Diet Quality of School-Age Children in the U.S. and Association With Participation in the School Meal Programs

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By Mary Kay Fox, Melissa Clark, Elizabeth Condon, and Ander Wilson, Mathematica Policy Research, Inc.

Abstract

This study examines the relationship between school meal program participation and diet quality of children over a 24-hour period using data from the third School Nutrition Dietary Assessment Study (SNDA-III). Diet quality was assessed using a slightly modified version of the Healthy Eating Index (HEI-2005) that more precisely reflected recommended food intake patterns for school-age children. The assessment also examined the relative contributions of specific foods to children's MyPyramid food group intakes. Propensity score matching techniques were used to control for differences in observed characteristics of school meal participants and nonparticipants. Overall, there were no significant differences in diet quality between school meal participants and nonparticipants on total modified HEI-2005 scores. However, National School Lunch Program (NSLP) participation and School Breakfast Program participation were both associated with a significantly higher score on the Milk component of the modified HEI-2005, and NSLP participants scored significantly lower than nonparticipants on the Oils component (this component tracks healthy, recommended oils, so a lower score is a negative outcome).

Keywords: Child nutrition, school meals, diet quality, Healthy Eating Index, FANRP, ERS, USDA

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Mary Kay Fox
Melissa Clark
Elizabeth Condon
Ander Wilson

Submitted to:

U. S. Department of Agriculture
Economic Research Service
Food Assistance Branch
1800 M Street, NW
Washington, DC 20036

Project Officer:
Joanne Guthrie

Submitted by:

Mathematica Policy Research, Inc.
855 Massachusetts Avenue
Suite 801
Cambridge, MA 02139
Telephone: (617) 491-7900

Project Director:
Mary Kay Fox

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EXECUTIVE SUMMARY

A healthy diet is an essential part of a healthy lifestyle (U.S. Department of Health and Human Services (DHHS), 2000; DHHS and U.S. Department of Agriculture (USDA), 2005; Institute of Medicine (IOM), 2007; American Dietetic Association, 2008). Schools are in a unique position to influence the quality of children's diets—no other institution has as much continuous and intensive contact with children (Story et al., 2002 and 2006; IOM, 2005; Wingspread Conference on Childhood Obesity, 2007). Within schools, the school meal programs—the National School Lunch Program (NSLP) and the School Breakfast Program (SBP) can be important vehicles for influencing children's diets on a daily basis and for contributing to the development of healthful dietary habits and preferences.

The overarching goal of both the NSLP and SBP is to safeguard the health and well-being of the nation's children (Ralston et al., 2008). Over time, the programs have expanded their focus from ensuring that children have enough to eat to improving the quality of children's diets (USDA/FNS, 2000a; USDA, 2006; Guthrie et al., 2007; Ralston et al., 2008). This shift reflects the growing consensus about the important role diet plays in the development of chronic diseases, including obesity, and the recognition that benefits provided by federally sponsored food assistance programs should reflect national nutrition policy, as embodied in the Dietary Guidelines for Americans and the MyPyramid food guidance system (USDA/FNS, 2000a; USDA, 2006; Guthrie et al., 2007; Ralston et al., 2008).

This study used data from the third School Nutrition Dietary Assessment Study (SNDA-III) to assess the quality of the diets consumed by school-age children overall, and to assess the relationship between school meal participation and diet quality. Our main outcome is the Healthy Eating Index (HEI)-2005. We use a slightly modified version of the measure that more precisely

reflects recommended food intake patterns for school-age children. We use propensity score matching techniques developed during the SNDA-III project to control for observed characteristics of school meal participants and nonparticipants (Gordon et al., 2007b and 2007c and Clark and Fox, 2009). A supplementary analysis examines the relative contribution of specific foods to children's MyPyramid food group intakes and assesses differences between NSLP participants and nonparticipants.

A. DATA AND METHODS

The SNDA-III study provides data for a nationally representative sample of public school children in grades 1-12. The analysis sample comprises 2,314 children who completed a 24-hour dietary recall and whose parent completed a parent interview.[1] School meal participants and nonparticipants were identified using variables in the SNDA-III file.

1. Estimating Healthy Eating Index-2005 Scores

The HEI-2005 is designed to measure how well diets conform to the 2005 *Dietary Guidelines* and to provide a tool for assessing diet quality of the population and monitoring change over time (Guenther et al., 2007). The index includes 12 component scores. Nine components assess compliance with recommendations in the MyPyramid food guidance system (total grains, whole grains, total vegetables, dark green and orange vegetables and legumes, total fruit, whole fruit, milk/dairy, meat and beans, and oils), two components assess compliance with *Dietary Guidelines* recommendations for intakes of saturated fat and sodium, and the final component assesses discretionary energy intake by looking at calories from solid fats, alcoholic

[1] Dietary recalls were collected from 2,718 children and complete parent interviews were collected for 2,330 children. Sampling weights were developed for the sample of 2,314 children who had both dietary recall and parent interview data (Gordon et al., 2007d).

beverages, and added sugars (SoFAAS). The index uses a density approach (amounts per 1,000 calories of intake) to define standards for food groups and most nutrients. This reflects the 2005 *Dietary Guidelines'* and MyPyramid's focus on meeting food group and nutrient needs while maintaining energy balance. Standards used in assigning scores are based on the assumptions that underlie the recommended eating patterns, accurately reflecting goals for intakes over time and the recommended mix of food groups.

Because some researchers questioned the use of the original HEI (Kennedy at al., 1995) in monitoring the diets of children and adolescents (see, for example Feskanich et al., 2004 and Rodriguez-Artejelo et al., 2003), we made some modifications to the standards used to assign maximum HEI–2005 scores to reflect the fact that our sample was limited to school-age children. We based modified HEI-2005 standards on the MyPyramid eating patterns for 1,800, 2,200, and 2,400 calories for elementary school, middle school, and high school children, respectively. These calorie levels were closest to the Estimated Energy Requirements (EERs) reported in the SNDA-III sample (Gordon et al., 2007b and Clark and Fox, 2009). The modified standards reflect the fact that, on a density (per 1,000 calorie) basis, children need to consume larger amounts from most of the MyPyramid food groups than the population overall, in order to achieve desired intakes without exceeding energy requirements. In addition, children's diets have substantially less room for discretionary calories (or, as measured in the HEI-2005, SoFAAS calories).

Using these modified standards, we estimated HEI-2005 scores for children in the SNDA-III sample, following procedures outlined in the HEI-2005 technical report (Guenther et al., 2007). Ideally, the HEI-2005 would be calculated based on the *usual* dietary intake of each individual. However, when only one day of intake is available for each sample member, we do not have a reliable estimate of an individual's usual intake. In this situation, the best estimate of the

population's mean HEI-2005 score is based on estimates of total intakes at the population level (Guenther et al., 2007; Freedman et al., 2008). Thus, we calculated HEI-2005 scores at the population level for elementary school children, middle school children, high school children, and all school-age children using the ratio of the population's total food group (or nutrient) intake to the population's total energy intake as the basis for the population's component score.

2. Statistical Methods

We used propensity score matching to adjust for observable differences between NSLP participants and nonparticipants (Rosenbaum and Rubin, 1983; Smith and Todd, 2001; Dehejia and Whaba, 2002). This approach is similar in spirit to a multivariate regression in that it statistically adjusts for differences in observable characteristics. However, unlike multivariate regression, it can be used in conjunction with population-based estimates like the HEI-2005 that are computed at the group rather than the individual level. To implement this approach for each school type (elementary, middle, and high), we estimated a logit model of NSLP participation as a function of (1) each child's age, sex, race, ethnicity, and height; (2) parent reports of whether the child was a hearty or picky eater, the child's health status, whether the child was on a diet, family income, and language spoken at home; and (3) school location (urbanicity and geographic region). We used the results of these models to estimate a propensity score reflecting the likelihood that a given child participated in the NSLP. We then used this score to match each participant to a nonparticipant with a similar propensity score using "nearest neighbor" matching (Dehejia and Whaba, 2002).[2]

[2] Additional information about the propensity score matching procedure is available in the SNDA-III report (Gordon et al., 2007b and 2007c).

All analyses are weighted so that the sample is representative of children in public NSLP schools nationwide. The final weights adjust both for unequal probabilities of selection at each stage of sampling and for nonresponse at each stage of data collection. Differences between participants and nonparticipants were tested for significance using two-tailed t-tests of the differences in the raw ratios associated with each HEI-2005 component score. Despite the fact that the propensity score matching procedure adjusts for observed differences between participants and nonparticipants, significant differences between the two groups cannot be interpreted as causal effects of the school meal programs because unobserved differences between participants and nonparticipants could influence their dietary intakes.

B. FINDINGS

1. Diet Quality of School-Age Children

Using the modified scoring criteria developed for this analysis, total HEI-2005 scores for school-age children ranged from a low of 53.7 for middle school children to a high of 55.3 for elementary school children, compared to the maximum possible score of 100. These total scores indicate a substantial need for improvement in the quality of the diets being consumed by school children of all ages.

- The maximum modified HEI-2005 score was achieved only for the Total Grains component. However, the data suggest that elementary and middle school children may be consuming *more* grains (on a per 1,000 calorie basis) than recommended. These additional grains may crowd out other important food groups or lead to excessive calorie intakes. Moreover, research that has examined the sources of grains in children's diets indicates that low-nutrient, energy-dense foods such as cookies, pastries, and corn-based salty snacks are leading contributors to children's grain intakes (see, for example, Cole and Fox, 2008).

- Children's consumption of whole grains was markedly below recommended levels.

- Modified HEI-2005 scores for the Total Fruit, Whole Fruit, and Total Vegetables components indicate that children's fruit and vegetable intakes are low, relative to

MyPyramid recommendations. Vegetables are more of a concern than fruit and fruit is more of a concern for middle school and high school children than for elementary school children. In addition, very low scores for the Dark Green and Orange Vegetables and Legumes component (equivalent to 10% of the maximum score), indicate that children's intakes of these vegetables are of particular concern.

- Modified HEI-2005 scores for the Milk and Meat and Beans components indicate that, in general, children's diets come closer to meeting recommendations for these food groups than other food groups. Nonetheless, the data indicate that children in all three school types, particularly elementary school children and high school children, need to increase consumption of milk and other dairy foods. To maintain energy balance and improve overall diet quality, skim and low-fat milk should be substituted for sweetened beverages and, if consumed in excess (more than 50% of total fruit intake), fruit juices.

- For all groups of children, scores on both the Sodium and SoFAAS (calories from solid fats, alcoholic beverages, and added sugars) components of the modified HEI-2005 were well below 50 percent of the maximum, indicating that children are consuming substantially more sodium and discretionary calories from solid fats and added sugars than recommended.

- Scores on the Oils and Saturated Fat components of the modified HEI-2005 indicate the need to replace some of the saturated fat in children's diets with healthier oils from nuts, seeds, fish, and non-hydrogenated vegetable oils.

2. Diet Quality of NSLP Participants and Matched Nonparticipants

Total modified HEI-2005 scores for NSLP participants and matched nonparticipants in all three types of schools approximated 55, out of a possible 100. There were no statistically significant differences between NSLP participants and matched nonparticipants in total modified HEI-2005 scores. However, some significant differences were noted for component scores. For school-age children overall, NSLP participants scored significantly higher on the Milk component (8.5 versus 7.2) and significantly lower on the Oils component (6.4 versus 7.3) than matched nonparticipants. These patterns were observed for all three school types, but differences were generally not statistically significant within school type.

3. Diet Quality of SBP Participants and Matched Nonparticipants

Total modified HEI-2005 scores for SBP participants and matched nonparticipants in all three types of schools ranged from about 50 to 55, out of a possible 100. There were no statistically significant differences between SBP participants and matched nonparticipants in total modified HEI-2005 scores; however, some significant differences were noted for the component scores. For school-age children overall, SBP participants scored significantly higher than matched nonparticipants on the Milk component (8.6 versus 6.9). This pattern was observed for children in all three school types, but the difference was statistically significant for elementary school children only.

4. Summary

This is the first study to look at the relationship between school meal participation and diet quality, using the HEI-2005 (modified to reflect recommended dietary patterns for school-age children), and one of the few to focus on food intakes (rather than nutrient intakes) of school meal participants and nonparticipants. The HEI-2005 focuses on usual dietary intake over 24 hours rather than intakes at specific meals. Therefore, associations noted between school meal participation and the HEI-2005, when consistent with patterns observed in analyses of meal-specific intakes, suggest associations that are not cancelled out by what participants and nonparticipants eat at other times of the day.

Overall, both NSLP participation and SBP participation were associated with a significantly higher score on the Milk component of the modified HEI-2005. This is consistent with findings from previous SNDA-III analyses that showed that NSLP participants and SBP participants were significantly more likely than the full samples of nonparticipants to drink milk at lunch or breakfast, respectively (Gordon et al., 2007b; Condon et al., 2009). It is also consistent with

previous work done by Gleason and Suitor which found, using data from the 1994-96 CSFII and multivariate regression techniques to control for differences in observable characteristics, that NSLP participants had higher total intakes of milk than nonparticipants, both at lunch and over 24 hours (Gleason and Suitor, 2001 and 2003).

The finding related to the Oils component contributes new information to the knowledge base about the relationship between school meals and dietary intakes. To our knowledge, no previous research has examined intakes of oils among NSLP participants and nonparticipants. Major factors that appear to contribute to the observed difference between NSLP participants and matched nonparticipants on the Oils component are differences in the proportion of children who consumed peanut butter sandwiches and snack chips at lunch. Previous tabulations of the SNDA-III data showed that NSLP participants were significantly less likely than nonparticipants in the full sample to consume peanut butter sandwiches (4% vs. 15%) or snack chips (4% vs. 12%) at lunch (Gordon et al., 2007b; Condon et al., 2009).

Overall, school meal participation was associated with relatively few differences in diet quality, and the differences that were observed were not consistently positive. There were no significant differences between school meal participants and matched nonparticipants in the areas of diet quality that are of greatest concern for school-age children—low intakes of vegetables and whole grains and excessive intakes of sodium, solid fats and added sugars. As policy makers and school food service professionals continue their efforts to improve school lunches, these aspects of diet quality are worthy of special attention.

I. INTRODUCTION

A healthy diet is an essential part of a healthy lifestyle (U.S. Department of Health and Human Services (DHHS), 2000; DHHS and U.S. Department of Agriculture (USDA), 2005; Institute of Medicine (IOM), 2007; American Dietetic Association, 2008). Schools are in a unique position to influence the quality of children's diets—no other institution has as much continuous and intensive contact with children (Story et al., 2002 and 2006; IOM, 2005; Wingspread Conference on Childhood Obesity, 2007). Within schools, the school meal programs—the National School Lunch Program (NSLP) and the School Breakfast Program (SBP) can be important vehicles for influencing children's diets on a daily basis and for contributing to the development of healthful dietary habits and preferences.

The NSLP and SBP are administered by the Food and Nutrition Service (FNS) of the USDA. Ninety-four percent of all schools nationwide, both public and private, participate in the NSLP (Ralston et al., 2008). Somewhat fewer schools participate in the SBP; in school year (SY) 2004-2005, 85 percent of all public schools that offered the NSLP also offered the SBP (Gordon et al., 2007a). Every child in a participating school can obtain a school lunch or breakfast and children from low-income families are eligible to receive meals for free or to purchase them at a reduced price. On an average school day in SY 2004-2005, about 62 percent of children in NSLP schools ate a school lunch (Gordon et al., 2007b). Participation in the SBP is lower; in SY 2004-2005, only about 18 percent of students in SBP schools participated in the program on an average day. Both the NSLP and SBP serve meals to millions of children every school day—an average of 31 million lunches and 10 million breakfasts per day in fiscal year (FY) 2008 (USDA/FNS, 2009a). A majority of these meals (59% of lunches and 81% of breakfasts in SY

2007-2008) are served free or at a reduced-price to children from low-income families (USDA/FNS, 2009b).

The overarching goal of both the NSLP and SBP is to safeguard the health and well-being of the nation's children (Ralston et al., 2008). Over time, the programs have expanded their focus from ensuring that children have enough to eat to improving the quality of children's diets (USDA/FNS, 2000a; USDA, 2006; Guthrie et al., 2007; Ralston et al., 2008). This shift reflects the growing consensus about the important role diet plays in the development of chronic diseases, including obesity, and the recognition that benefits provided by federally sponsored food assistance programs should reflect national nutrition policy, as embodied in the Dietary Guidelines for Americans and the MyPyramid food guidance system (USDA/FNS, 2000a; USDA, 2006; Guthrie et al., 2007; Ralston et al., 2008).

Since the mid-1990s, when findings from the first School Nutrition Dietary Assessment Study (SNDA-I) indicated that school meals were not consistent with the Dietary Guidelines (Devaney et al., 1993; Gordon et al., 1995), USDA/FNS has launched a number of initiatives to improve the quality of school meals. These include establishing new nutrition standards that require that meals meet the 1995 Dietary Guidelines recommendations for total fat and saturated fat (Officer of the Federal Register, 1995); providing training and technical assistance to help school food service personnel prepare healthier meals and promote healthy eating behaviors among children (USDA/FNS, 2000b, 2008a, 2008b); and improving the healthfulness of commodity foods offered to schools (USDA/FNS, 2008c).

A. PREVIOUS RESEARCH

1. Relationship Between School Meal Participation and Children's Diets

Previous research has shown that NSLP and SBP meals make meaningful contributions to children's nutrient intakes, generally satisfying the long-established goals of providing one-third and one-fourth, respectively, of the Recommended Dietary Allowances (RDAs) (Wellisch et al., 1983; St. Pierre et al., 1992; Devaney et al., 1993; Gordon et al., 1995; Gleason and Suitor, 2001 and 2003). The recently completed third School Nutrition Dietary Assessment Study (SNDA-III), which employed the most up-to-date dietary assessment methods and dietary standards, found that NSLP participants had higher mean intakes of calcium and fiber than matched nonparticipants; were less likely to have inadequate usual intakes of magnesium and phosphorus; and, among middle and/or high school children were less likely to have inadequate usual intakes of vitamins A, C, B_6, folate, and thiamin and phosphorus (Gordon et al., 2007b; Clark and Fox, 2009). SBP participants had higher usual intakes of potassium than matched nonparticipants and were less likely to have inadequate usual intakes of vitamin A and phosphorus (Gordon et al., 2007b; Clark and Fox, 2009).

On a less positive note, previous research has also shown that participation in the NSLP was associated with increased intakes of total fat, saturated fat, and/or sodium (Devaney et al., 1993; Gordon et al., 1995; Gleason and Suitor, 2001 and 2003). The SNDA-I study, which was conducted at a time when schools were not required to offer meals that were consistent with the Dietary Guidelines (SY 1992-1993), was one of the first studies to raise these concerns and the study's findings were widely disseminated (Devaney et al., 1993; Gordon et al., 1995). The SNDA-II study, conducted six years after SNDA-I—in SY 1998-1999—found that schools had made progress toward reducing levels of fat and saturated fat, while maintaining targeted levels of key nutrients (Fox et al., 2001). However, the lunches offered in most schools continued to be

high in total fat and saturated fat, relative to the 1995 Dietary Guidelines recommendations (Fox et al., 2001).

The SNDA-III study, which collected data in the spring of 2005, found that improvements in the dietary quality of school meals observed in SNDA-II had been maintained or enhanced over time, but that total fat, saturated fat, and sodium content of lunches continued to exceed recommended levels in the majority of schools (Gordon et al., 2007a; Crepinsek et al., 2009). Analysis of children's nutrient intakes found that, for certain age groups, participation in the school meal programs was associated with an increased prevalence of excessive sodium intakes (high school children only for the NSLP; all children and middle school children for the SBP) (Gordon et al, 2007b; Clark and Fox, 2009). No significant association was found between participation in either the NSLP or SBP and the prevalence of excessive intakes of fat or saturated fat (Gordon et al, 2007b; Clark and Fox, 2009). It is important to note that the standard used in earlier studies to assess children's intakes of total fat (no more than 30% of total calories) was based on 1990 and 1995 editions of the Dietary Guidelines (DHHS and USDA, 1990; DHHS and USDA, 1995). SNDA-III study used the less stringent Acceptable Macronutrient Distribution Range (AMDR) defined in the Dietary Reference Intakes (25–35% of total calories) (IOM, 2002/2005) and incorporated into the 2005 Dietary Guidelines (DHHS and USDA, 2005). The standard used to assess intakes of saturated fat (less than 10% of total calories) was consistent across studies.

Most previous research on the role of the school meal programs in children's diets has focused primarily on the relationship between program participation and children's *nutrient* intakes. Gleason and Suitor (2003) also examined the relationship between program participation and children's *food* intakes, using data from the Continuing Survey of Food Intakes by

Individuals (CSFII) 1994-96. They found that NSLP participants consumed significantly less added sugar at lunch than nonparticipants as well as significantly larger amounts of vegetables, milk, and meat and a significantly smaller amount of whole grains. SBP participants consumed significantly less added sugars and more fruit and milk at breakfast. All of these differences persisted over 24 hours. The CSFII 1994-96 data were collected in the early stages of school meal reform efforts and may not reflect the changes made in school meals since the mid-1990s. We identified only two previous studies that attempted to look at the relationship between school meal participation and diet quality in a comprehensive way, using the Healthy Eating Index (HEI) or the updated HEI-2005. These studies are described at the end of the next section.

