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Fruit and Vegetable Consumption by School Lunch Participants

Implications for the Success of New Nutrition Standards

Constance Newman





United States Department of Agriculture

Economic Research Service

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Fruit and Vegetable Consumption by School Lunch Participants

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Constance Newman, cnewman@ers.usda.gov

Abstract

Following the Healthy, Hunger-Free Kids Act of 2010, USDA instituted many changes to the National School Lunch Program (NSLP). School lunches have had to meet new nutrition standards since the fall of 2012. Using data collected as part of the 2005 School Nutrition and Dietary Assessment III, this report examines whether students who attended schools serving more fruits and vegetables, in amounts that would meet the new standards, actually ate more of them than students at schools that did not. Student consumption data were matched by date to lunch menu records for the same day. Tobit models were used to estimate consumption of fruits and vegetables in school lunches by NSLP participants, controlling for other characteristics of students and school food operations. Students in schools that offered more fruits and vegetables and in quantities that met daily standards consumed greater quantities of many of those foods. But most students did not eat any of the offered fruits and vegetables in 2005, suggesting that additional methods may need to be considered in order to meet nutritional goals.

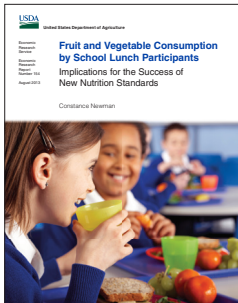
Keywords: National School Lunch Program, nutrition, fruit and vegetable consumption, food assistance, USDA meal patterns, school meal nutrition standards

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Fruit and Vegetable Consumption by School Lunch Participants

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What Is the Issue?

The Healthy, Hunger-Free Kids Act of 2010 instituted many changes to the National School Lunch Program (NSLP), and in concert with those changes, USDA issued new, more stringent school meal nutrition standards for the 2012-13 school year. Data are not yet available on student acceptance of meals that meet the higher nutrition standards implemented in 2012. This report uses 2005 data to determine which schools already met the 2012 weekly and daily standards for fruits and vegetables and investigates whether students who attended those schools ate more fruits and vegetables than did other students.

What Did the Study Find?

Students in schools that offered greater quantities of fruits and vegetables consumed more of these foods by most measures. However, many students did not eat any fruits and vegetables, implying that additional methods may need to be considered in order to achieve the goal of having students consume foods in schools that more closely meet the nutritional goals of the *Dietary Guidelines for Americans*.

Students who were offered fruit, dark green vegetables, red/orange vegetables, or “other” vegetables in amounts that would meet a daily standard for those foods ate more of those vegetables than students who were offered amounts that did not meet the daily standard. In addition, more students at schools that met the new daily standards tried vegetables than did students at schools that did not meet the new daily standards. Among students who ate at least some of a vegetable, student consumption at schools that met the daily standard was higher and exceeded the daily standard amount in many cases.

Other individual and school characteristics affected student intakes.

- Younger students, female students, Black students, Hispanic students, and those from a Spanish-speaking home were all more likely to eat fruit and specific types of vegetables, particularly dark green and orange vegetables.
- Students at schools that had no à la carte options or only healthy à la carte options had higher intakes of dark green vegetables.

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- Students identified as picky eaters by their parents were less likely to eat almost all of the food types, particularly dark green vegetables, orange vegetables, and total vegetables.
- Indicators of financial hardship or food insecurity were not significantly linked to higher levels of fruit and vegetable consumption, contrary to expectations.

Most schools in 2005 met the new weekly standards for total fruit and total vegetables. And while a majority of schools also met the weekly standards for specific vegetable subcategories, many schools will need to increase vegetable servings to meet weekly standards. More specifically:

- 96 percent of schools in 2005 met the new weekly standard for total vegetables, and 75 percent met the standard for total fruit.
- 75 percent of schools in 2005 offered lunches that met the new weekly standard for dark green vegetables, 83 percent met the weekly standard for red/orange vegetables, 21 percent met the standard for legumes, and 97 percent met the standard for “other” vegetables.

In terms of *daily* amounts, more than half of schools met the new standard for fruit (60 percent) while many more met the new daily standard for total vegetables (88 percent).

The results suggest that schools were closer to meeting most of the new standards than many observers and analysts have expected. Most schools would need to serve more fruit and legumes in order to meet the daily and weekly standards for each. And about a quarter of schools would need to serve more dark green vegetables to meet the weekly standard for those vegetables.

How Was the Study Conducted?

This study used data collected from the School Nutrition and Dietary Assessment III (SNDA-III), a nationally representative survey of students and schools conducted in 2005. The SNDA surveys provide the Nation’s most complete data on the nutritional content of school meals. The data include information about the school food environment, student food intake, and student characteristics. Food intake data for a sample of 1,442 students who ate school lunch in 257 schools were matched by date to lunch menu records for the same day. Seven types of fruit and vegetables were examined: fruit, dark green vegetables, orange vegetables, red/orange vegetables, legumes, “other” vegetables, and total vegetables. The study compares the consumption by students from schools that had already met the 2012 standards in 2005 to the consumption by students in schools that did not meet the standards in 2005, and it examines whether offering more of a specific food increased the amount consumed. Tobit models were used to estimate consumption of fruits and vegetables in school lunches by NSLP participants, controlling for other characteristics of students and school food operations.

Fruit and Vegetable Consumption by School Lunch Participants

Implications for the Success of New Nutrition Standards

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Introduction

The National School Lunch Program (NSLP) is the Nation's second largest food assistance program, serving low-cost or free lunches to over 31.6 million children daily. In December 2010, Congress passed the Healthy, Hunger-Free Kids Act (S. 3307), which expands access to school meal programs, grants USDA new regulatory powers to influence the quality of foods offered at schools, and changes the way the program is administered. In January 2012, USDA issued a new rule for the nutrition requirements that school meals would need to meet, starting with school year 2012-13. Changes include more servings and varieties of fruits and vegetables, more whole grains, and the restriction of milk servings to lowfat or fat-free only (table 1). The requirements closely follow recommendations made to USDA by the Institute of Medicine (IOM, 2010).

USDA is required by law to ensure that meals are consistent with the most recent *Dietary Guidelines for Americans* (referred to as "Dietary Guidelines") (USDA and HHS, 2010). In 2007, a USDA report found that while most schools served meals that met key nutrient requirements (like vitamins and minerals), they did not serve a variety of nutrient-dense foods from the basic food groups such as fruits, vegetables, and whole grains as recommended in the 2005 Dietary Guidelines. Most schools were also found to serve lunches with higher than recommended saturated fat content and sodium (USDA, 2007). The new meal pattern requirements were designed to more closely align school meals with the 2005 Dietary Guidelines and also, to some extent, the 2010 Dietary Guidelines.¹

School food providers are concerned that students may not accept healthier foods. A child nutrition services director of a public school district in Arkansas opined: "You're increasing serving sizes on fruits and vegetables so much, I think you're really going to just increase trash." He favors the new regulation, but cautioned, "Putting things on a plate doesn't make it a nutritious meal. The students have to consume it. And if they do, it will open them to more fresh fruits and vegetables. In the long run, this can do great things."²

School food operations need to attract students in order to stay financially solvent. While some students may have no other lunch options, many have a choice of whether to obtain a lunch on a given day. Even students who are certified to receive free or reduced-price lunches may refuse to eat

¹The 2010 Dietary Guidelines were published after the new school food meal recommendations had been developed, but they do not differ greatly from the 2005 Dietary Guidelines. They differ in a few ways that are reflected in the new school lunch standards. The recommended total vegetable consumption levels were not changed, but the composition changed toward higher levels of "red/orange" vegetables (a wider category than "orange" vegetables that includes tomatoes) relative to dark green vegetables. Other changes included recommendations to eat more seafood and plant-based foods.

²"A Fresh Look at What School Menus Can Be," *New York Times*, July 17, 2012.

Table 1

Summary of changes in weekly required minimum amounts and types of foods offered in USDA school lunches

	Pre-2012 requirement	New requirement
Total fruit and vegetables	2.5–5 cups of fruit and vegetables combined per week	2.5–5 cups of fruit 3.75–5 cups of total vegetables per week
Vegetables	No specifications as to type of vegetable	Weekly requirement of half a cup for dark green, legumes, starchy and other vegetables, respectively, and three-quarters of a cup for red/orange vegetables.
Meat/meat alternate	7.5–15 oz equivalents per week	8–12 oz equivalents per week
Grains	8–15 oz equivalents per week	9–13 oz equivalents per week
Whole grains	Encouraged, but not required.	Upon implementation, at least half of the grains to be whole grain-rich (>50% whole grain). After 2 years, all grains must be whole-grain rich.
Milk	5 cups	5 cups, fat content of milk to be 1% or less
Saturated fat	Energy from saturated fat must be no greater than 10% of total energy.	No greater than 10% of total energy.
Total fat	Energy from total fat must be no greater than 30% of total energy.	No standard for total fat.
Calories	Minimum of 633 for grades K-3, 785 for grades 4-12 or 825 for Optional grades 7-12	550-650 grades K-5, 600-700 grades 6-8, and 750-850 grades 9-12

Source: Author's summary of the former and the new weekly NSLP standards by food type (see "Nutrition Standards in the National School Lunch and School Breakfast Programs, Final Rule." *Federal Register* 77:17).

new menu items or skip lunches altogether. The bulk of school foodservice revenues come from the number of meals sold (USDA per-meal subsidies make up 51 percent of revenues and student meal payments make up 24 percent).³ Schools are reimbursed by USDA for each meal that is provided to students whether it is provided at full price, reduced price, or free.⁴ Maintaining student participation is, therefore, crucial to school foodservice sustainability.

This analysis examines likely outcomes as new standards are implemented in schools across the country. To what extent did schools already meet the new standards? To what extent are school meal participants likely to eat the new, more nutritional offerings? Is it enough to provide healthy foods as the new default offerings, or will schools need to encourage healthful consumption in other ways?

³USDA (2008), p. xii. The rest of the revenue components include à la carte sales, adult meal sales, and other non-reimbursable food sales (15.8 percent); State and local funds (8.8 percent); and other sources (0.6 percent).

⁴In 2012-13, the maximum reimbursement rates for each category are as follows: \$0.41 for a full price meal, \$2.69 for a reduced-price meal, and \$3.09 for a free meal. These rates are for the contiguous States and include a 6-cent increase that is provided for meals that meet the new nutrition standards. For a table of all 2012-13 reimbursement rates, see <http://www.fns.usda.gov/cnd/governance/notices/naps/NAPs12-13Chart.pdf>.

This report examines the consumption of fruits and vegetables in school lunches in 2005 to see whether their consumption was higher among students who were offered those foods in amounts that met the new standards. Specifically, the study first measures whether the 2005 school menus included any of each given food and whether they included enough of each to satisfy the new (2012-13) daily or weekly standard for that food. The analysis shows which of the individual standards may be more easily adopted by schools and those for which adoption may be more ambitious. Perhaps most usefully, the analysis provides a baseline for where schools were in 2005 relative to the new standards.

The analysis then examines how consumption of each food was related to the amounts offered, using three different measures of the amounts of foods offered:

- the absolute amount of food offered,
- whether or not the school served enough food to meet the new daily standard for each food type, and
- whether or not the school served enough food over the week in which menu data were collected to meet the 2012 standards for those foods.

The analysis controls for many student and school characteristics that are also likely to affect consumption. Although newer data on menu offerings have become available in a new School Nutrition and Dietary Assessment survey (SNDA-IV), dietary intake data are not available in that survey. The 2005 data are the most recent available for schoolchildren's dietary intake. We therefore need to assume that children's willingness to consume new and different fruits and vegetables is unlikely to have changed since then.

Previous Research

The new meal pattern requirements respond to concerns about children’s health and obesity outcomes. Many studies—but not all—have shown positive links between school meal participation and children’s weight or other outcomes that may be related to weight outcomes (Campbell et al., 2011; Millimet et al., 2009; Schanzenbach, 2009; USDA, 2007). On the other hand, Gleason and Dodd (2009) found no evidence linking NSLP participation to rates of overweight and obesity among children, but they did find that School Breakfast Program (SBP) participation was associated with lower body mass index (BMI). Another recent paper found that receipt of free and reduced-price lunches led to better health outcomes, including lower BMI (Gundersen et al., 2012). The NSLP and the SBP play an important role in children’s diets. For participants in both programs, Briefel et al. (2009) found that the proportion of calories consumed in a day in school meals was 47 percent. For an average child at school, 26 percent of calories consumed were from foods obtained and consumed in school. Understanding the extent to which fruit and vegetable offerings in school lunches are likely to be accepted by children has important implications for school meal policies and children’s health.

Behavioral economics findings have shown that offering healthier foods as part of the default servings can induce students to modify their behavior without students even noticing. A series of studies conducted in lunchroom settings has shown that making healthier foods more obvious and available can lead to higher sales and greater consumption of those foods (Just et al., 2007; Mancino and Guthrie, 2009; Hanks et al., 2012). In that spirit, the new lunch standards were designed to promote small changes in school lunch menus, not radical departures that students would reject. One of the criteria used by the Institute of Medicine in making its recommendations for the new nutrition standards was that the menus would need to “appeal to students of diverse cultural backgrounds” and “be sensitive to program costs and school administrative concerns.”⁵

A comprehensive report that accompanied the release of the SNDA-III data in 2007 showed that about 27 percent of NSLP participants consumed vegetables (other than french fries) as part of lunch served (USDA 2007, vol. II, table VI.7). Among NSLP participants, only 6 percent ate a green salad, a dark green or orange vegetable, or other vegetables during lunch. The share of elementary school participants who consumed some vegetables during lunch was higher than that of middle or high school students. And interestingly, a higher share of NSLP participants ate these vegetables than did nonparticipants (statistically significant difference for “other vegetables” only). Among NSLP participants, 20 percent consumed canned fruit and 16 percent consumed fresh fruit in 2005. As with vegetables, older students were less likely to consume fruit, and the share consuming canned fruit was higher among NSLP participants than nonparticipants (statistically significant). Nonparticipants were more likely to consume fresh fruit.

