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Do School Lunch Menus Influence National School Lunch Program Participation?

Janet G. Peckham
Graduate Student, Clemson University
jgemmil@clemson.edu
(Corresponding author)

Jaclyn D. Kropp
Assistant Professor, University of Florida
jkropp@ufl.edu

Thomas A. Mroz
Professor, Clemson University
tmroz@clemson.edu

Vivian Haley-Zitlin
Associate Professor, Clemson University
vivianh@clemson.edu

Ellen M. Granberg
Associate Professor, Clemson University
granber@clemson.edu

Nikki Hawthorne
Director of Food & Nutrition Services,
Anderson 5 School District
nikkihawthorne@anderson5.net

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Abstract: The National School Lunch Program (NSLP) is one of the largest nutrition assistance programs in the United States, providing free and reduced-price lunches for income-eligible students as well as minimally subsidizing paid lunches for students that do not qualify to receive free or reduce-price lunches. Although the levels of nutrient deficiencies vary slightly across studies, the majority of the research concedes that NSLP participants consume more fats and sodium than non-participants, which may lead to higher rates of overweight and obesity. Furthermore, differences across income in dietary intake among NSLP participants may be an underlying cause of the previous mixed results. In this study, we investigate the relationship between income-eligibility status (Free, Reduced, or Paid) and entrée selection. Using a unique dataset tracking daily entrée choices and their nutritional value among elementary students at a suburban school district, this paper provides a novel approach to understanding the healthfulness of the NSLP. We find that while controlling for age, gender, and race, students that purchase free lunch choose entrees with less sodium than students purchasing either reduced-price or paid lunches. Relative to students purchasing free-lunches, students purchasing paid lunches also choose entrees with more protein and fat and entrees with fewer carbohydrates.

JEL: D12, I18, I38 Q18

Keywords: National School Lunch Program, Obesity, Point of Sale Data

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Introduction

The National School Lunch Program (NSLP) is one of the largest nutrition assistance programs in the United States, providing free and reduced-price lunches for income-eligible students as well as minimally subsidizing paid lunches for students that do not qualify to receive free or reduce-price lunches. In 2011, over five billion lunches were served to an average of 31.7 million students per day (U.S. Department of Agriculture 2012). When the program was introduced in 1946, the ‘Type A’ qualifying lunch offered was designed to provide one-third to one-half of the daily food requirements of a ten- to twelve-year-old child (Ralston et al. 2008). As nutritional knowledge progressed over time, the Type A lunch was updated to reflect these advancements. New guidelines effective beginning in the 2012/13 school year align the required food components of a Type A lunch provided by the NSLP with the 2005 *Dietary Guidelines for Americans* as required by the Richard B. Russell National School Lunch Act (U.S. Department of Agriculture 2012). Specifically, the new guidelines increase the availability of healthful foods (fruits, vegetables, and whole grains), while reducing the levels of sodium and saturated fats and controlling calorie levels of the offered items. Although schools that offer the National School Lunch Program (NSLP) must adhere to the United States Department of Agriculture’s guidelines regarding menu offerings, individual schools have the ability to select the components offered on any particular day and generally offer several entrée options. The offerings at a given school on a particular day generally differ in the nutritional content and healthfulness.

In this study, we investigate the relationship between income-eligibility status (Free, Reduced, or Paid) and entrée selection. As previously indicated, some NSLP

participants are eligible to receive free lunches, other pay a reduced-cost, and some pay the full-price. Specifically, students from households with household incomes of 130 percent of the poverty line or less are eligible to receive free lunches, while students from households with household incomes between 130 percent and 185 percent of the poverty line are eligible to receive reduced-price lunches; roughly 69 percent of all lunches served are free or reduced-price lunches (Food and Nutrition Service 2013). Students from households with household incomes exceeding 185 percent of the poverty line are income-ineligible to receive free or reduced-price lunches, but may purchase “full-price” lunches.¹ Thus the nutritional standards of the NSLP may impact children of various socio-demographic backgrounds.

Previous research investigating the healthfulness of the NSLP is mixed. Recent studies have found positive correlation between participation in the NSLP and child weight (Millimet, Tchernis, & Husain 2010; Schanzenbach 2009) and energy consumption (Campbell et al. 2011). However, Campbell et al. (2011) also find that dietary quality between participants and non-participants is the same over the course of a day, suggesting participants consuming more calories at lunch may eat fewer calories at breakfast and dinner. Gleason and Suitor (2003) estimate that at lunch, NSLP participants on average consumed ninety-five percent more sodium than recommended while non-participants consumed eighty-eight percent more sodium than recommended. The authors also find that relative to non-participants (students presumably bringing lunch from home), NSLP participants consume more dietary fat as a percentage of calories. A recent study by Hanson and Olson (2013) compares the dietary intake of low-

¹ In 2012, the poverty line for a family of four was \$23,050 (U.S. Department of Agriculture 2012).

² If parents have a change in income at anytime during the school year, they can apply for a change in

income NSLP participants and high-income NSLP participants. The authors find that while all participants consumed more saturated fats and sodium than non-participants, high-income participants had lower saturated fat intake than low-income NSLP participants.

Although the levels of nutrient deficiencies vary slightly across studies, the majority of the research concedes that NSLP participants consume more fats and sodium than non-participants, which may lead to higher rates of overweight and obesity. This is particularly concerning since low-income minorities are both at greater risk for obesity and more likely to participate in the NSLP, creating the potential for positive selection bias (Ogden & Carroll 2010). Furthermore, differences across income in dietary intake among NSLP participants may be an underlying cause of the previous mixed results. Using a unique dataset tracking daily entrée choices among elementary students at a suburban school district, this paper provides a novel approach to understanding the healthfulness of the NSLP.

Data

Data were collected from the Anderson 5 School District in South Carolina, a suburban district with approximately 12,500 students in pre-kindergarten to twelfth grade. Student-level daily point of sale (POS) data were obtained from the Food and Nutrition Services department cafeteria transactions logs for the period Jan 7, 2013 to April 30, 2013. The data were collected after implementation of new nutritional guidelines. In the cafeteria, students complete transactions by entering their unique personal identification number (PIN). The PIN is linked to account information regarding lunch price status and

available funds; parents or students may add money to accounts at any time of the year. We utilized the PIN to track student-level purchases over the study period.

