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Impact of Portion-Size Control for School a la Carte Items: Changes in Kilocalories and Macronutrients Purchased by Middle School Students

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Abstract

We assessed the impact of a pilot middle school a la carte intervention on food and beverage purchases, kilocalories, fat, carbohydrate, and protein sold per student, and nutrient density of the foods sold. A la carte sales were obtained from six middle schools in three states for 1 baseline week and daily during the 6-week intervention. Intervention goals included reducing sizes of sweetened beverages and chips, and increasing the availability of water and reduced-fat/baked chips. Nutrients sold per day were computed and weekly nutrient means per student and per number of items sold were calculated and compared between baseline and week 6. Five schools achieved all goals at 6 weeks. Four schools showed increases in the percentage of kilocalories from protein and decreases in the amount of sweetened beverages sold; five showed substantial increases in water sales. Changes in regular chips varied by school. There were significant changes in energy density of foods sold. School foodservice changes in middle school snack bar/a la carte lines can be implemented and can lead to a reduction in the caloric density of foods purchased.

Recently, there has been much concern over the types and quality of food that students can purchase in schools (1,2), particularly in light of the dramatic increase in childhood obesity (3) and type 2 diabetes (4). Descriptive studies have noted that the top-selling snack bar foods (eg, pizza, chips, soda, French fries, candy, and ice cream) were high in fat and calories (5), and among middle school students, favorite snack bar selections included large sizes of sweetened beverages (≥ 16 oz) and large sizes of high-fat salty snack foods (eg, 3.75-oz bags

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of chips) (6). Access to middle school snack bar/a la carte foods was related to an increase in lunch consumption of sweetened beverages and French fries, and a decrease in lunch consumption of fruit and vegetables among middle school students (7). In prior studies, students who reported eating the National School Lunch Program meal consumed greater amounts of all nutrients except vitamin C, compared with students who reported eating lunch meals from home, restaurants, and other sources (8).

A recent study reported that making environmental school foodservice changes to improve item selections as a means to reduce incidence of youth type 2 diabetes risk factors was feasible (9). The specific improvements included promoting consumption of fruit and vegetables, water, and lower-fat food selections in all school foodservice environments, and reducing access to sweetened beverages and large packages of high-fat snack chips in the a la carte/snack bars. The purpose of this article is to document whether a 6-week snack bar/a la carte line intervention improved kilocalories, macronutrients, and food offerings purchased per student and per item sold (nutrient density) compared to baseline.

Methods

The Studies to Treat or Prevent Pediatric Type 2 Diabetes (STOPP T2D) were funded to develop a type 2 diabetes prevention program for middle schools. The overall goal of the larger intervention study, which began in 2006, is to reduce diabetes risk factors, including body mass index, blood sugar, and insulin levels among middle school students. Dietary outcomes for the main trial include increasing water, fruit, and vegetable consumption, and decreasing sweetened beverage and dietary fat consumption in all school food environments. In preparation for the full-scale trial, pilot nutrition interventions were conducted in six schools, in the winter/spring of 2004 by three field centers, Baylor College of Medicine, Houston, the University of California, Irvine, and the University of North Carolina at Chapel Hill. Two middle schools at each field center were recruited. Inclusion criteria were at least a 50% ethnic minority student population (African American, Native American, and Hispanic), the groups most at risk for type 2 diabetes (4), and at least 50% of the students eligible for free/reduced price meals. There were 13 pilot intervention goals, 6 of which were specific to the a la carte/snack bar area, with the others pertaining to the National School Lunch Program (9). This article presents data about the success of the a la carte/snack bar goals (reduce all regular chips serving size bags to ≤ 1.5 oz, increase lower-fat chip offerings by 25%; offer bottled water in a 20-oz size, and limit all sweetened beverages to ≤ 12 oz) most likely to impact energy balance. Although fruits and vegetables were offered in the snack bar/a la carte lines and the goal was achieved, purchases were very low. At week 6, no fruits and vegetables were sold at the two Texas schools, and 0.009 to 0.02 servings per student per day were sold at the other four schools.

Cafeteria sales data from the a la carte/snack bar lines were used to assess goal achievement, which was defined as achieving 75% of unmet baseline goals. The North Carolina and Texas schools each had one a la carte/snack bar line. California schools 1 and 2 had four and six a la carte/snack bar lines, respectively. Approximately 13 a la carte/snack bar items were sold daily in the Texas schools, 11 to 17 in the North Carolina schools, and 22 to 31 in the California schools. More details about the schools can be found in a previous publication (9). A research dietitian at each field center worked with the school foodservice manager to implement the intervention goals, and conducted in-service trainings with all foodservice workers to explain changes and enlist support for the intervention. Teachers received an information sheet describing the school foodservice changes. The research dietitian collected data on whether these goals were implemented from the daily school food production and sales records for a baseline week in early December 2003, and then daily during the 6-week pilot intervention. Each school received \$3,000 as partial compensation for implementing the foodservice

changes. The study was approved by the Institutional Review Boards of all participating institutions.