Dragoset and Gordon (2010) simulated the effects of several possible nutrition policy changes on NSLP participation, the characteristics of meals served, and participant consumption. The simulated policies included: (1) offering only lowfat or fat-free milk, (2) limiting french fries and similar potato product offerings to no more than 1 day a week, (3) offering fresh fruit daily, (4) not offering juice, and (5) offering dark green and orange vegetables at least 2 days a week. Using SNDA-III data, they found that servings of fruit, vegetables, and in particular, dark green and orange vegetables would increase and that a decrease in school meal participation would range from 0.1 to 9.4

⁵IOM (2010b), p. 4.

percentage points. They also found that consumption of fruits and vegetables would increase for elementary and secondary students, and that consumption of dark green and orange vegetables would increase slightly (less than 1 percent) for both types of students.

Other studies have examined how local and regional school policy changes have affected student consumption, and many have identified policy effects. Wordell et al. (2012) studied the consumption effects of a set of restrictive policies that were implemented in school year 2007-08 in six middle schools in Spokane, WA. In two intervention schools, administrators removed all juice products from vending machines (leaving only unflavored bottled water), limited à la carte items to fruit and milk, and offered a seasonal fruit and vegetable bar to all students whether they purchased a school meal or not. They found that students in the intervention schools were 56 percent less likely to consume pastries at school, 27 percent less likely to consume juice at school, and 24 percent more likely to consume milk outside of school. However, students at intervention schools were not more likely to consume fruit and vegetables.

In a review of European studies, Van Cauwenberghe et al. (2010) found that single interventions in the school food environment did not affect children's intake of fruits and vegetables but that interventions with multiple strategy components did increase intake of fruits and vegetables. Multiple strategy components included both environmental changes to stimulate more healthful diets, such as increased availability of healthy foods, and educational interventions, such as classroom-based activities designed to promote healthy foods.

Cullen et al. (2008) found that changes in school nutrition policies led to increased intakes of fruits and vegetables in three Texas middle schools. A statewide policy that limited portion size and the frequency of servings of high-fat and sugary foods in all school food (including vending) was implemented in 2004. Three years of student consumption data were collected in three southeast Texas middle schools, with the third year collected in 2005-06 after the nutrition policies had been implemented. Cullen et al. found statistically significant increases in the consumption of milk and vegetables and significant decreases in consumption of sweetened beverages, soft drinks, snack chips, and desserts after controlling for energy intake.

Data

The data are from the School Nutrition and Dietary Assessment Data III (SNDA-III), a nationally representative data set collected in the spring of 2005 (the most recent available for schoolchildren's dietary intake) from 398 public schools (USDA, 2007). The SNDA surveys provide the Nation's most complete data on the nutritional content of school meals. The data contain rich information about school food environments, student food intake, and student characteristics.

SNDA-III used a three-stage sampling process to represent (1) School Food Authorities (SFAs) that offer NSLP in U.S. public schools, (2) schools in those SFAs, and (3) students who attend those schools. First, 130 SFAs were randomly selected, and within each SFA (for the most part), an elementary, middle, and a high school were chosen, yielding 398 schools. Then, within a subsample of 287 schools (from 94 SFAs), approximately 8 students were chosen to answer another survey, resulting in a total of 2,314 students. The students and their parents answered detailed questions about consumption, household characteristics, opinions about school meals, and physical activity.

The data on children's consumption were obtained from a 24-hour dietary recall survey. Students, with the help of their parents, were asked to list all foods and beverages that they consumed in the preceding 24 hours, and about 30 percent of them were asked to report on 24 hours of consumption on a second day in the following week. Of the 2,314 students who responded to the intake survey, 1,620 students ate food that was part of a school lunch.

In order to test whether schoolchildren ate fruit or vegetables that were offered to them, this study uses data from both the menu and dietary intake surveys matched by date. The student recall data were collected from January 18, 2005 through June 21, 2005, and the menu data were similarly collected from January 18, 2005 to June 17, 2005. The dietary intake data were collected in the same week as the menu data, thus allowing a high number of exact date matches. The resulting observations are of children's consumption on days for which the exact menu data are available. The matched data have 1,442 unique NSLP participants from 257 schools.

Methods

The first step taken in the analysis was to determine whether school lunch menus in 2005 met the 2012 standards for fruits and vegetables (*Federal Register*, 2012). For example, if a high school lunch menu offered 5 cups of total vegetables per week, that school met the new weekly standard for total vegetables. Fortunately, the foods offered in school lunches varied a lot by type in 2005 (USDA, 2007), enabling us to test for significant differences in the effects of menu offerings on student consumption across schools.

The analysis focuses on the following types of foods: fruits, dark green vegetables, orange vegetables, “red/ orange” vegetables, “other” vegetables, total vegetables, and legumes. These foods are among the least consumed by students (Cullen, 2011; USDA, 2007) and are at the top of the Dietary Guidelines’ list of foods that should have higher intakes (USDA and HHS, 2010). “Orange” vegetables are examined as well as “red/orange” vegetables because the proposed rule included orange vegetables only, but the final rule added red vegetables (tomatoes) and raised the minimum amount required to be served (table 1). Since tomatoes (whole and as ingredients) are already popular among students, and orange vegetables less so, the proposed orange standard is included to illustrate how offering orange vegetables specifically can affect their consumption.

The new nutrition rule contains requirements for weekly and daily minimum amounts of fruits and vegetables to be served (table 2). All of the fruits and vegetables have weekly minimum amounts, and total fruit and total vegetables have daily minimum amounts. The specific vegetable types, such as dark green vegetables, do not have daily minimums, but this study uses an implied minimum as an estimate of a daily requirement. For example, the weekly requirement for dark green vegetables is half a cup, so the implied daily requirement would be one-tenth of a cup. The weekly requirement provides a more general portrayal of how a school is performing over time, but the daily requirement is interesting since we have data on daily intake and can directly measure consumption against offerings on that day.

The menu data were matched by USDA food codes to data from the My Pyramid Equivalent database in order to assess the amounts of each food type in cups provided in school lunches (Bowman et al., 2008). This was then compared to the weekly and daily standards—which are implied standards for specific vegetable types—in order to assess whether a school met the daily or weekly standard for that food.

The analysis examines the effects of offering more of a food on children’s consumption of that food type in three different ways: (1) simply offering more of the food, (2) meeting the daily or implied daily standard for the food, and (3) meeting the weekly standard for the food. The first test examines whether the amount offered, including in small amounts, is associated with the amount consumed. The second test examines whether offering the food in an amount that would satisfy the daily standard for a food type (total fruit or total vegetables) or the implied daily standard for a specific vegetable is associated with the amount consumed. The first two tests measure the effect of offering food types on the same day for which we have consumption data.

The third test examines whether offering the food in amounts that would satisfy the weekly standard for a food type is associated with the amount consumed. The weekly standard is measured from foods offered over the whole week of menu data, so this tests a more general effect of offering the food over time. Unlike the first two tests, the weekly standard test is a less direct test since it does not necessarily concern food served on the same day. It can be thought of as more of a test of generally exposing children to different foods rather than a test of the effect of serving it per se.

Table 2

New national school lunch program meal standards

	Weekly standards			Daily standards for total fruit and total vegetables and implied daily standards for specific vegetables ¹		
	Grades K-6	Grades 6-8	Grades 9-12	Grades K-5	Grades 6-8	Grades 9-12
	Recommended amount of food			Recommended amount of food		
Fruit (cups)	2.5	2.5	5.0	0.5	0.5	1.0
100% fruit juice can be up to half	1.25	1.25	2.5			
Vegetables (cups)						
Dark green ²	0.5	0.5	0.5	<i>0.1</i>	<i>0.1</i>	<i>0.1</i>
Orange*	<i>0.5</i>	<i>0.5</i>	<i>0.5</i>	<i>0.1</i>	<i>0.1</i>	<i>0.1</i>
Red/orange ³	0.75	0.75	1.25	<i>0.15</i>	<i>0.15</i>	<i>0.25</i>
Legumes ⁴	0.5	0.5	0.5	<i>0.1</i>	<i>0.1</i>	<i>0.1</i>
Other ⁵	0.5	0.5	0.75	<i>0.1</i>	<i>0.1</i>	<i>0.15</i>
Total vegetables	3.75	3.75	5.0	0.75	0.75	1.0

*The final rule includes “red” vegetables, but the analysis in the paper looks at orange vegetables also as defined in the proposed rule. The proposed rule for orange vegetables was the same as that for dark green vegetables, and that standard is used in the analysis (shown in italics).

¹There is no daily required minimum for dark green vegetables, red/orange vegetables, legumes, and other vegetables. These are estimates of what would be needed every day to meet the weekly minimum.

²Dark green vegetables include: bok choy, broccoli, collard greens, dark green leafy lettuce, kale, romaine lettuce, and spinach.

³Red/orange vegetables include: acorn squash, butternut squash, carrots, pumpkin, tomatoes, tomato juice, and sweet potatoes.

⁴Legumes (also referred to as “Beans and Peas” in the Final Rule) include: black beans, black-eyed peas, garbanzo beans, kidney beans, lentils, navy beans, pinto beans, soy beans, split peas, and white beans.

⁵Other vegetables include: artichokes, asparagus, avocado, bean sprouts, beets, Brussels sprouts, cabbage, cauliflower, celery, cucumbers, eggplant, green beans, green peppers, iceberg lettuce, mushrooms, okra, onions, parsnips, turnips, wax beans, and zucchini.

Source: Author’s summary of the new weekly NSLP standards by food type (See “Nutrition Standards in the National School Lunch and School Breakfast Programs, Final Rule.” *Federal Register* 77:17)

In the first part of the consumption analysis, mean consumption is presented for different student groupings. First, mean consumption of each food type is examined for students in schools that served the foods, regardless of whether the amounts served met a standard. Then mean consumption is compared across students in schools that met the daily standards and students in schools that did not meet the daily standards. Then the same is done for students in schools that met or did not meet the weekly standards. Mean consumption for these different categories is shown for all students, including those who ate none of the food in question, and then for only students who consumed at least some of the food in question.

The second part of the consumption analysis is a multivariate analysis that takes into account other factors that can influence student consumption of fruits and vegetables. A child’s age, sex, race/ethnicity, language spoken at home, household income, level of food insecurity, eligibility for a free or reduced-price meal, and metro location could all affect consumption (Campbell et al., 2011; USDA, 2007; Gleason and Sutor, 2003; Potamites and Gordon, 2010). The analysis uses data provided by parents about the degree to which they think their child is a picky eater or a hearty eater, how much time the child spends watching TV, whether there are two parents at home, and whether the family usually dines together. Key school characteristics are also included: the location (city, suburb, or rural) and region of the school, whether the school serves à la carte or more healthy à la carte items, and whether the school has “offer versus serve”⁶ policies.

⁶This is the policy that allows children to opt out of certain reimbursable food items offered.

To account for the fact that many students reported zero consumption of the foods in question, a Tobit model is used. This is the classic situation in which the dependent variable can be a corner solution response—the zeros, in this case—and for which the Tobit is considered appropriate (Wooldridge, 2003).⁷

Tobit models assume that there is a linear relationship between a latent or unobserved variable, y_i^* , and a set of independent variables, X_i , with a normally distributed error term, u_i . An observed variable, y_i , is equal to y_i^* when y_i^* is above zero and zero otherwise. The model is expressed as follows:

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}$$

Where y_i^* is a latent variable:

$$y_i^* = X_i\beta + u_i.$$

Two alternative models were considered: probit and Cragg’s “two-tier” alternative to Tobit (also called “double hurdle model”). The advantage of the Cragg specification is that it allows the coefficient estimates to differ for zero values and positive values. The model and various subsets of determinants were tried, but there were problems with convergence. This is said to be common when using the same set of determinants for both zeros and positive values (Burke, 2009), which was the case. Given that there are no strong reasons to believe that the determinants should differ for zero values or small positive values of consumption, the Tobit was chosen. Probit models using whether the food in question was consumed or not as the dependent variable were also run, and they resulted in similar estimates.⁸

As with the probit and Cragg’s two-tier models, Tobit models are sensitive to the assumption of normally distributed errors, and this problem is exacerbated with a high degree of censoring, or in this case, a large share of zeros (Willhelm, 2008). Censored Least Absolute Deviation (CLAD) models, which do not require the assumption of normally distributed errors, were also tried, but they did not converge. Given the high number of “zero consumption” entries for many of the foods analyzed here, this suggests an important caveat to the results.

Three sets of regressions are estimated to test the effect of providing more of the new foods to students, providing them in amounts that meet the daily or implied daily standards, and providing them in amounts over a week that meet the weekly standards. Not all schools provided each of the food types, so the samples differ in each regression. School-level or student-level weights (depending on the unit of analysis) and sample strata parameters are used in the bivariate and multivariate analyses unless noted as “unweighted” in the respective table.

⁷Tobits are also commonly used in situations in which the dependent variable is said to be “censored,” where the true values below or above a certain point are unknown. Consumption of foods is not a censored dependent variable because the zeros are true and valid responses, but the modeling issues in the two cases are very similar.

⁸The probit results are available upon request.

Results

Distribution of Schools by Whether They Met the New Standards

Many schools met one or more of the new standards in 2005 (table 3), and a small share of schools in the analysis sample met all of the new fruit and vegetable standards (not shown).⁹ (Appendixes B and C show the shares of schools meeting the daily and weekly standards for each food by characteristics of schools.)