For students purchasing a NSLP qualifying lunch, the cashier enters “Entrée 1”, “Entrée 2”, or “Vegetarian Entrée” and the student’s account is debited the appropriate amount given the student’s income-eligibility status (Free, Reduced, or Paid)². The entrée numbers coincide with the order in which the entrées are listed on the monthly menus. The three daily entrees come with a choice of sides; this information is not entered into the POS database. Students may also have the opportunity to purchase a la carte foods, such as dessert, milk, or chips. These purchases are also recorded. However, the POS data on these purchases is not as clearly defined: the cashier may ring up a cookie as “Dessert” or use another button with an equivalent price. Furthermore, the manner in which these transactions are recorded is not yet standardized at the district-level. In Anderson 5 elementary schools, a la carte transactions account for less than 0.5 percent of total transactions. Given the available data, this paper focuses only on entrée purchases.

POS data were collected for each school day between January and April 2013 at the district’s eleven elementary schools. We limit the sample to elementary schools because they offer fewer a la carte options (food choices that are available for purchase outside of a qualifying NSLP lunch) than middle or high schools and a larger percent of K-5 students typically participate in the NSLP than middle or high school students (Fox & Condon 2012). The district also provided all enrolled students’ race, gender, and grade

² If parents have a change in income at anytime during the school year, they can apply for a change in eligibility. This occurred for 174 students between January and April. In these cases, the lowest income level is used. For example, if a student’s status changes from “paid” to “reduced,” the student is considered reduced-price lunch status for the entire school year.

level information. Thus, the dataset includes the race, gender, and grade level of all students (including those students that do not have POS data because they have not purchased a NSLP lunch or a la carte item) and POS and income eligibility status data on students that have purchased a NSLP lunch at least once. If a student is recorded as attending school on a day he does not purchase a lunch, we assume the child has brought a lunch from home.

Each school district participating in the National School Lunch Program creates a lunch menu following the guidelines for a reimbursable lunch set by the USDA. As of July 2012, the federal guidelines for kindergarten through fifth grade require participating schools to offer at least one option for each of the five meal components each day. The five meal components that must be offered daily are: 1) meat or meat alternative, 2) bread or grain, 3) fruit, 4) vegetable, and 5) milk (U.S. Department of Agriculture 2012). Total calories per lunch must fall between 550 and 650kcal, and, beginning in the school year 2014/15, total sodium can be no greater than 640mg per lunch. Districts were given more time to meet the new sodium guidelines because it will be challenging for many as the existing vendors and suppliers may need to modify their products to meet these standards. For a summary of the federal guidelines, see Appendix A. Additionally, South Carolina requires that each school offer at least two different entrees and vegetables and recommends each school offers two or more fruits (Center for Disease Control and Prevention 2007).

Anderson 5 Food and Nutrition Service creates monthly school lunch menus that meet or exceed the guidelines for a reimbursable lunch. Students and parents can access school lunch menus on-line and menus are also sent home with each student on a

monthly basis. Thus caregivers and students are aware of what is being served for lunch in the school cafeteria and can use this information when deciding to buy a school lunch or bring one from home. On a typical day, a student has three entrée choices, two fruit options, two vegetable options, and milk options to choose from (see Appendix B for an example of a monthly menu). In order to be considered a qualifying lunch (in which the school is reimbursed by the government), a student must select a minimum of three items, one of which must be a fruit or vegetable.

In the Anderson 5 School District, menu offerings are set at the district-level. During the period of investigation, there were 37 different entrée options offered in rotation. Most entrees provide the meat/meat alternative as well as a bread or grain (starch). Five entrees do not include a starch. Nutrition information for each of the entrées served (provided by the school district nutrition services director) includes total calories (kCal), fat (grams), sodium (milligrams), protein (grams), and carbohydrates (grams) per entrée. In some cases, the district uses more than one vendor for the same entrée option and it is therefore difficult to determine the nutritional information of a specific food item served on a particular day at a particular elementary school from the nutritional information provided by the district. For food items supplied by multiple vendors, we calculated the median nutritional values of each food item and used that to estimate the calories and nutrients in the entrees offered. Once a month, a “Manager’s Choice” entrée is served. On these days, the cafeteria managers of each elementary school select the menu and therefore the offerings vary across elementary schools. These days are discarded because nutrition content information could not be calculated for this option without access to each cafeteria’s daily production records.

Methods

Our analysis begins with ordinary least squares regression (OLS) of each macronutrient and the available student demographics. This simple model will help determine whether grade level, gender, school location or race impacts the nutritional value of the chosen entrée. Let Y_i be the total nutrient value in the i^{th} entrée purchased

$$(1) \quad Y_i = \alpha_i + \mathbf{x}'_i\beta + School'_i\delta + \varepsilon_i$$

The model will be estimated once for each nutrient in the dataset: Calories, Fat, Sodium, Protein, and Carbohydrates. The vector \mathbf{x}'_i includes the grade-level (kindergarten to fifth), gender (male and female), income-eligibility (free, reduced, and paid status) and race (white, black, Hispanic, and other) of the student purchasing the i^{th} entrée. Let grade-level act as a proxy for age and income-status as a proxy for family income. Lastly, a vector of dummy variables, $School'_i$, indicating which elementary school the i^{th} entrée is purchased is included. The model includes categorical variables *Race*, *Status*, *Gender*, *School*, and *Grade*. There are eleven elementary schools in Anderson 5; we maintain confidentiality by labeling each school 1 through 11.

Results

Descriptive Statistics

Forty-seven percent of district students are enrolled in one of eleven elementary schools. The spring 2013 semester began on January 7 and POS data were collected through April 30. In the 66 school days represented in the dataset, 5,592 students purchased 279,698 school lunches. An additional 187 elementary students never purchased lunch. Table 1 provides summary statistics for the key demographics. Students are evenly distributed across kindergarten through fifth grades. The majority of elementary aged students are

white, 33 percent are black, and 6 percent are Hispanic. Fifty-six percent of students receive lunch for free and 36 percent of students pay full price for school lunch. Only 3 percent of elementary school students did not receive a NSLP lunch at least once during the sample period. These students will be referred to as “Non-Participants” and should not be confused with students receiving a free NSLP lunch.