2. The Healthy Eating Index and the Healthy Eating Index-2005

a. The Healthy Eating Index

The HEI was developed by USDA's Center for Nutrition Policy and Promotion (CNPP) in 1995 (Kennedy et al., 1995). It was designed to measure how well individuals' diets conform to the *Dietary Guidelines* and to provide a tool for assessing diet quality of the population and monitoring change over time. The index provided a single measure of diet quality based on 10 component scores. Five component scores were food-based and evaluated compliance with Food Guide Pyramid recommendations (grains, vegetables, fruits, dairy, and meat). Four component scores were nutrient-based and assessed compliance with *Dietary Guidelines* recommendations for intakes of total fat, saturated fat, cholesterol, and sodium. The tenth component score measured the level of variety in the diet.

The HEI was adopted by USDA as the tool used to monitor diet quality of the U.S. population and progress toward healthier eating habits among food assistance program participants (USDA/FNS, 2000a; Basiotis et al., 2002; USDA, 2006). Research showed that high

scores on the HEI were positively correlated with several blood nutrient concentrations, most notably biomarkers for fruit and vegetable intakes (Kennedy et al., 1995; Hann et al., 2001; Weinstein et al., 2004), and were inversely correlated with obesity and C-reactive protein, a measure of inflammation related to cardiovascular disease (Gou et al., 2004; Ford et al., 2005).

Nonetheless, there were some concerns about the HEI, including that HEI scores were highly correlated with total energy intake, that the index did not take into consideration the problem of overconsumption, or the fact that different choices within specific food groups can vary greatly in terms of dietary quality (for example, whole milk versus skim milk and baked/broiled versus fried meat, fish, and poultry) (Feskanich et al., 2004). Feskanich and colleagues (2004) showed that several components of the score were highly correlated, particularly scores for total fat and saturated fat, and that the variety component accounted for 60 percent of the variation in total scores. In addition, several studies found that there was only a weak correlation between HEI scores and chronic disease risk, particularly for cardiovascular disease and cancer (McCullough et al., 2000a and 2000b; Coulter, 2001; Feskanich et al., 2004).

Feskanich and her colleagues (2004) questioned use of the HEI in monitoring the diets of children and adolescents because its performance had not been tested in this age group. They were specifically concerned about the lack of focus on appropriate total energy intakes and consumption of energy-dense, nutrient-poor foods. They developed an alternative Youth HEI (YHEI) that focused exclusively on food choices and awarded higher scores for the most nutrient-dense choices within a group and lower scores for choices that were higher in fat and/or sugar (for example, skim and lowfat dairy products vs. high-fat dairy products). The YHEI also added components that assessed consumption of snack foods and sweetened beverages. Rodriguez-Artejelo et al. (2003) reported a similar concern about the HEI in assessing the diets

of children. These authors found that, among school-age children in Spain, consumption of bakery products (cakes, cookies, pastries, doughnuts, croissants, shortbread, fried dough, and similar products) was not associated with lower HEI scores, even though it was associated with higher calorie intakes overall and a higher share of calories from sugar. The authors pointed out that this inconsistency in results was due to the fact that the HEI gave "positive credit" for the grains provided by these foods without assigning any "negative credit" for the concentrated amounts of sugar provided, relative to more nutrient-dense, grain-based foods.

b. The Healthy Eating Index-2005

In the years since the HEI was first developed, the Dietary Guidelines and the USDA Food Guide Pyramid, which provide the underlying framework for the index, have been updated. The 2005 Dietary Guidelines place increased emphasis on specific factors that influence diet quality, including consumption of whole grains, specific types of fat, particular types of nutrient-dense vegetables, and "discretionary calories" (DHHS and USDA, 2005; Guenther et al., 2007, 2008b). The Food Guide Pyramid (USDA/CNPP, 1996) has been revised to reflect these changes and has been replaced by the MyPyramid food guidance system (Britten et al., 2006). These changes in the nutrition guidance that drives federal nutrition policy required that the HEI be revised and updated. The updated version of the HEI—the HEI-2005 (so-named to clearly link the index to the 2005 Dietary Guidelines)—was developed by a federal interagency workgroup led by CNPP. In developing the revised measure, CNPP staff attempted to address many of the weaknesses of the initial measure and undertook careful studies to examine the psychometric properties of the measure (Guenther et al., 2007; Freedman et al., 2008).

Table I.1 compares the original HEI measure to the HEI-2005, showing the components included in the two indices and the scoring criteria used for maximum and minimum scores.[1] Major differences between the HEI-2005 and the original HEI are summarized below. The HEI-2005 (Guenther et al., 2007):

- ***Uses a density approach (amounts per 1,000 calories of intake) to define standards for food groups and most nutrients***. This change reflects the 2005 Dietary Guidelines' and MyPyramid's focus on meeting food group and nutrient needs while maintaining energy balance. The standards are based on the assumptions that underlie the recommended eating patterns, accurately reflecting goals for intakes over time and the recommended mix of food groups.

- ***Includes new components that assess intakes of whole grains, whole fruit, and dark green and orange vegetables and legumes***. These changes allow assessment of the quality of food choices within major food groups (grains, fruit, vegetables). The 2005 Dietary Guidelines specify that at least half of grain intake should come from whole grains and recommend limiting juice to less than half of total fruit intake. The guidelines also suggest increasing intakes of dark green and orange vegetables and legumes to ensure adequate nutrient intake.

- ***Includes a new component that assesses intake of oils***. This change reflects the message in the 2005 Dietary Guidelines and MyPyramid that not all fats are 'bad' and the recommendation to consume oils (within recommended calorie allowances) since they provide essential polyunsaturated fatty acids and other nutrients, such as vitamin E.

- ***Includes a component that assesses discretionary calorie intake.*** This change addresses the importance the Dietary Guidelines Advisory Committee (2004) placed on the concept of discretionary calories—the difference between total energy requirements and the energy consumed to meet nutrient requirements. MyPyramid recommended food intake patterns include a discretionary calorie allowance that reflects the balance of calories remaining in a person's energy allowance after accounting for the calories in the most nutrient-dense form (fat-free or lowest fat form, with no added sugars) of the various foods needed to meet recommended nutrient intakes (Britten et al., 2006).

  The HEI-2005 includes a component that assesses calories from solid fats, alcoholic beverages, and added sugars (calories from SoFAAS). While this is a useful proxy measure of discretionary calorie intake, it is important to recognize that discretionary calories may also come from additional amounts of the nutrient-dense foods

[1] With the exception of saturated fat and sodium in the HEI-2005, intakes between the minimum and maximum criteria are scored proportionately.

TABLE I.1
HEALTHY EATING INDEX-2005 AND ORIGINAL HEALTHY EATING INDEX

	Healthy Eating Index-2005			Original Healthy Eating Index		
Component	**Max Score**	**Standard for Max Score**	**Standard for Minimum Score of Zero**	**Max Score**	**Standard for Max Score[f]**	**Standard for Minimum Score of Zero**
Total Fruit	5	≥ 0.8 cup	No fruit	10	2-4 servings	0 servings
Whole Fruit (not juice)	5	≥ 0.4 cup	No whole fruit	Not included		
Total Vegetables	5	≥ 1.1 cup	No vegetables	10	3-5 servings	0 servings
Dark Green and Orange Vegetables and Legumes[a]	5	≥ 0.4 cup	No dark green or deep orange vegetables or legumes	Not included		
Total Grains	5	≥ 3.0 oz	No grains	10	6-11 servings	0 servings
Whole Grains	5	≥ 1.5 oz	No whole grains	Not included		
Milk[b]	10	≥ 1.3 cup	No milk/dairy	10	2-3 servings	0 servings
Meat and Beans	10	≥ 2.5 oz	No meat or beans	10	2-3 servings	0 servings
Oils[c]	10	≥ 12 gm	No oil	Not included		
Saturated Fat	10[d]	≤ 7%	≥ 15%	10	< 10%	≥ 15%
Sodium	10[d]	≤ 0.7 gm	≥ 2.0 gm	10	≤ 2,400 mg	≥ 4,800 mg
Calories from SoFAAS[e]	20	≤ 20%	≥ 50%	Not included		
Total Fat	Not included			10	≤ 30%	≥ 45%
Cholesterol	Not included			10	≤ 300 mg	≥ 450 mg
Dietary Variety	Not included			10	≥ 8 different items	≥ 3 different items
Maximum Score	**100**			**100**		

Source: *Healthy Eating Index-2005*, U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, CNPP Fact Sheet No. 1, December 2006 and The Healthy Eating Index 1999-2000, U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, Publication number CNPP-12, December 2002.

Note: For the HEI-2005, standards for all components other than saturated fat and calories from SoFAAS reflect amounts per 1,000 calories. Standards for saturated fat and calories from SoFAAS reflect percentages of total energy intake. With the exception of sodium and saturated fat (see footnote d), intakes between the minimum and maximum are scored proportionately.

[a] Legumes are counted as vegetables only after the standard for intake of meat and beans is met.
[b] Includes all milk products, including fluid milks, yogurt, and cheese.
[c] Includes non-hydrogenated vegetable oils and oils in fish, nuts, and seeds.
[d] Saturated fat and sodium get a score of 8 for intake levels that reflect the 2005 *Dietary Guidelines*, <10% of energy from saturated fat and 1.1 gm sodium per 1,000 kcal, respectively.
[e] Calories from SoFAAS=Calories from solid fats, alcohol, and added sugars.
[f] Number of servings varied by age and gender, based on estimated energy requirements and associated *Food Guide Pyramid* recommended eating patterns.

recommended in the MyPyramid food intake patterns. Thus, the calories from the SoFAAS component should be viewed as a lower-bound estimate of discretionary calorie intake.

- ***Does not include components for total fat and cholesterol***. This change reflects the new emphasis in dietary guidance on *types of fat* and avoids the problem of individual components being highly correlated with each other.
- ***Does not include a variety component***. This change eliminates the problem observed in the original HEI—that the majority of the variance in the overall score was driven by this single component. It also avoids the concerns that some researchers raised about how the scoring criteria for this component should be applied—for example, whether a corn muffin and a blueberry muffin, or orange juice and grapefruit juice, should be counted as two different items or two different versions of the same item (muffin and citrus juice).

Analyses conducted by CNPP staff indicate that the HEI-2005 can successfully distinguish between population groups with differing dietary patterns and that the revised total score is no longer highly correlated with energy intake, successfully uncoupling the issues of diet quantity (how much food is consumed) from diet quality (the types of food consumed) (Guenther et al., 2007, 2008a, 2008b). Reedy and colleagues (2008) recently showed that the HEI-2005 was associated with a decreased risk of colon cancer among both men and women when comparing the highest scores with the lowest scores.

c. Previous Research on the Relationship Between School Meal Participation and HEI Scores

As noted previously, we identified only two previous studies that attempted to look at the relationship between school meal participation and diet quality in a comprehensive way, using the HEI or the HEI-2005. Dwyer and colleagues (2002) assessed HEI scores among a cohort of 8th graders who had participated in the Child and Adolescent Trial for Cardiovascular Health (CATCH) as 3rd through 5th graders. Data were collected in 1997 and students who reported that they bought a breakfast or lunch at school were considered school meal participants. The authors reported small but significant, positive effects of school meal participation on total HEI scores

and on component scores for milk, meat, vegetables, grains, and variety. School meal participation was also associated with significantly lower scores (signifying higher, less healthy intakes) for total fat, saturated fat, cholesterol, and sodium.

Cole and Fox (2008) estimated HEI-2005 scores for NSLP participants and nonparticipants using more recent data from the 1999-2002 National Health and Nutrition Examination Survey (NHANES). They looked at differences in HEI-2005 scores of participants and nonparticipants within two income groups: (1) low-income children, whose household income was at or below 185 percent of the federal poverty level (the income cut-off that defines eligibility for reduced-price school meals) and (2) higher-income children. Findings were also age-adjusted, to account for differences between participants and nonparticipants in the distribution of ages. The authors found no significant differences between NSLP participants and nonparticipants in overall HEI-2005 scores, but did find some differences in component scores. These included:

- Among low-income children, NSLP participants had a significantly higher mean score than nonparticipants on the total fruit component (which includes both whole fruit and juice).
- Among higher-income children, NSLP participants had a significantly lower mean score than nonparticipants on the whole fruit component.
- In both income groups, NSLP participants had significantly higher mean scores than nonparticipants on the milk and meat and beans components.

B. GOALS FOR THIS STUDY

In this study, we use data from SNDA-III to assess the quality of the diets consumed by school-age children overall, and to assess the relationship between school meal participation and diet quality. Our main outcome is the HEI-2005. We use a slightly modified version of the measure that more precisely reflects recommended food intake patterns for school-age children. We use propensity score matching techniques developed during the SNDA-III project to control

for observed characteristics of school meal participants and nonparticipants (Gordon et al., 2007b and 2007c and Clark and Fox, 2009). A supplementary analysis examines the relative contribution of specific foods to children's MyPyramid food group intakes and assesses differences between NSLP participants and nonparticipants.

The SNDA-III data used in our analysis have an important advantage over the NHANES 1999-2002 data used by Cole and Fox (2008). In SNDA-III, estimates of the food and nutrient content of foods provided in NSLP meals are based on school menu and recipe data rather than solely on children's descriptions of foods consumed (Gordon et al., 2007b and Clark and Fox, 2009). Thus, the SNDA-III data provide a more accurate picture of the foods children consumed from school meals. In addition, the SNDA-III data provide a better measure of NSLP participation than NHANES 1999-2002 and are more recent (collected in 2005). Our use of propensity score matching techniques to control for observed characteristics of participants and nonparticipants is also an important improvement over the analysis completed by Cole and Fox, which controlled only for differences in income and age of participants and nonparticipants.

Findings from this study make an important contribution to our understanding of the role of the school meal programs in children's diets by examining overall diet quality. Estimates of the relationship between school meal participation and detailed measures of diet quality are valuable because many of the relationships observed in previous research have conflicting implications. For example, NLSP participants tend to consume more vegetables, but this difference appears to be largely driven by consumption of french fries and similar processed potato products (Devaney et al., 1993; Gordon et al., 1995; Gleason and Suitor, 2001; Gordon et al., 2007b). Similarly, positive associations with vitamin and mineral intakes observed in previous studies have been accompanied by negative associations with saturated fat and/or sodium intakes (Devaney et al.,

1993; Gordon et al., 1995; Gleason and Suitor, 2001; Gordon et al., 2007b). Examining summary HEI-2005 scores as well as the individual component scores provides insights into how all of these various trade-offs affect the bottom line—overall diet quality—and which HEI-2005 components are driving this bottom line. A better understanding of the relationship between school meal participation and children's dietary patterns could facilitate development of targeted policies to maximize the benefits of school meals and improve children's diet quality.

II. DATA AND METHODS

In this chapter, we describe the SNDA-III data used in our analysis, the methods used in estimating our main outcome measure—a modified version of the HEI-2005—and the methods used to assess the relationship between school meal participation and children's diet quality. Methods used in the supplementary analysis that examine the relative contributions of specific foods to children's intakes of MyPyramid food groups are described in Chapter IV.

A. THE SNDA-III DATA

The SNDA-III study was sponsored by USDA/FNS and data were collected by Mathematica Policy Research. Data collection took place from January through June, 2005.[1] The study provides data for a nationally representative sample of public school children in grades 1-12. The study's multistage sampling approach first sampled School Food Authorities (SFAs), then schools served by these SFAs, and then children who attended these schools. Children were randomly sampled, from lists of all children enrolled at the sampled school, to complete a 24-hour dietary recall interview. Full details about sampling and weighting procedures used in SNDA-III are available elsewhere (Gordon et al., 2007d).

1. Data Collection

All data collection instruments and procedures were reviewed and approved by the 2004 Education Information Advisory Committee of the Council of Chief State School Officers and the Office of Management and Budget. In addition, study personnel worked with any institutional review process a school district required. Depending on school district requirements,

[1] Details about SNDA-III data collection methods are taken from Gordon et al., 2007b and 2007c and Gordon et al., 2009.

active or passive consent forms were used to obtain informed consent from parents or guardians of students to be interviewed.

Dietary recalls were conducted using a slightly modified version of the Automated Multiple Pass Method (AMPM) software (version 2.3, 2003, USDA/Agricultural Research Service (ARS) Food Surveys Research Group, Beltsville, MD) on laptop computers. Children in elementary schools were interviewed during the school day, after lunch if possible, about foods eaten that day since awakening. These children were interviewed a second time, usually the next day, to report intake for the rest of the 24-hour period. Parents attended the second in-person interview and were asked to help children recall and describe the foods and beverages consumed. Children in middle and high schools were interviewed about what they had eaten the day before the interview, using a midnight-to-midnight reference period. Interviewers used the USDA two-dimensional food models booklet to help children and parents describe portion sizes. In addition to information on the types and quantities of food and beverages consumed, the dietary recalls collected data on the time each item was consumed, the name of the reported eating occasion, and where each item was obtained (including whether it was obtained from the school cafeteria). Data on intake of dietary supplements were not collected. Parents of all children also completed a parent interview.[2]

2. Study Sample

The analysis sample comprises 2,314 children who completed a dietary recall and whose parent completed a parent interview.[3] School meal participants and nonparticipants were

[2] A randomly selected 29 percent subsample of children completed a second 24-hour dietary recall approximately one week later. The second recall is not used in the analyses presented in this report.

[3] Dietary recalls were collected from 2,718 children and complete parent interviews were collected for 2,330 children. Sampling weights were developed for the sample of 2,314 children who had both dietary recall and parent interview data (Gordon et al., 2007d).

identified using variables in the SNDA-III file. To determine whether a student participated in the NSLP on the day referenced in the 24-hour recall, SNDA-III researchers combined information on the foods reported by children with information from the school menus and student self-reports of whether they ate a "regular" school lunch or breakfast that day. Because of differences in meal-planning requirements, the definition of NSLP and SBP participation differed slightly depending on whether the school used food-based or nutrient-based menu planning. In schools with food-based menu-planning systems, children were counted as NSLP participants if they: (1) reported consuming at least three of the five required food items (one grain, one meat/meat alternate, two fruits and/or vegetables, one milk), and all three items were obtained from the school cafeteria and appeared on the associated school menu; or (2) reported consuming at least one of the five required food items, the item was obtained from the cafeteria and appeared on the associated school menu, and the child reported consuming a "regular school lunch" that day. In schools with nutrient-based menu planning, children were counted as NSLP participants if they: (1) reported consuming at least one entrée and one side and both were obtained from the cafeteria and appeared on the school menu; or (2) reported consuming at least one entrée or side that was obtained from the cafeteria and appeared on the school menu, and the child reported consuming a "regular school lunch" that day.

Similar rules were used to define SBP participants. In schools with food-based menu planning, children were classified as SBP participants if they reported consuming at least one of the four required food items (i.e., two grains or two meat/meat alternates, one fruit or vegetable, one milk), and this item was obtained from the school cafeteria and on the school menu. In schools with nutrient-based menu planning, children were counted as SBP participants if they reported consuming at least one required item (including milk) that was obtained from the cafeteria and on the school menu. Aggregate participation rates based on these definitions were

similar to aggregate participation rates based on USDA administrative data (Gordon et al., 2007b). All children who were not defined as participants were instead classified as nonparticipants; these children may have obtained their meal from home or from other sources outside the school or from some nonreimbursable source within the school (such as an a la carte line in the cafeteria or a vending machine), or they may have skipped the meal entirely.

3. Data Preparation

To estimate scores for most HEI-2005 components, we needed data on MyPyramid equivalents, which were not included in the publicly available SNDA-III dataset. To obtain these data, we linked each food reported in the SNDA-III 24-hour recalls to the MyPyramid Equivalents Database (MPED) for USDA Survey Food Codes (MPED, version 1.0, 2006, Agricultural Research Service, Beltsville, MD) (Friday and Bowman, 2006). The MPED provided data for the following MyPyramid food groups included in the HEI-2005: total fruit; total vegetables; dark green vegetables; orange vegetables; legumes; total grains; whole grains; milk; meat and beans; oils; solid fats; and added sugars. Units were consistent with those used in MyPyramid and included cup equivalents (fruits, vegetables, and milk), ounce equivalents (grains and meat and beans), grams (oils and discretionary solid fats), and teaspoons (added sugar). The MPED also includes data on alcoholic beverages; however, alcohol was not reported in the SNDA-III data. Data for the sodium and saturated fat components of the HEI-2005 came directly from the SNDA-III data file.

In the MPED, single-ingredient foods that are in their lowest-fat, lowest-sugar form, such as a fresh peach, skim milk, or fresh carrots, are assigned to single MyPyramid food groups. Foods that have added fat and/or sugar—for example, peaches canned in heavy syrup or whole milk—have MPED entries for both the relevant food group and for added sugars and/or discretionary solid fats. Food mixtures that have ingredients from more than one MyPyramid food group, for

example, pizza, are disaggregated and individual ingredients are assigned to appropriate MyPyramid food groups and subgroups and values for added fats and sugars are assigned as needed. Some ingredients that have few or no calories or nutrients (such as plain water, salt, spices, and non-caloric beverages) are not assigned values in the MPED. To obtain data for the whole fruit component of the HEI-2005, we linked SNDA-III foods to the CNPP 01-02 Fruit Database (version 1.0, 2007, Center for Nutrition Policy and Promotion, Alexandria, VA; available online at: http://www.cnpp.usda.gov/HealthyEatingIndex-2005report.htm). This database separates the "Total Fruit" group found in the MPED into two subgroups: whole fruit and fruit juice. If a food item included both whole fruit and juice, the entire amount was assigned to either whole fruit or fruit juice, based on whichever amount was greater (Guenther et al., 2007).