In table 3, the first three columns show the weighted shares, standard errors, and numbers of schools that served the different foods shown in each row on the matched day. The next set of three columns does the same for schools that *met the daily standard* on the matched day, and the last three columns show the same for schools that *met the weekly requirements* over the week surveyed.

Most schools served fruit on the matched day (93 percent), less than half of schools served dark green vegetables (40 percent), almost two-thirds served orange vegetables (63 percent), and only 19 percent served legumes. Most schools served red/orange vegetables (93 percent), and almost all schools served some “other” vegetable (96 percent) and at least one vegetable of all the types (98 percent).

More than half of schools met the new fruit daily standard (60 percent) on the matched day, and less than half of schools met the implied daily standard for dark green vegetables (39 percent) and the implied standard for orange vegetables (30 percent). More than half of schools met the implied daily red/orange vegetable standard (66 percent), while few schools met the implied legumes standard (19 percent). Most schools met the implied “other” vegetable daily standard (86 percent) and the daily total vegetables standard (88 percent) on the matched day.

The shares of schools meeting the 2012 weekly standards were higher than those of the daily and implied daily standards. Three-quarters of schools met the weekly standard for fruit (75 percent) and for dark green vegetables (75 percent). More than half met the weekly standard for orange vegetables (55 percent) and for red/orange vegetables (83 percent). Only 21 percent met the weekly standard for legumes, while almost all schools met the weekly standards for other vegetables (97 percent) and total vegetables (96 percent).

The results suggest that schools were closer to meeting most of the new standards than many observers and analysts have expected.¹⁰ Most schools would need to serve more fruit in order to meet the daily and weekly standards for fruit, and most schools would need to increase their servings of legumes on a daily and weekly basis. And about a quarter of schools would need to serve more dark green vegetables to meet the weekly standard for those vegetables. Orange vegetable minimums are not required in the

⁹Incidentally, in 2005, the existing standard for fruits and vegetables was a combined one calling for 2.5 cups of vegetables *or* fruit per week in elementary schools and 5 cups of either in middle and high schools. Almost all of the schools in the SNDA-III sample (98 percent) met the applicable combined standard at the time.

¹⁰In earlier research using these data, Newman (2012) came to different conclusions about the shares of schools meeting the fruit and vegetable standards. That analysis did not take advantage of the “My Pyramid” linked estimates of the contributions of each food type in the menu offerings, linked by USDA food code, as this analysis does. As a result, this analysis includes counts of the food types in all parts of the menu offerings, including entrees. For example, dark green vegetables that may have been included in entrees are counted toward the total dark green vegetable offerings whereas they were not counted in the previous analysis.

Table 3

Shares and frequencies of schools that served food types, met daily¹ and weekly standards in 2005 school lunches

Weekly standards	Schools that served > 0			Schools that met daily standard			Schools that met weekly standard		
	Weighted share (percent)	Standard error	Unweighted number of schools	Weighted share (percent)	Standard error	Unweighted number of schools	Weighted share (percent)	Standard error	Unweighted number of schools
Fruit	93	0.02	244	60	0.06	174	75	0.07	211
Vegetables									
Dark green	40	0.05	152	39	0.05	149	75	0.05	209
Orange	63	0.05	166	30	0.05	94	55	0.06	159
Red/orange	93	0.03	244	66	0.05	199	83	0.07	239
Legumes	19	0.03	72	19	0.03	70	21	0.03	82
Other	96	0.02	251	86	0.03	228	97	0.02	254
Total vegetables	98	0.02	256	88	0.03	236	96	0.02	251
Number of schools			257			257			257

Note: The total number of schools represents the schools in the sample for which the dates matched precisely between the menu survey and the student consumption survey. Since there are multiple observations on schools for different dates, the table shows whether the school ever served the food or ever met the daily standard over the dates included in the sample.

¹There is no daily required minimum for dark green vegetables, red/orange vegetables, legumes, and other vegetables. These are estimates of what would be needed every day to meet the weekly minimum.

Source: Author's analysis using SNDA-III data.

final rule, but the analysis shows that almost half of schools would have needed to increase orange vegetable offerings to meet the proposed standards for orange vegetables.

Differences in Consumption by Whether the Amounts Offered Met the New Standards

The mean consumption of fruits and vegetables by NSLP participants was very low overall (table 4). Among all participating students, the mean consumption of fruit was about a quarter of a cup, which is about half of the new daily standard for school lunches. Of the 1,364 students who were offered fruit, only 600 students consumed fruit at school on the matched day. However, among those who ate some fruit, the mean consumption was above half a cup, which is above the required serving amount per day for grades K through 8.

Consumption of vegetables did not come close to the standards, however. A very small share of students ate any of the offered dark green vegetables (51 out of 850), any orange vegetables (87 out of 901), or any legumes (56 out of 390). Among the few students who ate some, the mean amounts consumed were less than a quarter cup for dark green vegetables (0.23 cup), less for orange vegetables (0.16 cup), and over a quarter cup for legumes (0.30 cup). The weekly standards for dark green vegetables and legumes, and the proposed weekly standard for orange vegetables, stipulate servings of a half of a cup over a week, so these amounts consumed by the students who ate some are more than sufficient as daily contributions toward a weekly consumption of a half a cup. For red/orange vegetables and “other” vegetables that were consumed by many more students, the mean amounts consumed by those who ate some were also small but sufficient to meet a daily standard for grades

Table 4

Mean consumption of school lunch foods by students in 2005 by whether the school met the daily and weekly standards, and by whether the student consumed any portion¹

A - 2005 Mean consumption by all students of school lunches

	Mean consumption in schools that served some ¹			Mean consumption in schools that didn't meet daily standards		Mean consumption in schools that met daily standards		t-stat on Diff	
	No. students	Mean cups	Max cups	No. students	Mean cups	No. students	Mean cups	Diff	Mean cups
Fruit	1,364	0.25	2.84	398	0.23	966	0.26	1.05	0.03
Vegetables									
Dark green	850	0.02	2.00	15	0.01	835	0.02	2.17*	0.01
Orange	901	0.02	0.95	367	0.01	534	0.03	2.26*	0.02
Red/orange	1,366	0.13	2.53	257	0.09	1,109	0.15	3.47*	0.06
Legumes	390	0.05	1.10	15	0.00	375	0.05	4.19*	0.05
Other	1,403	0.09	1.99	148	0.04	1,255	0.10	3.23*	0.06
Total vegetables	1,439	0.37	3.09	146	0.30	1,293	0.38	2.32*	0.08

A - 2005 Mean consumption by all students of school lunches

	Mean consumption in schools that didn't meet weekly standards		Mean consumption in schools that met weekly standards		t-stat on Diff	
	No. students	Mean cups	No. students	Mean cups	Diff	Mean cups
Fruit	182	0.21	1,182	0.25	0.88	0.04
Vegetables						
Dark green	3	0.01	847	0.02	1.10	0.01
Orange	250	0.01	651	0.03	2.03*	0.02
Red/orange	66	0.10	1,300	0.14	1.69	0.04
Legumes	114	0.04	276	0.05	0.61	0.01
Other	15	0.00	1,388	0.09	10.61*	0.09
Total vegetables	33	0.31	1,406	0.37	0.81	0.06

—continued

Table 4

Mean consumption of school lunch foods by students in 2005 by whether the school met the daily and weekly standards, and by whether the student consumed any portion¹—continued

B - 2005 mean consumption by students of school lunches who consumed at least some of the food types

	Mean consumption in schools that served some ¹			Mean consumption in schools that didn't meet daily standards		Mean consumption in schools that met daily standards		t-stat on Diff	Diff
	No. students	Mean cups	Max cups	No. students	Mean cups	No. students	Mean cups		Mean cups
Fruit	600	0.52	2.84	178	0.47	422	0.54	1.44	0.07
Vegetables									
Dark green	51	0.23	2.00	7	0.01	44	0.26	6.66*	0.25
Orange	87	0.16	0.95	22	0.08	65	0.19	2.43*	0.11
Red/orange	864	0.21	2.53	151	0.14	713	0.23	5.38*	0.09
Legumes	56	0.30	1.10	1	0.04	55	0.30	6.64*	0.26
Other	980	0.13	1.99	88	0.06	892	0.13	2.85*	0.07
Total vegetables	1,148	0.46	3.09	102	0.41	1,046	0.47	1.49	0.06

B - 2005 mean consumption by students of school lunches who consumed at least some of the food types

	Mean consumption in schools that didn't meet weekly standards		Mean consumption in schools that met weekly standards		t-stat on Diff	Diff
	No. students	Mean cups	No. students	Mean cups		Mean cups
Fruit	80	0.46	520	0.53	1.07	0.07
Vegetables						
Dark green	1	0.01	50	0.23	5.85*	0.22
Orange	20	0.07	67	0.20	2.91*	0.12
Red/orange	40	0.15	824	0.21	2.22*	0.06
Legumes	21	0.27	35	0.31	0.58	0.04
Other	9	0.00	971	0.13	11.30*	0.13
Total vegetables	22	0.39	1,126	0.46	0.7	0.07

* Statistically significant difference (p<0.05).

¹There is no daily required minimum for dark green vegetables, red/orange vegetables, legumes, and other vegetables. The analysis uses implied values from weekly requirements.

Source: Author's analysis using SNDA-III data.

K through 8 (i.e., 0.21 cup for red/orange vegetables and 0.13 cup for “other” vegetables). The implied daily standards for red/orange vegetables are 0.15 cup for K through 8th graders and 0.25 cup for 9th through 12th graders.

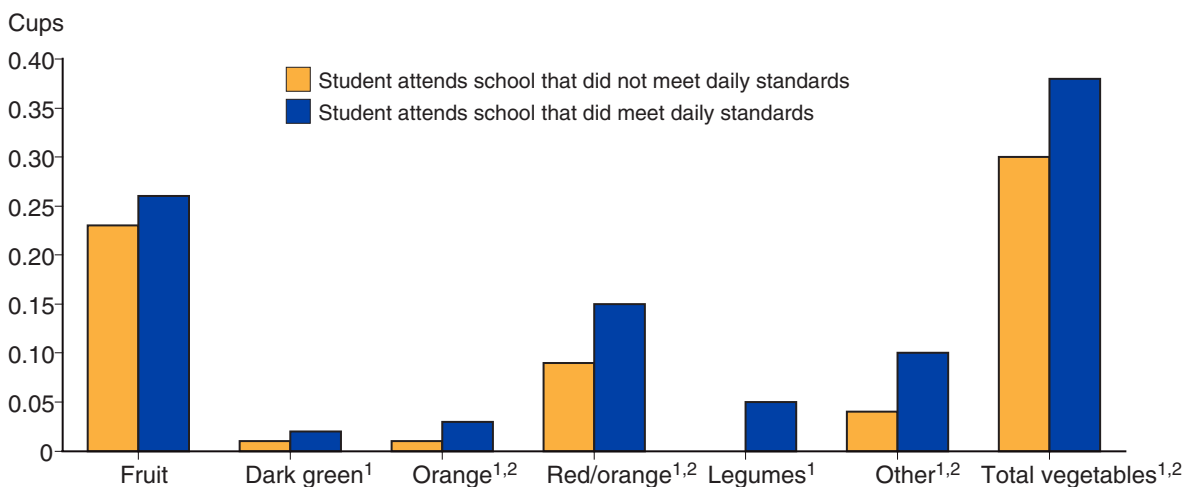
Mean consumption of total vegetables was 0.46 cup among students who consumed some, insufficient to meet the daily standard for either age group (0.75 cup for K through 8th graders and 1 cup for 9th through 12th graders). The “total vegetables” category includes starchy vegetables such as corn and potatoes (the only specific vegetable category not examined since it is already highly consumed by students).

Students in schools that met the implied and actual daily standards for vegetables consumed significantly more vegetables than students in schools that did not (table 4, panel A; fig. 1). Mean consumption of all vegetable types was higher among students in schools that met the daily standards. Mean consumption of orange vegetables and other vegetables was significantly higher among students in schools that met the weekly standards for those two vegetable categories. For all other categories, consumption among students was higher in schools that met the standards compared with students in schools that did not meet the standards, but the differences were not statistically significant.

A higher share of students tried some of the vegetables if they attended schools that met the daily standards as opposed to schools that did not meet the daily standards for the vegetable in question (table 4, panels A and B; fig. 2). The shares of students who ate some of the food were significantly higher at schools that met the daily standard for orange vegetables, legumes, and total vegetables. However, the share of students who tried some dark green vegetables was significantly lower at schools that met the daily standard.

Figure 1

Average cups consumed at lunch by all students



Note: The chart shows the average cups of fruit and vegetables by type separated by whether the school the students attended met the standards for those foods. The “orange” category shows schools that met or did not meet the 2011 proposed standard for orange vegetables, and the “red/orange” category shows schools the met or did not meet the final 2012 standard that combines red and orange vegetables together.

¹Indicates significant difference in the means ($p < 0.05$).

²Indicates significance when included with other independent variables in a Tobit model of consumption.