On average, a participating student purchased 50 school lunches in the 66 day sample period. Histograms in figure 1 show that the distribution of lunches purchased differs depending on lunch-price status, with the average free-lunch student purchasing 13 more lunches (about 1 more per week) than the paid-lunch students. The five most purchased entrees are the “Vegetarian Tray” (12.5 percent of sales), “Chicken Sandwich on Whole Grain Bun” (10.6 percent) “Chicken Nuggets with Dipping Sauce” (9.0 percent) “Cheese Pizza on a Whole Grain Crust” (7.4 percent), and “Hamburger on Whole Grain Bun” (6.6 percent). However, these entrées are also offered more often than others, i.e. the “Vegetarian Tray” consists of a yogurt, cheese, and crackers and is available every day. Given the number of days it is offered, the daily vegetarian option is actually one of the least popular entrees, averaging 528 transactions per day.

Using the average number of purchases per day for the days that the item was offered, the most popular entrée is “Chicken Nuggets with Dipping Sauce” (3,144 entrees purchased per day offered). Moreover, if all breaded bite-size chicken-style entrée transactions are combined (including chicken nuggets, chicken chunks, and popcorn chicken; served with or without a whole grain roll), bite-size chicken is served 13 days (19 percent of days sampled) with an average of 4,178 purchases per day. A nationally representative 2004-2005 study assessing school nutrition found 17 percent of daily

menus offered some type of breaded/fried chicken product, so Anderson 5 may offer this type of entrée slightly more than other school districts (Gordon et al. 2007). Similarly, if all pizza-style entrée transactions are combined (including cheese pizza, pepperoni pizza, pizzatas, and stuffed crust dippers³), pizza-style entrees are served more than 30 percent of all days sampled, but only an average of 2,375 entrees are purchased per day offered. The least popular entrees, measured by both percent of total sales and purchases per day offered are “Enchilada Pie with Whole Grain Roll” (0.12 percent of sales, 169 entrees purchased per day offered) and “Fish Nuggets with Dipping Sauce” (0.24 percent, 338 entrees per day).

Table 3 provides the nutritional values for the five most purchased entrees and Appendix B contains nutritional values and popularity ranking for all entrée options offered during the sample period. On average, an entrée contains 340 calories, 15g fat, 783mg sodium, 32g protein, and 19g carbohydrates. There are no federal mandates regarding the nutrition of an NSLP entrée, so without the nutritional information of the other food components offered, we are unable to determine whether or not the average lunch meets guidelines. However, the guidelines do require that a NSLP lunch provide between 550 and 650 calories (averaged over the week), leaving little wiggle room for very energy dense entrees. Figure 2 illustrates the distribution of the total nutrients per entrée. More than half of the 37 entrees have between 233 and 320kcal. The entrée highest in calories is “Chicken Alfredo with a Whole Grain Bun” (579 calories) and was only served once in our sample period. The entrée lowest in calories is “Deli Sliced Turkey on a Whole Grain Bun” (146.5 calories) and was only served twice. “Deli Sliced

³ Stuffed crust dippers are mozzarella cheese wrapped in pizza crust (Rich’s Food Service 2011a) and served with marinara sauce. Pizzatas are mozzarella cheese, pepperoni, and marinara sauce wrapped in pizza crust (Rich’s Food Service 2011b).

Turkey on a Whole Grain Bun” is also the entrée lowest in fat (2.2 grams). The “Rib-B-Q on a Whole Grain Bun” has the highest amount of fat (25.5 grams). Average total sodium is greater than the 640mg cap effective 2014/15, and more than half the entrees have sodium levels greater than 640mg. Total sodium ranges from 345mg in “Italian Spaghetti” to 1,301mg in “Grilled Cheese with Chicken Noodle Soup.”

According to the 2004-2005 School Nutrition Dietary Assessment (SNDA-III), entrees can contribute as much as 61 percent of the total protein in an NSLP elementary school lunch (Gordon et al. 2007).⁴ “Grilled Cheese” offers the least protein and “Chicken Alfredo with a Whole Grain Bun” offers the most protein. In this case, the entrée with the most protein is also the entrée with the highest calories. When transactions are separated by lunch-price status, the average nutritional values remain similar. However, there are a few statistically significant but numerically small differences. For example, paid-status lunches have 0.04 fewer grams of fat than free-status lunches on average (see Table 2).

Regression Results

It is important to remember that the data provide information on the entrée choice a student makes and the corresponding nutritional values. Recall that the dependent variables, Y_i , do not measure the nutrients *consumed*, only the nutrients *purchased*. For example, a positive coefficient on *Gender* would suggest that boys are systematically choosing entrees that are more energy dense (when $Y_i = \text{Calories}$) than girls. We would not know if boys are simultaneously choosing side items with fewer calories, or if girls are choosing more energy dense entrees and do not eat it all.

⁴ SNDA-III categorizes food groups differently than this paper. Our “Entrée” includes the following SNDA-III major food groups: combination entrees, meat/meat Alternatives, and bread/grains.

Calories

Race, *Status*, and *Gender* are not statistically significant (Table 4). *Grade*, our proxy for age, is significant. Relative to kindergartners, students in second to fifth grade choose entrees with more calories. Joint F-tests for *Status* and *Race* fail to reject the null hypothesis: neither income-eligibility status nor race influence the caloric content of a student's choice of entrée (Table 5).

Fat

The results for estimates pertaining to *Fat* are similar to the results pertaining to *Calories*. Black students purchase entrees with more fat than white students, but the resulting difference is negligible. The hypothesis that there is no significant difference across all *Race* groups is rejected in favor of the alternative; similar results are found with *Grade*. Like the *Calories* model, the R^2 is very small: less than one-hundredth of a percent of variation in *Fat* can be explained by the explanatory variables. The coefficient for income-ineligible students (*Paid Status*) is significant and positive, suggesting that students purchasing a paid-lunch choose entrees with more fat than students purchasing free lunch. The joint F tests conclude that all four groups of explanatory variables contribute to the total fat grams a student is served.

