



Changes in foods selected and consumed after implementation of the new National School Lunch Program meal patterns in southeast Texas

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ABSTRACT

Objective. We compared elementary students' school lunches selected and consumed before (Spring, 2011) and after (Spring, 2013) implementation of the new National School Lunch Program meal patterns in the fall of 2012.

Method. Students in eight elementary schools in one Southeast Texas school district were observed during lunch: foods selected/consumed were recorded. The percentage of students who selected each food group was compared between years, as were the differences in the consumption and the percent of food consumed by year, for students who selected the food group. All analyses controlled for student gender and grade and school free/reduced price meal status.

Results. Observations were conducted for 472 (2011) and 573 (2013) students. Significantly more 2013 students selected fruit, 100% juice, total fruit + 100% juice, other vegetables, whole grains, protein foods and milk, but fewer selected starchy vegetables. For those students selecting them, significantly more total fruit + 100% juice and red-orange vegetables, but significantly less other vegetables, legumes, and protein foods were consumed. There were no differences in waste of fruit, whole grains, or vegetables, with the exception of legumes. More legumes were wasted in 2013 than 2011.

Conclusion. The findings that students had similar consumption rates for fruit, whole grains, and most vegetables in this study are encouraging. Regular monitoring of student food selection and consumption at school is needed to assess whether the new meal patterns improve intake at school.

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Introduction

The 2010 Healthy, Hunger-Free Kids Act required an update to the National School Lunch Program (NSLP) standards to align them with the United States Dietary Guidelines (Food and Nutrition Service – U.S. Department of Agriculture, 2010, 2012). Changes in the new meal patterns included increasing the previous lunch pattern of two fruit and vegetable servings to three (two vegetables and one fruit) per meal (Food and Nutrition Service – U.S. Department of Agriculture, 2010, 2012) and weekly servings of vegetable subgroups were specified in the standards. Students have to select one fruit or vegetable serving for the meal to count as reimbursable (Food and Nutrition Service – U.S. Department of Agriculture, 2010, 2012). Half of the grains served had to be rich in whole grains. Kilocalorie (kcal) levels were set for elementary (550–650 kcal), grades 6–8 (600–700 kcal), and high school (750–850 kcal). A gradual reduction in the sodium content of the meals over 10 years was planned.

Concerns about the new meal patterns have been raised (Woo Baidal and Taveras, 2014). These have included increased food waste, because of the new OVS requirement, especially for fruit and vegetables. Previous school studies conducted before 2012 have documented fruit waste of 42% (Cohen et al., 2014), 37.2–54.8% (Cohen et al., 2013), and 37–47% (Smith and Cunningham-Sabo, 2013); and vegetable waste of 30–90% (Cohen et al., 2013, 2014; Smith and Cunningham-Sabo, 2013).

Only three studies have examined food selection and waste before and after the 2012 implementation. Cohen et al. (2014) reported that significantly more students in grades 3–8 selected fruit post-policy (75.7%), compared with pre-policy (52.7%), but there was no difference in the amount consumed for those selecting the item. Although there was no difference in the percentage of students selecting vegetables, significantly more was consumed for those selecting vegetables (41.1%), compared with pre-policy (24.9%) (Cohen et al., 2014). In a 2013 plate waste study with pre-kindergarten and kindergarten students, data from 304 meals documented that 33% of fruit and 51.4% of vegetables were wasted, but waste data prior to the new meal patterns was not assessed for comparison (Byker et al., 2014). Food selection and waste data were also collected from low to middle income school students in 12 schools before (Spring 2012) and after (Spring 2013 and

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2014) implementation of the new NSLP meal patterns (Schwartz et al., in press). Significantly more students selected fruit in 2014 (66%) compared with 2012 (54%), with no difference in the percentage consumed (72 and 74%). Although the percentage of students selecting a vegetable declined from 68% in 2012 to 52% in 2014, the amount consumed increased from 45.6% to 63.6%, reflecting less vegetable waste.

This study investigated whether elementary student food selection and consumption changed after implementation of the new NSLP meal patterns. We hypothesized that greater amounts of fruit and vegetables would be selected and consumed by students after implementation.

Methods

This study was conducted during the spring semesters of 2011 and 2013 with elementary school students in eight schools in one school district in southeast Texas (Cullen et al., 2015). In 2011, the Director of the Child Nutrition Department selected the schools based on eligibility for free or reduced price meals (FRP): four low (49–79% FRP) and four middle income elementary schools (7–18% FRP). In 2011, there was an average of 716 students per school; 6% African-American, 34% Hispanic, 49% White and 11% Other. In 2013, the average number of students in the schools was 731; 7% were African-American, 37% Hispanic, 46% White, and 10% Other.