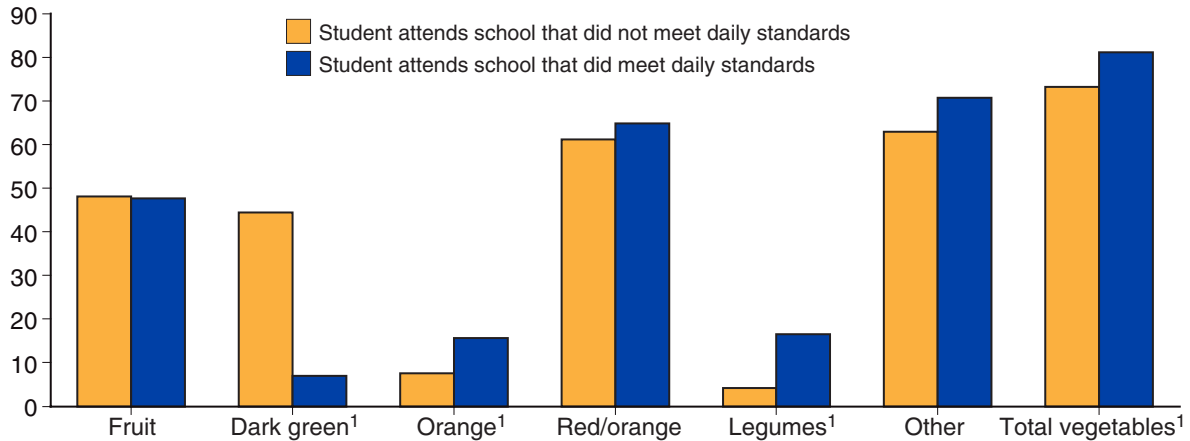
Source: ERS calculations using the data from the School Nutrition and Dietary Assessment III (SNDA III).

Among students who ate some of each food (table 4, panel B), mean consumption was significantly higher for each type of vegetable for students in schools that met the implied daily standards (figures 3 and 4 show the amounts relative to the standards for elementary and secondary students, respectively). The only exception was for the total vegetables category, where mean consumption levels for

Figure 2

Share of students who ate some of the lunch item when offered

Percent of students



Note: The chart shows the shares of students who tried different fruits and vegetables by type, separated by whether the school the students attended met the standards for those foods. The “orange” category shows schools that met or did not meet the 2011 proposed standard for orange vegetables, and the “red/orange” category shows schools the met or did not meet the final 2012 standard that combines red and orange vegetables together.

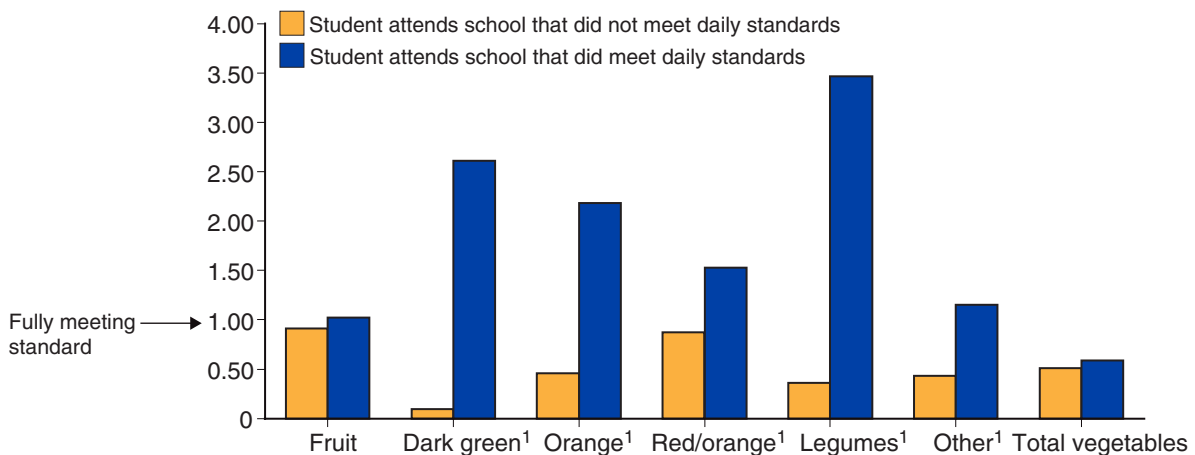
¹Indicates significant difference in the means ($p < 0.05$).

Source: ERS calculations using the data from the School Nutrition and Dietary Assessment III (SNDA III).

Figure 3

Amount consumed at lunch relative to the new standards by elementary school students who ate some fruits and vegetables

Cups consumed relative to standard



Note: The chart shows the amounts consumed by elementary students relative to the standards for fruits and vegetables by type, separated by whether the school the students attended met the standards for those foods. The “orange” category shows schools that met or did not meet the 2011 proposed standard for orange vegetables, and the “red/orange” category shows schools the met or did not meet the final 2012 standard that combines red and orange vegetables together.

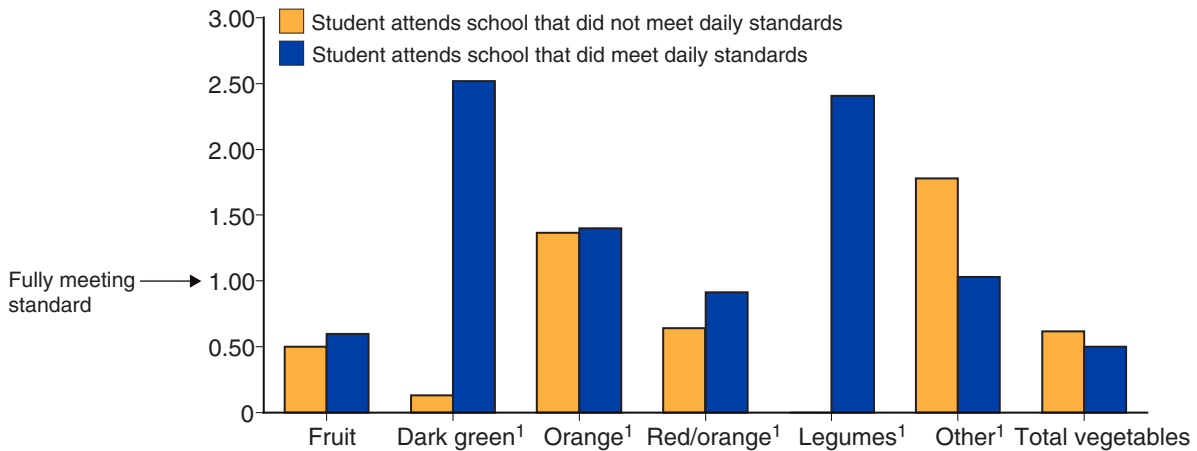
¹Indicates significant difference in the means ($p < 0.05$).

Source: ERS calculations using the data from the School Nutrition and Dietary Assessment III (SNDA III).

Figure 4

Amount consumed at lunch relative to the new standards by secondary school students who ate some fruits and vegetables

Cups consumed relative to standard



Note: The chart shows the amounts consumed by secondary students relative to the standards for fruits and vegetables by type, separated by whether the school the students attended met the standards for those foods. The “orange” category shows schools that met or did not meet the 2011 proposed standard for orange vegetables, and the “red/orange” category shows schools the met or did not meet the final 2012 standard that combines red and orange vegetables together.

¹Indicates significant difference in the means (p < 0.05).

Source: ERS calculations using the data from the School Nutrition and Dietary Assessment III (SNDA III).

students in schools that did not meet the standard was similar to the mean for those in schools that met the daily standard. And in schools that met the weekly standards, mean consumption among students who consumed at least some of the foods was significantly higher for dark green, orange, red/orange, and “other” vegetables compared with similar students in schools that did not meet the weekly standards.

Factors That Affect Consumption of Fruits and Vegetables Targeted by the 2012 Standards

Summary statistics are shown in table 5 for all students in the matched sample and for students in each of the samples served the different fruit and vegetable types. The Tobit regression results show the estimated correlation with consumption of offering more fruits and vegetables, and of meeting the daily and weekly standards on consumption, while controlling for a large set of potentially confounding factors.

The first set of regressions shows the results for students in schools that offered at least some of each of the foods on the matched day (table 6). The main hypothesis tested is whether offering more of the food is correlated with greater consumption that day. Only for red/orange vegetables does offering more of them appear to be correlated with greater consumption by standard levels of statistical significance. But the results are positive and significant if using a lower test of significance (10 percent) for dark green vegetables. The results suggest that for every cup of red/orange vegetables offered, 0.02 cup more will be eaten by NSLP participants, when the average consumed was only 0.13 cup (table 5). For every cup of dark green vegetables offered, 0.02 cup more would be eaten, which is double the amount consumed on average.

Table 5

Summary statistics for students who ate school lunch and who attended schools that offered each food type

All variables	All NSLP students		Fruit		Dark green		Orange	
	Mean	Std. error	Mean	Std. error	Mean	Std. error	Mean	Std. error
Fruit consumption (cups)	0.26	0.02	0.25	0.02	0.24	0.02	0.25	0.02
Dark green veg consumption (cups)	0.01	0.00	0.01	0.00	0.02	0.01	0.01	0.00
Orange vegetable consumption	0.01	0.00	0.01	0.00	0.01	0.00	0.02	0.01
Red/orange vegetable consumption	0.13	0.01	0.12	0.01	0.14	0.01	0.14	0.01
Legumes consumption	0.02	0.00	0.02	0.00	0.01	0.00	0.02	0.01
Other vegetable consumption	0.09	0.01	0.08	0.01	0.09	0.01	0.10	0.01
Total vegetable consumption	0.37	0.02	0.37	0.02	0.42	0.03	0.38	0.02
Age	11.18	0.19	11.32	0.20	12.31	0.29	11.60	0.28
Male	0.51	0.02	0.51	0.02	0.52	0.02	0.52	0.02
Received free or red-price lunch	0.51	0.03	0.49	0.03	0.45	0.04	0.49	0.04
Spanish spoken at home	0.12	0.02	0.10	0.02	0.08	0.01	0.13	0.03
White	0.51	0.04	0.51	0.04	0.54	0.05	0.52	0.05
Hispanic	0.24	0.03	0.23	0.03	0.20	0.02	0.25	0.04
Black	0.19	0.03	0.20	0.04	0.20	0.04	0.15	0.03
Other race/ethnic group	0.07	0.01	0.07	0.01	0.06	0.01	0.08	0.01
Watches no TV	0.08	0.01	0.08	0.01	0.07	0.01	0.08	0.01
Watches TV less than 1 hr/day	0.34	0.02	0.34	0.02	0.32	0.02	0.36	0.02
Watches TV 1 to 3 hrs/day	0.35	0.01	0.35	0.01	0.37	0.02	0.34	0.02
Watches TV 3 to more hrs/day	0.23	0.02	0.23	0.02	0.24	0.03	0.22	0.02
Very picky eater	0.22	0.01	0.20	0.01	0.21	0.02	0.22	0.02
Somewhat picky eater	0.44	0.02	0.44	0.02	0.43	0.02	0.44	0.02
Not a picky eater	0.35	0.02	0.35	0.02	0.36	0.02	0.34	0.02
Eats more than average	0.23	0.01	0.24	0.01	0.23	0.01	0.24	0.02
Eats same as average	0.60	0.02	0.60	0.02	0.63	0.02	0.58	0.02
Eats less than average	0.16	0.01	0.16	0.01	0.14	0.01	0.18	0.01
Two-parent family	0.66	0.02	0.67	0.02	0.70	0.02	0.68	0.03
Food-insecure household	0.22	0.02	0.21	0.02	0.19	0.02	0.23	0.02
Family dines together	0.21	0.02	0.21	0.02	0.31	0.03	0.24	0.02
Open campus	0.11	0.03	0.12	0.04	0.09	0.03	0.10	0.03
Fast-food available nearby	0.10	0.03	0.11	0.03	0.10	0.03	0.08	0.02
Offer vs. Serve available	0.94	0.02	0.95	0.02	0.96	0.02	0.94	0.03
Healthy/no a la carte ¹	0.34	0.04	0.32	0.04	0.17	0.04	0.34	0.05
Mid-Atlantic region	0.10	0.01	0.10	0.02	0.11	0.02	0.09	0.02
Midwest region	0.17	0.02	0.17	0.02	0.15	0.03	0.17	0.03
Mountain region	0.07	0.02	0.07	0.01	0.06	0.02	0.08	0.02
Northeast region	0.07	0.02	0.08	0.02	0.06	0.02	0.08	0.02
Southeast region	0.27	0.02	0.29	0.02	0.35	0.04	0.23	0.03
Southwest region	0.16	0.02	0.14	0.02	0.16	0.03	0.18	0.03
Western region	0.16	0.02	0.15	0.02	0.11	0.02	0.17	0.03
City	0.37	0.05	0.36	0.05	0.29	0.06	0.31	0.06
Urban fringe of city	0.30	0.05	0.30	0.05	0.38	0.06	0.32	0.05
Town	0.08	0.03	0.07	0.02	0.10	0.04	0.06	0.03
Rural area	0.26	0.04	0.27	0.04	0.22	0.05	0.31	0.05
Number of students	1,442		1,364		850		901	

—continued

Table 5

Summary statistics for students who ate school lunch and who attended schools that offered each food type—continued