A total of 3,021 unique food codes were reported in the 2,314 24-hour recalls included in the SNDA-III dataset. Of these, 2,086 foods were linked to the MPED through a common USDA food code. The remaining 935 foods included multicomponent foods, such as sandwiches and salads that were originally reported by students component by component, but were subsequently aggregated by SNDA-III researchers to form one food record; commercially prepared food products that are marketed specifically to school food service programs and often modified to be lower in fat, saturated fat, and/or sodium than their traditional counterparts; and modified recipes. The latter group included recipes that existed in the software used to collect the 24-hour recalls but were modified to reflect reported differences in the way foods were actually prepared. Such modifications were limited to changes that would have affected total fat or saturated fat content (Gordon et al., 2007a and 2007b).

Multicomponent foods (n=402) were linked to the MPED component by component, using the original disaggregated data. A similar approach was used for modified recipes (n=485) and

commercially prepared school foods (n=75), using the detailed recipes associated with these foods. Individual ingredients in these recipes were linked to the MPED, then values were summed across ingredients to determine full MPED values for the food. For commercial food service products, we used recipes that had been developed by the Agricultural Research Service (ARS) for the SNDA-III study. ARS developed recipes for 100 of the most commonly reported commercial food products to estimate nutrient values for the full range of nutrients included in the FNDDS (additional details about this process are available in the SNDA-III reports (Gordon et al., 2007a and 2007b)). For a few modified recipes and commercial food product recipes, we were not able to link to the MPED at the ingredient level because the recipes included dry ingredients not available in the MPED and/or because the recipes required complex adjustments for moisture or fat loss or gain. These items were linked to similar modified recipes in the MPED, when possible, or to the "closest match," based on description and nutrient content. If an exact match did not exist in the MPED, we ratio-adjusted MPED values for oils and discretionary solid fats, based on differences between the original (MPED) and modified (SNDA-III) foods to better represent the actual content of the commercially prepared school food product. Depending on the type of food and the types of modifications typically made in commercial school food service products, MPED values for cheese, grains, meat, and/or added sugars were also adjusted.

B. ANALYTIC METHODS

1. Estimating Healthy Eating Index-2005 Scores

We made some modifications to the standards used to assign maximum HEI–2005 scores to reflect the fact that our sample was limited to school-age children. We used the mean Estimated Energy Requirements (EERs) reported in the SNDA-III sample to select the most appropriate

MyPyramid eating patterns for children attending elementary schools, middle schools, and high schools. Mean EERs were 1,746 for elementary school children, 2,216 for middle school children, and 2,428 calories for high school children (Gordon et al., 2007b and Clark and Fox, 2009). Thus, we based modified HEI-2005 standards on the MyPyramid eating patterns for 1,800, 2,200, and 2,400 calories, respectively. To provide a benchmark for all school-age children, we used an average across the three school types. Table II.1 shows the standards for maximum scores used in the HEI-2005 (Guenther et al., 2007, 2008a, 2008b) and the modified standards used in this analysis. The modified standards reflect the fact that, on a density (per 1,000 calorie) basis, children need to consume larger amounts from most of the MyPyramid food groups than the population overall, in order to achieve desired intakes without exceeding energy requirements. In addition, children's diets have substantially less room for discretionary calories (or, as measured in the HEI-2005, SoFAAS calories). We did not make any modifications in the standards used for minimum scores of zero or in the standards used for saturated fat and sodium. The saturated fat and sodium standards are based on the 2005 Dietary Guidelines, which apply to all children over the age of 2 years.

We estimated HEI-2005 scores for children in the SNDA-III sample, following procedures outlined in the HEI-2005 technical report (Guenther et al., 2007), but incorporating the modified standards for school-age children shown in Table II.1.[4] As recommended by CNPP, HEI-2005 scores for each group of children were estimated at the population level rather than for each individual sample member (Guenther et al., 2007; Freedman et al., 2008). Ideally, the HEI-2005

[4] Results using the original (not modified) standards to assign maximum HEI-2005 scores are presented in Appendix A.

TABLE II.1

HEALTHY EATING INDEX (HEI)-2005: ORIGINAL AND MODIFIED SCORING CRITERIA

HEI Component	Maximum Score	Standards for Maximum Score					Standards for Minimum Score of Zero
		Original Criteria	Modified Criteria				
			Elementary School Children	Middle School Children	High School Children	All Children	
Total Fruit	5	≥ 0.8 cup	≥ 0.8 cup	≥ 0.9 cup	≥ 0.8 cup	≥ 0.8 cup	No fruit
Whole Fruit (not juice)	5	≥ 0.4 cup	≥ 0.4 cup	≥ 0.45 cup	≥ 0.4 cup	≥ 0.4 cup	No whole fruit
Total Vegetables	5	≥ 1.1 cup	≥ 1.4 cup	≥ 1.4 cup	≥ 1.3 cup	≥ 1.4 cup	No vegetables
Dark Green and Orange Vegetables and Legumes[a]	5	≥ 0.4 cup	≥ 0.6 cup	≥ 0.5 cup	≥ 0.5 cup	≥ 0.5 cup	No dark green or orange vegetables or legumes
Total Grains	5	≥ 3.0 oz.	≥ 3.3 oz.	≥ 3.2 oz.	≥ 3.3 oz.	≥ 3.3 oz.	No grains
Whole Grains	5	≥ 1.5 oz.	≥ 1.7 oz.	≥ 1.6 oz.	≥ 1.7 oz.	≥ 1.7 oz.	No whole grains
Milk[b]	10	≥ 1.3 cup	≥ 1.7 cup	≥ 1.4 cup	≥ 1.3 cup	≥ 1.5 cup	No milk/dairy
Meat and Beans	10	≥ 2.5 oz.	≥ 2.8 oz.	≥ 2.7 oz.	≥ 2.7 oz.	≥ 2.7 oz.	No meat or beans
Oils[c]	10	≥ 12.0 gm	≥ 13.0 gm	≥ 13.0 gm	≥ 13.0 gm	≥ 13.0 gm	No oil
Saturated Fat	10[d]	≤ 7%	≤ 7%	≤ 7%	≤ 7%	≤ 7%	≥ 15% of total energy
Sodium	10[d]	≤ 0.7 gm	≤ 0.7 gm	≤ 0.7 gm	≤ 0.7 gm	≤ 0.7 gm	≥ 2.0 gm per 1,000 calories
Calories from Solid Fats, Alcohol, and Added Sugars (SoFAAS)	20	≤ 20%[e]	≤ 11%	≤ 13%	≤ 15%	≤ 13%	≥ 50% of total energy
Total Score	**100**						

Source: Healthy Eating Index components and original scoring criteria are defined in *Development and Evaluation of the Healthy Eating Index-2005: Technical Report* (Guenther et al., 2007), available at: http://www.cnpp.usda.gov/HealthyEatingIndex. Modified criteria for elementary, middle, and highs school children were also obtained from that report (Table II.2), based on MyPyramid recommendations for 1,800, 2,200, and 2,400 calorie diets, respectively. Criteria for all children are an average of criteria for the three age groups.

Note: Standards for all components other than saturated fat and calories from SoFAAS reflect amounts per 1,000 calories. Standards for saturated fat and calories from SoFAAS reflect percentages of total energy intake. With the exception of sodium and saturated fat (see footnote d), intakes between the minimum and maximum are scored proportionately.

[a] Legumes are counted as vegetables only after the standard for intake of meat and beans is met.

[b] Includes all milk products, including fluid milks, yogurt, and cheese.

[c] Includes nonhydrogenated vegetable oils and oils in fish, nuts, and seeds.

[d] Scores for saturated fat and sodium = 8 for intake levels that reflect the 2005 Dietary Guidelines; <10% of energy from saturated fat and 1.1 gm sodium per 1,000 calories, respectively.

[e] The most generous allowance for discretionary calories in the MyPyramid food intake patterns.

would be calculated based on the *usual* dietary intake of each individual. When only one day of intake is available for each sample member, we do not have a reliable estimate of an individual's usual intake. However, a good estimate of a population's mean usual intake is the mean of one-day intakes in a sample representative of that population; and the best estimate of the population's mean HEI-2005 score is based on estimates of total intakes at the population level (Guenther et al., 2007; Freedman et al., 2008). Thus, we calculated the HEI-2005 component scores at the population level for elementary school children, middle school children, high school children, and all school-age children using the ratio of the population's total food group (or nutrient) intake to the population's total energy intake as the basis for the population's component score.[5]

As recommended, legumes were counted as part of the meat and bean group if the child did not consume enough meat and beans to reach the maximum score for that component (this adjustment was made at the individual level). For children who reached the maximum score for the meat and beans component, or who had additional legumes after meeting this score, legumes were counted as part of the dark green and orange vegetables/legumes component. Calories from SoFAAS were calculated by computing and summing the calories contributed by solid fats and added sugars (no alcohol was reported).

2. Statistical Methods

We used propensity score matching to adjust for observable differences between NSLP participants and nonparticipants (Rosenbaum and Rubin, 1983; Smith and Todd, 2001; Dehejia

[5] In response to a request made by ERS staff at the project's start-up meeting, we also estimated HEI-2005 scores at the individual level using one-day intakes. Results are presented in Appendix B.

and Whaba, 2002).[6] This approach is similar in spirit to a multivariate regression in that it statistically adjusts for differences in observable characteristics. However, unlike multivariate regression, it can be used in conjunction with population-based estimates like the HEI-2005 that are computed at the group rather than the individual level. To implement this approach for each school type (elementary, middle, and high), we estimated a logit model of NSLP participation as a function of (1) each child's age, sex, race, ethnicity, and height; (2) parent reports of whether the child was a hearty or picky eater, the child's health status, whether the child was on a diet, family income, and language spoken at home; and (3) school location (urbanicity and geographic region).[7] We used the results of these models to estimate a propensity score reflecting the likelihood that a given child participated in the NSLP. We then used this score to match each participant to a nonparticipant with a similar propensity score using "nearest neighbor" matching (Dehejia and Whaba, 2002).

To assess the quality of the matching model, we examined whether the participants and matched comparison groups were similar according to the observable characteristics included in the logit model. Table II.2 displays mean values for baseline characteristics of NSLP participants, the full group of nonparticipants, and the matched nonparticipants. As shown, there were a substantial number of significant differences between participants and the full sample of nonparticipants. For example, in elementary schools, NSLP participants were more likely than nonparticipants to be black or Hispanic, low-income, and from a home where the primary language was Spanish. For participants and matched nonparticipants, however, differences

[6] In response to a request made by ERS staff at the project's start-up meeting, we also estimated multivariate regression models, based on HEI-2005 scores estimated at the individual level. Results are presented in Appendix B.

[7] As a measure of the predictive power of the logit models used to estimate the propensity scores, we computed the area under the receiver-operating characteristic curves (Zou et al., 2007). Values ranged from 0.705 for the middle school model to 0.730 for the high school model.

TABLE II.2

BASELINE CHARACTERISTICS OF NSLP PARTICIPANTS, NONPARTICIPANTS, AND MATCHED NONPARTICIPANTS
(PROPORTION WITH CHARACTERISTIC UNLESS OTHERWISE NOTED)

	Elementary School Chlidren			Middle School Children			High School Children			All Children		
Variable	NSLP (n=531)	NonNSLP (n=201)	Matched NonNSLP (n=142)	NSLP (n=496)	NonNSLP (n=290)	Matched NonNSLP (n=176)	NSLP (n=358)	NonNSLP (n=437)	Matched NonNSLP (n=188)	NSLP (n=1,385)	NonNSLP (n=928)	Matched NonNSLP (n=506)
Student's demographic characteristics												
Female	0.48	0.51	0.50	0.48	0.59 **	0.45	0.45	0.57 **	0.49	0.47	0.55 **	0.49
White[a]	0.47	0.67 **	0.54	0.53	0.48	0.54	0.57	0.61	0.49	0.50	0.60 **	0.53
Black, non-Hispanic	0.20	0.09 **	0.18	0.17	0.25 *	0.23	0.18	0.11 *	0.23	0.19	0.13 **	0.20
Hispanic	0.27	0.15 **	0.23	0.24	0.22	0.19	0.19	0.21	0.20	0.24	0.19 *	0.22
Other race, non-Hispanic	0.06	0.10	0.04	0.07	0.05	0.04	0.07	0.07	0.07	0.06	0.08	0.05
Age (mean)[b]	8.80	8.82	8.90	12.78	12.87	13.07 *	15.92	15.99	15.98	11.07	12.75 **	11.20
Student's height in inches (mean)	136.16	135.77	136.04	159.17	158.62	160.36	167.80	167.23	167.22	147.30	154.30 **	147.42
Student's eating habits												
Student eats more than others[a]	0.22	0.27	0.24	0.26	0.21	0.27	0.23	0.20	0.27	0.23	0.22	0.25
Student eats about the same amount as others	0.61	0.58	0.61	0.60	0.63	0.57	0.62	0.67	0.56	0.61	0.63	0.59
Student eats less than others	0.17	0.15	0.15	0.14	0.17	0.15	0.15	0.13	0.17	0.16	0.15	0.15
Student a very picky eater[a]	0.23	0.20	0.24	0.17	0.24 *	0.21	0.21	0.20	0.25	0.22	0.21	0.24
Student somewhat picky eater	0.45	0.51	0.41	0.49	0.45	0.45	0.39	0.42	0.38	0.44	0.46	0.41
Student not picky eater	0.32	0.29	0.35	0.34	0.31	0.34	0.40	0.38	0.37	0.34	0.33	0.35
Student on a diet[c]	0.00	0.00	0.00	0.33	0.26 *	0.33	0.26	0.31	0.27	0.12	0.18 **	0.12
Student's health status (parent report)												
Student in fair to poor health[a]	0.03	0.02	0.04	0.08	0.03 *	0.06	0.07	0.04	0.10	0.05	0.03	0.06
Student in good health	0.13	0.08	0.13	0.14	0.14	0.14	0.15	0.15	0.24	0.13	0.13	0.15
Student in very good health	0.34	0.36	0.35	0.37	0.32	0.33	0.28	0.27	0.26	0.33	0.31	0.33
Student in excellent health	0.50	0.53	0.48	0.42	0.51 *	0.47	0.50	0.54	0.40	0.48	0.53	0.46
Family income as percent of poverty												
Less than 130[a]	0.36	0.15 **	0.38	0.35	0.24 **	0.32	0.33	0.21 **	0.43	0.35	0.20 **	0.38
130 to 185	0.15	0.06 **	0.13	0.14	0.12	0.17	0.16	0.07 **	0.13	0.15	0.08 **	0.14
185 to 200	0.18	0.23	0.22	0.19	0.22	0.19	0.15	0.17	0.17	0.18	0.20	0.20
200 to 300	0.10	0.20 *	0.09	0.13	0.15	0.13	0.15	0.21	0.11	0.12	0.19 **	0.10
>300	0.20	0.35 **	0.19	0.19	0.27 *	0.19	0.20	0.34 **	0.16	0.20	0.33 **	0.18
Primary language spoken at home												
English[a]	0.84	0.90	0.82	0.83	0.89 *	0.84	0.87	0.90	0.90	0.85	0.90 **	0.84
Spanish	0.13	0.07 *	0.12	0.12	0.05 **	0.10	0.09	0.07	0.07 *	0.12	0.07 **	0.11
Other	0.03	0.04	0.05	0.05	0.06	0.06	0.04	0.03	0.03	0.03	0.04	0.05
School urbanicity												
City[a]	0.39	0.36	0.28	0.30	0.40 *	0.26	0.29	0.40 **	0.37	0.35	0.39	0.29
Urban fringe of city	0.31	0.38	0.34	0.30	0.30	0.32	0.19	0.33 **	0.22	0.28	0.34 *	0.31
Town	0.07	0.05	0.09	0.09	0.07	0.07	0.11	0.09	0.05 **	0.09	0.07	0.08
Rural area	0.23	0.21	0.29 *	0.31	0.22 *	0.35	0.40	0.17 **	0.36	0.28	0.20 **	0.32

TABLE II.2 (con't)

BASELINE CHARACTERISTICS OF NSLP PARTICIPANTS, NONPARTICIPANTS, AND MATCHED NONPARTICIPANTS
(PROPORTION WITH CHARACTERISTIC UNLESS OTHERWISE NOTED)

	Elementary School Chlidren			Middle School Children			High School Children			All Children		
Variable	NSLP (n=531)	NonNSLP (n=201)	Matched NonNSLP (n=142)	NSLP (n=496)	NonNSLP (n=290)	Matched NonNSLP (n=176)	NSLP (n=358)	NonNSLP (n=437)	Matched NonNSLP (n=188)	NSLP (n=1,385)	NonNSLP (n=928)	Matched NonNSLP (n=506)
School geographic region												
Mid-Atlantic[a]	0.10	0.15	0.09	0.09	0.08	0.10	0.12	0.09	0.15	0.10	0.11	0.10
Midwest	0.15	0.20	0.11	0.15	0.12	0.14	0.21	0.17	0.25	0.16	0.17	0.15
Mountain	0.08	0.10	0.04	0.09	0.05	0.11	0.05	0.09 *	0.02	0.08	0.09	0.05
Northeast	0.07	0.13 *	0.14	0.07	0.13	0.07	0.08	0.09	0.05	0.07	0.11 **	0.11
Southeast	0.25	0.14 **	0.29	0.30	0.22 *	0.30	0.26	0.15 **	0.28	0.26	0.16 **	0.29
Southwest	0.17	0.08 **	0.15	0.17	0.20	0.20	0.14	0.17	0.16	0.16	0.14	0.16
Western	0.17	0.20	0.18	0.13	0.20 *	0.09	0.14	0.24 **	0.10	0.16	0.22 **	0.15

SOURCE: Data are from the School Nutrition Dietary Assessment-III, Student and Parent Interviews, school year 2004-2005 and from the 2002-2003 U.S. Department of Education Common Core of Data. Tabulations are weighted to be nationally representative of children in public National School Lunch Program schools. Sample sizes are unweighted.

Notes: NSLP = NSLP participant; NonNSLP = Nonparticipants in the full SNDA-III sample; Matched NonNSLP = Matched nonparticipants

* Difference between NSLP and specified nonparticipant group is statistically significant at the 0.05 level.
** Difference between NSLP and specified nonparticipant group is statistically significant at the 0.01 level.

[a] Omitted category in propensity score matching model.
[b] Propensity score matching model included a set of 12 dummy variables for ages 7-18 rather than mean age, which is presented here for ease of interpretation.
[c] Included in models for middle school and high school children only.

in means were generally small, and statistically significant for five percent or fewer of the characteristics in each group (the number of significant differences that would be expected due to chance with a five percent critical value). These statistics suggest that the participant and matched nonparticipant comparison groups are well-balanced in terms of observable characteristics. Additional information about the propensity score matching procedure is available in the SNDA-III report (Gordon et al., 2007b and 2007c).

Despite the fact that the propensity score matching procedure adjusts for observed differences between the diet quality of participants and nonparticipants, significant differences between the two groups cannot be interpreted as causal effects of the school meal programs because unobserved differences between participants and nonparticipants could influence their dietary intakes. The SNDA-III dataset includes a rich set of variables reflecting students' dietary preferences, including parent reports of whether the child was a hearty or picky eater, the child's health status, and whether the child was on a diet. These variables were included in the propensity score matching model in an effort to reflect underlying differences in dietary preferences. Nonetheless, they may not fully capture family eating habits or student preferences that would lead one student to participate in the school meal program while an observationally similar student did not.[8]

[8] For instance, the parents of a student very concerned about healthy eating may opt for their child to participate in the school meal program and may also prepare healthy, well-balanced meals at home. The parents of a student who appears similar according to all dimensions we observe in the data may be less concerned with their child's diet, may allow their child to purchase a la carte items from the school cafeteria, and may also eat out more frequently and prepare less healthful meals at home. If this were the case, the school meal participant may have a healthier diet than the non-participant, but this difference may be caused by the (unobserved) family attitudes about eating and nutrition rather than by the school meal program itself. Because we can never fully know what unobserved factors may influence both dietary intakes and school meal participation, we cannot interpret the propensity score matching results as causal effects of the school meal program or determine the direction of any potential bias.

All analyses are weighted so that the sample is representative of children in public NSLP schools nationwide. The final weights adjust both for unequal probabilities of selection at each stage of sampling and for nonresponse at each stage of data collection. Differences between participants and non-participants were tested for significance using two-tailed t-tests of the differences in the raw ratios associated with each HEI-2005 component score. In cases in which the HEI-2005 component score was truncated at the maximum (or minimum) value for one of the two groups, the raw ratio for the nontruncated group was compared with the ratio value associated with the maximum (or minimum) value of the component score, treating the latter value as a constant rather than a random variable, and thus assuming it had no standard error. The relatively small sample sizes for the propensity score matching analysis of SBP participants and nonparticipants (381 participants and 302 matched nonparticipants), as well as the relatively small samples in the school-type subgroups, provided limited power to detect significant differences between SBP participants and nonparticipants.

