtures	67	48	19 **
Eggs	1	1	0
Dry Beans, Peas, Other Legumes, and Nuts and Seeds	9	18	-9 **
Grain Products	86	81	5 **
Yeast breads	49	52	-3
Quick breads and tortillas	6	2	4 **
Cakes, cookies, pies, pastries	24	33	-9 **
Crackers and salty snacks	10	27	-17 **
Pancakes, waffles, french toast	0	1	0
Pasta, cooked cereal, rice	3	1	3 **
Dry cereal	0	1	-1 **
Grain-based mixtures	27	10	17 **
Fruits and Fruit Juices	48	32	17 **
Vegetables	73	40	32 **
Potatoes	36	24	12 **
Dark-green vegetables	1	0	1 **
Yellow vegetables	4	2	2 **
Tomatoes and tomato sauces	28	8	20 **
Other vegetables	41	16	25 **
Fats, Oils, and Salad Dressings	17	19	-2
Sugar, Sweets, and Sweetened Beverages	21	64	-43 **

SOURCE: Weighted tabulations of data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the NSLP and students at schools not offering the NSLP. Entries in the table are the percentage of students eating foods from each food group. Meat mixtures (such as chili) often include vegetables. Grain-based mixtures (such as pizza) may include cheese, meat, or vegetables.

** indicates the difference is statistically significant at the 99 percent confidence level with a two-tailed test.

TABLE III.4

FOOD SOURCES OF KEY NUTRIENTS AT LUNCH, BY NSLP PARTICIPATION STATUS

	Vitamin A (Percent of RDA)		Calcium (Percent of RDA)		Fat (Grams)		Carbohydrate (Grams)	
Food Group	NSLP Participant	Nonparticipant	NSLP Participant	Nonparticipant	NSLP Participant	Nonparticipant	NSLP Participant	Nonparticipant
Milk and Milk Products	15.5	6.6 **	28.3	12.7 **	6.2	4.0 **	18.7	7.8 **
White milk	4.5	1.7 **	10.1	3.5 **	2.0	0.6 **	3.7	1.4 **
Flavored milk	8.7	1.9 **	14.4	3.5 **	2.0	0.6 **	13.0	3.4 **
Cheese	1.8	2.4	3.0	4.5 *	1.5	2.0	0.3	0.4
Other milk products	0.6	0.7	0.8	1.2 *	0.7	0.8	1.8	2.5 *
Meat, Poultry, Fish, and Meat Mixtures	2.8	1.1 **	2.5	1.6 **	11.1	6.4 **	6.3	3.6 **
Eggs	0.1	0.2	0.0	0.1	0.1	0.1	0.0	0.0
Dry Beans, Peas, Other Legumes, and Nuts and Seeds	0.0	0.0	0.3	0.4 *	0.8	2.0 **	1.1	2.2 **
Grain Products	4.8	4.2	9.7	7.3 **	9.0	8.8	35.6	38.8
Fruits and Fruit Juices	1.2	0.9 *	0.7	0.9	0.1	0.2 **	10.5	10.0
Vegetables	8.4	4.2 **	1.5	0.6 **	3.4	3.1	10.5	6.0 **
Fat, Oils, and Salad Dressings	0.5	0.5	0.1	0.1 **	1.4	1.1 *	0.2	0.2
Sugar, Sweets, and Sweetened Beverages	0.1	0.6 **	0.3	1.3 **	0.3	0.8 **	7.0	23.3 **
All Foods	33.3	18.1 **	43.4	24.9 **	32.3	26.5 **	89.9	91.9

NOTE: Table entries for Vitamin A and calcium are the percentage of the RDA provided by foods in each food group. Entries for fat and carbohydrate indicate the mean grams provided by foods in each food group. See Appendix Table D.1 for food sources of other dietary components at lunch.

*/** indicates that participant/nonparticipant differences (not regression-adjusted) are statistically significant at the 95/99 percent confidence level.

NSLP participants are almost twice as likely as nonparticipants to eat ***vegetables*** at lunch (65 versus 36 percent), contributing (along with milk) to the higher consumption of vitamin A by participants.

Although NSLP participants and nonparticipants are almost equally likely to consume ***grain products*** at lunch, more NSLP participants consume grains as part of grain mixtures, such as pizza or macaroni and cheese, and fewer consume grains in the form of cookies, cakes, or salty snacks. In general, this finding implies that NSLP participants derive more nutrients from grain-based foods than do nonparticipants, and that NSLP participants and nonparticipants derive roughly equal amounts of fat and carbohydrate from these foods.

Nonparticipants are three times as likely as NSLP participants to eat ***sugar, sweets, and sweetened beverages*** (58 versus 19 percent). Nonparticipants' higher consumption of vitamin C is almost entirely due to their higher consumption of sweetened beverages, such as juice drinks or fruitades, that have been fortified with vitamin C (Appendix Table D.1).

Relative to NSLP participants, nonparticipants consume more carbohydrate as a percentage of food energy. The higher intake of sugar, sweets, and sweetened beverages by nonparticipants suggests that nonparticipants might consume more of their carbohydrate as sugar rather than as complex carbohydrate. (The consumption of sugar was not directly measured in our data.) However, nonparticipants' higher consumption of carbohydrate from sugar, sweets, and sweetened beverages is largely balanced by NSLP participants' higher consumption of carbohydrate from flavored milk (chocolate or strawberry) (Table III.4). More than one-half of all of the milk consumed by NSLP participants is flavored.

3. Dietary Intakes of Subgroups of Students

To provide additional insight into sources of the differences in the intakes of NSLP participants and nonparticipants, differences in dietary intakes are examined for subgroups of NSLP participants and nonparticipants.

a. Dietary Intake, by Age and Gender (Table III.5)

It is very important to examine participant-nonparticipant differences separately by age and by gender. As described in Chapter II, eating patterns over the day differ by age and gender in ways that could affect whether and what a student eats for lunch. Furthermore, the decision process and lunch options are very different for students in different age groups. Older students usually have many more non-NSLP lunch options than do younger students; their choices are more likely to include a la carte offerings, vending machines, and off-campus restaurants or stores, in addition to lunch brought from home.[7] Older students are also more likely to decide for themselves which type of meal they will select. The parents of younger students often make the choice or exert considerable influence. Thus, it is important to consider both simple differences and adjusted differences separately for young children (6- to-10-years old), and for both female and male adolescents (11- to-18-years old).