All variables	Red/orange		Legumes		Other vegs.		Total vegs.	
	Mean	Std. error	Mean	Std. error	Mean	Std. error	Mean	Std. error
Fruit consumption (cups)	0.26	0.02	0.25	0.03	0.26	0.02	0.26	0.02
Dark green veg consumption (cups)	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00
Orange vegetable consumption	0.01	0.00	0.02	0.01	0.01	0.00	0.01	0.00
Red/orange vegetable consumption	0.13	0.01	0.14	0.02	0.13	0.01	0.13	0.01
Legumes consumption	0.02	0.00	0.05	0.01	0.02	0.00	0.02	0.00
Other vegetable consumption	0.09	0.01	0.09	0.01	0.09	0.01	0.09	0.01
Total vegetable consumption	0.38	0.02	0.33	0.03	0.38	0.02	0.37	0.02
Age	11.29	0.20	12.02	0.50	11.24	0.19	11.19	0.19
Male	0.51	0.02	0.51	0.03	0.51	0.02	0.51	0.02
Received free or red-price lunch	0.49	0.03	0.56	0.03	0.50	0.03	0.51	0.03
Spanish spoken at home	0.11	0.02	0.18	0.05	0.12	0.02	0.12	0.02
White	0.52	0.04	0.45	0.05	0.52	0.04	0.51	0.04
Hispanic	0.24	0.03	0.37	0.05	0.24	0.03	0.24	0.03
Black	0.18	0.03	0.13	0.03	0.17	0.03	0.18	0.03
Other race/ethnic group	0.07	0.01	0.06	0.01	0.07	0.01	0.07	0.01
Watches no TV	0.08	0.01	0.07	0.02	0.08	0.01	0.08	0.01
Watches TV less than 1 hr/day	0.34	0.02	0.33	0.03	0.34	0.02	0.34	0.02
Watches TV 1 to 3 hrs/day	0.35	0.01	0.38	0.04	0.35	0.01	0.35	0.01
Watches TV 3 to more hrs/day	0.23	0.02	0.22	0.03	0.23	0.02	0.23	0.02
Very picky eater	0.21	0.01	0.21	0.02	0.21	0.01	0.21	0.01
Somewhat picky eater	0.44	0.02	0.42	0.03	0.45	0.02	0.44	0.02
Not a picky eater	0.35	0.02	0.38	0.03	0.34	0.02	0.34	0.02
Eats more than average	0.24	0.01	0.25	0.03	0.23	0.01	0.23	0.01
Eats same as average	0.60	0.02	0.63	0.02	0.60	0.02	0.60	0.02
Eats less than average	0.17	0.01	0.13	0.02	0.16	0.01	0.16	0.01
Two-parent family	0.67	0.02	0.68	0.03	0.67	0.02	0.66	0.02
Food-insecure household	0.22	0.02	0.26	0.02	0.22	0.02	0.22	0.02
Family dines together	0.22	0.02	0.32	0.04	0.21	0.02	0.21	0.02
Open campus	0.11	0.03	0.10	0.06	0.12	0.03	0.12	0.03
Fast food available nearby	0.10	0.03	0.15	0.07	0.10	0.03	0.10	0.03
Offer vs. Serve available	0.94	0.02	0.99	0.01	0.94	0.02	0.94	0.02
Healthy/no a la carte ¹	0.32	0.04	0.29	0.08	0.34	0.04	0.33	0.04
Mid-Atlantic region	0.10	0.02	0.05	0.03	0.10	0.01	0.10	0.01
Midwest region	0.16	0.02	0.12	0.03	0.16	0.02	0.16	0.02
Mountain region	0.08	0.02	0.04	0.01	0.07	0.02	0.07	0.02
Northeast region	0.08	0.02	0.03	0.01	0.07	0.02	0.07	0.02
Southeast region	0.27	0.02	0.17	0.03	0.26	0.02	0.27	0.02
Southwest region	0.15	0.02	0.25	0.04	0.16	0.02	0.16	0.02
Western region	0.16	0.02	0.34	0.05	0.16	0.02	0.16	0.02
City	0.35	0.05	0.29	0.07	0.35	0.05	0.36	0.05
Urban fringe of city	0.31	0.05	0.33	0.08	0.30	0.05	0.30	0.05
Town	0.07	0.03	0.05	0.04	0.08	0.03	0.08	0.03
Rural area	0.27	0.04	0.33	0.08	0.27	0.04	0.26	0.04
Number of students	1,366		390		1,403		1,439	

* FPL = Federal poverty line. NSLP = National School Lunch Program. ¹Healthy/no à la carte = either no à la carte available or à la carte does not include low-nutrition, energy dense foods.

Source: Author's analysis using SNDA-III data.

Table 6

Marginal effects of amounts offered on student consumption of foods in 2005 school lunches

Independent variables	Fruit	Dark green	Orange	Red/orange	Legumes	Other vgs.	Total vgs.
Age	-0.00744* (-2.18)	-0.00171 (-0.99)	-0.00275 (-1.69)	-0.000310 (-0.21)	-0.00887* (-2.13)	0.00221 (1.62)	0.00811* (2.62)
Male	-0.0121 (-0.72)	-0.0258* (-2.31)	-0.00633 (-0.86)	0.00260 (0.42)	0.0309* (2.44)	0.00734 (1.03)	0.0150 (1.14)
Received free or reduced-price lunch	0.0232 (1.03)	-0.0142 (-0.96)	-0.00474 (-0.39)	0.00656 (0.70)	0.0314* (2.06)	0.00783 (1.00)	0.00578 (0.29)
Spanish spoken at home	0.0312 (0.74)	0.0516* (2.40)	-0.0170 (-1.38)	-0.00156 (-0.10)	0.00302 (0.11)	-0.0190 (-1.54)	-0.00627 (-0.23)
Hispanic	0.0631* (2.18)	-0.0287 (-1.70)	-0.0314** (-2.81)	-0.00657 (-0.53)	-0.00964 (-0.49)	0.00560 (0.44)	-0.00691 (-0.25)
Black	0.0911*** (3.41)	0.0350* (2.28)	-0.0173 (-1.40)	-0.0139 (-1.07)	0.0497 (1.62)	0.0128 (1.41)	0.00242 (0.08)
Other race/ethnic group	-0.00841 (-0.26)	-0.0104 (-0.68)	-0.0289 (-1.80)	-0.0185 (-1.26)	-0.00514 (-0.16)	-0.0100 (-1.08)	-0.00995 (-0.36)
Watches TV less than 1 hr/day	0.0103 (0.27)	-0.0335 (-1.82)	0.00648 (0.41)	0.0293 (1.63)	-0.0125 (-0.28)	0.00848 (0.76)	0.0225 (0.67)
Watches TV 1 to 3 hrs/day	0.00760 (0.24)	-0.0284 (-1.77)	0.0221 (1.33)	0.0120 (0.71)	-0.0159 (-0.40)	0.0164 (1.60)	0.0334 (0.96)
Watches TV 3 to more hrs/day	0.0156 (0.42)	-0.0214 (-1.63)	0.0128 (0.79)	0.0130 (0.83)	-0.00919 (-0.25)	0.0125 (0.96)	0.0128 (0.32)
Very picky eater	-0.0228 (-1.09)	-0.0504*** (-3.79)	-0.0281* (-2.54)	-0.00588 (-0.53)	-0.0149 (-0.62)	-0.00971 (-1.14)	-0.0287 (-1.33)
Somewhat picky eater	-0.0122 (-0.61)	-0.0204 (-1.85)	-0.0152* (-1.99)	-0.0209* (-2.35)	-0.0160 (-0.92)	-0.00885 (-1.24)	-0.0452* (-2.42)
Eats more than average	0.000106 (0.00)	0.00579 (0.34)	0.00856 (0.71)	-0.00266 (-0.19)	-0.0105 (-0.46)	0.000601 (0.05)	0.00515 (0.18)
Eats same as average	0.00627 (0.24)	0.0126 (0.89)	0.00382 (0.40)	0.00485 (0.44)	-0.0118 (-0.45)	-0.00571 (-0.57)	-0.00865 (-0.39)
Two-parent family	-0.0187 (-1.19)	-0.0291* (-2.59)	0.00838 (0.98)	-0.00826 (-0.97)	0.00220 (0.14)	-0.00823 (-1.12)	-0.0228 (-1.18)
Food-insecure household	-0.00406 (-0.17)	0.0129 (1.34)	0.0202 (1.80)	0.0107 (1.06)	0.0210 (1.27)	0.0106 (1.55)	0.0250 (1.48)
Family dines together	-0.0491** (-2.71)	-0.00829 (-0.89)	-0.00128 (-0.14)	0.00170 (0.24)	0.0192 (0.98)	0.0114 (1.50)	0.0103 (0.65)
Open campus	-0.0340 (-1.04)	0.0119 (0.53)	-0.0132 (-0.69)	-0.00543 (-0.29)	0.00971 (0.37)	0.0120 (1.03)	-0.0277 (-1.11)
Fast food available nearby	0.0491 (1.21)	0.0186 (0.81)	0.0313 (1.66)	0.00599 (0.32)	-0.0138 (-0.64)	-0.0185 (-1.60)	0.0208 (0.91)

—continued

Table 6

Marginal effects of amounts offered on student consumption of foods in 2005 school lunches—continued

Independent variables	Fruit	Dark green	Orange	Red/orange	Legumes	Other vegs.	Total vegs.
Offer vs. Serve available	-0.0678 (-1.98)	0.0164 (0.66)		0.0175 (0.66)		0.0105 (0.44)	0.00227 (0.04)
Healthy/no à la carte ¹	0.000903 (0.04)	0.0340* (2.22)	-0.00459 (-0.40)	0.0162 (1.31)	-0.00665 (-0.25)	-0.000233 (-0.03)	0.0522 (1.97)
Mid-Atlantic region	0.00468 (0.08)	0.00262 (0.12)	-0.0257 (-0.94)	-0.0291 (-1.33)	0.00330 (0.11)	-0.0187 (-1.31)	0.0737 (1.62)
Midwest region	0.0623 (1.20)	-0.0000862 (-0.00)	0.0320* (2.08)	-0.00768 (-0.46)	-0.0859** (-3.28)	-0.00540 (-0.40)	0.0864* (2.19)
Mountain region	0.0134 (0.24)	-0.0125 (-0.33)	0.0178 (0.90)	0.0376 (1.71)	-0.0290 (-0.63)	0.0269* (2.08)	0.123** (3.38)
Northeast region	-0.0192 (-0.33)	0.0172 (0.57)	-0.0132 (-0.57)	-0.0110 (-0.59)	0.0281 (0.54)	0.00793 (0.36)	0.0576 (1.20)
Southeast region	0.0553 (1.02)	-0.00323 (-0.16)	0.0110 (0.72)	0.0182 (1.21)	-0.0495 (-1.55)	0.0121 (0.89)	0.135*** (4.40)
Southwest region	-0.0148 (-0.29)	-0.00918 (-0.40)	0.0155 (1.20)	0.00621 (0.45)	-0.0537* (-2.22)	0.0210 (1.66)	0.0986*** (3.76)
City	-0.0190 (-0.73)	0.00157 (0.11)	-0.0139 (-1.02)	-0.00866 (-0.76)	-0.0836** (-3.00)	-0.0285** (-3.13)	-0.0511 (-1.72)
Urban fringe of city	-0.0246 (-1.11)	-0.0237 (-1.42)	-0.00798 (-0.52)	-0.000374 (-0.03)	-0.0473 (-1.70)	-0.00767 (-0.80)	-0.00105 (-0.04)
Town	-0.0500 (-1.48)	-0.00319 (-0.17)	-0.0103 (-0.58)	0.0151 (0.69)	0.0105 (0.48)	-0.0120 (-0.79)	-0.0288 (-0.62)
Fruit offered (cups)	0.0119 (1.64)						
Quantity of dark green vegetables offered (cups)		0.0166 (1.70)					
Quantity of orange vegetables offered (cups)			0.0243 (1.58)				
Quantity of red/orange vegetables offered (cups)				0.0178* (2.16)			
Quantity of legumes offered (cups)					0.0577 (1.56)		
Quantity of other vegetables offered (cups)						0.00133 (0.22)	
Quantity of total vegetables offered (cups)							0.00370 (0.67)
Number of students	1,364	850	901	1,366	390	1,403	1,439

FPL = Federal poverty line.

¹Healthy/no à la carte = either no à la carte available or à la carte is does not include low-nutrition, energy dense foods.

Marginal effects are shown with t-statistics in parentheses, with levels of significance marked as such: *** p<0.001, ** p<0.01, * p<0.05

Reference dummy categories: White, Not a picky eater, Watches no TV, Eats less than average, More than 1,000 students, and Rural area.

Source: Author's analysis using SNDA-III data.

Table 7

Marginal effects of meeting daily standards on student consumption of foods in 2005 school lunches

