Dietary Effects of Menu Choices in the National School Lunch Program

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Abstract

Childhood and adolescence are unique periods of growth and development. In addition to maturing physically, children begin to make independent choices about when, where, and what they eat. Good nutrition during childhood and adolescence plays a key role in assuring adequate growth and development, preventing the long-term risk of chronic disease, and enhancing health and well-being. The U.S. Department of Agriculture's (USDA) school meal programs play an important role in children's diets and can thus influence their weight status and health. On average, children obtain more than one third of their daily energy intake from meals consumed at school during the school year (Briefel et al 2009). The National School Lunch Program (NSLP) is one of the largest government food assistance programs with the primary objective to "safeguard the health and well-being of the Nation's children." The program seeks to provide nutritious lunches at low-cost to all children, and for free to qualifying low-income children. As a result, making school lunches healthier may potentially impact a large number of children across different socioeconomic groups. Menu planning requirements and setting nutrition standards for the school meal programs can influence only the foods and nutrients offered to children in participating schools, not what is actually consumed. Thus, the challenge to those planning meals and setting standards is to design meals offered that enhance school lunch participants' selection and consumption of nutritious foods. The objective of this research is to evaluate the effect of foods offered in school lunches on the foods consumed at lunch by NSLP participants. More specifically, the model we have developed enables us to analyze the response of schoolchildren's nutrient intake to foods and nutrients offered at lunch. We use data from the third School Nutrition Dietary Assessment Study (SNDA-III), which provides comprehensive and up-to-date information on characteristics of students' and their parents, the school meal programs, the school environments that affect the food programs, the energy and nutrient content of school meals, and the contributions of school meals to students' diets. Our preliminary estimates show that there are significant between and within school variations in students' nutrient intakes. The nutrient composition of the menu offered has a less consistent effect across the various outcomes. However we found that the nutrient offered at school during lunch does have a positive and significant effect on the intake of the same nutrient consumed by students at school.

Key Words: National School Lunch Program, nutrition, SNDA-III, school menu, dietary intake, children
JEL Classification: I00

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INTRODUCTION

Childhood and adolescence are unique periods of growth and development. In addition to maturing physically, children begin to make independent choices about when, where, and what they eat. Good nutrition during childhood and adolescence plays a key role in assuring adequate growth and development, preventing the long-term risk of chronic disease, and enhancing health and well-being. The most pressing diet-related health concern among school-age children in the United States today is the high prevalence of overweight and obesity. During the period between 2003 and 2006, one in three children were overweight or obese (Ogden et al. 2008(a)). Despite the problem of childhood overweight, recent national data indicate dietary inadequacies for several key nutrients. Specifically, substantial proportions of school-age children—both males and females—have inadequate intakes of vitamin A, vitamin C, vitamin E, magnesium, and phosphorus, and intakes of calcium, potassium, and fiber well below recommended levels (Clark and Fox 2009; Cole and Fox 2008; Devaney et al. 2005; Moshfegh et al. 2005). School-aged children's diets are characterized by low intakes of vegetables and fruit, very low intakes of whole grains, and high intakes of sodium, and calories from total and saturated fat and added sugars (Cole and Fox 2008; Condon et al 2009; Clark and Fox 2009).

The U.S. Department of Agriculture's (USDA) school meal programs play an important role in children's diets and can thus influence their weight status and health. On average, children obtain more than one third of their daily energy intake from meals consumed at school during the school year (Briefel et al 2009). The National School Lunch Program (NSLP) is one of the largest government food assistance programs with the primary objective to "safeguard the

health and well-being of the Nation's children." The NSLP provides lunches to 31.0 million children each school day, which costs the federal government $8.3 billion in cash payments and another $1.1 billion in commodity food costs (USDA 2009(a)). The program seeks to provide nutritious lunches at low-cost or for free to school children. Children from lower income families are eligible for free or reduced-price lunch, while children from families with higher income can receive a "full-price" lunch, though the full-price is still subsidized[1]. In 2008, 50% of the lunches served were free, 10% reduced-price, and 40% full price (USDA 2009(b))[2]. As a result, making school lunches healthier may potentially impact a large number of children across different socioeconomic groups.