Sodium

Compared to white students, black, Asian, Indian, Pacific Islander, or mixed race ("*Other*") students all choose higher sodium entrees than white students. Students receiving free lunch (*Free Status*) choose entrees with less salt than students receiving reduced-price or full-price lunches. The coefficient on *Gender* was also statistically significant: male students chose lower sodium entrees than female students.

As in the model where *Fat* is the dependent variable, as students get older, they choose entrees with greater amounts of sodium. First graders choose entrees with 5.6mg more than kindergartners while fifth graders choose entrees with 45.9mg more sodium. The joint F tests conclude that all four groups of explanatory variables contribute to the total sodium a student is served.

Protein

When controlling for income, gender, age, and race, black students choose entrees with 0.24 more grams of protein than white students (the amount of protein in 3 baby carrots (U.S. Department of Agriculture 2011)). The coefficients for *Other Race* and *Gender* are also statistically significant, but very small in magnitude (0.06 and 0.07g, respectively). Income-ineligible students choose entrees with 0.11g more protein than income-eligible students purchasing a free lunch. Similarly to the model for sodium, older students choose entrees with statistically larger amounts of protein.

Carbohydrates

In the final nutrient analysis, the joint F-tests suggest that Race, Status, Gender, Grade, and school contribute to the total carbohydrates a student is served. The coefficient for *Black* (compared to *White*) is negative and statistically significant but small in magnitude. The same is true for the coefficient for *Paid Status* (*vs. Free lunch students*) students. We also find male students choose entrees with 0.14 fewer carbohydrates than female students. Additionally, younger students prefer entrees with more carbohydrates than older students.

Conclusion

In this study, we investigate the relationship between income-eligibility status (Free, Reduced, or Paid) and entrée selection. Using a unique dataset tracking daily entrée choices and their nutritional value among elementary students at a suburban school district, this paper provides a novel approach to understanding the healthfulness of the NSLP. Without controlling for age, gender, or race, there is no difference in the caloric content of entrees selected by students purchasing free, reduced-price, or paid lunches. Conversely, students purchasing paid-lunches choose entrees with less fat and sodium than students purchasing free lunches. When controlling for age, gender, and race, students that purchase free lunch choose entrees with less sodium than students purchasing either reduced-price or paid lunches. Relative to students purchasing free-lunches, students purchasing paid lunches also choose entrees with more protein and fat and entrees with fewer carbohydrates.

There was no statistically significant effect of status on total calories. Due to the new guidelines requiring each qualifying lunch to have an average of 550 to 650 calories, there was a narrow distribution of calories among the 37 entrees offered at Anderson 5 elementary schools. The new guidelines also require sodium levels to be less than 650mg per meal, but this will not be effective until the 2014/15 school year. Future research may compare the distribution of sodium among entrees before and after the guideline come into effect.

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Table 1. Student Demographics

	Status				
	<i>All Students</i>	<i>Free</i>	<i>Reduced</i>	<i>Paid</i>	<i>Non- Participant</i>
Gender (Percent)					
<i>Female</i>	48.6	48.1	50.0	49.3	47.6
<i>Male</i>	51.4	52.0	50.0	50.7	52.4
Race (Percent)					
<i>White</i>	55.1	36.0	53.5	82.6	87.2
<i>Black</i>	32.5	47.8	31.9	10.9	5.3
<i>Hispanic</i>	5.7	8.5	5.0	1.7	1.6
<i>Other</i>	6.7	1.5	9.6	4.8	5.9
Grade (Percent)					
<i>Kindergarten</i>	17.4	19.2	16.3	15.4	11.2
<i>First</i>	18.3	18.7	17.0	17.7	18.7
<i>Second</i>	16.2	16.9	14.2	15.9	10.7
<i>Third</i>	16.1	15.3	16.3	17.5	13.9
<i>Fourth</i>	15.5	14.5	17.0	16.7	16.6
<i>Fifth</i>	16.5	15.4	19.2	16.8	28.9
Status (Percent)					
<i>Free</i>	56.3	100.0	0	0	0
<i>Reduced</i>	4.9	0	100.0	0	0
<i>Paid</i>	35.6	0	0	100.0	0
<i>Non-Buyer</i>	3.2	0	0	0	100.0
No. Meals Purchased	50.0 (15.9)	55.0 (10.0)	53.3 (12.2)	41.7 (20.0)	0
Total Students	5,779	3,252	282	2,058	187

Notes: "Other" includes students of Asian, Indian, Pacific Islander, or mixed race. Standard deviation listed in parentheses.

Table 2. Food Energy and Nutrients

	<i>All Transactions</i>			Mean By Status		
	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Free</i>	<i>Reduced</i>	<i>Paid</i>
Food Energy						
<i>Calories (kCal)</i>	334.47 (50.54)	146.50	579.00	334.56 (50.74)	333.90 (50.60)	334.38 (50.13)
Nutrients						
<i>Fat (g)</i>	15.37 (4.75)	2.25	25.50	15.38 (4.77)	15.41 (4.77)	15.34* (4.71)
<i>Sodium (mg)</i>	722.30 (242.24)	345.00	1,301.00	721.80 (242.03)	727.11*** (240.39)	722.52†† (242.99)
<i>Protein (g)</i>	18.52 (3.83)	11.00	34.50	18.50 (3.82)	18.51 (3.82)	18.55*** (3.84)
<i>Carbohydrates (g)</i>	29.93 (7.33)	17.50	59.00	29.94 (7.35)	29.84* (7.29)	29.91 (7.31)
Total Transactions		279,698		178,865	15,023	85,810

Notes: Standard deviation listed in parentheses. Means statistically different than Free Status at the .1, .05, and .01 level denoted with *, **, and *** respectively. Differences between Reduced and Paid Status are denoted with †, ††, and †††.

Table 3. Nutritional Value of Top 5 Purchased Entrees

Entree	<i>Percent Sales</i>	<i>Cal (kCal)</i>	<i>Fat (g)</i>	<i>Sodium (mg)</i>	<i>Protein (g)</i>	<i>Carbs (g)</i>
<i>Vegetarian Tray</i>	12.46	325.0	12.5	395.0	14.0	37.5
<i>Chicken Sandwich</i>	10.58	316.5	11.5	727.5	19.5	36.0
<i>Chicken Nuggets</i>	8.99	326.0	12.0	656.0	15.0	19.0
<i>Cheese Pizza</i>	7.35	310.0	12.0	490.0	21.0	31.0
<i>Hamburger</i>	6.57	291.5	12.0	509.5	22.5	23.0

Notes: Vegetarian Tray is served each day and includes yogurt, cheese, and cracker. Chicken Nuggets are served with honey mustard dipping sauce. Chicken Sandwich is served on a whole grain bun. Hamburger served on a whole grain bun.