Independent variables	Fruit	Dark green	Orange	Red/orange	Legumes	Other vgs.	Total vgs.
Age	-0.00673 (-1.97)	-0.00176 (-1.00)	-0.00328* (-2.00)	-0.000969 (-0.61)	-0.00621 (-1.40)	0.00208 (1.62)	0.00741* (2.31)
Male	-0.0123 (-0.73)	-0.0243* (-2.08)	-0.00641 (-0.86)	0.00174 (0.26)	0.0407** (3.21)	0.00641 (0.89)	0.0117 (0.82)
Received free or reduced-price lunch	0.0222 (0.99)	-0.0156 (-1.04)	-0.00463 (-0.38)	0.00137 (0.14)	0.0230 (1.33)	0.00644 (0.81)	0.00510 (0.23)
Spanish spoken at home	0.0347 (0.83)	0.0543* (2.42)	-0.0173 (-1.40)	0.00192 (0.13)	0.00545 (0.15)	-0.0137 (-1.12)	0.00936 (0.35)
Hispanic	0.0628* (2.17)	-0.0320 (-1.83)	-0.0303** (-2.83)	-0.00791 (-0.62)	-0.00162 (-0.07)	-0.000727 (-0.06)	-0.0232 (-0.79)
Black	0.0942*** (3.60)	0.0299* (1.99)	-0.0158 (-1.31)	-0.0143 (-1.04)	0.0252 (0.82)	0.0117 (1.22)	0.00982 (0.33)
Other race/ethnic group	-0.00629 (-0.20)	-0.0147 (-0.98)	-0.0305 (-1.90)	-0.0199 (-1.23)	-0.00181 (-0.05)	-0.0116 (-1.16)	-0.00507 (-0.17)
Watches TV less than 1 hr/day	0.00922 (0.24)	-0.0351 (-1.91)	0.00713 (0.44)	0.0309 (1.65)	-0.0244 (-0.59)	0.00658 (0.52)	0.0188 (0.53)
Watches TV 1 to 3 hrs/day	0.00618 (0.19)	-0.0294 (-1.83)	0.0226 (1.31)	0.0154 (0.86)	-0.0245 (-0.65)	0.00988 (0.85)	0.0299 (0.81)
Watches TV 3 to more hrs/day	0.0152 (0.41)	-0.0232 (-1.79)	0.0134 (0.79)	0.0155 (0.96)	-0.0142 (-0.40)	0.0109 (0.75)	0.0129 (0.31)
Very picky eater	-0.0237 (-1.14)	-0.0503*** (-3.74)	-0.0265* (-2.46)	-0.0132 (-1.12)	-0.0340 (-1.25)	-0.0146 (-1.82)	-0.0507* (-2.46)
Somewhat picky eater	-0.0111 (-0.56)	-0.0217 (-1.86)	-0.0157* (-2.02)	-0.0235* (-2.55)	-0.0114 (-0.66)	-0.00898 (-1.22)	-0.0497* (-2.53)
Eats more than average	0.00125 (0.04)	0.00403 (0.24)	0.00992 (0.82)	-0.00181 (-0.13)	-0.00351 (-0.15)	-0.00160 (-0.13)	-0.00869 (-0.27)
Eats same as average	0.00730 (0.27)	0.0126 (0.91)	0.00502 (0.52)	0.00517 (0.43)	0.00135 (0.05)	-0.00718 (-0.67)	-0.0194 (-0.75)
Two-parent family	-0.0192 (-1.23)	-0.0297** (-2.70)	0.00784 (0.94)	-0.0116 (-1.39)	0.00587 (0.38)	-0.00892 (-1.15)	-0.0241 (-1.19)
Food-insecure household	-0.00315 (-0.14)	0.0122 (1.29)	0.0216 (1.86)	0.0137 (1.29)	0.0239 (1.27)	0.0120 (1.62)	0.0289 (1.73)
Family dines together	-0.0471* (-2.60)	-0.0108 (-1.17)	-0.000143 (-0.02)	-0.00161 (-0.21)	0.00844 (0.40)	0.0117 (1.47)	0.0106 (0.61)
Open campus	-0.0343 (-1.02)	0.0165 (0.70)	-0.00341 (-0.17)	0.0158 (1.11)	0.0209 (0.81)	0.0202 (1.63)	-0.00155 (-0.06)
Fast food available nearby	0.0504 (1.21)	0.0102 (0.41)	0.0261 (1.35)	-0.00748 (-0.47)	-0.0319 (-1.31)	-0.0249* (-2.06)	0.00458 (0.18)

—continued

Table 7

Marginal effects of meeting daily standards on student consumption of foods in 2005 school lunches—continued

Independent variables	Fruit	Dark green	Orange	Red/orange	Legumes	Other vegs.	Total vegs.
Offer vs. Serve available	-0.0735* (-2.13)	0.0126 (0.52)		0.0361 (1.36)		0.00894 (0.35)	0.00484 (0.08)
Healthy/no à la carte ¹	0.000692 (0.03)	0.0297 (1.88)	-0.00323 (-0.29)	0.0112 (0.91)	-0.0133 (-0.40)	0.00114 (0.12)	0.0509 (1.78)
Mid-Atlantic region	0.00674 (0.12)	-0.00105 (-0.04)	-0.0283 (-1.15)	-0.0171 (-0.76)	0.0146 (0.62)	-0.0250 (-1.63)	0.0804 (1.73)
Midwest region	0.0649 (1.25)	-0.0124 (-0.42)	0.0236 (1.39)	-0.000442 (-0.03)	-0.102*** (-3.84)	-0.0102 (-0.72)	0.100* (2.37)
Mountain region	0.0115 (0.20)	-0.0191 (-0.50)	0.0196 (0.94)	0.0476 (1.91)	-0.0256 (-0.78)	0.0189 (1.43)	0.132** (3.09)
Northeast region	-0.0192 (-0.33)	0.00928 (0.30)	-0.00978 (-0.38)	0.00614 (0.28)	0.0313 (0.46)	0.00261 (0.12)	0.0626 (1.32)
Southeast region	0.0530 (0.99)	-0.00889 (-0.41)	0.0101 (0.64)	0.0255 (1.63)	-0.0661* (-2.12)	0.00513 (0.37)	0.144*** (4.61)
Southwest region	-0.00371 (-0.07)	-0.0131 (-0.58)	0.0180 (1.22)	0.0161 (1.13)	-0.0538* (-2.03)	0.0199 (1.56)	0.116*** (4.19)
City	-0.0183 (-0.70)	0.00149 (0.10)	-0.0194 (-1.31)	-0.00665 (-0.53)	-0.102** (-3.07)	-0.0247* (-2.44)	-0.0352 (-1.08)
Urban fringe of city	-0.0247 (-1.14)	-0.0231 (-1.25)	-0.0118 (-0.76)	0.00959 (0.74)	-0.0474 (-1.65)	-0.00983 (-1.06)	0.00944 (0.33)
Town	-0.0473 (-1.37)	-0.00115 (-0.06)	-0.0138 (-0.94)	0.0251 (1.10)	0.0317 (1.45)	-0.0163 (-1.05)	-0.0256 (-0.51)
Met daily fruit standard	0.0313 (1.68)						
Met daily dark green veg. std.		-0.00101 (-0.04)					
Met daily orange veg. std.			0.0297* (2.28)				
Met daily red/orange veg. std.				0.0406** (2.97)			
Met daily legume standard					0.0428 (1.09)		
Met daily other veg. std.						0.0261* (2.21)	
Met daily total veg. std.							0.0612* (2.13)
No. of students served the food	1,364	850	901	1,366	390	1,403	1,439

FPL = Federal poverty line.

¹Healthy/no à la carte = either no à la carte available or à la carte is does not include low-nutrition, energy dense foods.

Marginal effects are shown with t-statistics in parentheses, with levels of significance marked as such: *** p<0.001, ** p<0.01, * p<0.05

Reference dummy categories: White, Not a picky eater, Watches no TV, Eats less than average, More than 1,000 students, and Rural area.

Source: Author's analysis using SNDA-III data.

The second set of regressions examines the correlation between consumption and schools offering the foods in amounts that meet the new daily or implied daily standards (table 7). These thresholds are fairly low, since they are daily thresholds and also because the implied daily thresholds are derived from weekly thresholds that are not meant to be too hard for schools to achieve.¹¹ Several of the dummy variables for whether the school met the daily standard are significant: the dummies for orange vegetables, red/orange vegetables, “other” vegetables, and total vegetables each have positive and significant effects on consumption. In other words, for every cup of a given food offered, NSLP participants in schools that offered quantities that met the real or implied daily standard for the food ate, respectively, 0.03 cup more of fruit, 0.03 cup more of orange vegetables, 0.04 cup more red/orange vegetables, 0.03 cup more of “other” vegetables, and 0.06 cup more of total vegetables. These marginal increases represent sizable shares of the amounts of fruit and vegetables consumed by students on a daily basis, which were 0.25 cup for fruit, 0.02 cup for orange vegetables, 0.13 cup for red/orange vegetables, 0.09 cup for “other” vegetables, and 0.37 cup for total vegetables (table 4).

The third set of regressions examines the correlation between consumption and offering the foods in amounts that meet the weekly standards (table 8). Here, there is no support for the hypothesis that a school meeting the weekly standard for a food affected the consumption of that food among students who were served at least some of the food.

Other variables that were found to be correlated with consumption of some of the foods examined were if the student was labeled by their parent as a “very picky eater” (negative effect), if the student was Black or came from a home in which Spanish is spoken (positive effects) or if the student was Hispanic (positive and negative effects). Being from a two-parent family was correlated with lower consumption of dark green vegetables in all three regressions, which was not quite expected, but could suggest an economic reason akin to lower levels of food insecurity. In all three sets of regressions, being a “very picky eater” or a “somewhat picky eater” was significantly correlated with reduced consumption for almost all food types, but particularly for dark green vegetables, legumes, other vegetables, and total vegetables.

Being a student from a food-insecure household was not significantly correlated with greater consumption of any of the foods. This was not expected, especially in light of findings from Potamites and Gordon (2010), who wrote: “Less food-secure students (the insecure or marginally secure) obtained higher proportions of their daily calories, nutrients, and foods from on-menu school foods than highly secure students” (p. 97).

Students without access to less healthy à la carte food options at lunch ate significantly more dark green vegetables in the first and third regressions. In the second regression, the estimated effect was significant at the 10-percent level. However, the lack of less healthy à la carte foods was not significantly correlated with the consumption of other foods. The finding for dark green vegetables is consistent with previous findings that removing less healthy snacks and à la carte foods led to higher consumption of vegetables (Cullen et al., 2008; Dragoset and Gordon, 2010). It is reasonable to expect consumption of other foods to increase when snack and à la carte foods are not available, but for children to increase their consumption of vegetables may represent an extra hurdle. Wordell et al. (2012) found that while consumption of less healthy foods decreased when à la carte foods were

¹¹Recall that in each of the food type categories, more schools met the weekly standards than met the real or implied daily standards (table 3), largely because the weekly standards are defined over a longer time period. So, the schools that met the daily standards definitely served the food that day, but possibly in a smaller amount over the week than would be needed to meet the weekly standard.

Table 8

Marginal effects of meeting weekly standards on student consumption of foods in 2005 school lunches

Independent variables	Fruit	Dark green	Orange	Red/orange	Legumes	Other vegs.	Total vegs.
Age	-0.00643 (-1.84)	-0.00176 (-0.99)	-0.00297 (-1.74)	-0.000320 (-0.21)	-0.00574 (-1.29)	0.00237 (1.85)	0.00809* (2.58)
Male	-0.0118 (-0.71)	-0.0242* (-2.20)	-0.00709 (-0.92)	0.00186 (0.27)	0.0405** (3.20)	0.00661 (0.92)	0.0139 (1.00)
Received free or reduced-price lunch	0.0205 (0.91)	-0.0158 (-1.05)	-0.00377 (-0.31)	0.00429 (0.43)	0.0242 (1.36)	0.00639 (0.80)	0.00280 (0.13)
Spanish spoken at home	0.0312 (0.74)	0.0541* (2.41)	-0.0170 (-1.41)	0.00235 (0.15)	0.00407 (0.11)	-0.0152 (-1.23)	0.00630 (0.24)
Hispanic	0.0636* (2.20)	-0.0319 (-1.83)	-0.0309** (-2.79)	-0.00788 (-0.59)	-0.0000821 (-0.00)	-0.000336 (-0.03)	-0.0213 (-0.73)
Black	0.0909** (3.40)	0.0294 (1.96)	-0.0202 (-1.54)	-0.0186 (-1.31)	0.0270 (0.87)	0.00950 (0.98)	0.00540 (0.17)
Other race/ethnic group	-0.00725 (-0.23)	-0.0148 (-0.99)	-0.0275 (-1.76)	-0.0191 (-1.19)	-0.000751 (-0.02)	-0.0122 (-1.22)	-0.00576 (-0.19)
Watches TV less than 1 hr/day	0.00932 (0.24)	-0.0351 (-1.91)	0.00677 (0.42)	0.0266 (1.45)	-0.0234 (-0.56)	0.00949 (0.80)	0.0193 (0.55)
Watches TV 1 to 3 hrs/day	0.00698 (0.22)	-0.0297 (-1.85)	0.0233 (1.34)	0.0129 (0.73)	-0.0221 (-0.59)	0.0121 (1.09)	0.0314 (0.86)
Watches TV 3 to more hrs/day	0.0173 (0.46)	-0.0231 (-1.76)	0.0139 (0.83)	0.0152 (0.93)	-0.0123 (-0.35)	0.0139 (0.98)	0.0173 (0.41)
Very picky eater	-0.0220 (-1.05)	-0.0499*** (-3.75)	-0.0288* (-2.55)	-0.0140 (-1.19)	-0.0340 (-1.25)	-0.0132 (-1.60)	-0.0477* (-2.30)
Somewhat picky eater	-0.0102 (-0.52)	-0.0215 (-1.85)	-0.0153* (-2.02)	-0.0229* (-2.46)	-0.0132 (-0.76)	-0.00851 (-1.14)	-0.0470* (-2.42)
Eats more than average	0.00115 (0.04)	0.00363 (0.22)	0.00764 (0.64)	-0.00545 (-0.39)	-0.00376 (-0.15)	-0.00203 (-0.16)	-0.00819 (-0.26)
Eats same as average	0.00849 (0.32)	0.0126 (0.91)	0.00326 (0.33)	0.00168 (0.15)	0.000377 (0.01)	-0.00691 (-0.64)	-0.0205 (-0.82)
Two-parent family	-0.0182 (-1.15)	-0.0297** (-2.69)	0.00795 (0.92)	-0.0113 (-1.32)	0.00619 (0.39)	-0.00895 (-1.15)	-0.0219 (-1.08)
Food-insecure household	-0.00203 (-0.09)	0.0123 (1.30)	0.0200 (1.82)	0.0134 (1.26)	0.0244 (1.30)	0.0118 (1.59)	0.0290 (1.73)
Family dines together	-0.0476** (-2.64)	-0.0106 (-1.12)	-0.00320 (-0.34)	0.00100 (0.13)	0.00911 (0.43)	0.0130 (1.65)	0.0132 (0.77)
Open campus	-0.0401 (-1.19)	0.0166 (0.72)	-0.0108 (-0.53)	0.0154 (0.99)	0.0198 (0.78)	0.0223 (1.81)	0.00667 (0.24)
Fast food available nearby	0.0556 (1.30)	0.0105 (0.45)	0.0298 (1.52)	-0.0134 (-0.88)	-0.0325 (-1.32)	-0.0288* (-2.49)	-0.00755 (-0.29)

—continued

Table 8

Marginal effects of meeting weekly standards on student consumption of foods in 2005 school lunches—continued