Many key findings are the same for all age and gender groups. In particular, within each age and gender subgroup, there are no significant selection-bias adjusted differences between NSLP participants and nonparticipants in food energy consumed at lunch, or in intakes of thiamin, niacin, vitamin B6, folate, vitamin B12, iron, magnesium, or sodium. NSLP participants within each subgroup have significantly higher levels of intake of saturated fat (as a percentage of food energy) and vitamin A.

With respect to differences between younger and older children, the NSLP leads to significantly higher protein and cholesterol intakes and to significantly lower vitamin C intake only for young children. Selection-bias adjusted participant-nonparticipant differences in these nutrients are insignificant for adolescents. The NSLP leads to significantly higher calcium intake among younger children and male adolescents, but not among female adolescents. Participant-nonparticipant

[7]See Chapter III of the companion report by Burghardt, Gordon, Chapman et al. (1993) for a discussion of lunch options.

TABLE III.5

DIFFERENCES IN DIETARY INTAKES AT LUNCH OF NSLP PARTICIPANTS AND NONPARTICIPANTS, BY AGE AND GENDER

Dietary Component	6- to 10-Year-Old Students		11- to 18-Year-Old Females		11- to 18-Year-Old Males	
	Regression-Adjusted Difference	Selection Bias Adjusted Difference	Regression-Adjusted Difference	Selection Bias Adjusted Difference	Regression-Adjusted Difference	Selection Bias Adjusted Difference
Macronutrients						
Food Energy (Percentage of the RDA)	1	0	8 **	-3	5 **	-1
Protein (Percentage of the RDA)	28 **	19 *	28 **	0	23 **	13
Percentage of Food Energy from:						
Total Fat	4 **	5 **	5 **	4	4 **	4
Saturated Fat	3 **	3 **	3 **	3 **	3 **	4 **
Carbohydrate	-9 **	-7 **	-10 **	-6	-9 **	-9 **
Vitamins (Percentage of the RDA)						
Vitamin A	18 **	25 **	15 **	19 *	14 **	17 **
Vitamin C	-43 **	-54 **	-4	-26	-9	-31
Thiamin	-2	-3	13 **	-8	6 *	-7
Riboflavin	14 **	12 **	22 **	4	16 **	14 *
Niacin	5 *	0	14 **	-7	7 **	-3
Vitamin B6	5 **	0	12 **	1	6 **	2
Folate	4	1	12 **	-4	10 **	-2
Vitamin B12	55 **	45 **	44 **	15	47 **	46 *
Minerals (Percentage of the RDA)						
Calcium	16 **	12 **	16 **	8	19 **	17 *
Iron	3	2	8 **	-3	7 **	2
Phosphorus	15 **	10 *	17 **	7	17 **	15
Magnesium	7 **	6	9 **	3	8 **	3
Zinc	11 **	9 *	15 **	4	11 **	6
Other Dietary Components (Intake)						
Cholesterol (mg)	28 **	27 **	39 **	-4	31 **	14
Sodium (mg)	209 **	238	588 **	48	484 **	272

SOURCE: Weighted regression results based on data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the NSLP and students at schools not offering the NSLP. Differences in the intakes of NSLP participants and nonparticipants are based on multiple regression models of students' dietary intakes. Adjusted differences in estimated intakes of NSLP participants and nonparticipants are based on selection-bias models of NSLP participation and students' dietary intakes.

mg = milligrams.

*/** *indicates the difference or estimated effect is statistically significant at the 95/99 percent confidence level with a two-tailed test.*

differences in the percentage of food energy from fat and carbohydrate are similar in magnitude across the three subgroups, but differences in fat are not statistically significant for female and male adolescents, and differences in carbohydrate are not significant for female adolescents.

Note also that the selection-bias adjustment makes very little difference in any of the estimates for young children (although the adjusted estimates are less precise). The similarity between the regression-adjusted and selection-bias-adjusted results for young children suggests that, for children 6- to 10-year olds, no important unobserved differences between NSLP participants and nonparticipants exist.

In contrast, the many differences between the regression-adjusted and selection-bias adjusted results for adolescents (especially adolescent females) suggest that the unmeasured needs or food preferences of adolescent NSLP participants differ systematically from those of adolescent nonparticipants. Adolescent students tend to have many choices about where they will go and what they will get for lunch. The findings suggest that adolescent students who choose the NSLP lunch have unmeasured food preferences, energy needs, or appetites that would independently lead to greater food consumption relative to adolescents who do not choose the NSLP lunch. In particular, the higher average intakes of food energy and most vitamins and minerals at lunch of adolescent NSLP participants relative to nonparticipants disappear with the selection-bias adjustments for participant-nonparticipant differences.

b. Dietary Intake, by Family Income (Table III.6)

To examine differences in dietary intakes by income level, participant-nonparticipant differences in intake were calculated separately for students with family incomes below 185 percent of the poverty level--the cutoff for eligibility for free or reduced-price meals--and for students with higher family incomes. In general, the results are similar for higher- and lower-income students. For both groups, there are no selection-bias adjusted differences in food energy, vitamin B6, folate, or iron intakes; positive differences in calcium intakes; and negative differences in vitamin C intakes. The