The study was approved by the Institutional Review Board at Baylor College of Medicine. The district superintendent and the principals of each school agreed to participate in the study. Observations were conducted anonymously, therefore individualized parental consent was not required.

Trained research staff observed students during lunch and recorded foods selected and consumed on preprinted checklists. The district used a 2-week cycle menu. All foods provided on the menus and sold as a la carte were preprinted on an observation checklist. There were columns to check the foods the student selected in the cafeteria line, and identify source (using codes for NSLP, home, a la carte, friend, etc.), and whether food was given away, spilled or obtained in purchase or trade. For each item, the amount eaten was recorded using the quarter waste method (0, 1/4, 1/2, 3/4, all), which has high inter-rater and inter-method reliability (Hanks et al., 2014). Student gender and grade level were also recorded.

The student selection and observation procedures are reported in the previous paper (Cullen et al., 2015). Briefly, trained research staffs were assigned to specific schools and visited each school weekly to obtain 8–10 observations per grade level over an 8-week period. Elementary school classrooms were assigned a table and this information was used so that equal numbers of students in each grade and equal numbers of boys and girls were observed over the semester. Each data collector first checked the observation checklist with the cafeteria line lunch items and menu for the day. Then the observer selected three to four students with a reimbursable NSLP meal, defined as a meal containing at least three of the five lunch food group components, who approached and then sat at the tables to be observed that day. The observations of these selected students were conducted unobtrusively from a distance.

The foods selected and consumed were entered into separate Nutrition Data System for Research (NDSR) files (version 2011, Nutrition Coordinating Center, University of Minnesota) to obtain student nutrient and food group intakes for meals selected and consumed (Cullen et al., 2004; Nutrition Coordinating Center, 2013). The food groups were fruit, 100% fruit juice, total fruit + 100% fruit juice, vegetables [total, dark green, red–orange, starchy (e.g., white potatoes, corn, peas), other (e.g., green beans, celery), legumes, high fat vegetables (e.g., french fries)], grains (e.g., breads, pasta), protein foods (e.g., meat, poultry, fish, cheese), snack chips, sugar sweetened beverages, desserts, and milk.

The percentage of elementary students who selected each food group was compared between 2011 and 2013 using the Cochran–

Mantel–Haenszel chi-square tests, adjusting for student sex, student grade, and school FRP. A mixed-effects regression analysis, controlling for student gender and grade and school FRP, examined whether students' consumption of calories and food groups and the percent of food groups consumed differed by year, for students who selected the food group. All the analyses were performed using SAS (version 9.3, 2011, SAS Institute Inc.).

Results

Observations were conducted for 472 and 573 elementary students in the spring of 2011 and 2013, respectively; approximately 50% were boys and 50% attended low income schools.

Compared with students in 2011, a significantly greater proportion of 2013 students selected fruit, 100% fruit juice, total fruit + 100% fruit juice, other vegetables, total grains, whole grains, protein foods, ($p < 0.001$ for all) and milk ($p < 0.05$), but a lower proportion of starchy vegetables ($p < 0.05$). The average kcal selected in 2011 and 2013 were 643 and 651, respectively (Table 1).

Compared with 2011 students, 2013 students selecting the food groups consumed significantly greater amounts of total fruit + 100% fruit juice ($p < 0.001$) and red–orange vegetables ($p < 0.01$), but significantly lower amounts of other vegetables, legumes, and protein foods ($p < 0.05$ for all) (Table 2).

In 2013, students consumed a lower percentage of milk than 2011 students ($p < 0.01$) (Table 3). There were no significant differences in the percentage of fruit, vegetable, or whole grains consumed, and thus wasted, between the two years except for legumes. A greater percentage of legumes were wasted in 2013 compared with 2011 (data not shown).

The energy content of the selected meals for each period (approximately 643 kcal in 2011 and 652 kcal in 2013) was very close to the new guidelines limit (650 kcal) (Table 1). However, the actual mean consumption for both groups was less than the 550 kcal lower limit; approximately 501 kcal in 2011 and 497 kcal in 2013 (Table 2).