Independent variables	Fruit	Dark green	Orange	Red/orange	Legumes	Other vegs.	Total vegs.
Offer vs. Serve available	-0.0733* (-2.09)	0.0116 (0.47)		0.0276 (1.01)		0.00785 (0.30)	0.00695 (0.11)
Healthy/no à la carte ¹	-0.00276 (-0.13)	0.0299* (2.02)	-0.00716 (-0.64)	0.00955 (0.70)	-0.00970 (-0.29)	-0.00131 (-0.14)	0.0404 (1.41)
Mid-Atlantic region	0.0106 (0.19)	-0.000571 (-0.02)	-0.0200 (-0.81)	-0.0237 (-0.99)	0.0140 (0.57)	-0.0258 (-1.66)	0.0816 (1.73)
Midwest region	0.0717 (1.38)	-0.0129 (-0.44)	0.0331* (2.01)	-0.0000344 (-0.00)	-0.103*** (-3.67)	-0.00932 (-0.64)	0.0947* (2.23)
Mountain region	0.0178 (0.31)	-0.0188 (-0.50)	0.0195 (1.01)	0.0477 (1.96)	-0.0213 (-0.68)	0.0177 (1.34)	0.127** (2.97)
Northeast region	-0.0265 (-0.45)	0.00873 (0.28)	-0.0141 (-0.61)	-0.00650 (-0.32)	0.0308 (0.44)	0.00189 (0.08)	0.0579 (1.18)
Southeast region	0.0577 (1.05)	-0.00853 (-0.42)	0.0131 (0.91)	0.0223 (1.35)	-0.0649 (-1.99)	0.00577 (0.42)	0.139*** (4.42)
Southwest region	-0.00243 (-0.05)	-0.0130 (-0.57)	0.0123 (1.01)	0.0143 (0.99)	-0.0554* (-2.05)	0.0205 (1.55)	0.112*** (4.13)
City	-0.0213 (-0.81)	0.00124 (0.09)	-0.0156 (-1.06)	-0.00731 (-0.56)	-0.105** (-3.07)	-0.0236* (-2.25)	-0.0392 (-1.19)
Urban fringe of city	-0.0230 (-1.04)	-0.0230 (-1.27)	-0.00587 (-0.40)	0.00908 (0.66)	-0.0502 (-1.71)	-0.00777 (-0.80)	0.0130 (0.44)
Town	-0.0532 (-1.57)	-0.00104 (-0.05)	-0.0115 (-0.69)	0.0140 (0.66)	0.0314 (1.43)	-0.0129 (-0.85)	-0.0245 (-0.51)
Met daily fruit standard	0.0282 (1.11)						
Met daily dark green veg. std.		-0.0207 (-0.62)					
Met daily orange veg. std.			0.0155 (1.54)				
Met daily red/orange veg. std.				0.0233 (1.61)			
Met daily legume standard					0.000131 (0.01)		
Met daily other veg. std.						0.0205 (1.18)	
Met daily total veg. std.							0.00175 (0.04)
No. of students served the food	1,364	850	901	1,366	390	1403	1,439

FPL = Federal poverty line.

¹Healthy/no à la carte = either no à la carte available or à la carte is does not include low-nutrition, energy dense foods.

Note: Marginal effects are shown with z-scores in parentheses, with levels of significance marked as: *** p<0.001, ** p<0.01, * p<0.05

Reference dummy categories: White, Not a picky eater, Watches no TV, Eats less than average, More than 1,000 students, and Rural area.

Source: Author's analysis using SNDA-III data.

removed, vegetable consumption did not increase. The results found here for dark green vegetables can be seen as evidence of students crossing that extra hurdle.

Age, sex, and race/ethnicity were associated with consumption (tables 6, 7, and 8). Interestingly, older students (variable “age”) ate significantly more total vegetables in all three regressions, and they ate less fruit in the regression that tested the effect of amount offered (and close to significantly less fruit in the other two regressions). But older students ate significantly less legumes in the regression that tested the effect of the amount offered and less orange vegetables in the regression that tested the effect of the implied daily standard. The results in the total vegetable consumption regressions suggest that older students ate more starchy vegetables than younger students since that category is the one type of vegetable not explicitly examined. Boys ate significantly less dark green vegetables and significantly more legumes than girls.

Compared to White students, Black students consumed more fruit in all three regressions and more dark green vegetables in the regression that tested the effect of amount offered and in the regression that tested the effect of the implied daily standard. Hispanics ate significantly less orange vegetables and more fruit in all three regressions. Yet, students from Spanish-speaking homes ate significantly more dark green vegetables in all three regressions.

Students who received free or reduced-price lunches consumed similar levels of each food type as students who paid the full lunch price. The one exception is that students who received free or reduced-price lunches consumed greater quantities of legumes in the regression that tested the effect of the amount offered. Defying expectations, hearty eaters did not eat more of any of the food types examined. Similarly, watching a lot of TV was not correlated with lower levels of consumption of fruits and vegetables. Contrary to expectations, access to other lunch options at school—through open campus and even the offer-versus-serve policy—was not correlated with lower fruit and vegetable consumption.

Discussion

The bivariate mean consumption results suggest that school lunch participants who were offered dark green vegetables, red/orange vegetables, legumes, and other vegetables in amounts that met an implied daily standard were more likely to eat those vegetables compared to students at schools that offered them in lower amounts. The same was true for school lunch participants who were offered orange vegetables in amounts that met the proposed standard. The implied daily threshold is small—one-tenth of a cup for dark green and orange vegetables, legumes and other vegetables—but most schools offer these vegetables in amounts well above that. For example, among schools that met the implied daily standard for dark green vegetables, the median amount offered was 0.57 cup, and among schools that met the orange vegetable daily standard the median amount was 0.78 cup.

Unlike the daily standard, the weekly standard does not necessarily reflect the amount of food available to be eaten on a given day. Instead, it represents the types and amounts of foods to which students are likely to have been exposed over time. The bivariate results suggest that students who were offered orange vegetables and “other” vegetables in amounts that met the weekly standards ate more of them, but that was not the case for the other vegetables examined. However, among students who ate at least some of the vegetables, mean consumption was significantly higher for students at schools that met the weekly standards for all of the specific vegetable types (but not total fruit or total vegetables). That could mean that once a student is willing to eat some of a vegetable, he or she is willing to eat more, if it is generally offered.

When controlling for characteristics of students and other school-related factors, the effects of offering greater quantities of fruits or vegetables (with the exception of red/orange vegetables) or of meeting the weekly standards on consumption are insignificant at the conventional level of statistical significance of 5 percent (tables 6 and 8). But the estimated correlation between consumption and offering more dark green vegetables is statistically significant at 10 percent significance (table 6). This suggests that there could be a positive effect on consumption of offering more dark green vegetables, albeit a weak one. On the other hand, the significant results for the correlation between the daily standard and consumption of many vegetables (orange, red/orange, “other” vegetables, and total vegetables) remained significant when controlling for other school and student factors. This is stronger support for the hypothesis that offering vegetables at the new required amounts leads to greater consumption of vegetables.

An important caveat is that selection effects and endogeneity might alter the composition of our NSLP participants and of the schools that provide healthier foods. Since students can generally choose whether to participate in the school lunch program, it is possible that students who are exposed to, say, more dark green vegetables in school lunches would choose not to participate if they were averse to eating those foods. The sample would be biased to the extent that it consists of participating students who are more willing to consume those foods than is the average student. Another possible confounding effect is that the relationship is endogenous if children’s willingness to consume certain fruits and vegetables makes it more likely and profitable for schools to serve those foods.

Unfortunately, the data do not permit a full analysis of these two possibilities. For modeling a selection effect, there is not a suitable instrument that would help determine participation but not be a factor in consumption. And we do not have data for modeling the menu offering choices made by the

school cafeteria, especially how those offerings would change in response to children's willingness to consume different foods.

However, there are several factors that mitigate these potential problems. Regarding the possible selection issue, most students are able to refuse certain items from their plate, making the presence of unwanted fruits or vegetables on the lunch line less of a reason for students to forego the whole lunch. The entrée is often more likely to be the reason for choosing to participate or not. Second, students who participate do not have to eat all of their lunch even if they get an unwanted item. Third, if students at schools that offered healthier options were more likely to opt out of the meal program, we might see a higher mean consumption of fruits and vegetables among school lunch participants compared to nonparticipants. Analysis of the SNDA-III data shows no significant differences in fruit and vegetable intakes between students who reported consumption of a reimbursable meal and those who did not except for the combined category of red/orange vegetables in which NSLP participants were found to consume significantly more (Appendix A).

Appendixes B and C present the shares of schools by different characteristics that met and did not meet the daily standards and the weekly standards, respectively, to explore any potential systematic differences across schools that could inform possible issues of endogeneity or selection. Schools on the urban fringe were more likely to meet many of the standards such as those for dark green vegetables, orange vegetables, and legumes, while schools from rural areas were less likely to meet many of the new standards. Other school types that had higher shares of schools meeting the standards than not meeting them include schools in districts with low child poverty, schools with healthy à la carte options or no à la carte options, Mid-Atlantic schools (for schools meeting daily dark green and orange vegetables), Southwest schools (for dark green vegetables and legumes), and Western schools (for legumes). These characteristics were all controlled for in the regressions (or were insignificant in earlier modeling and not included due to the need to be parsimonious), but there could be other unobservable and uncounted characteristics of schools that are important factors in determining children's consumption of fruits and vegetables.

The possible effects of selection and endogeneity underline the fact that the results show correlations and not necessarily causation. Thus, we cannot conclude that school offerings that met the new standards necessarily led to higher levels of student consumption. It is possible that the students in the sample were more willing to eat those foods to begin with.

Since the SNDA-III is a cross-sectional survey conducted at a point in time, the analysis may be flawed in terms of understanding the dynamics of students' ability to adapt and change their willingness to eat new foods over time. If the schools that offered the newer foods in 2005 had been offering those foods over many years, the results here could be interpreted more pessimistically to mean that students will generally refuse to consume such foods. On the other hand, if those offerings were fairly new to schools in 2005, then results are more supportive of the possibility that students can change their eating behaviors.

Conclusions

This report seeks to inform our understanding of how school-meal participants will respond to new school-meal nutrition standards that were first introduced in the 2012-13 school year. Will students consume the new amounts and newly emphasized types of fruits and vegetables being offered in school lunches? The changes that schools are required to make are not drastic—by design—but they have important implications for the health of children and the financial viability of school-meal programs. The analysis takes advantage of the fact that some schools had already met the new standards in 2005 when nationally representative school-meal intake data were last collected.

The research finds that more than half of schools met most of the weekly standards for fruits and vegetables. Only for “other” vegetables and total vegetables did almost all schools meet the weekly standards, suggesting that many schools will have needed to increase fruit and vegetable offerings to meet the 2012 standards. The study finds that only 55 percent of schools met the daily fruit standard in 2005, while 87 percent of schools met the total vegetable daily standard, meaning that schools will have needed to substantially increase their daily fruit offerings to meet the new standards (or serve the entire required weekly amount on 1 or 2 days). The implied daily standards used in the study are not important for compliance purposes, but they show that few schools met the implied daily standards for dark green vegetables and legumes. And though schools are not required to meet minimum serving levels for orange vegetables, the analysis shows that only 55 percent of schools met the proposed weekly standard for orange vegetables, and 28 percent an implied daily standard for orange vegetables.

Overall, the results are fairly sanguine for what can be expected to occur in the future as the new standards are implemented more widely. Bivariate and multivariate estimates of the correlation between offering students enough vegetables to meet a daily, or implied daily, standard and consumption of those vegetables were positive and either significant or marginally significant for most of the vegetables examined. In other words, student consumption of fruit and vegetables was generally correlated with school lunch offerings of those foods, although we do not know which causes which. We also find that more students at schools that met the new daily standards tried many of the new vegetables than did students at schools that did not meet the new daily standards. And of those students who ate some, consumption was higher and more likely to match the standards among students at schools that met the standards.

Less optimistically, many students did not eat any of the offered fruits and specific vegetables in 2005, such as dark green vegetables. Among those students who did eat some, however, the amounts consumed of most of the vegetables were enough to meet the implied daily standards. Other efforts will be needed to encourage more students to try the new fruit and vegetable offerings. Multiple strategies for encouraging consumption—such as in-class educational efforts and altering the food environment, as was done in some European schools (Van Cauwenberghe et al., 2012)—will probably be needed.

Given the positive correlations found in this report between consumption and providing foods in amounts that meet the new standards, children’s acceptance of fruit and vegetables may be more successful as more schools make them available, especially over time, and as schools develop additional strategies to encourage their consumption.

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Appendix Tables

Appendix A

Mean total consumption of fruit and vegetables in 2005 by whether students participated in the NSLP

	Mean total consumption over 24 hours by all students	Mean total consumption over 24 hours by NSLP participants	Mean total consumption over 24 hours by students who were not NSLP participants	t-stat	Difference
	Servings in cups/ounces				
Fruit	1.24	1.215	1.306	-1.15	-0.091
Vegetables					
Dark green	0.05	0.046	0.055	-0.84	-0.010
Orange	0.05	0.048	0.052	-0.44	-0.004
Red/orange	0.36	0.378	0.319	2.49*	0.059
Legumes	0.07	0.070	0.055	1.18	0.015
Other	0.29	0.284	0.312	-1.18	-0.028
Total vegetables	1.11	1.120	1.086	0.67	0.034
Observations	2,256	1,590	666		

* Statistically significant ($p < 0.05$). NSLP = National School Lunch Program.

Note: The total number of schools represents the schools in the sample for which the dates matched precisely between the menu survey and the student consumption survey.

Source: Author's analysis using SNDA-III data.