Table 4. OLS Regression Results

	(1) Calories (kCal)	(2) Fat (g)	(3) Sodium (mg)	(4) Protein (g)	(5) Carbs (g)
Race (White Omitted)					
<i>Black</i>	0.22 (0.24)	0.07** (0.02)	15.47*** (1.14)	0.24*** (0.02)	-0.30*** (0.03)
<i>Hispanic</i>	-0.20 (0.42)	-0.01 (0.04)	-3.01 (2.01)	0.02 (0.03)	0.02 (0.06)
<i>Other</i>	-0.31 (0.40)	-0.06 (0.04)	5.59** (1.89)	0.06* (0.03)	-0.02 (0.06)
Status (Free Omitted)					
<i>Reduced</i>	-0.41 (0.43)	0.05 (0.04)	6.81*** (2.07)	0.03 (0.03)	-0.12 (0.06)
<i>Paid</i>	0.40 (0.25)	0.07** (0.02)	7.58*** (1.19)	0.11*** (0.02)	-0.10** (0.04)
Gender (Female Omitted)					
<i>Male</i>	-0.17 (0.19)	-0.02 (0.02)	-3.44*** (0.92)	0.07*** (0.01)	-0.14*** (0.03)
Grade (Kindergarten Omitted)					
<i>First</i>	-0.44 (0.32)	0.21*** (0.03)	5.62*** (1.54)	-0.03 (0.02)	-0.39*** (0.05)
<i>Second</i>	0.72* (0.33)	0.34*** (0.03)	24.41*** (1.58)	0.15*** (0.02)	-0.59*** (0.05)
<i>Third</i>	0.78* (0.34)	0.36*** (0.03)	34.23*** (1.63)	0.30*** (0.03)	-0.71*** (0.05)
<i>Fourth</i>	0.94** (0.34)	0.36*** (0.03)	39.47*** (1.63)	0.43*** (0.03)	-0.85*** (0.05)
<i>Fifth</i>	1.09** (0.34)	0.45*** (0.03)	45.88*** (1.63)	0.47*** (0.03)	-0.94*** (0.05)
School (School 11 Omitted)					
<i>School 1</i>	4.47*** (0.44)	0.46*** (0.04)	35.34*** (2.10)	0.45*** (0.03)	-0.40*** (0.06)
<i>School 2</i>	3.31*** (0.43)	0.25*** (0.04)	17.48*** (2.07)	0.18*** (0.03)	0.13* (0.06)
<i>School 3</i>	2.69*** (0.45)	0.08 (0.04)	12.95*** (2.14)	0.22*** (0.03)	-0.04 (0.06)

	(1) Calories (kCal)	(2) Fat (g)	(3) Sodium (mg)	(4) Protein (g)	(5) Carbs (g)
<i>School 4</i>	4.05*** (0.50)	0.30*** (0.05)	16.88*** (2.38)	0.20*** (0.04)	0.07 (0.07)
<i>School 5</i>	1.02* (0.43)	-0.03 (0.04)	12.80*** (2.07)	0.32*** (0.03)	-0.09 (0.06)
<i>School 6</i>	0.65 (0.46)	-0.35*** (0.04)	13.56*** (2.18)	0.76*** (0.03)	-0.33*** (0.07)
<i>School 7</i>	4.18*** (0.46)	-0.06 (0.04)	29.26*** (2.20)	0.80*** (0.03)	0.01 (0.07)
<i>School 8</i>	2.85*** (0.46)	0.01 (0.04)	15.74*** (2.20)	0.41*** (0.03)	0.14* (0.07)
<i>School 9</i>	0.07 (0.56)	-0.00 (0.05)	4.37 (2.66)	-0.18*** (0.04)	0.09 (0.08)
<i>School 10</i>	1.40** (0.51)	0.31*** (0.05)	29.90*** (2.45)	0.36*** (0.04)	-0.68*** (0.07)
<i>Constant</i>	331.57*** (0.43)	14.96*** (0.04)	673.71*** (2.07)	17.79*** (0.03)	30.82*** (0.06)
R ² Squared	0.0010	0.0032	0.0084	0.0089	0.0039
F-Test	13.59	43.23	113.43	119.69	51.74
p-value	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: "Other" includes students of Asian, Indian, Pacific Islander, or mixed race. Standard errors in parentheses. *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% , respectively. Number of observations for each regression is 279,698.

Table 5. Joint F Tests for Indicator Variables

	<i>(1)</i> <i>Calories</i>	<i>(2)</i> <i>Fat</i>	<i>(3)</i> <i>Sodium</i>	<i>(4)</i> <i>Protein</i>	<i>(5)</i> <i>Carbs</i>
Race					
<i>F Test</i>	0.83	6.24	73.08	62.39	29.57
<i>p-value</i>	0.4783	0.0003	0.0000	0.0000	0.0000
Status					
<i>F Test</i>	2.09	4.76	22.77	16.87	4.70
<i>p-value</i>	0.1243	0.0085	0.0000	0.0000	0.0091
Grade					
<i>F Test</i>	6.19	50.06	249.90	130.45	93.73
<i>p-value</i>	0.0000	0.0000	0.0000	0.0000	0.0000
School					
<i>F Test</i>	24.82	59.09	44.34	128.65	26.77
<i>p-value</i>	0.0000	0.0000	0.0000	0.0000	0.0000

Note: F jointly tests the hypothesis that coefficients for each indicator variable (Race, Status, Grade, School) are different than zero.