Discussion

An increase in the amount of food wasted by students is a major concern that has been raised in reference to the new NSLP meal patterns, particularly because students are required to select at least one serving of a fruit or vegetable for the meal to qualify as reimbursable (Woo Baidal and Taveras, 2014). Without this requirement, studies conducted

Table 1

Differences in total calories selected per lunch and percent of elementary school students in southeast Texas selecting each food component in Spring 2011 and Spring 2013.^a

	Spring 2011		Spring 2013		% difference ^b
	n	n	n	n	
Calories (total selected)	643.46	472	651.52	573	8.06
Fruit*** (%)	58.26	275	76.09	436	17.83
Juice*** (%)	43.86	207	60.21	435	16.35
Fruit & juice*** (%)	81.36	384	94.07	539	12.71
Total vegetables (%)	68.17	317	64.05	367	−4.12
Dark green vegetables (%)	9.11	43	11.34	65	2.23
Red–orange vegetables (%)	27.31	127	28.27	162	0.96
Starchy vegetables* (%)	45.13	213	36.93	211	−8.2
Other vegetables*** (%)	35.59	168	47.29	271	11.7
Legumes (%)	3.18	15	5.58	32	2.4
Total grains*** (%)	85.81	405	100.00	573	14.19
Whole grains*** (%)	5.08	24	72.43	415	67.35
Protein foods*** (%)	96.77	450	99.83	572	3.06
Milk* (%)	90.04	425	93.19	534	3.15

Abbreviations: n, number; %, percent.

^a Cochran–Mantel–Haenszel test controlling for gender, school free/reduced price meal status, and grade.

^b Difference between 2011 and 2013 values.

* $p < .05$.

*** $p < .001$.

Table 2
Differences in the mean amounts of calories and food groups consumed for those elementary school students in southeast Texas selecting the item in Spring 2011 and Spring 2013.^a

	Consumed amount				Difference ^b
	Spring 2011		Spring 2013		
	Mean	SE	Mean	SE	
Energy (kilocalories)	500.53	23.81	497.36	23.84	−3.17
Fruit (c)	0.32	0.04	0.38	0.03	0.06
100% fruit juice (c)	0.43	0.03	0.46	0.03	0.03
Fruit + juice ^{***} (c)	0.46	0.04	0.60	0.04	0.14
Total vegetables (all in cup measure)	0.38	0.04	0.35	0.04	−0.03
Dark green vegetables	0.13	0.04	0.21	0.03	0.08
Red–orange vegetables ^{**}	0.13	0.02	0.22	0.02	0.09
Starchy vegetables	0.32	0.05	0.24	0.05	−0.08
Other vegetables [*]	0.18	0.03	0.10	0.02	−0.07
Legumes [*]	0.22	0.05	0.07	0.05	−0.15
Total grains (oz eq.)	1.45	0.21	1.73	0.21	0.28
Whole grains (oz eq.)	0.82	0.27	0.85	0.11	0.03
Protein foods [*] (oz eq.)	1.82	0.12	1.56	0.12	−0.26
Milk (ozs)	5.95	0.34	5.49	0.34	−0.46

Abbreviation: SE, Standard error; c, cup; oz eq., ounce equivalent; ozs, ounces.

^a Controlling for gender, school free/reduced price meal status, and grade, and taking into account the clustering effect of schools.

^b Difference between 2011 and 2013 values.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

before 2012 documented lunch fruit waste of 37–54.8% (Cohen et al., 2013), and vegetable waste of 30–90% (Cohen et al., 2013, 2014; Smith and Cunningham-Sabo, 2013). This study documented that with the new NSLP meal patterns, more students selected fruit and 100% fruit juice, other vegetables, and whole grains; and more total fruit + 100% fruit juice and red–orange vegetables were consumed, compared with 2011 lunch meal data. Student waste only increased for milk and legumes.

Only two previous studies assessed food selection and consumption before and after the 2012 implementation of the new meal patterns. In the first, significantly more students selected fruit post-implementation, but there was no difference in the amount consumed for those selecting fruit (Cohen et al., 2014). There were no differences in the percentage of students selecting vegetables before and after implementation; but, for

Table 3
Differences in the percent of calories and food groups consumed for those elementary school students in southeast Texas selecting the item in Spring 2011 and Spring 2013.^a