All public and non-profit private schools and child care institutions are eligible to participate in the NSLP. To obtain the cash subsidies and government commodities from the USDA, the meals are required to meet certain nutritional guidelines. When the National School Lunch Act was first established, underweight and inadequate nutrition were a key concern, so certain requirements were put in place about serving sizes of milk, protein-rich food, vegetables or fruit, a portion of a bread product and small quantity of butter or fortified margarine (the Type A lunch of the National School Lunch Act. 1946). Over time, however, the nation's problem shifted primarily from concerns about underweight to overweight and, as a result, from a focus on quantity to a focus on quality of the school lunches. For many years, the goal of the NSLP has been to provide approximately one-third of the Recommended Dietary Allowance (RDA). To

[1] Children are eligible for different levels of lunch subsidies if their family income as a percentage of the federal poverty level adjusted for family size is as follows; for free lunch at most 130% of the federal poverty level or whose families participate in the Food Stamp Program (FSP), Temporary Assistance for Needy Families (TANF) or assistance from the Food Distribution Program on Indian Reservations (FDPIR), reduced lunch between 130% and 185% and "full-price" lunch above 185%. Local school food authorities determine their own prices for full price lunch, but must operate their meal services as non-profit programs (USDA 2006).

[2] In 2008-2009 school year the federal government reimbursed schools as follows: $2.57 for a free lunch, $2.17 for a reduced-price lunch and $0.24 for a full-price lunch.

achieve this goal, NSLP regulations have always included food-based menu planning guidelines; since 1995, schools also have the option of using nutrient-based menu planning.

In 1994, the Healthy Meals for Healthy Americans Act required that school lunches adhere to the *Dietary Guidelines for Americans*, which includes limits of no more than 30% of an individual's allotted calories from fat, and less than 10% from saturated fat. Since 1995, with the adoption of the School Meals Initiative for Healthy Children, lunches served at schools must comply with both the RDA based standards for calories, protein, calcium, iron, and vitamins A and C and the *Dietary Guidelines* goals for calories from fat and saturated fat. Compliance with these nutrition standards is determined by averaging the nutritional content of the lunches offered over a school week (Office of the Federal Register 1995).

With the introduction of the Dietary Reference Intakes (DRIs), which replace RDAs school meal planners might now be interested in considering how school meals offered comply with DRI standards. The Institute of Medicine (IOM) prepared a report on how to use the DRIs in planning group diets (IOM 2003). The underlying principle of that framework is that the goal of planning group diets is for usual nutrient intakes to meet the nutrient requirements of as many members of the group as possible, without having excessive intakes. Menu planning requirements and setting nutrition standards for the school meal programs can influence only the foods and nutrients offered to children in participating schools, not what is actually consumed. Thus, the challenge to those planning meals and setting standards is to design meals offered that enhance school lunch participants' selection and consumption of nutritious foods. The objective of this research is to evaluate the effect of foods offered in school lunches on the foods consumed at lunch by NSLP participants. More specifically, the model we have developed

enables us to analyze the response of schoolchildren's nutrient intake to foods and nutrients offered at lunch.

We use data from the third School Nutrition Dietary Assessment Study (SNDA-III). The SNDA-III data provide comprehensive and up-to-date information on characteristics of the school meal programs, the school environments that affect the food programs, the energy and nutrient content of school meals, and the contributions of school meals to students' diets (Gordon et al 2007(a)). SNDA-III is a nationally representative, cross-sectional sample of public schools participating in the USDA school meal programs and of students (grades 1 through 12) attending those schools. The SNDA-III data collection took place primarily between January and June of 2005. The dataset provides a unique opportunity for assessing the role of the school meals programs and dietary outcomes for participating children analyzing students' food choices given what is offered by the schools. Data are available on the NSLP meals (foods and nutrients) offered by schools, school level variables, the food and nutrient intakes of NSLP participants as well as the children's socio-economic characteristics. Although dietary intakes of school-age children may differ across elementary, middle and high schools, in this paper we look closely at elementary school children, as this an important target group of children. Hence from the total of 732 elementary school students in 99 schools for whom 24-hour dietary recall intake data were recorded we have identified 471 students in 87 schools who were identified as target day NSLP participants.

We conducted two types of analysis:

(1) First, we have identified several nutrients of interest (calcium, total fat, saturated fat, vitamins A, C, and E, magnesium, potassium, sodium and dietary fiber) and expressed the menu offered at school during lunch in terms of menu offered per day and over the course of a school

day. We estimated how the nutrient composition of the menu offered affects the child's nutrient intake. Our estimation results show that school size, region, and race play a role in determining variation in the child's intake; the nutrient composition of the menu offered has a less consistent effect across the various outcomes, however we found that the nutrient offered at school during lunch has a positive significant effect on the intake of the same nutrient consumed by students at school.