III. FINDINGS

In this chapter, we present major findings from our analysis. The discussion is organized into two main sections. The first section presents findings on the diet quality of school-age children in elementary schools, middle schools, and high schools, as assessed using our modified HEI-2005 measure. The second section presents findings from the propensity score matching analyses that compared modified HEI-2005 scores for NSLP participants and matched nonparticipants and SBP participants and matched nonparticipants, respectively.

A. DIET QUALITY OF SCHOOL-AGE CHILDREN

Using the modified scoring criteria developed for this analysis (see Table II.1), total HEI-2005 scores for school-age children ranged from a low of 53.7 for middle school children to a high of 55.3 for elementary school children, compared to the maximum possible score of 100. These total scores indicate a substantial need for improvement in the quality of the diets being consumed by school children of all ages. While these aggregate scores provide a simple summary assessment of diet quality, they don't provide information about the specific aspects of children's diets that are most in need of improvement. For this reason, CNPP recommends that use of the HEI-2005 focus most on the 12 individual component scores and less on the aggregate scores. Table III.1 displays modified HEI-2005 component scores for school-age children, both in absolute terms and as percentages of the relevant maximum score.

1. Total Grains and Whole Grains

All three groups of school-age children received the maximum score of 5 (100%) for the Total Grains component of the modified HEI-2005, indicating that the relative concentration of grains in children's diets was adequate to meet their nutrient needs. However, because the

TABLE III.1
HEALTHY EATING INDEX (HEI)-2005 SCORES FOR SCHOOL-AGE CHILDREN IN THE U.S.
ESTIMATED USING MODIFIED CRITERIA FOR MAXIMUM SCORES

HEI Component	Max. Score	Modified HEI-2005 Scores				Modified HEI Scores as a Percentage of Maximum Scores (%)			
		Elementary School Children (n=732)	Middle School Children (n=787)	High School Children (n=795)	All Children (n=2,314)	Elementary School Children (n=732)	Middle School Children (n=787)	High School Children (n=795)	All Children (n=2,314)
Total Fruit	5.0	4.1	3.0	3.3	3.6	82.0	60.0	66.0	72.0
Whole Fruit (not juice)	5.0	4.1	2.9	2.7	3.4	82.0	58.0	54.0	68.0
Total Vegetables	5.0	1.9	1.9	2.3	2.0	38.0	38.0	46.0	40.0
Dark Green and Orange Vegetables and Legumes[a]	5.0	0.5	0.5	0.5	0.5	10.0	10.0	10.0	10.0
Total Grains	5.0	5.0	5.0	5.0	5.0	100.0	100.0	100.0	100.0
Whole Grains	5.0	0.9	0.8	0.8	0.8	18.0	16.0	16.0	16.0
Milk[b]	10.0	7.5	8.2	7.6	7.9	75.0	82.0	76.0	79.0
Meat and Beans	10.0	7.5	8.1	8.6	8.0	75.0	81.0	86.0	80.0
Oils[c]	10.0	6.2	6.6	7.1	6.6	62.0	66.0	71.0	66.0
Saturated Fat	10.0	6.2	6.1	5.7	6.0	62.0	61.0	57.0	60.0
Sodium	10.0	3.4	3.6	3.4	3.4	34.0	36.0	34.0	34.0
Calories from Solid Fats, Alcohol, and Added Sugars (SoFAAS)	20.0	7.9	6.9	7.6	7.6	39.5	34.5	38.0	38.0
TOTAL HEI-2005 SCORE	100.0	55.3	53.7	54.4	55.0	55.3	53.7	54.4	55.0

Source: Data are from the School Nutrition Dietary Assessment-III, 24-hour dietary recalls, school year 2004-2005. Tabulations are based on one 24-hour recall and weighted to be nationally representative of children in public National School Lunch Program schools. Sample sizes are unweighted.

Note: Standards for all components other than saturated fat and calories from SoFAAS reflect amounts per 1,000 calories. Standards for saturated fat and calories from SoFAAS reflect percentages of total energy intake.

[a] Legumes are counted as vegetables only after the standard for intake of meat and beans is met.

[b] Includes all milk products, including fluid milks, yogurt, and cheese.

[c] Includes nonhydrogenated vegetable oils and oils in fish, nuts, and seeds.

HEI-2005 score truncates at the maximum score of 5 and assigns that score for intakes that are at or above the recommended density (amount per 1,000 calories), it is possible that children's diets provided *more* grains per 1,000 calories than recommended. This is an important issue to explore because excess consumption of any food group can contribute to excess calories. Data on the relative concentration of grains in children's diets (per 1,000 calories) showed that children in elementary schools consumed about nine percent more grains than recommended—3.6 oz. equivalents per 1,000 calories, compared to the recommended level of 3.3 oz. equivalents—and middle school children consumed about six percent more grains than recommended—3.4 oz equivalents per 1,000 calories, compared to recommended level of 3.2 oz. equivalents. The density of grains in the diets of high-school-age children was consistent with recommendations. Children's consumption of whole grains fell far short of the recommendation that half of all grains consumed be whole grains. All three groups of children had scores on the Whole Grains component that were less than 20 percent of the maximum score (0.8 to 0.9 points, out of a possible 5).

2. Milk and Meat and Beans

For all three groups of children, scores on the Milk and Meat and Beans components were among the highest, preceded only by the Total Grains component and, for elementary school children, the Total Fruit and Whole Fruit components. The Milk component considers milk and all milk products, such as cheese and yogurt. Children's scores ranged from 7.5 to 8.2, relative to a maximum possible score of 10. Thus, on a percentage basis, children in all three groups consumed diets with concentrations of milk that were equivalent to 75 percent or more of recommended levels. Results for the Meat and Beans component, which considers all meat, poultry, and fish, as well as eggs, peanut butter, legumes, and nuts and seeds, were comparable.

Scores on the Meat and Beans component ranged from 7.5 to 8.6 or, relative to the maximum score of 10, 75 to 86 percent of recommended levels.

3. Total Fruit and Whole Fruit

Scores on the Total Fruit and Whole Fruit components varied more, across school type, than scores for the other components of the HEI-2005. Scores were highest for elementary school children, who scored 4.1 out of a possible 5 (82%) for both components. Scores for middle-school- and high-school-age children were notably lower, ranging from 2.7 to 3.3 (54 to 66%). Middle-school-age children had the lowest score for the Total Fruit component (3.0 or 60%) and high-school-age children had the lowest score for the Whole Fruit component (2.7 or 54%).

4. Total Vegetables and Dark Green and Orange Vegetables and Legumes

Scores on the two components that assess vegetable intakes were among the lowest for the food-based components of the HEI-2005. Scores for the Total Vegetables component ranged from 1.9 to 2.3, or 38 to 46 percent of the potential maximum score of 5. Scores for the Dark Green and Orange Vegetables and Legumes component were very low—0.5 out of 5, or 10% of the potential maximum, for all three groups of children. Previous research has shown that french fries are major contributors to children's vegetable intakes, starting at very young ages (Fox et al., 2004; Cole and Fox, 2008). Although white potatoes are naturally rich in potassium and vitamin C, french fries and other fried potatoes contribute added fat, sodium, and calories, all of which can have a negative impact on overall diet quality. We estimated scores for the Total Vegetables component of the modified HEI-2005 and found that scores decreased by 11 to 13 percent (from 1.9 to 1.7 for elementary and middle school children and from 2.3 to 2.0 for high school children) when french fries and other fried potatoes were not counted toward vegetable consumption.

5. Oils and Saturated Fat

Scores on the Oils and Saturated Fat components were roughly 6 to 7 out of 10, or 60 to 70 percent of the potential maximum, for all three groups of children. These two components are scored in inverse directions. The Dietary Guidelines recommend the healthful oils that are considered in the Oils component (oils from fish, nuts and seeds, and vegetable oils high in monounsaturated and polyunsaturated fats, such as canola, olive, and corn). So, the higher the score, the higher the concentration of these healthful oils in the diet (per 1,000 calories). Conversely, the Dietary Guidelines recommend limiting saturated fats to less than 10 percent of total energy. Thus, the higher the score on the Saturated Fat component, the lower the concentration of these unhealthy fats in the diet.

6. Sodium and Calories from SoFAAS

All three groups of children had low scores for both the Sodium and Calories from SoFAAS components of the modified HEI-2005. Only scores for the Dark Green and Orange Vegetables and Legumes component and the Whole Grains component were lower. Both of these components are scored so that a higher score indicates lower concentrations of sodium and fewer calories from SoFAAS. For the Sodium component, scores ranged from 3.4 to 3.6, out of a possible 10 (34 to 36% of the maximum). For the Calories from SoFAAS component, scores ranged from 6.9 to 7.9, out of a possible 20, or 35 to 40 percent of the maximum.

7. Summary

A major finding from this study is that diets of school-age children in the U. S. are a long way from being consistent with recommended dietary patterns. The maximum modified HEI-2005 score was achieved only for the Total Grains component. However, the data suggest that elementary and middle school children may be consuming *more* grains (on a per 1,000 calorie

basis) than recommended. These additional grains may crowd out other important food groups or lead to excessive calorie intakes. Moreover, research that has examined the sources of grains in children's diets indicates that low-nutrient, energy-dense foods such as cookies, pastries, and corn-based salty snacks are leading contributors to children's grain intakes (see, for example, Cole and Fox, 2008, and analyses presented in Chapter IV). This, taken with the finding that children's consumption of whole grains is markedly below recommended levels, indicates the need for a shift in the types of grains included in children's diets. Whole grain products should be substituted for many of the refined grain products children are currently consuming and intakes of low-nutrient, energy-dense grain-based desserts and snack foods should be moderated. The latter change would also have a positive effect on (decrease) children's intakes of sodium and calories from SoFAAS.

Modified HEI-2005 scores for the Total Fruit, Whole Fruit, and Total Vegetables components indicate that children's fruit and vegetable intakes are low, relative to MyPyramid recommendations. Vegetables are more of a concern than fruit and fruit is more of a concern for middle school and high school children than for elementary school children. In addition, the very low scores for the Dark Green and Orange Vegetables and Legumes component (equivalent to 5% of the maximum score) indicate that children's intakes of these vegetables are of particular concern. Children should be encouraged to consume more fruits (as opposed to fruit juice), especially fresh fruits, fruits that are canned or frozen without added sugar, and dried fruits. Children should also be encouraged to consume a wide array of different vegetables, decreasing the focus on french fries and other fried potatoes, and incorporating more dark green and orange vegetables and more legumes.

Modified HEI-2005 scores for the Milk and Meat and Beans components indicate that, in general, children's diets come closer to meeting recommendations for these food groups than other food groups. Nonetheless, the data indicate that children in all three school types, particularly elementary school children and high school children, need to increase consumption of milk and other dairy foods. To maintain energy balance and improve overall diet quality, skim and low-fat milk should be substituted for sweetened beverages and, if consumed in excess (more than 50% of total fruit intake), fruit juices.

The finding that children did not achieve maximum scores on the Meat and Beans component may be surprising, given that the Meat and Beans Group is not among the "food groups to be encouraged" in the 2005 Dietary Guidelines (DHHS and USDA, 2005). Indeed, the 2005 Dietary Guidelines state that "while protein [a major nutrient provided by the Meat and Bean Group], is an important macronutrient … Most Americans are already consuming enough … and do not need to increase their intake" (DHHS and USDA, 2005). Several factors contribute to this apparent discrepancy. First, protein comes from many sources and two major sources of protein in children's diets—cheese and milk (Gordon et al., 2007c)—are not included in the MyPyramid Meat and Beans Group. Second, HEI-2005 scores are based on ounce equivalents of lean meat. Many meat, poultry, and fish items that are popular with children are breaded and/or fried or are not lean choices (Gordon et al., 2007c; Condon et al., 2009; also see Chapter IV). So, ounce for ounce, these items provide fewer lean meat equivalents than plain, lean choices. For example, 100 grams of baked or broiled chicken breast, without the skin, provides 3.53 oz. meat equivalents. A comparable portion of chicken nuggets or breaded chicken patty provides only 2.14 oz. meat equivalents. Similarly, 100 grams of lean roast beef provides 3.53 oz. meat equivalents, while comparable portions of all-beef bologna or all-beef hot dogs provide 2.79 and

2.71 oz. meat equivalents, respectively. Children's scores on the HEI-2005 Meat and Beans component and, thus, their overall diet quality, could be improved by replacing breaded/fried and higher-fat meat choices with leaner versions.

There is also reason to be concerned about excesses in children's diets. For all groups of children, scores on both the Sodium and SoFAAS components of the modified HEI-2005 were well below 50 percent of the maximum, indicating that children are consuming substantially more sodium and discretionary calories from solid fats and added sugars than recommended. Scores on the Oils and Saturated Fat components of the modified HEI-2005 indicate the need to replace some of the saturated fat in children's diets with healthier oils from nuts, seeds, fish, and non-hydrogenated vegetable oils.

B. DIET QUALITY OF SCHOOL MEAL PARTICIPANTS AND MATCHED NON-PARTICIPANTS

1. NSLP Participants and Matched Nonparticipants

Table III.2 presents modified HEI-2005 scores for NSLP participants and matched nonparticipants by school type. Total modified HEI-2005 scores for NSLP participants and matched nonparticipants in all three types of schools approximated 55, out of a possible 100. There were no statistically significant differences between NSLP participants and matched nonparticipants in total modified HEI-2005 scores. However, some significant differences were noted for component scores. For school-age children overall, NSLP participants scored significantly higher on the Milk component (8.5 versus 7.2) and significantly lower on the Oils component (6.4 versus 7.3) than matched nonparticipants. These patterns were observed for all three school types, but differences were generally not statistically significant within school type.

TABLE III.2

HEALTHY EATING INDEX (HEI)-2005 SCORES[a] BY NSLP PARTICIPATION AND SCHOOL TYPE FOR SCHOOL-AGE CHILDREN IN MATCHED SAMPLE[b] (WEIGHTED)

HEI Component	Max. Score	Elementary Schools		Middle Schools		High Schools		All Schools	
		NSLP Participants (n=531)	Matched Nonparticipants (n=142)	NSLP Participants (n=496)	Matched Nonparticipants (n=176)	NSLP Participants (n=358)	Matched Nonparticipants (n=188)	NSLP Participants (n=1,385)	Matched Nonparticipants (n=506)
Total Fruit	5.0	4.1	4.6	2.7	3.5	3.1	2.8	3.5	3.9
Whole Fruit (not juice)	5.0	4.1	4.4	2.7	4.0	2.3	2.2	3.3	3.8
Total Vegetables	5.0	2.0	1.8	2.0	1.5 **	2.2	2.3	2.1	1.9
Dark Green and Orange Vegetables and Legumes[c]	5.0	0.5	0.7	0.5	0.4	0.5	0.3	0.5	0.6
Total Grains	5.0	5.0	5.0	5.0	5.0	5.0	4.8	5.0	5.0
Whole Grains	5.0	0.8	1.1	0.8	0.7	0.7	1.0	0.8	1.0
Milk[d]	10.0	7.9	6.7	8.9	6.2 **	7.8	7.3	8.5	7.2 *
Meat and Beans	10.0	7.2	7.8	7.8	9.0 *	8.8	7.9	7.7	8.1
Oils[e]	10.0	6.0	7.0	6.4	6.9	7.2	8.3	6.4	7.3 *
Saturated Fat	10.0	6.1	7.2	5.7	7.6 *	6.0	5.7	6.0	7.0
Sodium	10.0	3.3	3.9	3.5	3.5	3.4	3.9	3.3	3.8
Calories from Solid Fats, Alcohol, and Added Sugars (SoFAAS)	20.0	7.8	7.9	7.0	6.4	7.7	6.8	7.8	7.5
TOTAL HEI-2005 SCORE	100.0	54.7	58.2	53.2	54.8	54.6	53.3	55.0	57.0

Source: Data are from the School Nutrition Dietary Assessment-III, 24-hour dietary recalls, school year 2004-2005. Tabulations are based on one 24-hour recall and weighted to be nationally representative of children in public National School Lunch Program schools. Sample sizes are unweighted.

Note: Standards for all components other than saturated fat and calories from SoFAAS reflect amounts per 1,000 calories. Standards for saturated fat and calories from SoFAAS reflect percentages of total energy intake.

[a] HEI-2005 scores were estimated using modified criteria for assigning maximum score (see Table II.1).

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

[c] Legumes are counted as vegetables only after the standard for intake of meat and beans is met.

[d] Includes all milk products, including fluid milks, yogurt, and cheese.

[e] Includes nonhydrogenated vegetable oils and oils in fish, nuts, and seeds.

* Difference between NSLP participants and matched nonparticipants is statistically significant at the 0.05 level.

** Difference between NSLP participants and matched nonparticipants is statistically significant at the 0.01 level.

By school type, no significant differences were noted between NSLP participants and matched nonparticipants in elementary schools or high schools. However, among middle school children, NSLP participants scored significantly higher than matched nonparticipants on the Milk component (8.9 versus 6.2) as well as the Total Vegetables component (2.0 versus 1.5). The significant difference between groups in the Total Vegetables component persisted when french fries and other fried potatoes were not included in estimating the Total Vegetables score (1.8 versus 1.4). For the Meat and Beans and Saturated Fat components, middle school NSLP participants scored significantly lower than middle school matched nonparticipants. NSLP participants had a score of 7.8 on the Meat and Beans component, compared with a score of 9.0 for matched nonparticipants. For the Saturated Fat component, NSLP participants had a score of 5.7, compared with 7.6 for matched nonparticipants.

2. SBP Participants and Matched Nonparticipants

Table III.3 presents modified HEI-2005 scores for SBP participants and matched nonparticipants by school type. Total modified HEI-2005 scores for SBP participants and matched nonparticipants in all three types of schools ranged from about 50 to 55, out of a possible 100. There were no statistically significant differences between SBP participants and matched nonparticipants in total modified HEI-2005 scores; however, some significant differences were noted for the component scores. For school-age children overall, SBP participants scored significantly higher than matched nonparticipants on the Milk component (8.6 versus 6.9). This pattern was observed for children in all three school types. However, perhaps because of small sample sizes for children in middle schools and high schools, the difference between SBP participants and matched nonparticipants was statistically significant only for elementary school children (8.2 vs. 6.4). Scores on the Saturated Fat component differed

TABLE III.3

HEALTHY EATING INDEX (HEI)-2005 SCORES[a] BY SBP PARTICIPATION AND SCHOOL TYPE FOR SCHOOL-AGE CHILDREN IN MATCHED SAMPLE[b] (WEIGHTED)

HEI Component	Max. Score	Elementary Schools		Middle Schools		High Schools		All Schools	
		SBP Participants (n=160)	Matched Nonparticipants (n=118)	SBP Participants (n=127)	Matched Nonparticipants (n=99)	SBP Participants (n=94)	Matched Nonparticipants (n=85)	SBP Participants (n=381)	Matched Nonparticipants (n=302)
Total Fruit	5.0	4.3	3.6	2.7	2.7	3.6	2.4	3.8	3.2
Whole Fruit (not juice)	5.0	3.7	4.0	2.2	3.0	2.3	1.6	3.1	3.3
Total Vegetables	5.0	2.0	2.0	2.0	2.1	2.2	2.2	2.0	2.1
Dark Green and Orange Vegetables and Legumes[c]	5.0	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total Grains	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Whole Grains	5.0	0.7	0.8	0.7	0.7	0.6	0.5	0.7	0.7
Milk[d]	10.0	8.2	6.4 **	7.9	6.5	7.3	6.7	8.6	6.9 **
Meat and Beans	10.0	7.6	7.9	7.8	9.3 **	8.3	9.5	7.8	8.5
Oils[e]	10.0	6.4	5.6	7.4	6.2	6.5	6.4	6.6	5.8
Saturated Fat	10.0	5.9	7.3 *	5.9	5.8	6.8	5.0 *	6.1	6.6
Sodium	10.0	3.4	4.2	3.9	3.6	2.6	3.0	3.3	3.9
Calories from Solid Fats, Alcohol, and Added Sugars (SoFAAS)	20.0	8.1	7.3	6.9	6.2	8.1	6.8	8.1	7.2
TOTAL HEI-2005 SCORE	100.0	55.7	54.4	52.8	51.6	53.8	49.7	55.6	53.7

Source: Data are from the School Nutrition Dietary Assessment-III, 24-hour dietary recalls, school year 2004-2005. Tabulations are based on one 24-hour recall and weighted to be nationally representative of children in public National School Lunch Program schools. Sample sizes are unweighted.

Note: Standards for all components other than saturated fat and calories from SoFAAS reflect amounts per 1,000 calories. Standards for saturated fat and calories from SoFAAS reflect percentages of total energy intake.

[a] HEI-2005 scores were estimated using modified criteria for assigning maximum score (see Table II.1).

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

[c] Legumes are counted as vegetables only after the standard for intake of meat and beans is met.

[d] Includes all milk products, including fluid milks, yogurt, and cheese.

[e] Includes nonhydrogenated vegetable oils and oils in fish, nuts, and seeds.

* Difference between SBP participants and matched nonparticipants is statistically significant at the 0.05 level.