Figure 1. Total Number of Lunches Purchased Per Student

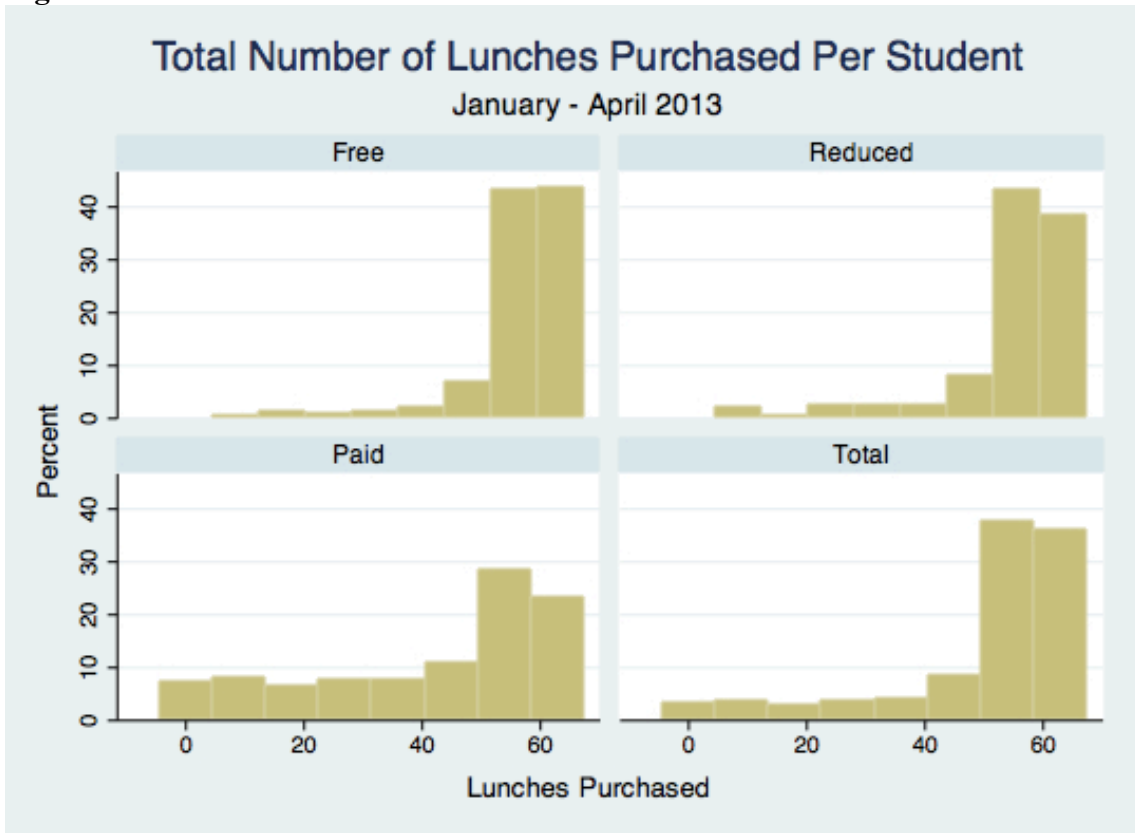
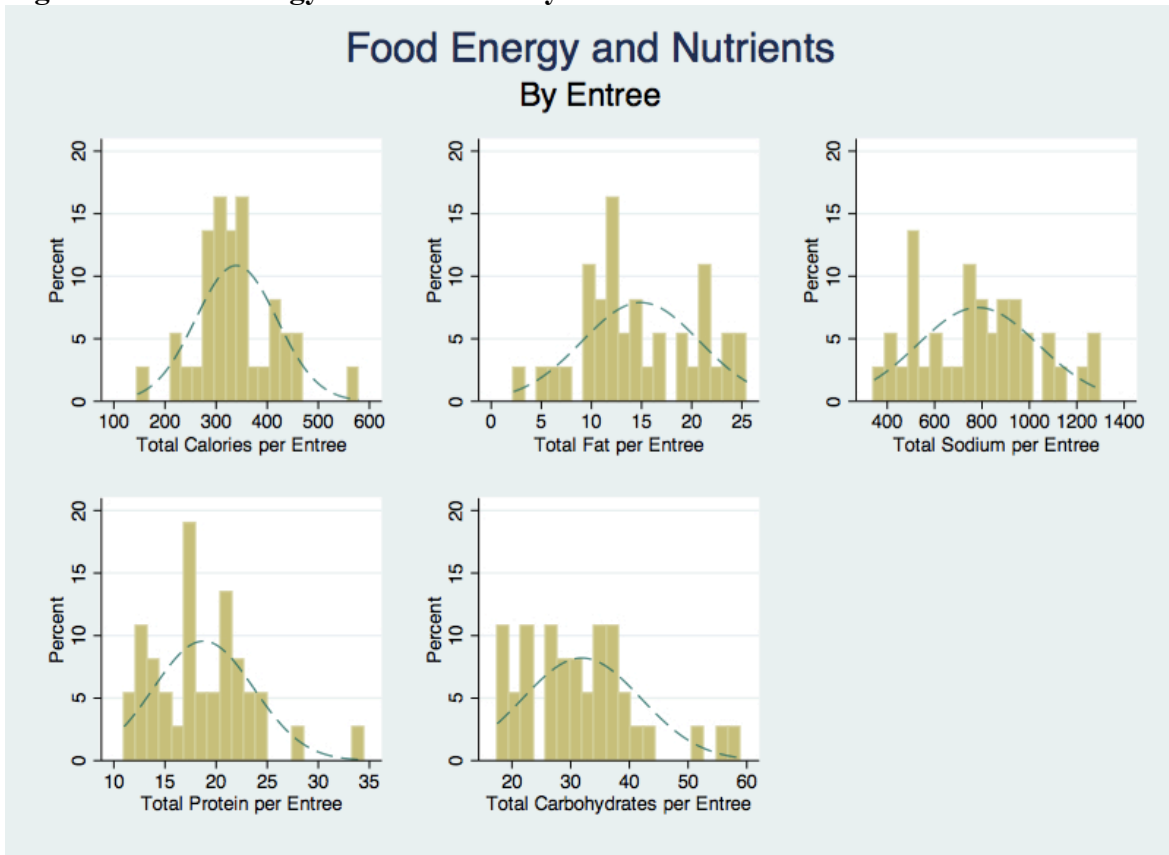