(2) We identified foods/food groups from the school lunch menu that may increase calcium consumption among NSLP participants. We found that number of milk choices and pizza offered at school during lunch has a significant positive effect on calcium intake of students' from lunch. Some of the school and student level covariates had a significant effect on calcium intake of students.

THE MODEL

This section describes the methodology used for estimating the relationship between students' nutrient intake and foods/nutrients offered by schools at lunch. The model we employ in estimating this relationship needs to account for a specific feature of our data—outcomes are observed for students attending the same schools. Because students attending the same school may share certain characteristics, observations based on these students are not necessarily independent. Consequently, the standard OLS assumption that residuals are unrelated to one another cannot be made here. Also it is of interest to researchers and policymakers to distinguish individual and school effects on our outcome of interest—nutrient intake associated with student food choices. Thus, a hierarchical model is used. The general form of the model we employ in this paper is the following:

$$c_{is} = \alpha_s + x_{is}\beta + \varepsilon_{is}, \qquad \varepsilon_{is} \overset{iid}{\sim} N(0, \sigma_\varepsilon^2), \tag{1}$$

$$\alpha_s = w_s\theta + u_s, \qquad u_i \overset{iid}{\sim} (0, \sigma_s^2), \tag{2}$$

where c_{is} refers to nutrient intake of student *i* in school *s*, x_{is} denotes a vector of student and household level controls, such as age, gender, race/ethnicity, household size and composition, poverty status, and parent education level. We include a school-specific intercept α_s to capture the effect of the school-specific variables. In the second equation we express the school level intercepts as a function of school related variables, w_s, such as the amount of foods/nutrients offered in the school's lunch program, school size and geographic region. Here σ_ε^2 represents variation in students' nutrient intake within schools and σ_s^2 represents the variation between school means. We substitute Equation 2 into Equation 1 and estimate our model using the PROC MIXED procedure in SAS version 9.1.

It is possible to add another level of hierarchy to our model--the School Food Authority (SFA) level. (A SFA is equivalent to a school district or group of small districts that administer the NSLP.) The data allow us to identify schools that belong to the same SFA and include potentially relevant SFA characteristics, such as how food purchasing and menu planning decisions are made. However, since roughly one elementary school was sampled from each sampled SFA, the number of schools and the number of SFAs in our data are almost the same; thus we have not included SFA characteristics in the model.

Detailed description of the data and derivation of the dependent and independent variables are given in the following section.

THE DATA

The SNDA-III data

We make use of the data from the third School Nutrition Dietary Assessment Study (SNDA-III). As part of its ongoing assessment of program performance, the Food and Nutrition Service (FNS) sponsored SNDA-III to provide up-to-date information on the on characteristics of students' and their parents, school meal programs, the school environments that affect the food programs, the nutrient content of school meals, and the contributions of school meals to students' diets. SNDA-III is a nationally representative, cross-sectional sample of public schools participating in the USDA school meal programs and students attending those schools. The study used a multistage sampling approach to sample School Food Authorities (SFAs), schools (approximately three schools per district—one elementary, one middle, and one high school), and students (grades 1 through 12) (Gordon et al 2007(b)).

The SNDA-III data collection took place primarily between January and June of 2005. Data were collected from SFA directors; school food service managers and principals; and parents and students. In addition, field interviewers completed observation checklists pertaining to competitive foods during their visits to the sampled schools and measured children's height and weight.

The final sample sizes of the SNDA-III data were 129 SFAs (school districts); 397 schools with complete menu data for school lunches; and 2,314 students with complete data from 24-hour dietary recalls, parent interviews, and height/weight measurement. A total of 329 schools (83 percent) provided school lunch data for five days, 66 for four days, and 2 for three days. By design, some schools provided only SFA- and school-level data, so the students were

from 287 schools in 94 districts. The NSLP participation rate was 74.4 percent for elementary school students, 68 percent for middle school students, and 51 percent for high school students.