** Difference between SBP participants and matched nonparticipants is statistically significant at the 0.01 level.

significantly for SBP participants and matched nonparticipants in elementary schools and high schools; however, the direction of the difference was not consistent across school types. In elementary schools, SBP participants had a significantly lower score than matched nonparticipants (5.9 vs. 7.3). In high schools, SBP participants had a significantly higher score than matched nonparticipants (6.8 vs. 5.0). The only other significant difference between SBP participants and matched nonparticipants was noted for the Meat and Beans component among middle school children. SBP participants had a significantly lower score for this component than matched nonparticipants (7.8 vs. 9.3)

3. Summary

This is the first study to look at the relationship between school meal participation and diet quality, using the HEI-2005 (modified to reflect recommended dietary patterns for school-age children), and one of the few to focus on food intakes (rather than nutrient intakes) of school meal participants and nonparticipants. The HEI-2005 focuses on usual dietary intake over 24 hours rather than intakes at specific meals. Therefore, associations noted between school meal participation and the HEI-2005, when consistent with patterns observed in analyses of meal-specific intakes, suggest associations that are not cancelled out by what participants and nonparticipants eat at other times of the day.

Overall, both NSLP participation and SBP participation were associated with a significantly higher score on the Milk component of the modified HEI-2005. This is consistent with findings from previous SNDA-III analyses that showed that NSLP participants and SBP were significantly more likely than the full samples of nonparticipants to drink milk at lunch or breakfast, respectively (Gordon et al., 2007b; Condon et al., 2009). It is also consistent with previous work done by Gleason and Suitor which found, using data from the 1994-96 CSFII and multivariate regression techniques to control for differences in observable characteristics, that

NSLP participants had higher total intakes of milk than nonparticipants, both at lunch and over 24 hours (Gleason and Suitor, 2001 and 2003).

The finding related to the Oils component contributes new information to the knowledge base about the relationship between school meals and dietary intakes. To our knowledge, no previous research has examined intakes of oils among NSLP participants and nonparticipants. Major factors that appear to contribute to the observed difference between NSLP participants and matched nonparticipants on the Oils component are differences in the proportion of children who consumed peanut butter sandwiches and snack chips at lunch. Previous tabulations of the SNDA-III data showed that NSLP participants were significantly less likely than nonparticipants in the full sample to consume peanut butter sandwiches (4% vs. 15%) or snack chips (4% vs. 12%) at lunch (Gordon et al., 2007b; Condon et al., 2009). These two foods contributed significantly larger shares of the oil intakes of matched nonparticipants than NSLP participants (see Chapter IV).

Among middle school children, NSLP participants scored significantly higher than matched nonparticipants on the Total Vegetables component (as well as the Milk component). The finding related to vegetables is consistent with findings from previous SNDA-III analyses that showed that NSLP participants were significantly more likely than the full sample of nonparticipants to eat discrete servings of vegetables at lunch (not including vegetables from mixed dishes or other foods) (Gordon et al., 2007b; Condon et al., 2009). It is also consistent with work done by Gleason and Suitor (2001 and 2003) which found that NSLP participants had higher total intakes of vegetables (including vegetables from mixed dishes and other foods) than nonparticipants, both at lunch and over 24 hours. This study demonstrated that, even though french fries are commonly consumed by NSLP participants, the association between NSLP participation and vegetable intake is not driven by increased consumption of french fries among NSLP

participants. Even when french fries and similar products are "not counted" toward vegetable consumption, the association between NSLP participation and modified HEI-2005 score for Total Vegetables was still statistically significant.

Among middle school children, NSLP participation was also associated with significantly lower scores on the Meat and Beans and Saturated Fat components. These differences may be at least partially attributable to a greater prevalence of pizza among NSLP participants. Twenty-five percent of middle school NSLP participants consumed pizza at lunch compared with nine percent of middle school nonparticipants in the full sample (Gordon et al., 2007b; Condon et al., 2009). Pizza made relatively minor contributions to meat and bean intakes of middle school NSLP participants at lunch (5%), but was the leading contributor of saturated fat intakes at lunch (18%) (Gordon et al., 2007c; also see Chapter IV). Considered together, the overall finding related to the Oils component and the finding for the Saturated Fat component among middle school children suggest that policy makers and school food service professionals should focus on strategies to replace some of the saturated fat in NSLP meals with healthier oils from nuts, seeds, fish, and non-hydrogenated vegetable oils.

Overall, school meal participation was associated with relatively few differences in diet quality, and the differences that were observed were not consistently positive. There were no significant differences between school meal participants and matched nonparticipants in the areas of diet quality that are of greatest concern for school-age children—low intakes of vegetables and whole grains and excessive intakes of sodium, solid fats and added sugars. As policy makers and school food service professionals continue their efforts to improve school lunches, these aspects of diet quality are worthy of special attention.

IV. FOODS CONTRIBUTING TO INTAKES OF FOOD GROUPS AND OTHER DIETARY COMPONENTS CONSIDERED IN THE HEI-2005: NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS

In this chapter, we present results of a supplementary analysis that examined the relative contributions of different foods/food groups to children's intakes of MyPyramid groups and other dietary components considered in the HEI-2005 (saturated fat, sodium, discretionary solid fats, and added sugars), and assessed differences between NSLP participants and matched nonparticipants. The analysis was limited to NSLP participants and matched nonparticipants because of the limited samples of SBP participants and matched nonparticipants.

A. ANALYSIS METHODS

The relative importance of a food as a source of a particular dietary component is influenced by: (1) the concentration of the dietary component in the food and (2) the frequency with which the food is consumed by the population of interest. Information about the relative contributions of various foods and food groups to children's intakes of the components considered in the HEI-2005 can provide insights about strategies for improving children's diets. It can also suggest patterns that may be driving differences observed in the HEI-2005 component scores of NSLP participants and matched nonparticipants, as discussed in the preceding chapter.

The approach used in this analysis was adapted from methods developed by Krebs-Smith et al. (1992) and later expanded by Subar and colleagues (1998). An important difference is that this analysis considered foods as they were consumed by students rather than breaking combination foods down into their constituent ingredients. So, for example, pizza was considered as a whole food rather than as cheese, bread, tomato sauce, and, where appropriate, meat. The analysis used data from the single 24-hour recalls used in the HEI-2005 analyses

described in preceding chapters. All foods reported in the 24-hour recalls were divided into 103 minor food source groups. Population proportions were calculated to estimate the contribution of each food source group to 24-hour intakes of MyPyramid food groups, saturated fat, sodium, and the solid fats and added sugars components of the HEI-2005's "calories from SoFAAS" component. This was done by summing the weighted amount of a given dietary component provided by a given food group for all individuals in the sample and dividing by the total weighted amount of that dietary component consumed by all individuals. Differences between NSLP participants and matched nonparticipants were tested for statistical significance on the basis of two-tailed t-tests, using SUDAAN statistical software. Major findings are summarized below. Detailed tables are presented in Appendix C. Tables show, for each school type, the food source groups that contributed one percent or more to the intakes of NSLP participants or matched nonparticipants. Within school type, foods are sorted based on contribution to intakes of NSLP participants.

B. FINDINGS

1. Total Fruit (Fruit and Juice)

For NSLP participants and matched nonparticipants in all three school types, the major contributor to intakes, when individual types of fruit are considered separately, was 100% juice (Table C.1). Among elementary school children, bananas, applesauce, fruit cocktail, and pineapple contributed significantly more to total fruit intakes of NSLP participants than matched nonparticipants. The difference in the relative contribution of pineapple to total fruit intakes of NSLP participants and matched nonparticipants was also significant among middle school children.

2. Whole Fruit

For all groups of children, apples were the leading contributor to intakes of whole fruit (Table C.2). Several fruits commonly offered in NSLP lunches accounted for significantly greater shares of whole fruit intakes of NSLP participants than matched nonparticipants in one or more school types. These included bananas, applesauce, fruit cocktail, pineapple, and peaches. Among elementary school and middle school children, melons made substantially smaller contributions to the whole fruit intakes of NSLP participants than that of matched nonparticipants. However, these differences were not statistically significant.

3. Total Vegetables (Excluding Legumes)[1]

Leading contributors to children's vegetable intakes included french fries and similar potato products, other types of white potatoes, and condiments and spreads (mainly ketchup) (Table C.3). There were no statistically significant differences between NSLP participants and matched nonparticipants in the relative contribution of french fries and similar products to total vegetable intakes. Across all school types, these foods contributed nine to 16 percent of total vegetable intakes.

Among elementary school children, pizza, pasta-based mixed dishes, Mexican entrees, lettuce salads, and string beans all made significantly greater contributions to the vegetable intakes of NSLP participants than that of matched nonparticipants. Contributions of other white potatoes, carrots, and other raw vegetables were substantially greater for matched nonparticipants, but these differences were not statistically significant. Among middle school

[1] Legumes are excluded because the analysis is done at the population level and the way legumes are counted (as a vegetable or as meat/beans) varies for each individual. In addition, because consumption of dark green and orange vegetables and legumes was so rare, we did not tabulate data for this component of the HEI-2005.

children, Mexican entrees, string beans, and vegetable soups made significantly greater contributions to the vegetables intakes of NSLP participants than matched nonparticipants.

Among high school children, NSLP participants obtained significantly greater shares of their total vegetable intakes from white potatoes (not including french fries and similar products), condiments and spreads (mainly ketchup), and plain (unbreaded) meat/poultry sandwiches (lettuce and tomato) than matched nonparticipants. In addition, relative to NSLP participants, matched nonparticipants obtained a significantly greater share of their total vegetable intakes from snack (mainly potato) chips (16% versus 6%).

4. Total Grains

For NSLP participants in all three school types, the leading contributor to grain intakes was pizza and pizza products (for example, calzones and pizza bites) (Table C.4). Among elementary school and middle school children, the relative contribution of these foods to total grain intakes was significantly greater for NSLP participants than for matched nonparticipants (12-15% versus 5-10%). In addition, among elementary school children, sweet rolls/donuts/toaster pastries, hamburgers/cheeseburgers, and hot dogs/corn dogs made significantly greater contributions to the total grain intakes of NSLP participants than of matched nonparticipants. Cookies/cakes/ brownies, cold cereals, fruit-based desserts (such as pies and cobblers), and "Lunchables" made significantly smaller contributions to the total grain intakes of NSLP participants, relative to matched participants.

In addition to the difference in the relative contribution of pizza and pizza products, middle school NSLP participants obtained significantly more of their total grain intakes from sandwiches that included breaded or fried meat or poultry and from buttered toast or bagels with cream cheese. Matched nonparticipants, on the other hand, obtained significantly more of their total grain intakes from peanut butter sandwiches.

In high schools, NSLP participants obtained significantly more of their total grain intakes from pancakes, waffles, and French toast and from breakfast sandwiches than did matched nonparticipants. Matched nonparticipants obtained significantly more of their total grain intakes from grain/cereal bars than did NSLP participants.

5. Whole Grains

For all groups of children, the leading contributor to intakes of whole grains was cold cereal, which accounted for 21 to 46 percent of whole grain intakes (Table C.5). In all three types of schools, pizza and pizza products accounted for significantly larger shares of the whole grain intakes of NSLP participants than matched nonparticipants. This is attributable to the frequency of pizza consumption among NSLP participants and to the use, in some schools, of pizza and pizza products that were specially formulated to incorporate whole grain flours. Among middle school children, hot cereal contributed a significantly larger share of the whole grain intakes of NSLP participants than matched nonparticipants, and plain (unbreaded) meat/poultry sandwiches contributed a significantly smaller share. Among high school students, whole grain bread and rolls (not part of a sandwich) and pancakes, waffles, and French toast contributed significantly more to the whole grain intakes of NSLP participants than matched nonparticipants.

6. Milk/Dairy

For all groups of children, unflavored 2% milk was the leading contributor to intakes of foods in the milk/dairy group (Table C.6). In addition, in all three school types, flavored 1% milk and flavored skim milk made significantly greater contributions to the milk/dairy intakes of NSLP participants than matched nonparticipants. The magnitude of the differences was large—for example, among elementary school children, 1% and skim flavored milk accounted for 19 percent of the total milk intakes of NSLP participants but only 4 percent of the total milk intakes of matched nonparticipants. Among elementary school children, cheese (consumed separately

(not in a sandwich or mixed dish), including as an optional topping) contributed significantly more to the milk/dairy intakes of NSLP participants than matched nonparticipants, and yogurt contributed significantly less.

7. Meat Group (Excluding Legumes)[2]

For all groups of children, the two leading contributors to intakes in the meat group (excluding legumes) were unbreaded meat, poultry, or fish (not part of a sandwich or mixed dish) and breaded/fried chicken products, such as chicken nuggets, strips, and patties (Table C.7). Among elementary school children, NSLP participants obtained a significantly larger share of their meat intakes from hamburgers/cheeseburgers, hot dogs/corn dogs, Mexican entrees, and pizza and pizza products than matched nonparticipants. Matched nonparticipants obtained a significantly larger share of their meat intakes from peanut butter (not part of a sandwich)/nuts/seeds/trail mix. Among middle school children, NSLP participants obtained a significantly larger share of their meat intakes from hamburgers/cheeseburgers, pasta-based mixed dishes, sandwiches with breaded/fried meat or poultry, and candy (that included peanuts or peanut butter) than matched nonparticipants. There were no significant differences among high school children in the sources of meat intakes of NSLP participants and matched nonparticipants.

8. Oils

Leading contributors to intakes of oils among school-age children included salad dressings, breaded/fried chicken products, corn/tortilla chips, other snack chips, peanut butter sandwiches, and other condiments and spreads (Table C.8). Among middle school children, corn/tortilla chips

[2] Legumes are excluded because the analysis is done at the population level and the way legumes are counted (as a vegetable or as meat/bean) varies for each individual.

accounted for significantly less of the oil intakes of NSLP participants than matched nonparticipants (12% versus 19%) and other snack chips accounted for significantly more of NSLP participants' intakes (13% versus 7%). Among high school children, the significant difference between NSLP participants and matched nonparticipants in the relative contribution of other snack chips to oil intakes was reversed. Among NSLP participants other snack chips accounted for seven percent of oil intakes, compared with 17% for matched nonparticipants.

Relative to matched nonparticipants, NSLP participants in one or more school types obtained significantly more of their oil intakes from entrees commonly offered in school lunches (for example, pizza and pizza products, hamburgers/cheeseburgers, sandwiches with breaded/fried meat or poultry, Mexican entrees, and hot dogs) and significantly less of their oil intakes from peanut butter sandwiches and peanuts/nuts/seeds/trail mix.

9. Saturated Fat

School-age children consumed saturated fat from a wide array of food sources (Table C.9). Among elementary school children, common NSLP entrees (pizza and pizza products, Mexican entrees, hamburgers/cheeseburgers, hot dogs), 1% flavored milk, and cheese (consumed separately) made significantly greater contributions to the saturated fat intakes of NSLP participants than matched nonparticipants, and cold cereal, peanuts/nuts/seeds/trail mix, and "Lunchables" made significantly smaller contributions. Among middle school children, corn/tortilla chips and peanut butter sandwiches made significantly smaller contributions to the saturated fat intakes of NSLP participants than matched nonparticipants. Among high school children, dairy-based desserts and flavored 1% milk made significantly greater contributions to the saturated fat intakes of NSLP participants than matched nonparticipants, and snack chips other than corn/tortilla chips and grain/cereal bars made significantly smaller contributions.

10. Sodium

Children obtained sodium from a broad array of foods (Table C.10). However, in all three school types, the leading contributor to sodium intakes of NSLP participants was pizza and pizza products Among elementary school children and middle school children, differences between NSLP participants and matched nonparticipants in the relative contribution of pizza and pizza products to sodium intakes were statistically significant. Other significant differences between NSLP participants and matched nonparticipants were driven by entrée choices or flavored 1% milk. Among elementary school children, cold cereal made a significantly smaller contribution to the sodium intakes of NSLP participants than matched nonparticipants and sweet rolls/donuts/toaster pastries made a significantly greater contribution. Among high school children, snack chips other than corn/tortilla chips made a significantly smaller contribution to sodium intakes of NSLP participants than matched nonparticipants.

11. Discretionary Solid Fats

In all three school types, the leading contributor to discretionary solid fat intakes of NSLP participants was pizza and pizza products (Table C.11). The same was true for matched nonparticipants in high schools. Among matched nonparticipants in elementary and middle schools, the leading contributor to discretionary solid fat intakes was cookies, cakes, and brownies. Significant differences between NSLP participants and matched nonparticipants in the relative contribution of specific foods/food groups to intakes of discretionary solid fats were largely driven by entrée choices and flavored 1% milk. In addition, among high school children, NSLP participants obtained significantly more of their discretionary solid fats from dairy-based desserts, relative to matched nonparticipants, and significantly less from crackers and pretzels and grain/cereal bars.

12. Added Sugars

For all groups of children, the leading contributors to intakes of added sugars were carbonated sodas and juice drinks (Table C.12). Together, these two types of sweetened beverages accounted for 30 to 55 percent of all added sugars. Among high school children, NSLP participants obtained a significantly smaller share of their added sugar intakes from carbonated sodas than did matched nonparticipants (27% versus 41%). In contrast, in all three school types, NSLP participants obtained significantly more of their added sugar intakes from flavored 1% and skim milk than matched nonparticipants.

Among elementary school children, NSLP participants obtained significantly more of their added sugar intakes from sweet rolls/donuts/toaster pastries than matched nonparticipants, and significantly less from cold cereal, yogurt, and fruit-based desserts. Among high school children, NSLP participants obtained significantly more of their added sugar intakes from dairy-based desserts, sweetened tea/coffee (mostly iced tea), and sweet rolls/donuts/toaster pastries than did matched nonparticipants.

C. SUMMARY AND CONCLUSIONS

There were many similarities across school types and NSLP participation status in leading contributors to intakes of MyPyramid groups and other dietary constituents considered in the HEI-2005. For all groups of children:

- 100% fruit juice was the leading contributor to total fruit intakes, when individual types of fruit were considered separately.
- Apples were the leading source of whole fruit.
- Leading contributors to vegetable intakes were french fries and similar potato products, other white potatoes, and condiments and spreads (mainly ketchup).
- Cold cereals were leading contributors to intakes of whole grains.

- Unflavored 2% milk was the leading contributor to intakes in the dairy/milk group.

- Leading contributors to intakes in the meat group, excluding legumes, were unbreaded meat or poultry not consumed as part of a sandwich and breaded/fried chicken products such as chicken nuggets, patties, and strips.

- Major contributors to healthy oils were salad dressing, breaded/fried chicken products, corn/tortilla chips, other snack chip, peanut butter sandwiches, and other condiments and spreads.

- Carbonated sodas and fruit-flavored drinks were the leading contributors to intakes of added sugars.

At the same time, there were noteworthy differences between NSLP participants and matched nonparticipants in the relative contributions of specific foods/food groups. These differences were most often significant for elementary school and middle school students. Some of the differences suggest that participation in the NSLP may serve a protective role, relative to lunches brought from home or obtained from other sources within a school. For example:

- Among elementary school children, NSLP participants obtained a significantly smaller share of their grain intakes from cookies/cakes/brownies and fruit-based desserts than matched nonparticipants.

- Among high school children, NSLP participants obtained a significantly smaller share of their total vegetable, saturated fat, and sodium intakes from snack chips other than corn/tortilla chips (mainly potato chips) than matched nonparticipants.

- Among elementary school children, NSLP participants obtained a significantly smaller share of their added sugar intakes from fruit-based desserts.

- Among high school children, NSLP participants obtained a significantly smaller share of their added sugar intakes from carbonated sodas.

Other significant differences between NSLP participants and matched nonparticipants in the relative contributions of specific foods/food groups may be useful in identifying targets for future program improvement efforts. For example, the findings demonstrated that pizza and

pizza products played a more prominent role in the dietary intakes of NSLP participants than matched nonparticipants. Some of the differences in the relative contribution of pizza and pizza products to intakes of NSLP participants were positive (significantly greater contributions to intakes of vegetables, grains, and whole grains) and some were negative (significantly greater contributions to intakes of saturated fat, sodium, and discretionary solid fats). These findings illustrate the important role that pizza and pizza products play in the dietary intakes of NSLP participants and suggest a need to either reduce the saturated fat, sodium, and solid fat content of pizza and pizza products provided through the NSLP or to replace some of these products with other options that are lower in these dietary constituents.

Similarly, this analysis found that flavored 1% milk plays an important role in the dietary intakes of NSLP participants. Flavored 1% and skim milks account for greater shares of milk/dairy group intakes of NSLP participants than matched nonparticipants. However, flavored 1% milk also accounts for significantly larger shares of NSLP participants' intakes of saturated fat, discretionary solid fats, sodium, and added sugars, relative to matched nonparticipants. Replacing flavored 1% milks with flavored *skim* milks would have a positive effect on NSLP participants' intakes of saturated fat and discretionary solid fats.