Figure 2. Food Energy and Nutrients by Entrée



Appendix A. National School Lunch Program: Weekly Meal Pattern K to 5 Grades

	Required Amount	
	Weekly	Daily
Fruits (cups)	2.5	0.5
Vegetables (cups)	3.75	0.75
Dark Green	0.5	-
Red/Orange	0.75	-
Legumes	0.5	-
Starchy	0.5	-
Other	0.5	-
Additional Veg. to Reach Total	1	-
Grain/Bread (oz eq)	8 to 9	1
Meat/Meat Alternatives (oz eq)	8 to 10	1
Milk (cups)	5	1
Calories (kcal)		Must average 550 to 650
Saturated Fat (% kcal from sat. fat)		≤ 10
Sodium (mg)		Must average ≤ 640

Notes: Requirements are for meals as offered for a 5-day school week. These represent minimum portion sizes. Milk can be flavored skim milk or unflavored 1% or skim milk. Beginning in SY 2012/13, 50 percent of all grains must be whole grain rich; effective SY 2014/15 all grains must be whole grain rich. Sodium requirement is effective beginning in SY 2014/15. Weekly requirements prior to SY 2012/13 are calculated using the Traditional Food-Based Approach; requirements differ for Enhanced Food-Based Approach. (U.S. Department of Agriculture 2012)

Appendix B. Sample School Menu



In accordance with Federal Law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability. To file a complaint of discrimination, write USDA, Director, Office of Adjudication, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410 or call toll free (866) 632-9992 (Voice). Individuals who are hearing impaired or have speech disabilities may contact USDA through the Federal Relay Service at (800) 877-8339; or (800) 845-6136 (Spanish). USDA is an equal opportunity provider and employer.

**DON'T FORGET TO
SPRING
FORWARD
ON MARCH 10!**



Friday, March 1

Breakfast
Scrambled Eggs, Grits, w/Cheese
Toast or WG Cereal w/Toast & Jelly
Choice of Juice and Milk

Lunch
Cheese Pizza on WG Crust or
Nachos w/Chili & Cheese
Seasoned Steamed Broccoli
Kidney Beans
Banana
Rosy Applesauce
Brownie
Milk

Monday, March 4

Breakfast
Brown Sugar Oatmeal Bowl w/
Raisins or
WG Cereal w/Toast & Jelly
Choice of Juice and Milk

Lunch
BBQ Sandwich or
Chicken Nuggets w/Dipping Sauce
Baked Tater Tots
Seasoned Green Beans
Baby Carrots w/Dip
Fresh Apple
Applesauce
Milk

Tuesday, March 5

Breakfast
Sausage Pancake Roll Up w/Syrup
& String Cheese or
WG Cereal w/Toast & Jelly
Choice of Juice & Milk

Lunch
Chicken Sandwich on WG Bun or
Turkey Pot Pie w/WG Roll
Pickle & Cucumber Chips w/Dip
Mixed Vegetables
Fresh Fruit
Applesauce
Milk

Wednesday, March 6

Breakfast
Chicken Biscuit or
WG Cereal w/Toast & Jelly
Choice of Juice & Milk

Lunch
Early Release Day

**No Lunch
Today**

Thursday, March 7

Breakfast
Breakfast Pizza or
WG Cereal w/Toast & Jelly
Choice of Juice & Milk

Lunch
Grilled Cheese w/Vegetable Soup or
Turkey & Gravy over Brown Rice
Broccoli Salad
Sweet Potato Wedges
Fruit Cocktail
Diced Pears
Milk

Friday, March 8

Breakfast
Scrambled Eggs, Grits, w/Biscuit or
WG Cereal w/Toast & Jelly
Choice of Juice and Milk

Lunch
Cheese Pizza on WG Crust or
Nachos w/Chili & Cheese
Spinach Salad w/Dressing
Corn
Banana
Rosy Applesauce
Milk



Monday, March 11

Breakfast
Sausage Biscuit or
WG Cereal w/Toast & Jelly
Choice of Juice and Milk

Lunch
Pizzas or
Hot Dog w/Chili
Cole Slaw
Baked Beans
Sweet Potato Wedges
Fresh Apple
Mandarin Oranges
Cookie
Milk

Tuesday, March 12

Breakfast
Chicken Biscuit or
WG Cereal w/Toast & Jelly
Choice of Juice and Milk

Lunch
Grilled Cheese w/Chicken Noodle
Soup or
Rib B Q on WG Bun
Seasoned Green Beans
Steamed Mixed Vegetables
Fresh Fruit
Applesauce
Milk

RUNNING ON EMPTY?

A good breakfast gives you the fuel you need to accelerate into your day and excel all morning long! For a healthy breakfast, try to include whole grains and fresh fruit. Next school year, we'll be serving up more of these items, too, when the new School Breakfast guidelines take effect.

**EAT BETTER. PLAY HARDER. LIVE HEALTHIER. LEARN EASIER.
WELLNESS IS A WAY OF LIFE!**

Wednesday, March 13

Breakfast
Sausage Pancake Roll Up w/Syrup
& String Cheese or
WG Cereal w/Toast & Jelly
Choice of Juice and Milk

Lunch
Hamburger on WG Bun or
Chicken Chunks w/Dipping Sauce
Baked Tater Tots
Baby Carrots w/Dip
Fresh Fruit
Pineapple Tidbits
Milk

Thursday, March 14

Breakfast
Brown Sugar Oatmeal Bowl w/
Raisins or
WG Cereal w/Toast Jelly
Choice of Juice and Milk

Lunch
Stuffed Crust Dippers w/
Marinara Sauce or
Macaroni Cheese Bake w/WG Roll
Herbed Broccoli & Cauliflower
Roasted Potatoes
Fruit Cocktail
Diced Pears
Birthday Cake
Milk

Friday, March 15

Breakfast
Scrambled Eggs, Grits, w/Cheese
Toast or WG Cereal w/Toast & Jelly
Choice of Juice and Milk

Lunch
Cheese Pizza on WG Crust or
Nachos w/Chili & Cheese
Seasoned Steamed Broccoli
Kidney Beans
Banana
Rosy Applesauce
Brownie
Milk