Data are also available on the school food environment, which includes not only meals offered through the USDA school meals but also "competitive" foods—other non-USDA foods available in schools. This includes foods and beverages that are sold on an à la carte basis in cafeterias; in other venues such as vending machines, school stores, snack bars, and at fund-raising activities; and provided by teachers or through parties or other school activities.

The sample data

We have identified several nutrients of interest because of problems with inadequate or excessive intakes among schoolchildren, including calcium, total fat, saturated fat, vitamins A, C, and E, magnesium, potassium, sodium and dietary fiber. The SNDA-III data files include values for food energy and 61 nutrients at the food, meal, and day levels, and, for USDA school meals, weekly nutrient averages. The food-level data have also been categorized into nine major food groups (milk, fruits, vegetables, combination entrées, meat/meat alternates, grains/breads, desserts, accompaniments (condiments and toppings), and other menu items (e.g., snack items, juice drinks – not 100% juice) and minor subgroups (e.g., fruits is included as fresh, canned-sweetened, canned-unsweetened, frozen, dried, citrus fruit juice-100%, non-citrus fruit juice; the combination entrées include "pizza with meat" and "pizza without meat," "Mexican style entrées"). Using this food-level data we were able to identify the number of foods offered by schools at lunch that contribute to the nutrients of interest in our analysis.

From a total of 2413 students in 287 schools who completed a single, in person, 24-hour dietary recall interview we selected elementary school students and identified target day NSLP

participants. The 24-hour recalls captured information on where each item was obtained (e.g., school cafeteria, vending machine, home, restaurant), and whether or not the food was eaten at school. In our analysis we included students with only one day of recall data, although a second 24-hour recall was available for a subsample of 778 students. Also we selected students who ate lunch at school from school reimbursable food source. The recall data were merged with student and parent survey data.

The school menu data was also used in the analysis. The menu data were collected over a typical five-day period; however, in some schools, data were available for only three or four days because of holidays or other school closings. The menu survey contained detailed information on the foods offered to students in USDA school meals, separately for breakfast and lunch, the food name and a complete description, portion size and number of portions served to students. We calculated the amount of nutrients of interest offered to students during lunch at school by using "offer weight" variable.

In general, the first 24-hour recall was conducted during the same target week as the menu survey in each school. Hence we merged student recall data with school menu data by day of interview and day of school menu.

Our final sample consists of 471 students attending 87 elementary schools. Tables 1 and 2 provide definitions, mean values and standard deviations of independent and dependent variables used in the analysis. We found that in general students consume less than that is offered during lunch at school: students' mean nutrient intakes at lunch were smaller compared to the mean values of nutrients offered by schools at lunch. The mean values for students' nutrient intakes and mean values for nutrient offered during lunch at schools were similar to those reported on SNDA-III report (Gordon et al 2007(b)). We found that 49% of students in our

sample were female and 58% of students were receiving free or reduced-price lunches. About 69% of students reside in the households with income at or below 200% federal poverty level.

ESTIMATION RESULTS

In this section we present estimation results for two models we specified:

(a). *The effect of nutrients offered on students' nutrient intake (Tables 3a and 3b)*: estimates for the nutrients consumed at school based on expressing the menu offered at lunch in schools on the target day in terms of total nutrient components.

(b). *The effect of foods offered on students' nutrient intake (Table 4)*: estimates for the calcium consumed at school based on the number of different foods offered during lunch at school that contribute to calcium.

The effect of nutrient offered on students' nutrient intake

With respect to school level variables we found that larger schools with 1,000 or more students enrolled have a negative and significant effect on students' intakes of total fat, saturated fat, vitamin C, magnesium, sodium and dietary fiber compared to smaller schools with 500 or less students. Regional variables played a significant role in explaining the variation in students' nutrient intakes. School location in the northeast and southwest regions had a negative and significant effect on students' intake of calcium and vitamin A from lunch compared to location in southeast. Also schools located in the northeast had a negative and significant effect on the intake of total fat, saturated fat, potassium and sodium compared to schools located in Southeast region. The nutrient composition of the menu offered had a less consistent effect across the various outcomes, however, as hypothesized, we did find that the nutrient offered at school

during lunch has a positive significant effect on the intake of the same nutrient consumed by students at school. More specifically, the amount of calcium offered during lunch at school has a positive significant effect on the students' calcium intake from lunch. The similar relationships were observed for all other nutrients of interest, except for vitamin E for which there was no significant effect.