TABLE III.6

DIFFERENCES IN DIETARY INTAKES AT LUNCH OF NSLP PARTICIPANTS AND NONPARTICIPANTS, BY FAMILY INCOME

	Low-Income Students		Non-Low-Income Students	
	Regression-Adjusted Difference	Selection Bias Adjusted Difference	Regression-Adjusted Difference	Selection Bias Adjusted Difference
Macronutrients				
Food Energy (Percentage of the RDA)	4 **	-2	5 **	-2
Protein (Percentage of the RDA)	26 **	20 *	27 **	1
Percentage of Food Energy from:				
Fat	3 **	3	5 **	5 **
Saturated Fat	3 **	3 **	3 **	4 **
Carbohydrate	-8 **	-9 **	-9 **	-6 *
Vitamins (Percentage of the RDA)				
Vitamin A	15 **	26 **	17 **	10
Vitamin C	-17 **	-50 **	-20 **	-34 *
Thiamin	4	-5	6 **	-9
Riboflavin	17 **	12 **	18 **	7
Niacin	8 **	2	9 **	-10
Vitamin B6	8 **	4	8 **	-3
Folate	10 **	5	7 **	-9
Vitamin B12	50 **	55 **	49 **	23
Minerals (Percentage of the RDA)				
Calcium	17 **	15 **	17 **	11 *
Iron	5 **	3	7 **	-3
Phosphorus	17 **	14 **	16 **	7
Magnesium	9 **	9 *	7 **	2
Zinc	12 **	9 *	12 **	4
Other Dietary Components (Intake)				
Cholesterol (mg)	26 **	23 *	36 **	11
Sodium (mg)	394 **	252	415 **	16

SOURCE: Weighted regression results based on data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the NSLP and students at schools not offering the NSLP. Low-income students are from households with income up to 185 percent of the poverty level. Non-low-income students are from households with income of more than 185 percent of the poverty level. Differences in the intakes of NSLP participants and nonparticipants are based on multiple regression models of students' dietary intakes. Adjusted differences in estimated intakes of NSLP participants and nonparticipants are based on selection bias models of NSLP participation and students' dietary intakes.

mg = milligrams.

*/** indicates the difference or estimated effect is statistically significant at the 95/99 percent confidence level with a two-tailed test.

general pattern that NSLP lunches are higher in the percentage of food energy from saturated fat and are lower in the percentage from carbohydrate than alternative lunches also holds for both income groups. However, the selection-bias adjusted difference in the percentage of food energy from fat is not significant for low-income students, because low-income students who do not participate in the NSLP consume more fat than do higher-income nonparticipants. In addition, the selection-bias adjusted results indicate that the NSLP leads to significant increases in intakes of protein, vitamin A, riboflavin, vitamin B12, phosphorus, magnesium, and zinc for low-income students.

4. Dietary Intakes at Lunch of Students Eating Non-NSLP Lunches, by Source of Lunch (Table III.7)

The analysis of dietary intake at lunch by source of non-NSLP lunch compares the following non-NSLP sources:[8]

- ***Non-NSLP lunches obtained at school***, which include foods obtained from vending machines, foods purchased at a school store, and a la carte items bought in the cafeteria
- ***Lunches obtained from home supplies***, which include foods brought from home and eaten in school and foods eaten at home
- ***Lunches obtained off-campus***, which include foods obtained at a store (and either eaten at school or eaten away from school) and foods eaten at a restaurant

Average food energy intake ranges from 23 percent of the RDA for non-NSLP lunches obtained in school to 31 percent for lunches obtained from home supplies, and to 34 percent for lunches obtained off-campus. The low food energy intake of students who obtain a non-NSLP lunch at school is particularly striking and again suggests that some students who select this type of non-NSLP

[8]Non-NSLP lunches are classified according to the source that provided the greatest number of calories.

TABLE III.7

DIETARY INTAKES AT LUNCH OF STUDENTS EATING NON-NSLP LUNCHES

Dietary Component	Obtained at School	Obtained from Home Supplies	Obtained Off Campus
Macronutrients			
Food Energy (Percentage of the RDA)	23	31	34
Protein (Percentage of the RDA)	36	60	60
Percentage of Food Energy from:			
Fat	33	32	38
Saturated Fat	12	11	13
Carbohydrate	59	58	51
Vitamins (Percentage of the RDA)			
Vitamin A	14	20	15
Vitamin C	54	96	46
Thiamin	27	47	42
Riboflavin	29	41	37
Niacin	25	42	43
Vitamin B6	18	28	30
Folate	26	51	38
Vitamin B12	37	57	69
Minerals (Percentage of the RDA)			
Calcium	19	27	24
Iron	21	33	35
Phosphorus	26	39	37
Magnesium	20	37	26
Zinc	16	24	29
Other Components (Intake)			
Cholesterol (mg)	41	52	79
Sodium (mg)	798	1,175	1,527
Sample Size (Unweighted)	**329**	**823**	**230**

SOURCE: Weighted tabulations of data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the NSLP and students at schools not offering the NSLP.

mg = milligrams.

lunch may differ from students selecting a full NSLP lunch in their food preferences, energy needs, or appetites.[9]

Consistent with the low level of food energy provided by non-NSLP lunches obtained at school, such lunches provide considerably less than one-third of the RDA for all vitamins and minerals with the exception of vitamin C (54 percent) and vitamin B12 (37 percent). Non-NSLP lunches obtained at school are especially low in vitamin A (14 percent of the RDA), vitamin B6 (18 percent), calcium (19 percent), and zinc (16 percent).

Lunches brought from home provide an average of one-third of the RDA for most vitamins and minerals. Although the mean intakes of vitamin A, vitamin B6, calcium, and zinc are less than one-third of the RDA, they are higher than the mean intakes from non-NSLP lunches obtained at school.

Lunches obtained off-campus provide mean intakes of at least one-third of the RDA for fewer nutrients than do lunches brought from home, even though the mean food energy consumed in off-campus meals is greater. For example, the mean intake is less than one-third of the RDA for five nutrients--vitamin A, vitamin B6, calcium, magnesium, and zinc.

Off-campus meals also provide higher levels of fat, cholesterol, and sodium than do the other types of non-NSLP meals. Interestingly, the off-campus meals are quite similar to the NSLP meals in terms of their sodium and fat content, although the former generally provide lower levels of vitamins and minerals (compare Table III.1 and Table III.7).

Students who eat non-NSLP lunches obtained either from home or from school derive more of their total intake of food energy from carbohydrate and less from fat than do students who eat meals obtained off-campus. This pattern is consistent with consumption of lunches that are composed of fewer animal products and more grain products, fruits, vegetables, and/or sweets. The pattern would

---

[9]Because the NSLP meal is subsidized by the federal government, but a la carte foods are not, it is very likely that the prices of a la carte foods are set so that the cost of a reimbursable lunch would be lower than the same collection of foods purchased a la carte. In this event, the smaller amount purchased is likely to reflect a decision to eat less, rather than an inability to purchase a full meal. However, it is not possible to draw firm conclusions, because the study did not collect data on the prices of a la carte foods.

also account for the relatively low intake of cholesterol by students obtaining lunches from home or school.