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APPENDIX A

SUPPLEMENTARY TABLES: HEALTHY EATING INDEX-2005 SCORES USING ORIGINAL (NOT MODIFIED) CRITERIA FOR MAXIMUM SCORES

This appendix presents findings based on the original (not modified) HEI-2005 standards. The three tables presented in this appendix (Tables A.1-A.3) correspond to Tables III.1 through III.3 in the report. There are no differences between the two sets of findings in the general conclusions drawn about children's diets or about differences between school meal participants and matched nonparticipants. The major difference is that the modified standards generally result in lower scores than the original (not modified) standards.[1] This trend reflects the fact that, on a density (per 1,000 calorie) basis, children need to consume larger amounts from most of the MyPyramid food groups than the population overall, in order to achieve desired intakes without exceeding energy requirements (see Table II.1). In addition, children's diets have substantially less room for discretionary calories (or, as measured in the HEI-2005, SoFAAS calories). Thus, findings based on the modified standards show that the gap between children's intakes and recommendations is greater than suggested by findings based on the original (not modified) standards. Differences between the two sets of findings are most pronounced for elementary school children because, for many HEI-2005 components, their needs are greater (on a per 1,000 calorie basis) than the population overall or than the two older groups of children. Differences between the two sets of findings are generally most pronounced for the following components: Total Vegetables, Dark Green and Orange Vegetables and Legumes, Milk, Meat and Beans, and Calories from SoFAAS.

[1] This is not true for the Saturated Fat component or the Sodium component because no modifications were made to the standards used for these components. In addition, this is not true for components where the modified standard turned out to be the same as the original standard (see Table II.1).

TABLE A.1
HEALTHY EATING INDEX (HEI)-2005 SCORES FOR SCHOOL-AGE CHILDREN IN THE U.S.
ESTIMATED USING ORIGINAL (NOT MODIFIED) CRITERIA FOR MAXIMUM SCORES

HEI Component	Max. Score	Original (Not Modified) HEI-2005 Scores			
		Elementary School Children (n=732)	Middle School Children (n=787)	High School Children (n=795)	All Children (n=2,314)
Total Fruit	5.0	4.1	3.3	3.3	3.7
Whole Fruit (not juice)	5.0	4.1	3.3	2.7	3.5
Total Vegetables	5.0	2.5	2.5	2.7	2.5
Dark Green and Orange Vegetables and Legumes[a]	5.0	0.9	0.7	0.7	0.8
Total Grains	5.0	5.0	5.0	5.0	5.0
Whole Grains	5.0	1.0	0.8	0.9	0.9
Milk[b]	10.0	9.8	8.8	7.6	8.9
Meat and Beans	10.0	8.3	8.7	9.3	8.7
Oils[c]	10.0	6.7	7.2	7.7	7.1
Saturated Fat	10.0	6.2	6.1	5.7	6.0
Sodium	10.0	3.4	3.6	3.4	3.4
Calories from Solid Fats, Alcohol, and Added Sugars (SoFAAS)	20.0	10.3	8.5	8.6	9.4
TOTAL HEI-2005 SCORE	100.0	62.3	58.6	57.5	60.1

Source: Data are from the School Nutrition Dietary Assessment-III, 24-hour dietary recalls, school year 2004-2005. Tabulations are based on one 24-hour recall and weighted to be nationally representative of children in public National School Lunch Program schools. Sample sizes are unweighted.

Note: Standards for all components other than saturated fat and calories from SoFAAS reflect amounts per 1,000 calories. Standards for saturated fat and calories from SoFAAS reflect percentages of total energy intake.

[a] Legumes are counted as vegetables only after the standard for intake of meat and beans is met.

[b] Includes all milk products, including fluid milks, yogurt, and cheese.

[c] Includes nonhydrogenated vegetable oils and oils in fish, nuts, and seeds.

TABLE A.2

HEALTHY EATING INDEX (HEI)-2005 SCORES[a] BY NSLP PARTICIPATION AND SCHOOL TYPE FOR SCHOOL-AGE CHILDREN IN MATCHED SAMPLE[b] (WEIGHTED)

HEI Component	Max. Score	Elementary Schools		Middle Schools		High Schools		All Schools	
		NSLP Participants (n=531)	Matched Nonparticipants (n=142)	NSLP Participants (n=496)	Matched Nonparticipants (n=176)	NSLP Participants (n=358)	Matched Nonparticipants (n=188)	NSLP Participants (n=1,385)	Matched Nonparticipants (n=506)
Total Fruit	5.0	4.1	4.6	3.1	3.9	3.1	2.8	3.7	4.0
Whole Fruit (not juice)	5.0	4.1	4.4	3.1	4.5	2.3	2.2	3.4	3.9
Total Vegetables	5.0	2.6	2.4	2.6	2.0 **	2.7	2.7	2.6	2.4
Dark Green and Orange Vegetables and Legumes[c]	5.0	0.8	1.0	0.7	0.5	0.7	0.4	0.8	0.8
Total Grains	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Whole Grains	5.0	0.9	1.3	0.9	0.8	0.8	1.1	0.9	1.1
Milk[d]	10.0	10.0	8.8	9.6	6.7 **	7.8	7.3	9.6	8.0 *
Meat and Beans	10.0	8.0	8.7	8.4	9.7 *	9.4	8.5	8.4	8.9
Oils[e]	10.0	6.5	7.6	7.0	7.5	7.8	9.0	6.9	7.9 *
Saturated Fat	10.0	6.1	7.2	5.7	7.6 *	6.0	5.7	6.0	7.0
Sodium	10.0	3.3	3.9	3.5	3.5	3.4	3.9	3.3	3.8
Calories from Solid Fats, Alcohol, and Added Sugars (SoFAAS)	20.0	10.2	10.3	8.6	7.9	9.0	7.9	9.6	9.3
TOTAL HEI-2005 SCORE	100.0	61.5	65.1	58.1	59.6	57.8	56.5	60.1	62.1

Source: Data are from the School Nutrition Dietary Assessment-III, 24-hour dietary recalls, school year 2004-2005. Tabulations are based on one 24-hour recall and weighted to be nationally representative of children in public National School Lunch Program schools. Sample sizes are unweighted.

Note: Standards for all components other than saturated fat and calories from SoFAAS reflect amounts per 1,000 calories. Standards for saturated fat and calories from SoFAAS reflect percentages of total energy intake.

[a] HEI-2005 scores were estimated using the original (not modified) scoring criteria for assigning maximum score (see Table II.1).

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

[c] Legumes are counted as vegetables only after the standard for intake of meat and beans is met.

[d] Includes all milk products, including fluid milks, yogurt, and cheese.

[e] Includes nonhydrogenated vegetable oils and oils in fish, nuts, and seeds.

* Difference between NSLP participants and matched nonparticipants is statistically significant at the 0.05 level.

** Difference between NSLP participants and matched nonparticipants is statistically significant at the 0.01 level.

TABLE A.3

HEALTHY EATING INDEX (HEI)-2005 SCORES[a] BY SBP PARTICIPATION AND SCHOOL TYPE FOR SCHOOL-AGE CHILDREN IN MATCHED SAMPLE[b] (WEIGHTED)

HEI Component	Max. Score	Elementary Schools		Middle Schools		High Schools		All Schools	
		SBP Participants (n=160)	Matched Nonparticipants (n=118)	SBP Participants (n=127)	Matched Nonparticipants (n=99)	SBP Participants (n=94)	Matched Nonparticipants (n=85)	SBP Participants (n=381)	Matched Nonparticipants (n=302)
Total Fruit	5.0	4.3	3.6	3.1	3.0	3.6	2.4	4.0	3.3
Whole Fruit (not juice)	5.0	3.7	4.0	2.5	3.3	2.3	1.6	3.2	3.4
Total Vegetables	5.0	2.6	2.5	2.5	2.7	2.6	2.6	2.6	2.6
Dark Green and Orange Vegetables and Legumes[c]	5.0	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.7
Total Grains	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Whole Grains	5.0	0.8	0.9	0.7	0.7	0.7	0.6	0.8	0.8
Milk[d]	10.0	10.0	8.4 **	8.5	7.0	7.3	6.7	9.6	7.8 **
Meat and Beans	10.0	8.4	8.8	8.4	10.0 **	9.0	10.0	8.5	9.3
Oils[e]	10.0	6.9	6.0	8.0	6.7	7.0	6.9	7.1	6.3
Saturated Fat	10.0	5.9	7.3 *	5.9	5.8	6.8	5.0 *	6.1	6.6
Sodium	10.0	3.4	4.2	3.9	3.6	2.6	3.0	3.3	3.9
Calories from Solid Fats, Alcohol, and Added Sugars (SoFAAS)	20.0	10.6	9.5	8.5	7.7	9.5	7.9	10.0	8.9
TOTAL HEI-2005 SCORE	100.0	62.2	60.8	57.6	56.3	57.0	52.5	60.8	58.5

Source: Data are from the School Nutrition Dietary Assessment-III, 24-hour dietary recalls, school year 2004-2005. Tabulations are based on one 24-hour recall and weighted to be nationally representative of children in public National School Lunch Program schools. Sample sizes are unweighted.

Note: Standards for all components other than saturated fat and calories from SoFAAS reflect amounts per 1,000 calories. Standards for saturated fat and calories from SoFAAS reflect percentages of total energy intake.

[a] HEI-2005 scores were estimated using the original (not modified) scoring criteria for assigning maximum score (see Table II.1).

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

[c] Legumes are counted as vegetables only after the standard for intake of meat and beans is met.

[d] Includes all milk products, including fluid milks, yogurt, and cheese.

[e] Includes nonhydrogenated vegetable oils and oils in fish, nuts, and seeds.

* Difference between SBP participants and matched nonparticipants is statistically significant at the 0.05 level.

** Difference between SBP participants and matched nonparticipants is statistically significant at the 0.01 level.

APPENDIX B

SUPPLEMENTARY ESTIMATES: COMPARISON OF PROPENSITY SCORE MATCHING AND REGRESSION ESTIMATES OF THE RELATIONSHIP BETWEEN SCHOOL MEAL PROGRAM PARTICIPATION AND HEI-2005 SCORES

The main analysis of the relationship between school meal program participation and dietary quality used a propensity score matching procedure to adjust for differences in observable characteristics between participants and nonparticipants. Multivariate regression is a commonly used alternative to propensity score matching for adjusting for differences in observable characteristics between groups. The propensity score matching approach was preferred for our main analysis because, unlike the regression approach, it could be applied at the group level, allowing us to deal with group-level HEI-2005 scores constructed following CNPP recommendations (Guenther et al. 2007; Freedman et al. 2008). In this appendix, we briefly examine how results from a regression analysis compare to those from the propensity score matching analysis. These results may be of methodological interest, given that regression adjustment is simpler to implement than propensity score matching. However, as shown, regression results are often inconsistent with those from the preferred propensity-score-matching approach.

A. REGRESSION ANALYSIS

To generate regression-adjusted estimates of the differences in HEI-2005 scores between school meal program participants and nonparticipants, we first computed HEI-2005 scores at the individual level, as the ratio of each individual's food or nutrient intake to their intake of energy. We then estimated the following regression model on the full sample of students, overall and separately by school type (elementary, middle, and high):

(1) $y_i = \alpha_0 + X_i\beta + \alpha_1 NSLP_i + \alpha_2 SBP_i + \varepsilon_i$,

where y_i is student i's HEI-2005 score (total or component); X_i is a set of observable characteristics; $NSLP_i$ is an indicator of the student's NSLP participation status; SBP_i is an

indicator of the student's SBP participation status; and ε_i is a random error term. The estimate of α_1 is the regression-adjusted estimate in the difference in mean HEI-2005 scores between NSLP participants and nonparticipants; the estimate of α_2 is the regression-adjusted estimate in the difference in mean HEI-2005 scores between NSLP participants and nonparticipants.

Covariates in *X* are the same as those used by Gordon et al. (2007b) to generate regression adjusted estimates of mean nutrient intakes and are similar to those used in the propensity score matching models. Table B.1 lists the covariates included in both the propensity score matching and regression models. The set of covariates included in the regression models includes all covariates included in the propensity score matching models along with several additional covariates, since, in the interest of parsimony, the propensity score matching models included only those characteristics that had been shown to be correlated with nutrient intakes and were also thought to influence participation (Gordon et al. 2007c, Appendix I).

B. COMPARISON OF REGRESSION AND PROPENSITY SCORE MATCHING RESULTS

Estimates of participant-nonparticipant differences in HEI-2005 scores from the regression models could differ from our main propensity score matching estimates for two reasons: (1) computation of HEI-2005 scores at the individual versus group level, and (2) differences in statistical technique (regression adjustment versus propensity score matching). To isolate the effects of these two factors, we present results from three different estimation models:

1. Propensity score matching estimates using scores computed at the group level (our main analysis results)
2. Propensity score matching estimates using scores computed at the individual level
3. Regression adjusted estimates using scores computed at the individual level

TABLE B.1

COVARIATES INCLUDED IN REGRESSION MODELS OF HEI-2005 SCORES

Covariate	Values
NSLP participation	A binary variable indicating the student participated in the NSLP
SBP participation	A binary variable indicating the student participated in the SBP
Gender	A binary variable indicating the student's gender
Race/ethnicity	A set of three binary variables indicating the student's race/ethnicity
Age	A set of 12 binary variables indicating the student's age
Hearty eater	A set of two binary variables indicating how much the student eats relative to others
Picky eater	A set of two binary variables indicating whether the student is not picky, somewhat picky, or very picky
Height	The student's height in feet
Food allergies[a]	A binary variable indicating whether the student has food allergies or special dietary needs
Dieting	A binary variable indicating whether the student is on a diet
Dietary supplement use[a]	A binary variable indicating whether the student takes dietary supplements
Health status	A set of three binary variables indicating how healthy the student is, based on parent reports
Physical activity[a]	A set of three binary variables indicating the student's level of physical activity relative to others
TV watching[a]	A set of three binary variables indicating the amount of television the student watches per day
Family income	A set of four binary variables indicating the student's family income relative to poverty
Public assistance[a]	A binary variable indicating whether the student's family receives public assistance
Number of children in household[a]	A set of two binary variables indicating the number of children in the household

Covariate	Values
Relationship of respondent to student[a]	A binary variable indicating whether the respondent was the student's parent or partner of parent
Parental employment[a]	A set of four binary variables indicating the employment status of the student's parent(s)
Primary language spoken at home	A set of two binary variables indicating the primary language spoken in the student's home
Parental education[a]	A set of two binary variables indicating the highest level of education completed by the student's parent(s)
Family dining habits[a]	A binary variable indicating whether the student's family eats dinner together 5 nights a week or more
School SBP participation[a]	A binary variable indicating whether the student's school participated in the SBP
Open campus[a]	A binary variable indicating whether the student's school has an open-campus policy
Competitive foods offered during mealtimes[a]	A binary variable indicating whether the student's school offers competitive foods during mealtimes
Healthy foods offered competitively[a]	A binary variable indicating whether the student's school offers healthy foods offered in vending machines, snack bars, or school store
Healthy foods offered a la carte[a]	A binary variable indicating whether the student's school offers healthy foods a la carte
Recess[a]	A binary variable indicating whether the student's school offers recess
Urbanicity	A set of three binary variables indicating whether the student's school serves an urban area, urban fringe, town, or rural area
Region	A set of six binary variables indicating which region of the country the student lives in
Day of week[a]	A set of four binary variables indicating the day of the week of the student's dietary recall
Imputation indicators[a]	A set of five binary variables indicating whether the values of particular covariates were imputed for that student

[a] These variables were not included in the propensity score matching model since they did not appear to be correlated with students' nutrient intakes.

Although the primary comparison of interest is between models 1 and 3 (to see how results from the propensity score matching and regression adjustment approaches differ), results from model 2 can shed light on whether any differences are due to the use of individual versus group scores or to the statistical procedure (propensity score matching versus regression adjustment). Results from these three approaches are presented in Table B.2 (differences in NSLP participation between participants and nonparticipants) and Table B.3 (differences in SBP participation between participants and nonparticipants).

As shown in Table B.2, overall, there are no statistically significant different in Total HEI-2005 scores between NSLP participants and nonparticipants regardless of the method that is used, and estimated differences are 2 points or less (which is small, relative to the average total score of about 50). There are, however, some differences in magnitude and statistical significance of estimates for the individual component scores. For instance, models 2 and 3 show statistically significant differences of 0.2-0.3 points on the Total Grains component, compared with a null effect under model 1. For the Oils component, models 1 and 2 show statistically significant differences of close to 1 point, while the difference estimated in model 3 is small and not statistically significant.

In general, across the different school types, results also vary according to the estimation approach in both magnitude and statistical significance. In some cases, when results from the regression estimates differ from the main propensity score matching estimates these differences appear to be driven primarily by the estimation procedure (with results from model 2 more closely matching results from model 1), while in other cases they seem to be driven primarily by the computation of scores at the individual level (with results from model 2 more closely matching results from model 3).

Table B.2

Estimated Differences in HEI-2005 Scores Between NSLP Participants and Nonparticipants: Comparison of Propensity Score Matching and Regression Adjustment Approaches

	All			Elementary			Middle			High		
Score	1	2	3	1	2	3	1	2	3	1	2	3
HEI1: TOTAL FRUIT	-0.4	-0.2	-0.1	-0.5	-0.4	0.0	-0.8	-0.2	0.0	0.3	0.3	0.0
HEI2: WHOLE FRUIT	-0.5	0.0	0.1	-0.3	0.0	0.3	-1.3	-0.2	0.0	0.1	0.0	-0.2
HEI3: TOTAL VEGETABLES	0.2	0.1	0.1	0.2	0.1	0.3 *	0.5 **	0.3 *	0.1	0.0	0.0	0.0
HEI4: DARK GREEN & ORANGE VEG & LEGUMES	0.0	-0.1	0.0	-0.1	-0.2	0.1	0.1	0.1	-0.1	0.2	0.1	0.0
HEI5: TOTAL GRAINS	0.0	0.3 **	0.2 **	0.0	0.3 *	0.1	0.0	0.1	0.1	0.2	0.4 *	0.3 *
HEI6: WHOLE GRAINS	-0.3	-0.2	-0.1	-0.4	-0.3	-0.2	0.1	0.1	0.1	-0.3	-0.1	-0.1
HEI7: MILK	1.4 *	1.1 **	1.0 **	1.1	1.1 *	1.2 **	2.8 **	1.7 **	1.1 **	0.5	0.7	0.6 *
HEI8: MEAT & BEANS	-0.4	-0.2	-0.1	-0.7	-0.3	-0.5	-1.2 *	-0.6	-0.3	0.9	0.6 *	0.7 **
HEI9: OILS	-0.9 *	-0.6 *	-0.2	-1.0	-0.8	-0.6	-0.5	0.0	0.5	-1.2	-0.4	0.0
HEI10: SATURATED FAT	-1.0	-0.6 *	-0.1	-1.2	-0.7	-0.1	-1.9 *	-1.1 **	-0.3	0.3	0.0	0.3
HEI11: SODIUM	-0.5	-0.5	-0.3	-0.6	-0.6	-0.5	0.0	-0.1	0.0	-0.6	-0.6	-0.3
HEI12: CALORIES FROM SOLID FATS, ALCOHOL & ADDED SUGARS (SoFAAS)	0.3	0.1	0.4	-0.1	-0.6	-0.1	0.6	0.7	0.4	0.9	1.3 *	1.2 **
HEI2005: TOTAL HEI-2005 SCORE	-2.1	-0.7	0.9	-3.5	-2.3	-0.1	-1.6	0.8	1.7	1.3	2.3	2.5 *
NUMBER OF STUDENTS	1,891	1,891	2,314	673	673	732	672	672	787	546	546	795

1 = Propensity score matching with group-level scores (main results)

2 = Propensity score matching with individual-level scores

3 = Regression adjustment with individual-level scores

Note: Numbers in table are differences between scores for NSLP participants and nonparticipants.

Table B.3
Estimated Differences in HEI-2005 Scores Between SBP Participants and Nonparticipants:
Comparison of Propensity Score Matching and Regression Adjustment Approaches

	All			Elementary			Middle			High		
Score	1	2	3	1	2	3		2	3	1	2	3
HEI1: TOTAL FRUIT	0.6	0.4	0.3	0.7	0.4	0.3	0.1	0.0	0.1	1.1	0.7 *	0.4
HEI2: WHOLE FRUIT	-0.2	-0.1	0.1	-0.3	-0.1	0.2	-0.8	-0.6	-0.2	0.7	0.3	0.1
HEI3: TOTAL VEGETABLES	0.0	-0.1	0.0	0.0	0.0	0.0	-0.2	-0.2	-0.1	-0.1	-0.1	0.0
HEI4: DARK GREEN & ORANGE VEG & LEGUMES	0.0	-0.1	-0.1	-0.1	-0.2	-0.1	0.0	0.0	0.0	0.0	0.1	0.1
HEI5: TOTAL GRAINS	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.1	0.2
HEI6: WHOLE GRAINS	0.0	-0.1	0.0	-0.1	-0.1	0.0	0.0	0.0	-0.1	0.1	-0.1	-0.1
HEI7: MILK	1.6 **	1.2 **	0.6 **	1.8 **	1.3 **	0.7 **	1.4	1.3 *	0.7 *	0.6	0.8	0.4
HEI8: MEAT & BEANS	-0.7	-0.4	-0.3	-0.3	-0.3	-0.3	-1.5 **	-0.6	-0.4	-1.2	-0.4	-0.2
HEI9: OILS	0.7	0.6	0.3	0.8	0.5	0.3	1.2	0.7	0.8 *	0.1	0.7	-0.1
HEI10: SATURATED FAT	-0.5	-0.3	0.0	-1.4 *	-0.7 *	-0.3	0.1	0.2	0.0	1.8 *	1.2 *	0.7 *
HEI11: SODIUM	-0.5	-0.4	-0.2	-0.8	-0.6	0.0	0.3	-0.3	-0.1	-0.4	0.1	-0.7 *
HEI12: CALORIES FROM SOLID FATS, ALCOHOL & ADDED SUGARS (SoFAAS)	0.9	0.4	0.3	0.8	0.3	-0.2	0.6	0.8	0.4	1.3	0.4	0.8
HEI2005: TOTAL HEI-2005 SCORE	1.9	1.2	1.1	1.3	0.5	0.5	1.1	1.5	1.2	4.1	3.8	1.6
NUMBER OF STUDENTS	683	683	2,314	278	278	732	226	226	787	179	179	795

1 = Propensity score matching with group-level scores (main results)

2 = Propensity score matching with individual-level scores

3 = Regression adjustment with individual-level scores

Note: Numbers in table are differences between scores for NSLP participants and nonparticipants.