With respect to student level variables we found that Hispanic female students living in households with two parents, one parent employed and with low household income consume less calcium at lunch compared to their other counterparts. The intakes of calcium, magnesium and potassium were significantly lower for white students compared to black students. Hispanic students consumed smaller amounts of total fat, saturated fat, vitamin E, magnesium and potassium at lunch compared to black students. Compared to students living in households with two working parents, students in two parents with one parent working consumed less sodium at lunch. Sodium intakes at lunch were higher for older students. Most other explanatory variables were not significant and this may be due to the fact that our sample consists of elementary school students that participated in the NSLP on the target day.

The results also suggest that schools do differ in their students' calcium intake from school lunches (σ_s^2 =0.3571) and that there is even more variation among students within schools (σ_ε^2 =3.3123). Similar significant results were found for saturated fat, vitamin A, vitamin E, potassium, sodium and dietary fiber. This suggests that further analysis is needed and estimating Eqns. (1) and (2) without substituting Eqn. (2) into Eqn. (1) can give us good insight about the school level parameters.

The effect of foods offered on students' nutrient intake

Table 4 presents the results of the analysis of the effect of number of foods offered that contribute to calcium on calcium intake of student's at lunch. Some strong and significant effects are found for the number of milk choices offered and number of pizza offered during the lunch. Number of flavored milk choices offered has a significant negative effect on calcium intake, which is somewhat surprising. Some of the school and student level covariates had significant effects on the variable of interest. For example, larger schools were associated with lower intakes of calcium compared to smaller schools. Also schools located Mid-Atlantic region had a positive significant effect on the variable of interest compared to school located in Southeast. Boys consumed more calcium at lunch than girls. Household income with respect to federal poverty guidelines had a positive significant effect on calcium intake.

DISCUSSION AND CONCLUSION

The SNDA-III data provide a unique data set with which to examine the effect of child and school characteristics and program meals offered on dietary intakes. The results of this paper provide good insight regarding the relationship between foods offered by schools during lunch and how they affect elementary school student's consumption. Further analysis is needed in terms of how much of the variation can school level variables explain. Also conducting the analysis for middle and high school students accounting for NSLP participation can yield interesting results since there will be more food choices available and older students have more flexibility of eating food outside of school grounds. The next step is to directly measure and estimate the effect of the composition of foods offered on the students' nutrient intakes. This

allows us to fit specific foods and food groups offered to nutrient intake (student food choices), conditioned on the school food environment.

Table 1. Definition of Variables, Sample Mean Values and Standard Deviations (N=471)

Variables	Mean	Std.	Variables	Mean	Std.
Receipt of free or reduced-price lunch	0.58	0.49			
Student's age	8.74	1.75	**Total nutrients offered by school during lunch**		
Household size	4.64	1.60	Total fat	26.70	0.08
Less than high school	0.15	0.36	Saturated fat	8.56	0.02
High school	0.29	0.45	Calcium	536.91	0.95
College	0.35	0.48	Vitamin A	279.76	1.01
Female	0.49	0.50	Vitamin C	29.79	0.27
2 parent, both employed	0.25	0.43	Vitamin E	2.41	0.01
2 parent, one employed	0.34	0.47	Magnesium	102.21	0.19
2 parent, neither employed	0.06	0.23	Potassium	1103.26	2.08
1 parent, employed	0.21	0.41	Sodium	1339.56	3.53
1 parent, not employed	0.09	0.29	Dietary fiber	6.51	0.02
Family income related to federal poverty level			**Number of choices of foods that contribute to calcium**		
No more than 130%	0.38	0.49	Number of flavored milk choices	1.39	0.52
131 to 185%	0.14	0.35	Number of milk choices	3.06	0.98
185 to 200%	0.17	0.37	Higher fat milk	0.76	0.82
201 to 300%	0.10	0.30	Non-milk beverage not offered	0.43	0.78
>300%	0.19	0.40	Portion size larger than 8 fl. Oz offered	0.03	0.31
Student's race/ethnicity			Pizza offered	0.32	0.61
Hispanic	0.29	0.45	Any sandwich with cheese offered	0.28	0.53
Black	0.47	0.50	Self-serve or made-to-order sandwich bar offered	0.07	0.26
White	0.19	0.39	Mexican-style entrée offered	0.17	0.42
Other race	0.06	0.23	Entrée salad or salad bar offered	0.29	0.62
FNS regions			Cheeseburger	0.08	0.27
Mid-Atlantic	0.10	0.30	Yogurt offered	0.12	0.32
Midwest	0.15	0.36	Any dairy-based dessert offered	0.16	0.46
Mountain-Plains	0.07	0.26	Number of entrees with cheese offered	1.14	1.10
Northeast	0.08	0.28	**School enrollment**		
Southeast	0.24	0.42	Small (less than 500 students)	0.39	0.49
Southwest	0.18	0.39	Medium (500-999 students)	0.51	0.50
Western	0.18	0.38	Large (1,000 or more)	0.11	0.31