However, non-NSLP lunches obtained at school are more likely to provide inadequate levels of food energy and other nutrients. In general, lunches brought from home have higher nutrient densities of vitamins and minerals than do non-NSLP school lunches, suggesting, in turn, that lunches obtained from home might include comparatively more grain products, fruits, and vegetables, and comparatively fewer sweets. In particular, lunches obtained from home provide one-third of the RDA for iron, whereas non-NSLP lunches obtained in school provide only 21 percent.[10]

D. 24-HOUR DIETARY INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS

Differences in the 24-hour dietary intakes of NSLP participants and nonparticipants might be larger or smaller than differences in lunch intakes because NSLP participants might eat different types or amounts of foods at other meals. For example, although NSLP participants consume more calcium and less vitamin C at lunch than do nonparticipants (by consuming more milk and fewer juice drinks), they might "make up" for these differences by consuming less calcium and more vitamin C at other meals (more juice drinks and less milk).

Over 24 hours, participation in the NSLP is associated with significantly higher consumption of fat and saturated fat as a percentage of food energy, and a significantly lower consumption of carbohydrate as a percentage of food energy (Table III.8). In addition, NSLP participants consume significantly more vitamin A and less vitamin C than do nonparticipants, even after adjustment for observed and unobserved differences in characteristics. There are no other statistically significant differences in selection-bias adjusted dietary intakes between NSLP participants and nonparticipants. In particular, participant-nonparticipant differences in intakes of calcium, magnesium, and zinc are

[10]However, differences in the age and gender composition of the groups who obtain non-NSLP lunches from home or from school might also be a determinant of the greater likelihood that a student who also brings lunch from home attains one-third of the RDA for iron. Younger students (who are more likely to bring lunch from home) are generally more likely to meet the target than are adolescent females (who are more likely to obtain a non-NSLP meal in school).

TABLE III.8

24-HOUR DIETARY INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS

Dietary Component	Regression-Adjusted Dietary Intakes: NSLP Participants	Nonparticipants	Difference	Selection-Bias Adjusted Difference
Macronutrients				
Food Energy (Percentage of the RDA)	113	108	5 **	-2
Protein (Percentage of the RDA)	257	233	24 **	20
Percentage of Food Energy from:				
Fat	35	33	1 **	3 **
Saturated Fat	13	12	1 **	1 **
Carbohydrate	51	54	-3 **	-5 **
Vitamins (Percentage of the RDA)				
Vitamin A	136	122	14 **	33 *
Vitamin C	272	290	-19	-105 **
Thiamin	178	176	2	-5
Riboflavin	193	177	16 **	4
Niacin	167	160	7 *	-3
Vitamin B6	135	128	7 *	-3
Folate	243	232	11	-35
Vitamin B12	358	304	54 **	67
Minerals (Percentage of the RDA)				
Calcium	124	105	19 **	6
Iron	146	142	4	-6
Phosphorus	164	147	17 **	11
Magnesium	136	126	10 **	5
Zinc	115	104	12 **	10
Other Components (Intake)				
Cholesterol (mg)	308	283	25 **	17
Sodium (mg)	4,803	4,405	398 **	387

SOURCE: Weighted regression results based on data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the NSLP and students at schools not offering the NSLP. Intakes and differences in the intakes of NSLP participants and nonparticipants are based on multiple regression models of students' dietary intakes. Selection-bias adjusted differences in estimated intakes of NSLP participants and nonparticipants are based on models of NSLP participation and students' dietary intakes. See Appendix Table C.6 for detailed regression results.

mg = milligrams.

*/** indicates the difference is statistically significant at the 95/99 percent confidence level with a two-tailed test.

not statistically significant, although there were significant differences in the lunch intakes of these nutrients.[11]

One important caveat to bear in mind is that the measurement of participant-nonparticipant differences in 24-hour intakes inevitably is less precise than is the measurement of differences in lunch intakes; the measures of 24-hour intake are influenced by unmeasured factors and measurement errors affecting intake at other eating occasions, in addition to unmeasured factors and measurement errors affecting intake at lunch. Thus, for some nutrients--such as magnesium and zinc--the selection-bias adjusted differences in 24-hour intake, although insignificant, are similar to or larger in magnitude than the significant regression-adjusted differences in lunch intake (see Table III.9). In such cases, one should be cautious about concluding that the difference does not persist over 24 hours. In other instances--for example, for calcium--both the magnitude and significance of the difference in intakes declines over 24 hours, suggesting that NSLP participants might be relatively more likely to consume calcium-rich foods, such as milk, at lunch, but relatively less likely to consume calcium-rich foods at other eating occasions.

[11]The NSLP also is associated with significant differences in lunch intakes, but not in 24-hour intakes, of riboflavin, vitamin B12, and phosphorus.

TABLE III.9

LUNCH-SPECIFIC AND 24-HOUR DIFFERENCES IN INTAKES
BETWEEN NSLP PARTICIPANTS AND NONPARTICIPANTS

Dietary Component	Intake at Lunch			Intake Over 24 Hours		
	Participants	Nonparticipants	Adjusted Difference	Participants	Nonparticipants	Adjusted Difference
Macronutrients						
Food Energy (Percentage of the RDA)	34	30	-2	113	108	-2
Protein (Percentage of the RDA)	84	57	12	257	233	20
Percentage of Food Energy from:						
Fat	37	33	4 **	35	33	3 **
Saturated Fat	14	11	3 **	13	12	1 **
Carbohydrate	48	57	-7 **	51	54	-5 **
Vitamins (Percentage of the RDA)						
Vitamin A	33	17	19 **	136	122	33 *
Vitamin C	59	78	-42 **	272	290	-105 **
Thiamin	46	42	-8	178	176	-5
Riboflavin	55	38	9 *	193	177	4
Niacin	47	38	-4	167	160	-3
Vitamin B6	34	26	0	135	128	-3
Folate	53	45	-2	243	232	-35
Vitamin B12	108	57	44 **	358	304	67
Minerals (Percentage of the RDA)						
Calcium	43	25	11 **	124	105	6
Iron	37	31	0	146	142	-6
Phosphorus	53	36	9 **	164	147	11
Magnesium	41	33	5 *	136	126	5
Zinc	35	23	8 **	115	104	10
Other Components (Intake)						
Cholesterol (mg)	85	52	15	308	283	17
Sodium (mg)	1,524	1,113	126	4,803	4,405	387