	% Consumed				Difference ^b
	Spring 2011		Spring 2013		
	Mean	SE	Mean	SE	
Energy (kilocalories)	78.08	2.65	77.21	2.66	−0.87
Fruit (c)	70.13	5.39	69.18	5.30	−0.95
100% fruit juice (c)	85.69	4.76	86.90	4.61	1.21
Fruit + juice (c)	79.39	3.84	76.62	3.81	−2.77
Total vegetables (all in cup measure)	68.46	5.36	68.11	5.47	−0.35
Dark green vegetables	43.69	7.00	45.18	6.07	1.49
Red–orange vegetables	64.42	5.98	70.57	6.25	6.15
Starchy vegetables	68.72	5.53	79.99	5.83	11.27
Other vegetables	69.44	5.25	65.70	4.82	−3.74
Legumes [*]	45.35	12.33	28.34	12.26	−17.01
Total grains (oz eq.)	65.02	6.13	67.64	6.12	2.62
Whole grains (oz eq.)	88.33	10.13	73.91	2.58	−14.42
Protein foods (oz eq.)	85.77	10.40	79.81	10.42	−5.96
Milk ^{**} (ozs)	78.83	5.53	68.09	5.58	−10.74

Abbreviation: SE, standard error; c, cup; oz eq., ounce equivalent; ozs, ounces.

^a Controlling for gender, school free/reduced price meal status, and grade, and taking into account the clustering effect of schools.

^b Difference between 2011 and 2013 values.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

those selecting vegetables, significantly more was consumed after implementation (Cohen et al., 2014). Food selection and waste data were also collected from middle school students in 12 low-income schools before (spring 2012) and after (spring 2013 and 2014) implementation of the new NSLP meal patterns (Schwartz et al., in press). The percentage of students selecting fruit significantly increased from 54% in 2012 to 66% in 2014, with no difference in the amount consumed (72 and 74%). Although the percentage of students selecting a vegetable declined from 68% in 2012 to 52% in 2014, the amount consumed increased from 45.6% to 63.6%, reflecting less vegetable waste (Schwartz et al., in press). The percentage of students in the current study selecting fruit (~58% in 2011 and ~76% in 2013) and the percentage of fruit consumed (~70% in 2011 and ~69% in 2013) are similar to the published values. Although the percentage of students selecting vegetables prior to the new meal patterns was similar in the current study (~68%), it was higher than the Schwartz et al. study afterwards (~64%). The percentage of vegetables consumed was stable at about 68% for both years.

Finally, in a pilot study testing the new fruit and vegetable meal patterns in 2011, fruit waste was 31% and vegetable waste was 60% for elementary school students (Cullen et al., 2015). The rates were not significantly different than the control school students in that study (Cullen et al., 2015).

The amount of calories consumed was lower than previously reported data. For elementary school students in a national study during the 2004–05 school year, the mean lunch intake was 587 kcal (Gordon et al., 2007). The slightly lower values in the current study may be the result of the more objective method of obtaining dietary intake (observation by trained staff) in contrast to the self-report method used in the previous study that required portion size estimation by students. However, a Colorado study that used digital photography of the foods selected and left at the end of the meal reported a lower mean intake of 426 kcal (Smith and Cunningham-Sabo, 2013). Perhaps students in that study obtained foods from friends or the snack bar and the wrapper or container were not on the trays. Whether student energy needs are met by school meals is an important area for future research, especially for those children for whom the school lunch meals are an important safety net for meeting food needs.

The generally low consumption of fruit and vegetables in this study is a concern. Future research efforts should target improving student food preferences, selection, and consumption. Verbal prompts from cafeteria staff (Perry et al., 2004), improved cafeteria design and food presentation (Hanks et al., 2013; Wansink et al., 2012, 2013), taste testing, marketing and media campaigns (Fulkerson et al., 2004; Wechsler et al., 1998; Food and Nutrition Service – U.S. Department of Agriculture, 2013; Stallings et al., 2009) were found to influence student selection and consumption in the cafeteria. Support and training for school food service staff are also needed (Stallings et al., 2009).

Several limitations should be noted. The study was conducted in eight elementary schools in the Houston area; approximately 40% of students were eligible for FRP meals compared with 66% of Texas students during 2012 (Center for Public Policy Priorities, 2012). Thus the findings from this district might not generalize to Texas and the US, or to students in middle or high schools. There was non-random selection of the schools and students who were observed, and students were not tracked between the two semesters. The amount consumed was assessed by observation, not weighing the foods left on the tray.

The findings from this study are encouraging. Regular monitoring of student food selection and consumption at school is needed to assess whether the new meal patterns improve intake at school.

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Conflict of interest statement

The authors have no potential conflict of interest to report.

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