Table 2. Dependent Variables, Mean Values and Standard Deviations

Variables	Mean	Std.
Student nutrient intake from School Lunch		
Total fat intake	19.21	0.11
Saturated fat intake	6.62	0.04
Vitamin A intake	188.23	1.31
Vitamin C intake	17.11	0.28
Vitamin E intake	1.49	0.01
Calcium intake	388.40	2.05
Magnesium intake	73.22	0.33
Potassium intake	786.43	3.32
Sodium intake	989.71	5.80
Dietary fiber intake	4.43	0.03

Table3a. Parameter Estimates

	Calcium		Total Fat		Saturated Fat		Vitamin A		Vitamin C	
Variable	**Estimate**	**Std. Err.**	**Estimate**	**Std. Err.**	**Estimate**	**Std. Err.**	**Estimate**	**Std. Err.**	**Estimate**	**Std. Err.**
Student Level										
Intercept	3.18***	1.05	0.12**	0.05	0.04*	0.02	2.29***	0.67	0.41***	0.14
Household size	-0.09	0.07	0.00	0.00	0.00	0.00	-0.04	0.04	-0.01	0.01
Female	-0.36**	0.19	-0.01	0.01	0.00	0.00	-0.05	0.12	0.01	0.03
Hispanic	-0.56**	0.29	-0.05***	0.01	-0.01***	0.01	-0.17	0.18	-0.01	0.04
White	-0.49*	0.30	-0.01	0.02	0.00	0.01	-0.28	0.19	0.02	0.04
Other race	-0.34	0.43	0.00	0.02	0.00	0.01	-0.32	0.28	-0.03	0.06
Student's age	-0.05	0.06	0.00	0.00	0.00	0.00	-0.05	0.04	0.00	0.01
Free or reduced-price lunch	0.16	0.28	0.02	0.01	0.01	0.01	-0.07	0.18	0.04	0.04
Less than high school	-0.01	0.31	0.01	0.02	0.00	0.01	-0.16	0.20	-0.04	0.04
High school	-0.19	0.23	0.00	0.01	0.00	0.00	-0.11	0.15	0.03	0.03
2 parent, one employed	-0.43*	0.24	-0.02	0.01	0.00	0.00	-0.03	0.15	0.02	0.03
2 parent, neither employed	-0.10	0.44	0.02	0.02	0.01	0.01	-0.05	0.28	0.13**	0.06
1 parent, employed	-0.26	0.29	-0.01	0.02	-0.01	0.01	-0.09	0.19	0.03	0.04
1 parent, not employed	-0.43	0.38	-0.02	0.02	-0.01	0.01	0.18	0.24	-0.01	0.05
No more than 130% of poverty	0.65**	0.31	0.01	0.02	0.01	0.01	0.24	0.20	0.00	0.04
131 to 185% of poverty	0.56*	0.35	0.01	0.02	0.01	0.01	0.27	0.23	-0.08*	0.05
185 to 200% of poverty	0.29	0.31	0.01	0.02	0.01	0.01	0.03	0.20	-0.04	0.04
201 to 300% of poverty	0.75**	0.36	0.03*	0.02	0.01**	0.01	0.15	0.23	-0.03	0.05
School Level										
Large (1,000 or more students)	-0.47	0.38	-0.04*	0.02	-0.01**	0.01	0.09	0.24	-0.10**	0.05
Medium (500-999 students)	-0.05	0.24	0.00	0.01	0.00	0.00	0.05	0.15	0.05	0.03
Mid-Atlantic	0.35	0.38	0.02	0.02	0.01*	0.01	-0.06	0.24	-0.06	0.05
Midwest	-0.35	0.35	-0.02	0.02	-0.01*	0.01	-0.14	0.22	-0.03	0.05
Mountain-Plains	0.54	0.44	-0.03	0.02	-0.01*	0.01	0.34	0.28	0.04	0.06
Northeast	-0.77*	0.42	-0.04**	0.02	-0.02**	0.01	-0.71***	0.27	0.00	0.06
Southwest	-0.67**	0.33	-0.01	0.02	-0.01**	0.01	-0.40**	0.21	0.03	0.05
Western	-0.07	0.37	-0.02	0.02	-0.01	0.01	-0.43*	0.24	-0.02	0.05
Calcium offered	0.46***	0.15	0.00	0.01	0.00	0.00	0.18*	0.10	0.01	0.02
Total fat offered	-0.69	3.16	0.31**	0.16	-0.02	0.06	-1.42	2.02	-0.10	0.43
Saturated fat offered	-0.16	9.92	-0.02	0.52	0.38**	0.19	-0.86	6.33	0.45	1.35
Vitamin A offered	0.02	0.12	0.00	0.01	0.00	0.00	0.20***	0.07	0.01	0.02
Vitamin C offered	-0.57	0.41	0.00	0.02	0.00	0.01	-0.41	0.26	0.20***	0.06
Vitamin E offered	-13.48	12.39	-0.89	0.64	-0.26	0.23	0.79	7.90	-0.75	1.68
Magnesium offered	1.31	1.00	0.04	0.05	0.01	0.02	-0.24	0.64	-0.11	0.14
Potassium offered	-0.13*	0.08	0.00	0.00	0.00	0.00	-0.03	0.05	-0.01	0.01
Sodium offered	-0.01	0.04	0.00	0.00	0.00	0.00	-0.01	0.02	-0.02***	0.01
Dietary fiber offered	6.53	8.62	0.01	0.45	0.23	0.16	4.58	5.50	3.24***	1.17