SOURCE: Weighted regression results based on data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the NSLP and students at schools not offering the NSLP. Intakes of NSLP participants and nonparticipants are based on multiple regression models of students' dietary intakes. Adjusted differences in estimated intakes of NSLP participants and nonparticipants are based on selection-bias models of NSLP participation and students' dietary intakes. See Appendix Tables C.2 and C.6 for detailed regression results.

mg = milligrams.

*/** indicates the difference is statistically significant at the 95/99 percent confidence level with a two-tailed test.

IV. DIETARY INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS

This chapter presents study findings on the dietary intakes of participants and nonparticipants in the School Breakfast Program (SBP) at breakfast and over 24 hours. It addresses the following questions, which parallel the issues considered in the analysis of the National School Lunch Program (NSLP):

- How do the breakfast intakes of SBP participants compare with the intakes of nonparticipants and with standards based on the Recommended Dietary Allowances (RDA), Dietary Guidelines, and National Research Council (NRC) recommendations?
- What are the sources of the differences in the intakes of SBP participants and nonparticipants?
  - Are they associated with differences in the nutrient density of foods consumed?
  - Do SBP participants and nonparticipants eat different types of food at breakfast?
  - How does the intake of nutrients vary according to the source of non-SBP breakfasts?
- What are the differences in 24-hour dietary intakes of SBP participants and nonparticipants?

A. SUMMARY

In general, both SBP participants and nonparticipants consume breakfasts that meet one-fourth of the RDA and other dietary recommendations, although nonparticipants' intake of food energy is less than one-fourth of the RDA, and SBP participants' intakes of saturated fat, cholesterol, and sodium are higher than dietary recommendations. Participation in the SBP is associated with higher intakes of food energy, calcium, riboflavin, phosphorus, and magnesium at breakfast. It also is associated with a higher percentage of breakfast food energy from fat, saturated fat, and protein, and a lower percentage of food energy from carbohydrate. These differences arise largely because SBP participants are more likely than nonparticipants to consume meat, milk, and fruit or fruit juice at breakfast. Most differences between the breakfast intakes of SBP participants and nonparticipants, including the difference in food energy intake, also persist over 24 hours. However, the differences at breakfast in the percentage of food energy obtained from fat and carbohydrate become insignificant over 24 hours.

B. DIETARY INTAKES AT BREAKFAST OF SBP PARTICIPANTS AND NONPARTICIPANTS

1. Dietary Intakes

SBP participants are close to meeting dietary recommendations for breakfast intake for most dietary components (Table IV.1). In particular, their average intakes of energy are one-fourth of the RDA, and their intakes of protein, vitamins, and all minerals with the exception of zinc exceed one-fourth of the RDA. SBP participants' percentages of food energy derived from fat (28 percent) and carbohydrate (61 percent) at breakfast are within the recommended range, and their average intakes of saturated fat and cholesterol exceed the dietary recommendations by only a small amount. As with NSLP lunches, consumption of sodium by SBP participants is substantially above the NRC recommended maximum.

The average breakfast intakes of students who eat breakfast from a source other than the SBP also meet most dietary recommendations, on average. Although their intake of food energy is only 19 percent of the RDA--below the target level of one-fourth of the RDA--nonparticipants consume more than one-fourth of the RDA for protein, vitamins, and minerals (again, with the exception of zinc). Furthermore, unlike SBP participants, nonparticipants' average intakes of saturated fat, cholesterol, and sodium are within the recommended ranges.

In contrast to findings on the NSLP, controlling for *unobserved* characteristics of SBP participants and nonparticipants does not substantially change estimated differences in dietary intakes between SBP participants and nonparticipants, except that the selection-bias adjusted estimates have larger standard errors and, therefore, are less often significant at the 95 percent confidence level

TABLE IV.1

DIETARY INTAKES AT BREAKFAST OF SBP PARTICIPANTS AND NONPARTICIPANTS

Dietary Component	Regression-Adjusted Dietary Intakes: SBP Participants	Nonparticipants	Difference	Selection-Bias Adjusted Difference
Macronutrients				
Food Energy (Percentage of the RDA)	25	19	6 **	6 **
Protein (Percentage of the RDA)	51	36	15 **	19 **
Percentage of Food Energy from:				
Fat	28	24	3 **	4
Saturated Fat	11	10	1 *	1
Carbohydrate	61	65	-4 **	-6 *
Vitamins (Percentage of the RDA)				
Vitamin A	39	41	-2	2
Vitamin C	89	83	5	12
Thiamin	57	48	9 **	10
Riboflavin	64	56	8 **	14 *
Niacin	38	37	1	2
Vitamin B6	37	38	-1	4
Folate	88	94	-6	-3
Vitamin B12	85	74	11	15
Minerals (Percentage of the RDA)				
Calcium	38	29	10 **	11 **
Iron	40	43	-4	-9
Phosphorus	42	32	10 **	12 **
Magnesium	34	27	7 **	9 **
Zinc	21	19	1	1
Other Components (Intake)				
Cholesterol (mg)	81	62	19 **	21
Sodium (mg)	796	586	210 **	142

SOURCE: Weighted regression results based on data from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the SBP and students at schools not offering the SBP. The sample size is 2,896; students not eating breakfast are excluded. Intakes and differences in the intakes of SBP participants and nonparticipants are based on multiple regression models of students' dietary intakes. Selection-bias adjusted differences in estimated intakes of SBP participants and nonparticipants are based on models of SBP participation and students' dietary intakes. See Appendix Table C.4 for detailed regression results.