Daily sales of food items sold at lunch during the baseline week and each of the 6 intervention weeks were recorded on worksheets and entered into the Nutrition Data System for Research (version 2004, Nutrition Coordinating Center, University of Minnesota, Minneapolis). For each week, total kilocalories, the percentage of energy from protein, fat, and carbohydrate, and ounces of sweetened beverages, water, and regular and reduced-fat/baked fat chips sold were divided by the total number of students in the school (data supplied by the schools) to provide an index of nutrients/food offerings sold per student (10). To assess whether nutrient density of items sold was improved by the intervention, kilocalories, fat, and percent fat from all items sold each day were divided by the total number of items sold that day. A coordinating center at the George Washington University Biostatistics Center provided support and coordination for study activities.

PROC MIXED in SAS (version 8, 1999, SAS Inc, Cary, NC) was used to conduct the statistical analyses. Mixed models, accounting for the clustering of observations within schools, were used to analyze changes between baseline and week 6 for two models. In model 1, changes in nutrients and food offerings (kilocalories, percent kilocalories from fat, protein, and carbohydrate, water, sweetened beverages, regular, and reduced-fat/baked chips) sold per student were analyzed. Model 2 tested whether there was an improvement in the nutrient density of items purchased (kilocalories, total fat, and percent kilocalories from fat per item sold). Significant *P* values indicate a significant change (increase or decrease) in the daily mean nutrients sold or nutrient density of items sold between baseline and week 6. This pilot was a feasibility study and was not powered to detect significant differences in sales among schools.

Results and Discussion

The demographic characteristics of the participating schools are shown in Table 1. The majority of students identified themselves as members of ethnic minority groups (Hispanic, African American, and Native American).

At baseline, only one of the goals was met by one school; North Carolina school 2 offered reduced-fat/baked chips as 25% of their snack chips. At week 6, all goals were achieved by five of the schools. California school 1 did not meet the reduced-fat/baked-chip goal.

Table 2 shows the mean daily nutrient sales per student (model 1) and per item (model 2) from a la carte/snack bar lines at baseline and week 6.

Model 1: Changes in Nutrient Sales per Student

Significant changes in percent of kilocalories from protein ($P<0.05$) and ounces of water ($P<0.01$), sweetened beverages ($P<0.01$), and regular chips ($P<0.05$) were found across the six schools (Table 2). For the California and Texas schools, percent of kilocalories from protein increased. All but one North Carolina school showed increases in water sold. Sales of sweetened beverages decreased for California and Texas schools. The changes in regular-chip sales varied by school; three schools had little change, and two had large changes.

Model 2: Changes in Nutrient per Item Sold (Nutrient Density)

There was a significant reduction in kcal density per item sold ($P<0.01$). Texas school 2 showed a reduction in kilocalorie density from 277 to 216. Other reductions were modest (1 to 12 kcal per item sold). Kilocalorie density increased for California school 2 by 9 kcal per item sold. There were no changes in fat or percent fat per item sold.

Few school-based nutrition interventions have reported the changes in foods served in the school snack bar/a la carte lines. In this pilot study, the a la carte/snack bar fruit, vegetable, water, sweetened beverage, and regular chip goals were achieved, and five of six schools met the reduced-fat/baked-chip goal. These changes resulted in more water and less sweetened beverages and regular chips sold per day per student, and is probably related to the finding that the energy density of individual items sold per day was reduced for four of the schools. In comparison, a recent 2-year intervention study promoting low-fat foods in high school snack bars resulted in a substantially greater percentage of lower-fat food items available and sold in the intervention school compared with control condition schools (11). However, in another middle school environmental intervention study, no difference was found in the grams of fat sold or served from the school cafeteria or school stores, or brought from home at the end of the 2-year intervention (10).