Characteristics of schools that met and did not meet the daily and implied daily NSLP standards from 2013 by food type in 2005¹

Met the daily standard or not:	All schools	Fruit		Dark green veg.		Orange veg.		Red/orange veg.	
		Yes	No	Yes	No	Yes	No	Yes	No
Elementary	0.63	0.65	0.59	0.47	0.73	0.62	0.63	0.52	0.82
Middle or high	0.37	0.35	0.41	0.53	0.27	0.38	0.37	0.48	0.18
Region									
Mid-Atlantic	0.12	0.15	0.08	0.15	0.10	0.15	0.11	0.12	0.12
Midwest	0.18	0.24	0.10	0.22	0.16	0.24	0.16	0.17	0.20
Mountain	0.13	0.06	0.24	0.05	0.19	0.07	0.16	0.12	0.17
Northeast	0.09	0.08	0.12	0.10	0.09	0.06	0.11	0.07	0.15
Southeast	0.21	0.27	0.13	0.27	0.18	0.18	0.22	0.23	0.18
Southwest	0.13	0.10	0.17	0.13	0.13	0.13	0.13	0.14	0.11
Western	0.13	0.10	0.17	0.09	0.15	0.16	0.11	0.16	0.06
Urbanicity									
City	0.32	0.29	0.35	0.28	0.34	0.35	0.30	0.31	0.33
Urban fringe	0.27	0.31	0.22	0.35	0.22	0.34	0.24	0.28	0.26
Town	0.09	0.09	0.09	0.12	0.08	0.05	0.11	0.06	0.15
Rural area	0.32	0.31	0.34	0.25	0.37	0.26	0.35	0.35	0.26
District child poverty									
Less than 20% FPL ²	0.59	0.69	0.44	0.70	0.52	0.72	0.54	0.61	0.55
Between 20 - 30% FPL ²	0.33	0.25	0.46	0.22	0.41	0.16	0.41	0.29	0.41
More than 30% FPL ²	0.07	0.06	0.09	0.09	0.07	0.12	0.06	0.09	0.04
Share of free/reduced-price eligible students	0.46	0.46	0.46	0.45	0.47	0.47	0.46	0.49	0.40
Healthy/no à la carte ³	0.40	0.35	0.48	0.28	0.48	0.33	0.43	0.38	0.42
Offer vs. serve	0.91	0.92	0.89	0.93	0.90	0.89	0.92	0.91	0.90
Open campus	0.11	0.12	0.11	0.12	0.11	0.09	0.12	0.11	0.13
Fast food close by	0.10	0.10	0.09	0.09	0.10	0.08	0.10	0.10	0.08
Food service management co.	0.07	0.03	0.12	0.04	0.08	0.02	0.09	0.04	0.11
Chain food available at lunch	0.27	0.29	0.23	0.23	0.29	0.24	0.28	0.27	0.26
Menu planning method									
Nutrient-based	0.27	0.25	0.29	0.25	0.28	0.24	0.28	0.23	0.35
Enhanced food-based	0.21	0.26	0.14	0.25	0.19	0.34	0.16	0.25	0.13
Traditional food-based	0.52	0.49	0.56	0.50	0.53	0.42	0.56	0.52	0.52
Kitchen type									
On site	0.69	0.71	0.66	0.69	0.69	0.66	0.70	0.71	0.64
Base kitchen	0.12	0.13	0.11	0.17	0.09	0.16	0.10	0.13	0.10
Receiving kitchen	0.19	0.16	0.24	0.14	0.23	0.18	0.20	0.16	0.26
Number of schools	257	174	83	149	108	94	163	199	58

—continued

Characteristics of schools that met and did not meet the daily and implied daily NSLP standards from 2013 by food type in 2005¹—continued

Met the daily standard or not:	All schools	Legume veg.		Other veg.		Total veg.	
		Yes	No	Yes	No	Yes	No
Elementary	0.63	0.45	0.67	0.60	0.81	0.59	0.87
Middle or high	0.37	0.55	0.33	0.40	0.19	0.41	0.13
Region							
Mid-Atlantic	0.12	0.06	0.14	0.12	0.15	0.13	0.05
Midwest	0.18	0.14	0.19	0.18	0.21	0.16	0.36
Mountain	0.13	0.07	0.15	0.13	0.13	0.14	0.11
Northeast	0.09	0.02	0.11	0.11	0.01	0.10	0.04
Southeast	0.21	0.15	0.23	0.22	0.18	0.23	0.11
Southwest	0.13	0.29	0.09	0.14	0.09	0.12	0.20
Western	0.13	0.28	0.09	0.11	0.23	0.13	0.12
Urbanicity							
City	0.32	0.32	0.31	0.27	0.61	0.28	0.57
Urban fringe	0.27	0.26	0.27	0.27	0.30	0.29	0.17
Town	0.09	0.14	0.08	0.11	0.02	0.09	0.11
Rural area	0.32	0.28	0.33	0.36	0.07	0.34	0.16
District child poverty							
Less than 20% FPL ²	0.59	0.63	0.58	0.61	0.47	0.62	0.36
Between 20 - 30% FPL ²	0.33	0.32	0.34	0.32	0.43	0.30	0.59
More than 30% FPL ²	0.07	0.05	0.08	0.07	0.10	0.08	0.06
Share of free/reduced-price eligible students	0.46	0.50	0.45	0.44	0.59	0.44	0.59
Healthy/no à la carte ³	0.40	0.41	0.39	0.36	0.61	0.34	0.80
Offer vs. serve	0.91	0.99	0.89	0.91	0.91	0.90	0.95
Open campus	0.11	0.13	0.11	0.12	0.10	0.12	0.06
Fast food close by	0.10	0.18	0.08	0.10	0.10	0.10	0.06
Food service management co.	0.07	0.02	0.08	0.07	0.05	0.07	0.06
Chain food available at lunch	0.27	0.29	0.26	0.26	0.30	0.24	0.45
Menu planning method							
Nutrient-based	0.27	0.40	0.24	0.25	0.39	0.26	0.33
Enhanced food-based	0.21	0.12	0.23	0.21	0.23	0.22	0.18
Traditional food-based	0.52	0.48	0.53	0.54	0.38	0.52	0.50
Kitchen type							
On site	0.69	0.65	0.70	0.71	0.52	0.71	0.51
Base kitchen	0.12	0.14	0.12	0.13	0.07	0.12	0.08
Receiving kitchen	0.19	0.22	0.19	0.16	0.40	0.16	0.41
Number of schools	257	70	187	228	29	236	21

Note: The “orange” category shows schools that met or did not meet the 2011 proposed standard for orange vegetables, and the “red/orange” category shows schools the met or did not meet the final 2012 standard that combines red and orange vegetables together.

¹The sample is of the schools of students who ate a school lunch and for which SNDA-III intake data are available and could be matched by date to the consumption survey dates.

²FPL = Federal poverty line.

³Healthy/no à la carte = either no à la carte available or à la carte does not include low-nutrition, energy-dense foods.

Source: Author’s analysis using SNDA-III data.

Characteristics of schools that met and did not meet the weekly NSLP standards from 2013 by food type in 2005¹

Met the daily standard or not:	All schools	Fruit		Dark green veg.		Orange veg.		Red/orange veg.	
		Yes	No	Yes	No	Yes	No	Yes	No
Elementary	0.63	0.67	0.49	0.57	0.80	0.66	0.59	0.63	0.63
Middle or high	0.37	0.33	0.51	0.43	0.20	0.34	0.41	0.37	0.37
Region									
Mid-Atlantic	0.12	0.14	0.06	0.10	0.18	0.12	0.12	0.13	0.09
Midwest	0.18	0.19	0.16	0.18	0.20	0.15	0.22	0.14	0.37
Mountain	0.13	0.06	0.36	0.15	0.10	0.07	0.21	0.06	0.49
Northeast	0.09	0.12	0.00	0.10	0.08	0.10	0.09	0.11	0.00
Southeast	0.21	0.23	0.16	0.20	0.26	0.23	0.19	0.25	0.04
Southwest	0.13	0.13	0.12	0.16	0.03	0.17	0.08	0.15	0.00
Western	0.13	0.12	0.13	0.12	0.16	0.16	0.08	0.15	0.00
Urbanicity									
City	0.32	0.33	0.26	0.30	0.35	0.34	0.28	0.32	0.32
Urban fringe	0.27	0.30	0.18	0.30	0.18	0.31	0.23	0.30	0.11
Town	0.09	0.11	0.04	0.09	0.10	0.05	0.15	0.09	0.11
Rural area	0.32	0.26	0.52	0.30	0.37	0.30	0.34	0.29	0.47
District child poverty									
Less than 20% FPL ²	0.59	0.66	0.39	0.63	0.47	0.66	0.51	0.65	0.32
Between 20 - 30% FPL ²	0.33	0.26	0.56	0.30	0.43	0.24	0.45	0.27	0.67
More than 30% FPL ²	0.07	0.08	0.05	0.07	0.10	0.10	0.04	0.09	0.01
Share of free/reduced-price eligible students	0.46	0.46	0.47	0.43	0.54	0.47	0.44	0.48	0.35
Healthy/no à la carte ³	0.40	0.37	0.48	0.35	0.53	0.37	0.44	0.36	0.59
Offer vs. serve	0.91	0.90	0.94	0.94	0.82	0.92	0.90	0.90	0.97
Open campus	0.11	0.12	0.09	0.12	0.09	0.13	0.10	0.11	0.13
Fast food close by	0.10	0.10	0.09	0.10	0.08	0.13	0.06	0.11	0.04
Food service management co.	0.07	0.06	0.10	0.08	0.04	0.08	0.05	0.07	0.04
Chain food available at lunch	0.27	0.30	0.17	0.27	0.27	0.29	0.24	0.28	0.20
Menu planning method									
Nutrient-based	0.27	0.28	0.24	0.28	0.24	0.30	0.23	0.29	0.18
Enhanced food-based	0.21	0.24	0.12	0.22	0.20	0.18	0.25	0.20	0.26
Traditional food-based	0.52	0.48	0.64	0.50	0.56	0.52	0.52	0.51	0.56
Kitchen type									
On site	0.69	0.66	0.76	0.70	0.65	0.70	0.67	0.71	0.59
Base kitchen	0.12	0.13	0.09	0.12	0.11	0.14	0.10	0.13	0.04
Receiving kitchen	0.19	0.21	0.14	0.18	0.24	0.16	0.23	0.16	0.37
Number of schools	257	211	46	209	48	159	98	239	18

—continued

Characteristics of schools that met and did not meet the weekly NSLP standards from 2013 by food type in 2005¹—continued

Met the daily standard or not:	All schools	Legume veg.		Other veg.		Total veg.	
		Yes	No	Yes	No	Yes	No
Elementary	0.63	0.47	0.67	0.62	1.00	0.62	0.78
Middle or high	0.37	0.53	0.33	0.38	0.00	0.38	0.22
Region							
Mid-Atlantic	0.12	0.02	0.15	0.13	0.00	0.13	0.05
Midwest	0.18	0.01	0.23	0.17	0.84	0.17	0.51
Mountain	0.13	0.02	0.16	0.14	0.00	0.13	0.16
Northeast	0.09	0.02	0.11	0.10	0.00	0.09	0.07
Southeast	0.21	0.30	0.19	0.22	0.00	0.22	0.00
Southwest	0.13	0.35	0.07	0.13	0.00	0.13	0.00
Western	0.13	0.27	0.09	0.13	0.16	0.12	0.20
Urbanicity							
City	0.32	0.27	0.33	0.30	0.84	0.29	0.89
Urban fringe	0.27	0.38	0.24	0.27	0.16	0.28	0.11
Town	0.09	0.05	0.11	0.10	0.00	0.10	0.00
Rural area	0.32	0.30	0.32	0.33	0.00	0.33	0.00
District child poverty							
Less than 20% FPL ²	0.59	0.57	0.60	0.61	0.00	0.61	0.15
Between 20 - 30% FPL ²	0.33	0.37	0.33	0.32	1.00	0.31	0.85
More than 30% FPL ²	0.07	0.07	0.08	0.08	0.00	0.08	0.00
Share of free/reduced-price eligible students	0.46	0.56	0.44	0.46	0.64	0.45	0.65
Healthy/no à la carte ³	0.40	0.37	0.40	0.38	1.00	0.37	0.95
Offer vs. serve	0.91	0.99	0.89	0.91	1.00	0.91	0.85
Open campus	0.11	0.20	0.09	0.12	0.00	0.12	0.00
Fast food close by	0.10	0.24	0.06	0.10	0.00	0.10	0.00
Food service management co.	0.07	0.01	0.08	0.07	0.00	0.06	0.16
Chain food available at lunch	0.27	0.39	0.24	0.25	0.84	0.26	0.51
Menu planning method							
Nutrient-based	0.27	0.32	0.25	0.25	0.84	0.26	0.51
Enhanced food-based	0.21	0.10	0.24	0.22	0.00	0.21	0.16
Traditional food-based	0.52	0.57	0.51	0.53	0.16	0.53	0.33
Kitchen type							
On site	0.69	0.61	0.71	0.71	0.00	0.71	0.21
Base kitchen	0.12	0.19	0.10	0.12	0.00	0.13	0.00
Receiving kitchen	0.19	0.20	0.19	0.17	1.00	0.17	0.79
Number of schools	257	82	175	254	3	251	6

Note: The “orange” category shows schools that met or did not meet the 2011 proposed standard for orange vegetables, and the “red/orange” category shows schools the met or did not meet the final 2012 standard that combines red and orange vegetables together.

¹The sample is of the schools of students who ate a school lunch and for which SNDA-III intake data are available and could be matched by date to the consumption survey dates.

²FPL = Federal poverty line.

³Healthy/no à la carte = either no à la carte available or à la carte does not include low-nutrition, energy-dense foods.

Source: Author’s analysis using SNDA-III data.