*/** indicates the difference is statistically significant at the 95/99 percent confidence level with a two-tailed test.

mg = milligrams.

(compare the regression-adjusted and selection-bias-adjusted difference columns in Table IV.1).[1] Furthermore, several statistical tests suggest that the regression model that controls only for observed characteristics is the preferred model for breakfast intakes.[2] Thus, conclusions are appropriately based on the statistical significance levels presented in the regression-adjusted difference column in Table IV.1. Participation in the SBP is associated with:

- Higher average intakes of food energy, protein, calcium, magnesium, thiamin, riboflavin, and phosphorus
- Higher percentages of food energy from fat and saturated fat, higher intakes of sodium and cholesterol, and a lower percentage of food energy from carbohydrate[3]
- No statistically significant difference in intakes of vitamin A, vitamin C, niacin, vitamin B6, folate, vitamin B12, iron, or zinc

It is important to note that the higher level of food energy provided by SBP breakfasts brings these breakfasts precisely to the target of one-fourth of the RDA for food energy. Furthermore, the higher percentage of food energy from fat consumed in SBP breakfasts is still within the Dietary Guideline of less than 30 percent of food energy from fat.

In contrast to the findings on NSLP participants, SBP participants' higher intakes of some nutrients appear to be due to their consumption of larger amounts of food, rather than to consuming more nutrient-dense foods. In fact, SBP breakfasts as consumed have lower nutrient densities for most vitamins and minerals than do non-SBP breakfasts (Table IV.2). SBP breakfasts are denser than non-SBP breakfasts in protein and are about equally dense in calcium, phosphorus, and magnesium--

---

[1]However, controlling for *observed* characteristics of participants and nonparticipants does affect the estimated differences. In particular, because most SBP participants are low-income students, and low-income students consume more fat than do higher-income students, controlling for income reduces participant-nonparticipant differences in the percentage of food energy derived from fat. This was not the case for the NSLP estimates.

[2]See Appendix A.

[3]As further evidence of the stability of these results, it is worth noting that the selection-bias-adjusted participant-nonparticipant differences in intakes of fat, saturated fat, and sodium had t-statistics greater than 1.65.

TABLE IV.2

NUTRIENT DENSITIES OF SBP AND NON-SBP BREAKFASTS

Nutrient	Nutrient Density: SBP Breakfasts	Nutrient Density: Non-SBP Breakfasts	Relative Nutrient Density of SBP Breakfasts
Food Energy	NA	NA	--
Protein	2.18	1.89	+15
Vitamin A	1.61	2.44	-34
Vitamin C	4.03	5.21	-23
Thiamin	2.21	2.69	-18
Riboflavin	2.69	3.22	-16
Niacin	1.49	2.08	-28
Vitamin B6	1.48	2.24	-34
Folate	3.80	5.47	-30
Vitamin B12	3.48	4.00	-13
Calcium	1.69	1.65	+2
Iron	1.53	2.40	-36
Phosphorus	1.79	1.77	+1
Magnesium	1.44	1.57	-8
Zinc	.81	1.09	-26

SOURCE: Weighted tabulations of data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the SBP and students at schools not offering the SBP. Nutrient density of a given nutrient is intake of the nutrient relative to the RDA for that nutrient divided by intake of food energy relative to the RDA for food energy. The relative nutrient density of SBP breakfasts is the percentage by which the nutrient density of SBP breakfasts for a particular nutrient exceeds (+) or is less than (-) the nutrient density of non-SBP breakfasts.

NA = not applicable.

all nutrients for which there are significant positive differences in intake. However, SBP breakfasts are relatively less dense in other vitamins and minerals.

2. Types of Foods Consumed at Breakfast

SBP participants consumed more food than did nonparticipants (as evidenced by higher intakes of food energy), most of which was from specific food groups. In particular, SBP participants were three times more likely than nonparticipants to consume ***meat, poultry, fish, or meat mixtures*** (30 percent versus 9 percent) and were also more likely to consume ***milk and milk products*** (83 percent versus 66 percent) (Table IV.3). The higher proportion of SBP participants consuming foods from these two groups largely accounts for their higher intakes of protein, fat, and saturated fat (see Table IV.4).[4] In addition, the larger proportion of SBP participants consuming milk or milk products explains their higher calcium intakes.

SBP participants were also twice as likely as nonparticipants to consume ***fruit or fruit juices*** at breakfast (73 percent versus 32 percent). As shown in Chapter VI of the companion report by Burghardt, Gordon, Chapman et al. (1993), most fruit/fruit juice offerings in SBP breakfasts are fruit juice, which largely contribute food energy, vitamin C, magnesium, and carbohydrate.

Finally, more SBP participants than nonparticipants consume ***grain products***--usually cereal or bread--at breakfast (97 percent versus 86 percent). In particular, SBP participants consume more grain mixtures (such as pizza), yeast bread, quick breads, pancakes, and french toast and consume relatively less fortified cereal. The larger role of fortified breakfast cereals in non-SBP breakfasts largely explains the lower nutrient density of SBP breakfasts (see Appendix Table D.2).

[4]Table D.2 in Appendix D presents more detail on the nutrients contributed by foods consumed at breakfast for SBP participants and nonparticipants.

TABLE IV.3

FOODS CONSUMED IN SBP AND NON-SBP BREAKFASTS
(Percentage of Students Eating Foods)

Food Group	SBP Participants	Nonparticipants	Difference
Milk and Milk Products	83	66	17 **
White milk	64	60	4
Flavored milk	20	3	17 **
Cheese	6	4	2
Other milk products	1	3	-2 **
Meat, Poultry, Fish, and Meat Mixtures	30	9	21 **
Eggs	13	10	4
Dry Beans, Peas, Other Legumes, and Nuts and Seeds	4	3	1
Grain Products	97	86	11 **
Yeast breads	33	24	9
Quick breads and tortillas	22	4	18 **
Cakes, cookies, pies, pastries	12	12	0
Crackers and salty snacks	2	2	0
Pancakes, waffles, french toast	16	9	7
Pasta, cooked cereal, rice	5	5	0
Dry cereal	39	42	-3
Grain-based mixtures[a]	8	1	7 *
Fruits and Fruit Juices	73	32	41 **
Vegetables	3	3	0
Potatoes	2	2	0
Dark-green vegetables	0	0	0
Yellow vegetables	0	0	0
Tomatoes and tomato sauces	1	1	0
Other vegetables	1	1	0
Fats, Oils, and Salad Dressings	15	19	-5
Sugar, Sweets, and Sweetened Beverages	43	42	1
Sample Size (Unweighted)	**322**	**2,644**	-

SOURCE: Weighted tabulations of data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the SBP and students at schools not offering the SBP.