When all the schools in this study were included in model 1, there was no significant change in number of kilocalories sold per student from week 1 to week 6. However, the two Texas schools showed small but important savings of 31 and 24 kcal per student per day. These values are somewhat lower than the 47 kcal savings per student per day found in a previous study reporting the potential impact of the implementation of a statewide school food policy with food/beverage changes similar to those in the current study (6). Whether these changes can promote energy balance among middle school youth is unknown. A deficit of just 20 kcal per day, with no change in energy expenditure, would amount to a deficit of 7,300 kcal in 1 year. Researchers have suggested that an energy deficit of 100 kcal per day, through a combination of increased energy expenditure and reduced intake, may prevent weight gain among adults (12). Future research should include longer-term studies that measure daily student consumption before and after environmental interventions to determine the impact of such changes on energy balance.

In future research, all snack bar food items should meet nutritional standards, including sweets and dessert foods, and sales of all snack bar food items should be assessed. One problem that might have influenced the results in the current study was the lack of a restriction on how many items could be purchased per student. Some study schools increased the type and number of dessert/snack items available, and there were no restrictions on portion size per package for these items. Whether students buy double servings or compensate by buying other snack foods is unknown. Studies in which student dietary intake is measured before and during such environmental interventions are needed.

Several limitations should be noted. This was a pilot study conducted in just three states with only six schools lasting only 6 weeks. Therefore, generalizability of findings may be limited. However, much school-based research is done with a limited number of schools in one district, so results across three states could also be considered a strength. All the data were from existing school sales records. No data on foods brought from home were available. No data on individual student consumption were obtained to measure the impact on student intake. Using student attendance as a denominator is only a rough approximation of the number of students who purchased a la carte items.

Conclusions

Results from this pilot study document that school foodservice changes in the school snack bar/a la carte line can be implemented in middle schools. However, changes in revenue were not ascertained, and any deleterious impact on school revenue could be an issue for sustainability. Also, it was apparent that restrictions on portion sizes of other snack foods like dessert foods were needed. Marketing and promotion of the healthful food offerings also appears necessary. Future work should implement longer interventions, include portion-size

requirements on all foods in a la carte lines, assess cost issues, and measure student dietary intake to assess whether school food environmental change was reflected in student dietary change.

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Table 1
Student demographics of the six nutrition intervention pilot study schools at baseline

	California		North Carolina		Texas	
	School 1	School 2	School 1	School 2	School 1	School 2
No. of students	1,165	1,708	715	850	778	1,032
Student ethnicity (%)						
African American	7	0	50	49	88	<1
White	1	48	23	49	<1	1
Native American	0	1	25	1	0	0
Hispanic	91	48	1	<1	10	98
Other	1	4	1	<1	1	<1
% NSLP ^a free/reduced-price meals	97	55	75	57	93	94

^aNSLP=National School Lunch Program.

Table 2

Change in mean daily nutrients sold from a la carte/snack food purchases per student^a and per item sold^b between baseline and week 6 of the intervention in six nutrition intervention pilot study schools

	California				Texas				North Carolina			
	School 1		School 2		School 1		School 2		School 1		School 2	
	Baseline	Week 6	Baseline	Week 6	Baseline	Week 6	Baseline	Week 6	Baseline	Week 6	Baseline	Week 6
Per student (Model 1)^a												
Kilocalories	76	81	77	96	167	136	113	89	102	150	84	94
% kcal from fat	41	43	28	26	33	40	32	30	30	24	29	23
% kcal from protein [*]	6	7	4	5	10	13	5	6	8	8	7	7
% kcal from carbohydrate	54	51	68	70	58	48	65	66	65	70	68	74
Water (oz) ^{**}	0.05	0.13	0.45	0.71	—	0.26	0.10	0.26	0.34	0.50	0.56	0.35
Sweetened beverages (oz) ^{**}												
(except juice)	0.96	0.15	1.06	0.67	2.59	0.90	3.31	2.30	2.28	3.08	1.69	1.85
Regular-fat chips (oz) [*]	0.21	0.25	0.15	0.16	—	—	0.21	0.09	0.13	0.02	0.02	0.02
Reduced-fat/baked fat chips (oz)	0.01	0.04	—	0.11	—	—	—	0.08	—	0.02	0.03	0.27
Per item sold (density) Model 2^b												
Kilocalories ^{**}	155	154	158	167	291	279	277	216	155	147	162	160
Total fat (g)	6.95	7.40	4.99	4.89	10.58	12.28	9.83	7.19	5.10	3.92	5.23	4.13
% kcal from fat	41	43	28	26	33	40	32	30	30	24	29	23

^aModel 1 analysis conducted on variables created by dividing nutrients and food offerings sold each day by number of students per school.

^bModel 2 analysis conducted on variables created by dividing kilocalories, fat and percent fat sold per day by number of items sold.

^cP value: change from baseline to post from mixed models.

* P<0.05.

** P<0.01.