Here ***=1% significance level; **=5% significance level and *=10% significance level.

Table3. Parameter Estimates

	Vitamin E		Magnesium		Potassium		Sodium		Dietary Fiber	
Variable	**Estimate**	**Std. Err.**	**Estimate**	**Std. Err.**	**Estimate**	**Std. Err.**	**Estimate**	**Std. Err.**	**Estimate**	**Std. Err.**
Student Level										
Intercept	0.01**	0.01	0.79***	0.17	8.05***	1.71	5.10*	2.93	0.06***	0.01
Household size	0.00	0.00	-0.02	0.01	-0.09	0.11	0.06	0.18	0.00	0.00
Female	0.00	0.00	-0.05	0.03	-0.51*	0.31	-0.55	0.53	0.00	0.00
Hispanic	0.00**	0.00	-0.14***	0.05	-1.02**	0.47	-1.26	0.80	-0.01*	0.00
White	0.00	0.00	-0.12***	0.05	-0.90*	0.49	-0.45	0.85	0.00	0.00
Other race	0.00	0.00	-0.04	0.07	-0.48	0.71	0.45	1.21	0.00	0.01
Student's age	0.00	0.00	0.00	0.01	0.02	0.09	0.34**	0.15	0.00	0.00
Free or reduced-price lunch	0.00	0.00	0.04	0.04	0.14	0.45	0.50	0.77	0.00	0.00
Less than high school	0.00	0.00	0.01	0.05	0.09	0.50	0.22	0.86	-0.01*	0.00
High school	0.00	0.00	0.03	0.04	0.22	0.38	-0.36	0.65	0.00	0.00
2 parent, one employed	0.00	0.00	-0.04	0.04	-0.43	0.39	-1.41**	0.67	0.00	0.00
2 parent, neither employed	0.00	0.00	0.03	0.07	0.19	0.72	0.69	1.23	-0.01	0.01
1 parent, employed	0.00	0.00	-0.02	0.05	-0.01	0.48	-0.79	0.82	0.00	0.00
1 parent, not employed	0.00	0.00	-0.02	0.06	0.27	0.62	-1.39	1.07	0.00	0.00
No more than 130% of poverty	0.00	0.00	0.10**	0.05	0.54	0.50	-1.07	0.86	0.01	0.00
131 to 185% of poverty	0.00	0.00	0.06	0.06	0.02	0.58	-0.79	0.99	0.00	0.00
185 to 200% of poverty	0.00	0.00	0.03	0.05	-0.07	0.51	-1.07	0.88	0.00	0.00
201 to 300% of poverty	0.00	0.00	0.10*	0.06	0.28	0.60	-0.32	1.02	0.00	0.00
School Level										
Large (1,000 or more)	0.00	0.00	-0.12**	0.06	-0.92	0.62	-1.93*	1.07	-0.01**	0.00
Medium (500-999 students)	0.00	0.00	-0.03	0.04	0.03	0.39	-1.46**	0.67	0.00	0.00
Mid-Atlantic	0.00	0.00	-0.06	0.06	-0.04	0.62	-0.69	1.06	0.00	0.00
Midwest	0.00	0.00	-0.07	0.06	-0.23	0.56	-0.97	0.97	-0.01	0.00
Mountain-Plains	0.00	0.00	-0.01	0.07	0.20	0.72	-1.40	1.23	0.00	0.01
Northeast	0.00	0.00	-0.10	0.07	-1.34**	0.68	-3.24***	1.17	0.00	0.01
Southwest	0.00	0.00	-0.02	0.05	-0.46	0.54	-1.27	0.93	0.00	0.00
Western	0.00	0.00	-0.10*	0.06	-1.12**	0.60	-1.53	1.04	-0.01	0.00
Calcium offered	0.00	0.00	0.02	0.02	0.34	0.25	0.28	0.42	0.00	0.00
Total fat offered	0.01	0.02	0.09	0.51	8.40*	5.16	10.60	8.84	-0.01	0.04
Saturated fat offered	-0.03	0.06	-1.47	1.61	-23.79	16.19	-35.82	27.76	-0.09	0.13
Vitamin A offered	0.00	0.00	0.00	0.02	-0.23	0.19	0.31	0.33	0.00	0.00
Vitamin C offered	0.00	0.00	-0.06	0.07	-1.02	0.67	-1.42	1.16	0.00	0.01
Vitamin E offered	0.07	0.07	-0.87	2.01	-17.42	20.23	-12.95	34.68	0.09	0.16
Magnesium offered	0.00	0.01	0.35**	0.16	-1.23	1.64	2.73	2.81	-0.01	0.01
Potassium offered	0.00	0.00	-0.01	0.01	0.30**	0.12	-0.25	0.21	0.00	0.00
Sodium offered	0.00	0.00	-0.01	0.01	-0.14**	0.06	0.26***	0.11	0.00	0.00
Dietary fiber offered	-0.03	0.05	-0.33	1.40	1.89	14.08	8.27	24.14	0.47***	0.11