[a]Grain-based mixtures are combinations of breads with meats and/or vegetables. Pizza is the most commonly offered food item in this category.

*/** indicates the difference is statistically significant at the 95/99 percent confidence level with a two-tailed test.

TABLE IV.4

FOOD SOURCES OF KEY NUTRIENTS AT BREAKFAST, BY SBP PARTICIPATION STATUS

	Food Energy (Percent of RDA)		Protein (Percent of RDA)		Calcium (Percent of RDA)		Fat (Grams)	
Food Group	SBP Participant	Nonparticipant	SBP Participant	Nonparticipant	SBP Participant	Nonparticipant	SBP Participant	Nonparticipant
Milk and Milk Products	6.1	4.2 **	21.9	15.4 **	27.6	20.5 **	5.7	4.0 **
Meat, Poultry, Fish, and Meat Mixtures	2.5	0.7 **	9.5	2.4 **	0.6	0.2 **	4.2	1.3 **
Eggs	1.1	0.7	5.0	2.8	1.3	0.6	1.7	1.2
Dry Beans, Peas, Other Legumes, and Nuts and Seeds	0.6	0.2	1.7	0.5	0.2	0.1	1.1	0.3
Grain Products	11.0	8.6 **	16.6	12.1 **	9.0	6.0 **	6.5	4.2 **
Fruits and Fruit Juices	2.9	1.8 **	1.8	1.3 **	1.2	0.8 **	0.1	0.1 **
Vegetables	0.2	0.3	0.2	0.2	0.0	0.1	0.2	0.3
Fat, Oils, and Salad Dressings	0.3	0.4	0.0	0.0	0.0	0.0	0.7	1.0 *
Sugar, Sweets, and Sweetened Beverages	1.6	1.7	0.1	0.2	0.3	0.4 **	0.1	0.2
All Foods	26.1	18.5 **	56.7	34.9 **	40.2	28.7 **	20.2	12.6 **

NOTE: Table entries for food energy, protein and calcium are the mean percentage of the RDA provided by foods in each food group. Entries for fat indicate the mean grams of fat provided by foods in each food group. Appendix Table D.2 shows the food sources of other dietary components.

*/** indicates that participant/nonparticipant differences are statistically significant at the 95/99 percent confidence level.

3. Dietary Intakes at Breakfast of Students Eating Non-SBP Breakfasts, by Source of Breakfast (Table IV.5)

Almost all students who eat a non-SBP breakfast eat breakfast at home or from home supplies; however, some obtain breakfast at school (either a la carte from the school cafeteria, or from vending machines or a school store), and others purchase food off-campus (in a store or restaurant). Sixty-nine percent eat breakfast at home, 7 percent eat a non-SBP school breakfast, and 5 percent obtain food off-campus. Eleven percent eat no breakfast.

In general, breakfasts consumed by students from home supplies conform to the dietary recommendations for breakfast. They provide one-quarter of the RDA for all vitamins and minerals with the exception of zinc. The average levels of fat, saturated fat, cholesterol, and sodium in breakfasts obtained from home meet dietary recommendations, and the breakfasts provide levels of protein and carbohydrate within the targeted ranges. However, breakfasts consumed at home provide only 18 percent of the RDA for food energy--less than the target for breakfast.

Non-SBP breakfasts obtained at school provide slightly more food energy (21 percent of the RDA) than do non-SBP breakfasts obtained from home supplies, but also provide lower levels of protein and of most vitamins and minerals. In particular, non-SBP breakfasts obtained at school provide less than one-fourth of the RDA for calcium, magnesium, and zinc. They provide slightly less fat and more carbohydrate than do breakfasts obtained from home. This pattern is consistent with smaller amounts of milk and meat in non-SBP breakfasts obtained at school relative to breakfasts obtained from home.

Breakfasts obtained off-campus provide 25 percent of the RDA for food energy--the target for breakfast. However, they are higher than breakfasts obtained from home in protein, fat, saturated fat, cholesterol, and sodium and are roughly comparable in vitamins and minerals provided. These patterns suggest that off-campus breakfasts are more likely than breakfasts obtained from home to contain meat or eggs. Interestingly, the dietary content of non-SBP breakfasts obtained off-campus

TABLE IV.5

DIETARY INTAKES AT BREAKFAST OF STUDENTS EATING A NON-SBP BREAKFAST

Dietary Component	Obtained at School	Obtained from Home Supplies	Obtained Off Campus
Macronutrients			
Food Energy (Percentage of the RDA)	21	18	25
Protein (Percentage of the RDA)	30	35	42
Percentage of Food Energy from:			
Fat	23	24	28
Saturated Fat	10	10	11
Carbohydrate	70	65	62
Vitamins (Percentage of the RDA)			
Vitamin A	28	43	34
Vitamin C	88	84	85
Thiamin	38	48	55
Riboflavin	45	57	58
Niacin	28	38	40
Vitamin B6	29	40	35
Folate	62	96	93
Vitamin B12	50	75	77
Minerals (Percentage of the RDA)			
Calcium	24	29	29
Iron	28	45	45
Phosphorus	27	32	35
Magnesium	23	27	30
Zinc	15	19	24
Other Components (Intake)			
Cholesterol (mg)	54	59	94
Sodium (mg)	555	570	816
Sample Size (Unweighted)	**203**	**2,280**	**161**

SOURCE: Weighted tabulations of data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the SBP and students at schools not offering the SBP.

mg = milligrams.

is very similar to that of SBP breakfasts in general, except that SBP breakfasts contain higher average levels of calcium.