Similarly, for estimates of differences in HEI-2005 scores between SBP participants and nonparticipants (Table B.3), estimated differences in total scores are generally small and are never statistically significant across any of the estimation approaches. However, estimates do vary between the propensity score matching and regression estimates for individual component scores. In some cases these differences appear to be largely driven by differences in whether the score was computed at the group or individual level, and in other cases to the difference in estimation method.

The propensity score matching approach is the only possible method for adjusting for differences in individual characteristics between participants and nonparticipants while still following CNPP's recommendation of computing scores at the group level. Results of this comparative analysis suggest that estimating differences in HEI-2005 scores using regression models may yield substantively different conclusions, both due to the fact that scores must be computed at the individual level and to the differences in statistical technique.

APPENDIX C

SUPPLEMENTARY TABLES:
FOOD SOURCES OF MYPYRAMID INTAKES

TABLE C.1

FOOD SOURCES OF TOTAL FRUIT (FRUIT AND JUICE) CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Fruit juice, 100%	44.4	42.8		Fruit juice, 100%	39.0	34.3		Fruit juice, 100%	51.3	46.7	
Apple	11.9	18.2		Apple	18.6	18.5		Apple	14.3	10.4	
Banana	7.7	2.3	**	Banana	9.2	11.3		Juice drinks (not 100% juice)	10.3	12.0	
Citrus fruit	4.9	5.9		Juice drinks (not 100% juice)	9.1	7.0		Banana	5.6	7.3	
Juice drinks (not 100% juice)	4.7	6.8		Citrus fruit	3.2	3.6		Fruit cocktail	2.6	0.9	
Melons	4.0	10.7		Peaches	3.1	0.4		Citrus fruit	2.1	6.2	
Applesauce	3.3	0.5	**	Melons	2.5	12.9		Melons	2.1	3.3	
Fruit cocktail	2.5	0.4	**	Berries	1.9	3.3		Peaches	2.0	1.2	
Peaches	2.5	1.3		Grapes	1.9	1.9		Other fresh fruit	1.8	1.5	
Grapes	2.2	0.9		Pears	1.8	1.7		Pears	1.4	0.0	
Other fresh fruit	1.9	1.5		Other fresh fruit	1.7	0.6		Pineapple	1.0	2.4	
Berries	1.8	2.5		Fruit cocktail	1.3	0.7		Applesauce	0.9	0.3	
Pears	1.4	1.0		Pineapple	1.2	0.0	**	Cookies, cakes, brownies	0.7	0.7	
Pineapple	1.4	0.1	*	Fruit-based desserts	1.0	0.7		Fruit-based desserts	0.6	0.2	
Fruit-based desserts	1.3	1.8						Berries	0.5	2.3	

TABLE C.2

FOOD SOURCES OF WHOLE FRUIT CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Apple	24.2	38.0		Apple	37.1	32.2		Apple	38.2	26.0	
Banana	15.5	4.8	**	Banana	18.4	19.7		Banana	14.9	18.2	
Citrus fruit	9.9	12.3		Citrus fruit	6.5	6.4		Fruit cocktail	7.0	2.4	*
Melons	8.2	22.2		Peaches	6.1	0.6	*	Citrus fruit	5.6	15.6	
Applesauce	6.6	1.1	**	Melons	5.0	22.5		Melons	5.5	8.2	
Fruit cocktail	5.1	0.8	**	Berries	3.8	5.8		Peaches	5.2	3.0	
Peaches	5.1	2.8		Grapes	3.8	3.3		Other fresh fruit	4.9	3.7	
Grapes	4.4	1.8		Pears	3.5	2.9		Pears	3.7	0.0	
Other fresh fruit	3.8	3.2		Other fresh fruit	3.4	1.0		Pineapple	2.7	6.1	
Berries	3.6	5.2		Fruit cocktail	2.7	1.2		Applesauce	2.4	0.8	
Pears	2.9	2.0		Pineapple	2.3	0.0	**	Cookies, cakes, brownies	1.8	1.7	
Pineapple	2.8	0.2	*	Applesauce	1.5	1.1		Berries	1.3	5.7	
Cookies, cakes, brownies	1.2	1.4		Cookies, cakes, brownies	1.2	0.4		Other frozen fruit	1.1	0.0	
Yogurt	0.4	1.1						Fruit-based desserts	1.0	0.0	
								Grapes	0.9	1.5	
								Condiments and spreads	0.3	1.6	
								Cold cereal	0.2	1.9	

TABLE C.3

FOOD SOURCES OF TOTAL VEGETABLES CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
French fries/potato products	11.5	15.6		Condiments and spreads	10.5	12.7		French fries/potato products	13.6	11.4	
Condiments and spreads	9.4	8.8		Pizza and pizza products	9.5	8.5		White potatoes	13.5	6.8	*
White potatoes	9.2	18.8		French fries/potato products	9.2	10.4		Condiments and spreads	13.3	8.4	*
Mixtures with pasta or noodle base	9.1	4.3	*	Snack chips (popcorn, potato chips)	8.7	7.9		Pizza and pizza products	9.3	6.0	
Pizza and pizza products	8.8	2.9	**	Lettuce salads	8.3	7.9		Mixtures with pasta or noodle base	8.2	13.7	
Lettuce salads	6.5	1.5	**	White potatoes	6.9	17.8		Lettuce salads	6.5	5.3	
Corn	6.0	7.8		Mixtures with pasta or noodle base	5.9	4.8		Snack chips (popcorn, potato chips)	5.7	16.0	**
Snack chips (popcorn, potato chips)	5.6	8.9		Corn	4.5	3.7		Entree salads, entree salad bars	5.4	4.9	
Entree salads, entree salad bars	4.1	1.8		Soups	4.1	0.6		Mixtures with meat/grain/ vegetables	3.5	6.1	
String beans	3.0	1.2	*	Mexican-style entrees	4.0	1.5	*	Corn	2.9	2.6	

TABLE C.3 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Mexican-style entrees	3.0	0.7	**	Mixtures with meat/grain/ vegetables	3.8	6.9		Mexican-style entrees	1.9	2.2	
Broccoli	2.5	2.5		Entree salads, entree salad bars	3.2	1.1		String beans	1.7	2.5	
Mixed vegetables	2.3	0.7		Rice/pasta	2.4	1.3		Carrots	1.6	1.2	
Carrots	2.1	5.0		Chili con carne	2.4	1.8		Chili con carne	1.4	0.3	
Mixtures with meat/grain/ vegetables	1.7	4.4		String beans	2.2	0.4	**	Rice/pasta	1.2	0.8	
Other raw vegetables	1.5	3.6		Broccoli	2.2	3.6		Hamburgers/ cheeseburgers	1.2	1.3	
Hamburgers/ cheeseburgers	1.4	0.5		Carrots	1.7	2.5		Sandwiches with plain meat or poultry	1.2	0.0	**
Unbreaded poultry/meat/ fish	1.3	0.2		Other raw vegetables	1.5	1.8		Soups	1.2	0.8	
Tomatoes	1.1	0.6		Vegetable soups	1.4	0.2	*	Beef or chicken stir fry	0.6	2.3	
Soups	1.1	1.0		Unbreaded poultry/meat/ fish	1.0	0.2		Vegetable soups	0.5	1.1	
Rice/pasta	0.9	1.4		Peas	0.7	1.3		Unbreaded poultry/meat/ fish	0.3	2.7	
Vegetable soups	0.7	1.4		Mixed vegetables	0.7	1.2		Other raw vegetables	0.2	1.3	

TABLE C.4

FOOD SOURCES OF TOTAL GRAINS CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Pizza and pizza products	12.0	4.5	**	Pizza and pizza products	14.8	9.7	*	Pizza and pizza products	14.0	12.1	
White bread, rolls, bagels	8.4	5.5		White bread, rolls, bagels	7.9	4.9		White bread, rolls, bagels	7.0	7.0	
Crackers and pretzels	6.5	8.1		Cold cereal	6.5	5.9		Sandwiches with plain meat or poultry	6.5	7.2	
Mixtures with pasta or noodle base	6.4	4.0		Cookies, cakes, brownies	5.6	7.0		Mixtures with pasta or noodle base	6.5	7.5	
Cookies, cakes, brownies	5.8	8.8	*	Mixtures with pasta or noodle base	5.5	4.2		Corn/tortilla chips	5.8	6.6	
Sweet rolls, donuts, toaster pastries	5.1	2.4	*	Corn/tortilla chips	5.4	8.3		Cookies, cakes, brownies	5.8	7.4	
Mexican-style entrees	5.0	3.2		Mexican-style entrees	5.3	3.8		Hamburgers/ cheeseburgers	5.5	3.8	
Cold cereal	4.9	8.5	*	Hamburgers/ cheeseburgers	5.3	3.2		Mexican-style entrees	5.2	4.8	
Corn/tortilla chips	4.7	4.5		Crackers and pretzels	5.0	4.6		Sweet rolls, donuts, toaster pastries	5.1	3.1	
Breaded/fried chicken products	4.6	4.3		Sandwiches with plain meat or poultry	3.9	5.8		Cold cereal	4.6	8.1	

TABLE C.4 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Hamburgers/ cheeseburgers	4.6	1.7	**	Sweet rolls, donuts, toaster pastries	3.7	6.1		Breaded/fried meat or poultry sandwich	4.1	2.7	
Pancakes, waffles, French toast	3.8	5.0		Rice/pasta	3.5	3.2		Breaded/fried chicken products	3.8	3.6	
Sandwiches with plain meat or poultry	3.4	7.2		Breaded/fried chicken products	3.3	4.3		Biscuits, croissants, cornbread	3.2	2.6	
Rice/pasta	3.1	5.5		Breaded/fried meat or poultry sandwich	2.9	0.6	**	Rice/pasta	2.7	5.7	
Hot dog on a bun/corn dog	2.8	0.8	**	Pancakes, waffles, French toast	2.2	1.6		Pancakes, waffles, French toast	2.5	0.3	**
Peanut butter sandwiches	2.8	6.4		Hot dog on a bun/corn dog	2.1	1.7		Crackers and pretzels	1.7	4.0	
Biscuits, croissants, cornbread	1.5	3.1		Biscuits, croissants, cornbread	2.0	2.4		Hot dog on a bun/corn dog	1.6	0.6	
Whole grain breads and rolls	1.4	2.3		Cheese sandwiches	1.4	0.7		Breakfast sandwiches	1.5	0.4	*
Breaded/fried meat or poultry sandwich	1.4	1.9		Snack chips (popcorn, potato chips)	1.4	1.0		Whole grain breads and rolls	1.4	0.9	
Muffins, sweet/quick breads	1.3	0.9		Peanut butter sandwiches	1.3	4.1	**	Mixtures with meat/grain/vegetables	1.4	0.9	

TABLE C.4 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Snack chips (popcorn, potato chips)	1.2	1.1		Buttered toast/bagels with cream cheese	1.3	0.1	**	Peanut butter sandwiches	1.2	1.2	
Hot cereal	1.2	0.5		Whole grain breads and rolls	1.2	3.0		Snack chips (popcorn, potato chips)	1.0	1.5	
Buttered toast/bagels with cream cheese	1.2	0.7		Muffins, sweet/quick breads	1.1	0.5		Breaded/fried beef/pork/fish	1.0	0.6	
Cheese sandwiches	1.2	1.8		Soups	1.1	5.5		Buttered toast/bagels with cream cheese	0.7	1.3	
Soups	1.0	0.5		Mixtures with meat/grain/ vegetables	0.9	2.5		Grain/fruit cereal bars, granola bars	0.6	1.8	*
Fruit-based desserts	0.3	1.5	**	Grain/fruit cereal bars, granola bars	0.5	1.0					
Breakfast sandwiches	0.3	1.7									
Lunchables	0.1	1.0	**								

TABLE C.5

FOOD SOURCES OF WHOLE GRAINS CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Cold cereal	23.0	30.9		Cold cereal	33.9	21.0		Cold cereal	31.3	46.1	
Snack chips (popcorn, potato chips)	16.8	9.4		Snack chips (popcorn, potato chips)	18.1	15.4		Snack chips (popcorn, potato chips)	14.8	14.5	
Hot cereal	13.2	4.7		Pizza and pizza products	11.3	3.5	**	Hot cereal	11.6	7.1	
Pizza and pizza products	10.8	0.3	**	Crackers and pretzels	5.2	3.3		Pizza and pizza products	9.0	1.5	*
Pancakes, waffles, French toast	6.8	8.1		Whole grain breads and rolls	5.1	16.0		Whole grain breads and rolls	6.5	1.8	**
Whole grain breads and rolls	6.1	8.0		Hot cereal	4.8	0.5	*	Sandwiches with plain meat or poultry	5.2	6.6	
Grain/fruit cereal bars, granola bars	5.2	3.0		Grain/fruit cereal bars, granola bars	4.4	6.8		Grain/fruit cereal bars, granola bars	4.3	12.9	
Crackers and pretzels	3.9	2.5		Pancakes, waffles, French toast	4.2	1.9		Pancakes, waffles, French toast	4.0	0.0	*
Rice/pasta	3.7	1.9		Sandwiches with plain meat or poultry	2.1	9.6	*	Hot dog on a bun/corn dog	2.0	0.1	
Sandwiches with plain meat or poultry	1.9	10.4		Rice/pasta	1.4	10.4		Cookies, cakes, brownies	1.9	2.0	

TABLE C.5 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Cookies, cakes, brownies	1.7	1.7		Candy	1.2	0.0		Breakfast sandwiches	1.3	0.3	
Peanut butter sandwiches	1.5	3.5		Peanut butter sandwiches	1.2	4.9		Breaded/fried meat or poultry sandwich	1.2	0.0	
Breaded/fried meat or poultry sandwich	1.3	0.0		Cookies, cakes, brownies	1.2	1.0		Corn/tortilla chips	1.1	0.0	
Biscuits, croissants, cornbread	0.0	1.4		Corn/tortilla chips	1.0	2.7		Hamburgers/ cheeseburgers	1.1	0.3	
				Breakfast sandwiches	0.7	1.7		Peanut butter sandwiches	1.0	1.8	
								Crackers and pretzels	0.9	3.6	

TABLE C.6
FOOD SOURCES OF MILK (DAIRY) CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
2% milk, unflavored	19.7	34.6		2% milk, unflavored	21.4	22.0		2% milk, unflavored	23.8	21.2	
1% milk, flavored	12.8	2.7	**	Pizza and pizza products	12.2	9.5		Pizza and pizza products	13.4	8.5	
1% milk, unflavored	11.9	8.8		1% milk, unflavored	10.9	10.1		1% milk, flavored	10.6	3.1	**
Pizza and pizza products	10.6	2.9	**	1% milk, flavored	9.7	4.6	*	Whole milk, unflavored	7.7	11.1	
Whole milk, unflavored	8.8	15.4		Whole milk, unflavored	7.8	7.6		Skim or nonfat milk, flavored	5.6	0.3	**
Skim or nonfat milk, flavored	6.4	0.9	**	Skim or nonfat milk, flavored	5.2	2.2	*	1% milk, unflavored	5.3	9.4	
2% milk, flavored	3.6	7.2		Skim or nonfat milk, unflavored	4.8	8.4		Mexican-style entrees	5.2	6.0	
Mexican-style entrees	3.2	1.7		Mexican-style entrees	3.8	3.2		Sandwiches with plain meat or poultry	4.2	9.1	
Mixtures with pasta or noodle base	3.1	2.1		Cheese	3.5	4.1		Mixtures with pasta or noodle base	3.9	4.5	
Cheese	2.6	1.1	*	2% milk, flavored	2.8	1.2		Skim or nonfat milk, unflavored	3.1	4.4	
Dairy-based desserts	2.5	2.2		Mixtures with pasta or noodle base	2.8	3.9		Hamburgers/ cheeseburgers	2.5	2.1	

TABLE C.6 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Skim or nonfat milk, unflavored	2.3	3.9		Sandwiches with plain meat or poultry	2.1	3.1		Dairy-based desserts	2.1	1.3	
Other milk items	2.2	1.4		Hamburgers/ cheeseburgers	2.0	1.4		2% milk, flavored	1.9	1.1	
Sandwiches with plain meat or poultry	1.6	3.2		Dairy-based desserts	1.9	3.0		Cheese	1.9	2.5	
Yogurt	1.5	4.8	*	Cheese sandwiches	1.6	0.7		Other milk items	1.3	3.5	
Condiments and spreads	1.1	0.8		Yogurt	1.5	2.2		Condiments and spreads	0.8	2.2	
Cheese sandwiches	1.0	1.8		Other milk items	1.4	2.9		Candy	0.7	1.1	
Hamburgers/ cheeseburgers	1.0	0.7		Whole milk, flavored	0.3	2.0		Entree salads, entree salad bars	0.7	1.1	
				Broccoli	0.2	1.2		Yogurt	0.6	1.1	
				Mixtures with meat/grain/ vegetables	0.1	1.5		Eggs	0.2	1.2	
								Hot cereal	0.0	1.1	

TABLE C.7

FOOD SOURCES OF MEAT EQUIVALENTS (EXCLUDING LEGUMES) CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Unbreaded poultry/meat/ fish	19.4	21.4		Unbreaded poultry/meat/ fish	18.2	24.3		Unbreaded poultry/meat/ fish	19.4	16.6	
Breaded/fried chicken products	18.2	20.2		Breaded/fried chicken products	15.0	15.4		Breaded/fried chicken products	14.5	14.8	
Hamburgers/ cheeseburgers	10.5	2.9	**	Hamburgers/ cheeseburgers	10.8	4.6	*	Sandwiches with plain meat or poultry	10.3	14.2	
Peanut butter sandwiches	6.1	7.5		Sandwiches with plain meat or poultry	7.5	8.7		Hamburgers/ cheeseburgers	9.7	7.0	
Hot dog on a bun/corn dog	5.1	1.3	**	Mexican-style entrees	6.9	3.9		Breaded/fried beef/pork/fish	7.3	4.1	
Mexican-style entrees	5.1	2.5	*	Mixtures with pasta or noodle base	5.6	2.7	*	Breaded/fried meat or poultry sandwich	4.2	2.7	
Sandwiches with plain meat or poultry	5.0	9.6		Breaded/fried beef/pork/fish	4.1	3.8		Mixtures with pasta or noodle base	4.2	6.1	
Breaded/fried beef/pork/fish	4.5	7.6		Peanut butter sandwiches	3.9	7.9		Mexican-style entrees	3.6	5.5	

TABLE C.7 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	**Participants**	**Matched Non-Participants**		**Food Group/Food(s)**	**Participants**	**Matched Non-Participants**		**Food Group/Food(s)**	**Participants**	**Matched Non-Participants**	
Sausages, hot dogs, cold cuts	4.5	2.2		Hot dog on a bun/corn dog	3.5	2.4		Peanut butter/nuts/ seeds/trail mixes	3.4	2.1	
Mixtures with pasta or noodle base	4.5	2.6		Breaded/fried meat or poultry sandwich	3.4	0.4	**	Mixtures with meat/grain/ vegetables	2.9	3.4	
Peanut butter/nuts/ seeds/trail mixes	2.7	9.1	*	Pizza and pizza products	2.8	1.7		Peanut butter sandwiches	2.5	2.6	
Eggs	2.2	1.1		Mixtures with meat/grain/ vegetables	2.6	8.4		Pizza and pizza products	2.2	2.6	
Breaded/fried meat or poultry sandwich	1.9	2.0		Eggs	2.2	2.5		Sausages, hot dogs, cold cuts	2.1	1.3	
Pizza and pizza products	1.9	0.6	*	Peanut butter/nuts/ seeds/trail mixes	2.1	5.3		Hot dog on a bun/corn dog	2.1	1.0	
Soups	1.7	2.6		Soups	1.7	0.5		Entree salads, entree salad bars	1.9	1.5	
Mixtures with meat/grain/ vegetables	1.3	2.5		Entree salads, entree salad bars	1.7	0.2		Breakfast sandwiches	1.8	0.7	

TABLE C.7 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Entree salads, entree salad	1.0	0.3		Chili con carne	1.5	0.7		Eggs	1.3	2.4	
Breakfast sandwiches	0.4	1.4		Sausages, hot dogs, cold cuts	1.2	3.1		Soups	1.2	0.8	
				Candy	1.1	0.4	*	Chili con carne	1.0	0.2	
								Candy	0.9	2.0	
								Cookies, cakes, brownies	0.8	3.8	
								Beef or chicken stir fry	0.6	2.1	