Here ***=1% significance level; **=5% significance level and *=10% significance level.

Table4. Parameter Estimates

Variable	Calcium	
	Estimate	**Std. Err.**
Student Level		
Intercept	4.54***	0.84
Household size	-0.08	0.07
Female	-0.37**	0.19
Hispanic	-0.61**	0.29
White	-0.43	0.29
Other race	-0.35	0.44
Student's age	-0.05	0.06
Free or reduced-price lunch	0.15	0.28
Less than high school	0.04	0.31
High school	-0.13	0.23
2 parent, one employed	-0.40*	0.24
2 parent, neither employed	-0.04	0.44
1 parent, employed	-0.22	0.29
1 parent, not employed	-0.19	0.38
No more than 130% of poverty	0.63**	0.31
131 to 185% of poverty	0.55	0.35
185 to 200% of poverty	0.26	0.31
201 to 300% of poverty	0.65*	0.37
School Level		
Large (1,000 or more students)	-0.71*	0.40
Medium (500-999 students)	0.12	0.24
Mid-Atlantic	0.75*	0.41
Midwest	-0.17	0.36
Mountain-Plains	0.63	0.46
Northeast	-0.47	0.42
Southwest	-0.20	0.37
Western	-0.13	0.44
Number of flavored milk choices	-0.79***	0.29
Number of milk choices	0.35**	0.16
Higher fat milk	-0.21	0.17
Non-milk beverage not offered	0.08	0.15
Portion size larger than 8 fl. Oz offered	0.41	0.36
Pizza offered	0.74***	0.18
Any sandwich with cheese offered	0.23	0.24
Self-serve or made-to-order sandwich bar offered	0.10	0.52
Mexican-style entrée offered	0.01	0.25
Entrée salad or salad bar offered	0.11	0.20
Cheeseburger	0.29	0.41
Yogurt offered	0.34	0.34
Any dairy-based dessert offered	0.32	0.23

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