Appendix C. Food Energy and Nutrients for All Entrees

Entree	Calories (kCal)	Fat (g)	Sodium (mg)	Protein (g)	Carbs (g)	Percent of Total Sales	Number of Days Offered	Total Entrees Purchased Per Days Served
Barbeque on whole grain bun	357.0	14.5	901.0	22.0	34.0	2.63%	6	1,226.2
Cheese or pepperoni pizza on whole grain crust†	310.0	13.0	540.0	20.0	29.0	1.69%	2	2,365.5
Cheese pizza on whole grain crust	310.0	12.0	490.0	21.0	31.0	7.35%	10	2,056.2
Chicken alfredo with whole grain roll	579.0	25.3	730.0	34.5	51.5	0.36%	1	1,013.0
Chicken chunks with honey mustard sauce & whole grain roll†	438.5	22.8	917.5	21.5	38.0	0.74%	1	2,073.0
Chicken chunks with honey mustard sauce†	348.5	21.5	762.5	18.0	21.5	0.76%	1	2,138.0
Chicken nuggets with honey mustard sauce & whole grain roll†	416.0	23.3	811.0	18.5	35.5	2.81%	3	2,620.3
Chicken nuggets with honey mustard sauce†	326.0	22.0	656.0	15.0	19.0	8.99%	8	3,144.3
Chicken sandwich on whole grain bun†	316.5	11.5	727.5	19.5	36.0	10.58%	10	2,960.3
Deli sliced turkey on whole grain bun†	146.5	2.2	494.0	13.0	18.1	0.62%	4	430.3
Enchilada pie with whole grain roll	445.0	15.5	1087.0	16.5	59.0	0.12%	2	169.0
Fish nuggets with tarter sauce†	225.0	11.5	505.0	13.0	18.5	0.24%	2	337.5
Grilled cheese with chicken noodle soup†	360.0	14.0	1301.0	21.0	37.0	2.44%	3	2,277.3
Grilled cheese with vegetable soup†	308.0	12.0	1069.0	14.0	33.0	1.40%	2	1,960.5
Grilled cheese†	250.0	11.0	700.0	11.0	27.0	1.87%	3	1,747.0
Hamburger on whole grain bun†	291.5	12.0	509.5	22.5	23.0	6.57%	7	2,627.0
Hot dog with chili	344.0	19.0	847.0	12.5	30.0	1.56%	3	1,456.7
Hot ham & cheese on whole grain bun†	290.0	13.5	1000.0	18.0	23.0	0.31%	1	880.0
Italian spaghetti with garlic toast†	386.0	7.3	450.0	24.3	55.5	0.52%	1	1,467.0
Italian spaghetti†	306.0	6.3	345.0	21.3	39.5	1.30%	3	1,211.3
Macaroni and cheese bake with whole grain roll	463.0	19.3	1283.0	27.5	43.5	0.81%	4	568.8
Mandarin orange chicken rice bowl†	284.0	5.5	422.5	14.0	41.5	0.40%	1	1,108.0
Mexican beef soft tacos with trimmings	453.0	17.3	616.0	22.5	22.0	4.24%	5	2,370.4
Mozzarella cheese sticks with marinara sauce†	287.0	10.3	800.0	17.7	34.5	0.39%	1	1,102.0
Nachos with chili and cheese	304.0	17.0	942.0	23.5	23.0	5.88%	8	2,056.9

Entree	Calories (kCal)	Fat (g)	Sodium (mg)	Protein (g)	Carbs (g)	Percent of Total Sales	Number of Days Offered	Total Entrees Purchased Per Days Served
Pizzatas	360.0	21.0	930.0	18.0	26.0	3.43%	4	2,396.5
Popcorn chicken with honey mustard sauce and whole grain roll†	413.0	23.3	1114.0	15.5	36.5	3.71%	4	2,593.3
Popcorn chicken with honey mustard sauce† “Rib-b-q” on whole grain bun	323.0	22.0	959.0	12.0	20.0	2.40%	3	2,238.3
Scrambled eggs, grits, sausage patty†	420.0	25.5	790.0	18.0	27.0	1.18%	3	1,097.3
Stuffed baked potato with ham and cheese and crackers†	351.0	20.1	527.0	25.0	17.5	1.76%	2	2,457.0
Stuffed baked potato with chili and cheese	335.0	12.0	1220.0	21.0	36.0	1.07%	3	999.7
Stuffed baked potato with chili and cheese	264.0	10.0	837.0	12.5	32.0	0.34%	1	960.0
Stuffed crust dippers with marinara sauce	340.0	14.3	1005.0	19.0	29.5	5.36%	5	2,997.2
Teriyaki dippers over brown rice†	286.5	10.0	623.0	17.0	29.5	1.73%	5	970.0
Turkey and gravy over brown rice	220.0	10.0	770.0	17.0	26.0	1.17%	5	654.6
Turkey pot pie with whole grain roll	380.0	12.3	887.0	23.5	39.5	0.77%	5	432.0
Vegetarian Tray†	325.0	12.5	395.0	14.0	37.5	12.46%	66	527.8
Mean	339.5	14.9	782.8	18.8	31.9	-	3	1,613.2
Standard Deviation	79.5	5.9	254.4	4.9	10.1	-	10.5	855.4
Minimum	146.5	2.2	345.0	11.0	17.5	0.12%	1	169.0
Maximum	579.0	25.5	1301.0	34.5	59.0	12.46%	66	3,144.3
Weighted Average	334.5	15.4	722.3	18.5	29.9	-	-	-

Notes: There are 279,698 total transactions. Weighted average is weighted by the percent of total sales. Pizzatas are mozzarella cheese, pepperoni, and marinara sauce wrapped in pizza crust (Rich’s Food Service 2011b). Rib-b-q is a boneless, chopped pork rib patty (AdvancePierre Foods 2013). Stuffed crust dippers are mozzarella cheese wrapped in pizza crust (Rich’s Food Service 2011a) and served with marinara sauce. Monthly menus did not consistently list which dipping sauce was offered with each entrée. After consultation with Anderson 5 District Food Services, the authors assumed bite-sized chicken entrees were served with honey mustard sauce, fish nuggets served with tartar sauce, and stuffed crust dippers and mozzarella sticks served with marinara sauce. For food items supplied by multiple vendors, macronutrients are calculated by the median value of all possible options. These entrées are denoted with †.