TABLE C.8
FOOD SOURCES OF OILS CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Breaded/fried chicken products	15.6	17.3		Salad dressings	14.5	12.9		Salad dressings	18.8	14.6	
Corn/tortilla chips	10.4	10.2		Snack chips (popcorn, potato chips)	12.6	6.6	*	Breaded/fried chicken products	11.1	10.6	
Snack chips (popcorn, potato chips)	9.4	10.1		Corn/tortilla chips	12.1	19.1	*	Corn/tortilla chips	9.0	10.7	
Peanut butter sandwiches	8.7	10.7		Breaded/fried chicken products	10.8	15.9		Condiments and spreads	8.2	9.0	
Salad dressings	8.1	12.0		Condiments and spreads	5.9	7.2		Snack chips (popcorn, potato chips)	7.4	17.0	*
Condiments and spreads	7.4	6.4		Breaded/fried meat or poultry sandwich	5.5	0.5	**	Breaded/fried meat or poultry sandwich	6.1	3.7	
Pizza and pizza products	4.0	0.8	**	Peanut butter sandwiches	5.3	11.9	*	Candy	5.1	6.5	
Peanut butter/nuts/ seeds/trail mixes	3.4	10.8	*	Candy	4.6	3.0		Peanut butter/nuts/ seeds/trail mixes	4.3	2.2	
Hamburgers/ cheeseburgers	3.3	0.7	**	Pizza and pizza products	4.4	2.0	**	Peanut butter sandwiches	3.6	2.8	

TABLE C.8 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
French fries/potato products	3.0	2.1		Mexican-style entrees	3.4	1.9		Pizza and pizza products	3.2	1.3	*
Candy	3.0	3.4		Peanut butter/nuts/ seeds/trail mixes	2.6	6.8		Mexican-style entrees	3.2	1.9	
Breaded/fried meat or poultry sandwich	2.8	2.3		Hamburgers/ cheeseburgers	2.6	0.9	**	Hamburgers/ cheeseburgers	2.2	1.2	
Mexican-style entrees	2.1	0.6	*	Cookies, cakes, brownies	1.7	1.4		Cookies, cakes, brownies	2.0	2.9	
Unbreaded poultry/meat/ fish	1.9	0.4		Sandwiches with plain meat or poultry	1.4	1.1		Sandwiches with plain meat or poultry	1.7	1.1	
Cookies, cakes, brownies	1.5	2.3		Rice/pasta	1.2	0.2	*	Mixtures with meat/grain/ vegetables	1.3	1.1	
White bread, rolls, bagels	1.3	0.7		Hot dog on a bun/corn dog	1.2	0.5	*	White bread, rolls, bagels	1.2	1.2	
Hot dog on a bun/corn dog	1.3	0.3	**	Breaded/fried beef/pork/fish	1.1	1.4		Breaded/fried beef/pork/fish	1.1	1.0	
Mixtures with pasta or noodle base	1.2	0.3		French fries/potato products	1.0	0.3		Okra	1.0	0.0	
Sandwiches with plain meat or poultry	1.1	0.8		White bread, rolls, bagels	1.0	0.6		French fries/potato products	0.9	1.5	

TABLE C.8 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Breaded/fried beef/pork/fish	1.1	0.3		Breakfast sandwiches	0.2	1.1		Rice/pasta	0.5	1.0	
Pancakes, waffles, French toast	1.0	0.0	*					Unbreaded poultry/meat/ fish	0.5	3.6	
Rice/pasta	0.6	1.1									
Other raw vegetables	0.5	1.0									
Cold cereal	0.3	1.1									

TABLE C.9

FOOD SOURCES OF SATURATED FAT CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Pizza and pizza products	8.1	2.8	**	Pizza and pizza products	9.5	6.9		Pizza and pizza products	9.1	7.4	
2% milk, unflavored	6.5	10.4		Mexican-style entrees	7.1	4.6		Mexican-style entrees	6.3	6.8	
Dairy-based desserts	5.7	3.9		2% milk, unflavored	6.5	5.1		Hamburgers/ cheeseburgers	6.2	4.4	
Mexican-style entrees	5.6	2.4	**	Hamburgers/ cheeseburgers	5.5	3.1		2% milk, unflavored	5.9	4.8	
Condiments and spreads	5.2	5.4		Dairy-based desserts	5.3	3.5		Sandwiches with plain meat or poultry	5.2	8.4	
Hamburgers/ cheeseburgers	4.7	2.0	**	Condiments and spreads	4.6	5.2		Condiments and spreads	5.1	5.7	
Breaded/fried chicken products	4.6	6.1		Mixtures with pasta or noodle base	4.1	3.6		Mixtures with pasta or noodle base	4.6	4.7	
Mixtures with pasta or noodle base	4.4	3.1		Cookies, cakes, brownies	4.0	4.9		Breaded/fried chicken products	4.4	3.7	
Whole milk, unflavored	4.3	6.9		Breaded/fried chicken products	3.9	5.5		Dairy-based desserts	4.3	1.8	**
Cookies, cakes, brownies	3.9	5.3		Whole milk, unflavored	3.5	2.6		Cookies, cakes, brownies	4.2	6.0	

TABLE C.9 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Hot dog on a bun/corn dog	3.3	1.1	*	Unbreaded poultry/meat/ fish	3.2	6.2		Unbreaded poultry/meat/ fish	3.7	3.2	
Unbreaded poultry/meat/ fish	3.3	2.8		Snack chips (popcorn, potato chips)	3.1	2.1		French fries/potato products	3.4	2.7	
Sandwiches with plain meat or poultry	2.5	4.3		Sandwiches with plain meat or poultry	2.9	3.9		Candy	3.1	4.6	
Snack chips (popcorn, potato chips)	2.3	3.1		Cheese	2.6	2.4		Whole milk, unflavored	2.8	3.7	
French fries/potato products	2.2	3.6		Candy	2.5	2.1		Breaded/fried beef/pork/fish	2.6	1.1	
1% milk, flavored	2.2	0.4	**	French fries/potato products	2.3	2.3		Salad dressings	2.2	1.9	
Sausages, hot dogs, cold cuts	2.1	1.4		Hot dog on a bun/corn dog	2.2	1.9		Snack chips (popcorn, potato chips)	1.9	5.1	**
Cheese	2.0	0.9	*	Corn/tortilla chips	1.7	3.0	*	Breaded/fried meat or poultry sandwich	1.7	1.1	
1% milk, unflavored	2.0	1.3		1% milk, unflavored	1.7	1.2		Hot dog on a bun/corn dog	1.5	0.7	
Candy	1.9	2.7		Cheese sandwiches	1.6	0.7		Corn/tortilla chips	1.4	1.9	

TABLE C.9 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Peanut butter sandwiches	1.7	2.6		1% milk, flavored	1.5	0.6	*	Breakfast sandwiches	1.4	0.5	
Corn/tortilla chips	1.4	1.7		Salad dressings	1.4	1.5		1% milk, flavored	1.4	0.4	**
Cheese sandwiches	1.4	1.8		Breaded/fried meat or poultry sandwich	1.3	0.7		Cheese	1.3	1.4	
2% milk, flavored	1.2	2.3		Peanut butter sandwiches	1.1	2.9	*	Sweet rolls, donuts, toaster pastries	1.2	0.7	
Crackers and pretzels	1.2	2.3		Sweet rolls, donuts, toaster pastries	1.0	1.2		Mixtures with meat/grain/vegetables	1.2	0.8	
Sweet rolls, donuts, toaster pastries	1.1	0.7		Crackers and pretzels	0.9	1.1		Biscuits, croissants, cornbread	1.0	0.7	
Other milk items	1.1	0.6		Soups	0.8	2.5		Entree salads, entree salad bars	0.9	1.2	
Breaded/fried beef/pork/fish	1.0	2.0		Eggs	0.8	1.3		1% milk, unflavored	0.7	1.1	
Salad dressings	0.8	1.5		Mixtures with meat/grain/ vegetables	0.8	2.8		Eggs	0.5	1.4	
Cold cereal	0.6	1.4	*	Sausages, hot dogs, cold cuts	0.7	1.6		Other milk items	0.4	1.1	

TABLE C.9 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	**Participants**	**Matched Non-Participants**		**Food Group/Food(s)**	**Participants**	**Matched Non-Participants**		**Food Group/Food(s)**	**Participants**	**Matched Non-Participants**	
Breaded/fried meat or poultry sandwich	0.6	1.0		Peanut butter/nuts/ seeds/trail mixes	0.4	1.5		Grain/fruit cereal bars, granola bars	0.4	2.0	*
Biscuits, croissants, cornbread	0.5	1.0									
Peanut butter/nuts/ seeds/trail mixes	0.5	2.3	*								
Yogurt	0.4	1.0									
Lunchables	0.1	1.0	*								

TABLE C.10
FOOD SOURCES OF SODIUM CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Pizza and pizza products	9.2	2.7	**	Pizza and pizza products	10.9	6.6	*	Pizza and pizza products	9.9	7.3	
Condiments and spreads	7.4	5.7		Condiments and spreads	7.0	5.5		Condiments and spreads	8.0	6.4	
Mixtures with pasta or noodle base	6.7	3.6	*	Mixtures with pasta or noodle base	6.0	3.8		Sandwiches with plain meat or poultry	7.2	10.4	
Breaded/fried chicken products	5.5	4.4		Sandwiches with plain meat or poultry	4.9	6.1		Mixtures with pasta or noodle base	6.4	7.7	
Mexican-style entrees	4.1	1.8	**	Mexican-style entrees	4.5	2.7		Hamburgers/cheeseburgers	4.3	3.2	
Unbreaded poultry/meat/fish	3.7	4.3		Hamburgers/cheeseburgers	4.1	2.2	*	Mexican-style entrees	4.3	3.9	
Sandwiches with plain meat or poultry	3.6	7.7	*	Cold cereal	3.6	3.5		Breaded/fried chicken products	4.0	3.6	
Hot dog on a bun/corn dog	3.5	1.0	**	Breaded/fried chicken products	3.5	4.0		Unbreaded poultry/meat/fish	3.8	4.0	
Crackers and pretzels	3.4	4.0		Unbreaded poultry/meat/fish	3.5	5.1		Salad dressings	3.5	2.9	

TABLE C.10 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-		Food Group/Food(s)	Participants	Matched Non-		Food Group/Food(s)	Participants	Matched Non-	
Hamburgers/cheeseburgers	3.3	1.4	**	Crackers and pretzels	2.6	2.4		Cold cereal	2.7	4.3	
Cold cereal	3.1	5.6	*	Rice/pasta	2.6	2.2		Cookies, cakes, brownies	2.4	2.8	
White bread, rolls, bagels	2.5	1.6		Hot dog on a bun/corn dog	2.5	2.1		White potatoes	2.2	1.2	
Cookies, cakes, brownies	2.4	3.6		Cookies, cakes, brownies	2.5	3.1		White bread, rolls, bagels	2.1	2.4	
Rice/pasta	2.2	4.0		Salad dressings	2.2	1.9		Mixtures with meat/grain/ vegetables	2.0	2.3	
Pancakes, waffles, French toast	2.1	2.5		White bread, rolls, bagels	2.2	1.4		Biscuits, croissants, cornbread	2.0	1.8	
French fries/potato products	1.8	2.1		Snack chips (popcorn, potato chips)	2.0	1.2		Hot dog on a bun/corn dog	1.8	0.7	
Soups	1.7	4.5		Corn/tortilla chips	1.8	3.0		Rice/pasta	1.7	3.5	
Peanut butter sandwiches	1.6	3.1		Soups	1.7	4.8		French fries/potato products	1.7	1.8	
Sausages, hot dogs, cold cuts	1.6	1.0		2% milk, unflavored	1.7	1.2		Breakfast sandwiches	1.7	0.7	

TABLE C.10 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
2% milk, unflavored	1.6	2.5		Mixtures with meat/grain/vegetables	1.5	6.5		Corn/tortilla chips	1.6	2.0	
1% milk, flavored	1.6	0.3	**	Cheese sandwiches	1.4	0.5		Soups	1.6	1.1	
Snack chips (popcorn, potato chips)	1.5	1.8		Chili con carne	1.3	0.8		Breaded/fried beef/pork/fish	1.5	0.9	
Corn/tortilla chips	1.5	1.7		Biscuits, croissants, cornbread	1.2	1.5		2% milk, unflavored	1.5	1.3	
Sweet rolls, donuts, toaster pastries	1.5	0.8	*	French fries/potato products	1.2	1.2		Pancakes, waffles, French toast	1.5	0.2	**
Salad dressings	1.4	2.0		Juice drinks (not 100% juice)	1.2	3.7		Breaded/fried meat or poultry sandwich	1.4	1.1	
White potatoes	1.2	2.3		Breaded/fried meat or poultry sandwich	1.2	0.8		Sweet rolls, donuts, toaster pastries	1.4	0.8	
Mixtures with meat/grain/ vegetables	1.2	1.8		1% milk, flavored	1.1	0.3	**	Juice drinks (not 100% juice)	1.3	1.4	
Cheese sandwiches	1.0	1.4		Pancakes, waffles, French toast	1.1	0.9		Snack chips (popcorn, potato chips)	1.2	3.3	**
1% milk, unflavored	1.0	0.7		Sweet rolls, donuts, toaster pastries	1.1	1.5		1% milk, flavored	1.0	0.3	**

TABLE C.10 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Breaded/fried beef/pork/fish	1.0	1.5		Cheese	1.0	1.0		Crackers and pretzels	0.9	1.9	
Biscuits, croissants, cornbread	0.8	1.9		White potatoes	1.0	2.3		Entree salads, entree salad bars	0.7	1.0	
Whole milk, unflavored	0.7	1.1		Peanut butter sandwiches	0.9	2.3	*	Eggs	0.4	1.2	
Juice drinks (not 100% juice)	0.6	1.1		Eggs	0.7	1.0		Beef or chicken stir fry	0.2	1.0	
Breaded/fried meat or poultry sandwich	0.6	1.1		Sausages, hot dogs, cold cuts	0.5	1.4					
Breakfast sandwiches	0.5	1.2									

TABLE C.11

FOOD SOURCES OF DISCRETIONARY SOLID FATS CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Pizza and pizza products	9.7	3.5	**	Pizza and pizza products	11.9	9.0		Pizza and pizza products	11.5	11.3	
Cookies, cakes, brownies	7.7	10.6		Cookies, cakes, brownies	7.8	11.0		Cookies, cakes, brownies	8.0	9.1	
Mexican-style entrees	5.8	2.4	**	Mexican-style entrees	6.4	4.4		French fries/potato products	7.4	6.5	
2% milk, unflavored	5.6	9.3		2% milk, unflavored	5.7	4.6		Mexican-style entrees	6.2	7.3	
Dairy-based desserts	5.2	3.8		French fries/potato products	5.5	5.3		Mixtures with pasta or noodle base	5.5	5.3	
Mixtures with pasta or noodle base	5.1	4.0		Dairy-based desserts	4.9	3.3		2% milk, unflavored	5.2	4.7	
Condiments and spreads	4.6	4.6		Mixtures with pasta or noodle base	4.6	4.4		Hamburgers/ cheeseburgers	4.9	4.0	
Whole milk, unflavored	4.2	6.9		Hamburgers/ cheeseburgers	4.2	2.2		Condiments and spreads	4.1	4.6	
French fries/potato products	4.1	7.9		Condiments and spreads	4.0	4.3		Sandwiches with plain meat or poultry	4.1	7.0	
Hot dog on a bun/corn dog	3.9	1.3	**	Whole milk, unflavored	3.5	2.7		Dairy-based desserts	4.0	1.9	**

TABLE C.11 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Hamburgers/ cheeseburgers	3.5	1.6	*	Breaded/fried chicken products	3.3	3.6		Breaded/fried chicken products	3.6	2.4	
Breaded/fried chicken products	3.4	3.7		Hot dog on a bun/corn dog	2.6	2.3		Sweet rolls, donuts, toaster pastries	3.3	2.2	
Sweet rolls, donuts, toaster pastries	3.0	2.0		Sweet rolls, donuts, toaster pastries	2.5	3.5		Whole milk, unflavored	2.8	4.1	
Crackers and pretzels	2.6	4.6		Cheese	2.4	2.3		Breaded/fried beef/pork/fish	2.8	0.9	
Sausages, hot dogs, cold cuts	2.5	1.8		Sandwiches with plain meat or poultry	2.0	2.5		Biscuits, croissants, cornbread	2.2	1.8	
Sandwiches with plain meat or poultry	1.9	3.5		Unbreaded poultry/meat/ fish	1.9	3.7		Unbreaded poultry/meat/ fish	2.0	1.8	
1% milk, flavored	1.8	0.4	**	Crackers and pretzels	1.8	2.0		Hot dog on a bun/corn dog	1.9	0.9	
Unbreaded poultry/meat/ fish	1.8	1.0		Cheese sandwiches	1.6	0.3	*	Breakfast sandwiches	1.8	0.5	*
Cheese	1.8	0.8		Candy	1.4	1.3		Candy	1.7	2.6	
1% milk, unflavored	1.6	1.1		1% milk, unflavored	1.4	1.0		White potatoes	1.6	0.9	
Pancakes, waffles, French toast	1.3	1.3		1% milk, flavored	1.3	0.5	*	Cheese	1.2	1.4	

TABLE C.11 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Breaded/fried beef/pork/fish	1.2	2.3		Biscuits, croissants, cornbread	1.3	1.4		1% milk, flavored	1.2	0.3	**
Snack chips (popcorn, potato chips)	1.2	1.4		Snack chips (popcorn, potato chips)	1.3	1.0		Mixtures with meat/grain/ vegetables	1.1	0.7	
2% milk, flavored	1.1	2.2		Breakfast sandwiches	1.0	0.9		Sausages, hot dogs, cold cuts	1.1	1.1	
Cheese sandwiches	1.0	1.5		White bread, rolls, bagels	1.0	0.4		Crackers and pretzels	0.7	1.6	*
Candy	1.0	1.4		Sausages, hot dogs, cold cuts	0.9	1.9		Entree salads, entree salad bars	0.7	1.3	
Biscuits, croissants, cornbread	1.0	1.9		Eggs	0.7	1.4		Snack chips (popcorn, potato chips)	0.6	1.7	
Other milk items	1.0	0.4		Mixtures with meat/grain/ vegetables	0.7	3.5		1% milk, unflavored	0.5	1.0	
Cold cereal	0.6	2.3		Pancakes, waffles, French toast	0.7	1.3		Eggs	0.5	1.6	
Lunchables	0.1	1.2	*	Soups	0.7	3.2		Other milk items	0.4	1.1	
				White potatoes	0.7	1.0		Grain/fruit cereal bars, granola bars	0.2	1.2	*

TABLE C.12

FOOD SOURCES OF ADDED SUGARS CONSUMED OVER 24 HOURS BY NSLP PARTICIPANTS AND MATCHED NONPARTICIPANTS, BY SCHOOL TYPE

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
Carbonated sodas	16.9	13.7		Carbonated sodas	24.2	30.7		Carbonated sodas	27.0	40.6	**
Juice drinks (not 100% juice)	13.5	19.5		Juice drinks (not 100% juice)	17.9	24.4		Juice drinks (not 100% juice)	16.2	14.8	
Cookies, cakes, brownies	9.3	12.8		Cookies, cakes, brownies	9.1	8.1		Candy	9.0	9.8	
Condiments and spreads	8.8	6.4		Cold cereal	8.4	5.6		Cookies, cakes, brownies	8.1	9.6	
Cold cereal	7.0	12.0	*	Candy	6.7	6.1		Cold cereal	5.5	5.1	
Dairy-based desserts	5.8	3.7		Condiments and spreads	4.5	4.6		Condiments and spreads	5.3	3.0	
1% milk, flavored	5.2	0.8	**	Dairy-based desserts	4.3	2.6		Dairy-based desserts	3.7	1.4	**
Candy	5.2	5.7		1% milk, flavored	3.2	1.1	**	Tea and coffee	3.5	1.7	*
Sweet rolls, donuts, toaster pastries	3.5	1.8	*	Tea and coffee	2.5	2.7		1% milk, flavored	2.9	0.7	**
Skim or nonfat milk, flavored	3.0	0.3	**	Sweet rolls, donuts, toaster pastries	2.3	2.5		Sweet rolls, donuts, toaster pastries	2.7	1.3	*
Other desserts	2.8	2.8		Other desserts	2.3	1.1		Other desserts	1.9	2.4	
Other milk items	1.5	1.1		Skim or nonfat milk, flavored	1.9	0.5	**	Skim or nonfat milk, flavored	1.7	0.1	**

TABLE C.12 continued

Elementary Schools				Middle Schools				High Schools			
	Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake				Percentage Contribution to 24-Hour Intake		
Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants		Food Group/Food(s)	Participants	Matched Non-Participants	
2% milk, flavored	1.5	2.2		Yogurt	1.2	1.1		Other milk items	1.4	1.6	
Yogurt	1.4	4.1	*	Other milk items	1.2	1.3		Salad dressings	1.0	0.5	
Tea and coffee	1.1	1.1		Peanut butter sandwiches	0.8	1.2		Grain/fruit cereal bars, granola bars	0.7	1.5	
Peanut butter sandwiches	1.1	1.6									
Peaches	1.1	0.7									
Fruit-based desserts	0.9	2.7	*								