C. 24-HOUR DIETARY INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS

Over 24 hours, average intakes of vitamins and minerals of both SBP participants and nonparticipants exceed the RDA (Table IV.6).[5] However, average food energy intakes of both groups exceed the RDA, and their protein intakes are more than twice the RDA. Furthermore, both SBP participants and nonparticipants consume more fat and saturated fat than recommended in the Dietary Guidelines, and more sodium and less carbohydrate than recommended by the NRC.

Most of the differences in dietary intake of SBP participants and nonparticipants at breakfast persist over 24 hours, suggesting that, although SBP participants eat more food than nonparticipants at breakfast, this difference does not affect foods eaten at other meals (Table IV.7). In particular, SBP participants consume significantly more food energy, protein, thiamin, calcium, magnesium, and phosphorus over 24 hours than do nonparticipants.[6] The differences in daily intakes as a percentage of the RDA are substantially the same as the differences in breakfast intakes.

However, the participant-nonparticipant differences in breakfast intakes of fat, saturated fat, and carbohydrate as a percentage of food energy become negligible and insignificant over 24 hours. The absence of a significant difference in 24-hour fat intake does not necessarily imply that the higher intake of fat in SBP breakfasts leads to lower fat intake by SBP participants at other eating occasions. Rather, it is indicative of the relatively small contribution of breakfast to total food energy intake during the day (about 22 percent of total food energy). A difference of four percentage points in

---

[5]The models of 24-hour intakes include both NSLP and SBP participation as control variables (see Appendix A). The selection-bias-adjusted version of the model is a joint model of NSLP participation and 24-hour intakes. Because unobserved characteristics related to SBP participation did not substantially affect breakfast intakes, only unobserved characteristics related to NSLP participation in the 24-hour model were controlled for.

[6]Although estimated differences in sodium and cholesterol intake are of similar magnitude over the 24-hour period as at breakfast, they are not statistically significant over 24 hours.

TABLE IV.6

24-HOUR DIETARY INTAKES OF SBP PARTICIPANTS AND NONPARTICIPANTS

	Regression-Adjusted Dietary Intakes			
Dietary Component	SBP Participants	Nonparticipants	Difference	Selection-Bias Adjusted Difference
Macronutrients				
Food Energy (Percentage of the RDA)	116	110	6	6 *
Protein (Percentage of the RDA)	266	243	23 **	23 **
Percentage of Food Energy from:				
Fat	35	34	.6	.4
Saturated Fat	13	13	.3	.2
Carbohydrate	52	53	-1	-.7
Vitamins (Percentage of the RDA)				
Vitamin A	115	130	-16	-18
Vitamin C	302	279	23	32
Thiamin	189	176	13 *	14 *
Riboflavin	195	184	11	12
Niacin	166	164	2	3
Vitamin B6	134	132	2	3
Folate	241	237	4	9
Vitamin B12	351	330	21	20
Minerals (Percentage of the RDA)				
Calcium	124	114	10 *	11 **
Iron	143	144	-1	.1
Phosphorus	167	154	13 **	13 **
Magnesium	140	130	9 *	10 *
Zinc	119	109	10	10
Other Components (Intake)				
Cholesterol (mg)	317	294	23	24
Sodium (mg)	4,782	4,592	191	192

SOURCE: Weighted regression results based on data from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the SBP and students at schools not offering the SBP. Intakes and differences in the intakes of SBP participants and nonparticipants are based on multiple regression models of students' dietary intakes. Selection-bias adjusted differences in estimated intakes of SBP participants and nonparticipants are based on models of NSLP participation and students' dietary intakes. See Appendix Table C.6 for detailed regression results.

mg = milligrams.

*/** indicates the difference is statistically significant at the 95/99 percent confidence level with a two-tailed test.

TABLE IV.7

BREAKFAST-SPECIFIC AND 24-HOUR DIFFERENCES IN INTAKES BETWEEN SBP PARTICIPANTS AND NONPARTICIPANTS

	Intake at Breakfast			24-Hour Intake		
Dietary Component	SBP Participants	Nonparticipants	Difference	SBP Participants	Nonparticipants	Adjusted Difference
Macronutrients						
Food Energy (Percentage of the RDA)	25	19	6 **	116	110	6 *
Protein (Percentage of the RDA)	51	36	15 **	266	243	23 **
Percentage of Food Energy from:						
Fat	28	24	3 **	35	34	.4
Saturated Fat	11	10	1 *	13	13	.2
Carbohydrate	61	65	-4 **	52	53	-.7
Vitamins (Percentage of the RDA)						
Vitamin A	39	41	-2	115	130	-18
Vitamin C	89	83	5	302	279	32
Thiamin	57	48	9 **	189	176	14 *
Riboflavin	64	56	8 **	195	184	12
Niacin	38	37	1	166	164	3
Vitamin B6	37	38	-1	134	132	3
Folate	88	94	-6	241	237	9
Vitamin B12	85	74	11	351	330	20
Minerals (Percentage of the RDA)						
Calcium	38	29	10 **	124	114	11 **
Iron	40	43	-4	143	144	.1
Phosphorus	42	32	10 **	167	154	13 **
Magnesium	34	27	7 **	140	130	10 *
Zinc	21	19	1	119	109	10
Other Components (Intake)						
Cholesterol (mg)	81	62	19 **	317	294	24
Sodium (mg)	796	586	210 **	4,782	4,592	192

SOURCE: Weighted tabulations of data collected from Dietary Intake Interviews with students, School Nutrition Dietary Assessment study.

NOTE: The estimation sample includes students at schools offering the SBP and students at schools not offering the SBP. Intakes of SBP participants and nonparticipants are based on multiple regression models of students' dietary intakes. Adjusted differences in estimated intakes of SBP participants and nonparticipants over 24 hours are based on selection bias models of NSLP participation and students' dietary intakes.

mg = milligrams.

*/** indicates the difference is statistically significant at the 95/99 percent confidence level with a two-tailed test.

the percentage of food energy derived from fat at breakfast, with no differences at other meals, implies that the 24-hour difference is less than one percentage point.