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Improving the School Food Environment:

Results from a Pilot Study in Middle Schools

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Abstract

Our objective for this study was to examine the feasibility of instituting environmental changes during a 6-week pilot in school foodservice programs, with long-term goals of improving dietary quality and preventing obesity and type 2 diabetes in youth. Participants included students and staff from six middle schools in three states. Formative assessment with students and school staff was conducted in the spring of 2003 to inform the development of school foodservice policy changes. Thirteen potential policy goals were delineated. These formed the basis for the environmental change pilot intervention implemented during the winter/spring of 2004. Questionnaires were used to assess the extent to which the 13 foodservice goals were achieved. Success was defined as achieving 75% of goals not met at baseline. Daily data were collected on goal achievement using the schools' daily food production and sales records. Qualitative data were also collected after the pilot study to obtain feedback from students and staff. Formative research with staff and students identified potential environmental changes. Most schools made substantial changes in the National School Lunch Program meal and snack bar/a la carte offerings. Vending goals were least likely to be achieved. Only one school did not meet the 75% goal achievement objective. Based on the objective data as well as qualitative feedback from student focus groups and interviews with students and school staff, healthful school foodservice changes in the cafeteria and snack bar can be implemented and were acceptable to the staff and students. Implementing longer-term and more ambitious changes and assessing cost issues and the potential enduring impact of these changes on student dietary change and disease risk reduction merits investigation.

Foods available in schools, particularly from a la carte lines and vending services, often do not meet dietary guidelines (1). Recent longitudinal data documented increased sweetened beverage and high-fat vegetable intake and decreased fruit and milk intake when students gained access to a la carte lines and vending foods in middle school, where children typically

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are between the ages of 11 and 14 (2). Preferred middle school student food/beverage selections included large containers of sweetened beverages (>16 oz) and large portions of high-fat, salty snack foods (eg, 3.75-oz chip bags) (3). Consumption of sweetened beverages, dietary fat, and low fruit and vegetable consumption have been associated with obesity (4-8).

Previous interventions to improve middle school student food consumption have had limited success (9,10). A 2-year intervention promoting lower-fat foods in the cafeteria and a la carte food lines, and from lunches from home, was not successful (9). A 2-year intervention that included a classroom component with peer leaders, parental activities, and environmental changes also reported little dietary change among participants (10).

This article reports the results of a middle school pilot study improving food and beverage selections in the school environment. The improvements targeted all school food environments and included promoting fruits and vegetables, water, and lower-fat food and reducing access to sweetened beverages and large portions of high-fat snack chips.

METHODS

The Studies to Treat or Prevent Pediatric Type 2 Diabetes was funded by the National Institutes of Diabetes and Digestive and Kidney Diseases and includes a pediatric treatment study and a prevention program for middle schools. The overall goal of the prevention study, which will be conducted from 2006 to 2009, is to reduce diabetes risk factors (ie, body mass index, blood glucose, and insulin levels) among middle school students. This pilot study was conducted to inform the main study.

Formative Research

The three original field centers (four were subsequently added after this pilot) (Baylor College of Medicine, Houston, TX; University of California, Irvine; and the University of North Carolina at Chapel Hill) conducted 11 focus groups with students and school staff in the spring of 2003 to inform them of the school foodservice changes. A coordinating center, the George Washington University Biostatistics Center, provided support for key study activities. Two middle schools at each field center were recruited. Inclusionary criteria were an at least 50% African-American and Hispanic student population, the groups most at risk for type 2 diabetes (11), and at least 50% of the students were eligible for free/reduced price meals. The focus group questions addressed the following issues: student use of National School Lunch Program (NSLP) meals, a la carte lines and vending machines, favorite foods served, and ways to improve school foods. The study was approved by all participating institutional review boards, and informed parental consent and child assent were obtained.

In general, focus group results documented that students' favorite lunch foods included hamburgers, cheeseburgers, and sweet foods, with infrequent consumption of fruits and vegetables. They believed they were not always served fresh or healthful food items like vegetables. Alternatively, the students reported that school snack bars served better foods, such as ice cream, chips, and sweets, and that vending machines provided preferred sweetened beverages and snack foods. Many students said that they would eat fruits and vegetables if schools offered a variety and served them fresh.

Seven district school food administrators were interviewed. They reported that the primary role of school lunch was to prepare and serve healthful meals. However, several barriers were reported: the popularity of junk food and soft drinks, student access to vending machines, time, and finances. About 400 students had to be served every 30 minutes, reducing the time available to make foods look appealing. Serving fresh fruits and vegetables would increase food costs. Principals were responsible for vending, which provided discretionary revenue for the school,

and thereby a disincentive to change. Obtaining support from teachers and school staff was reported to be important to maintain participation rates.

The resulting intervention with 13 goals targeted all school food environments (Table 1). Five goals related to serving more of a variety of fresh fruits and vegetables and lower fat entrees in the NSLP and a la carte lines. Although not mentioned by students or staff, reduced portion sizes of large sweetened beverages and snack chips in the a la carte lines were initiated (goal nos. 7 and 10), and 25% of the chips were to be reduced-fat/baked varieties. Bottled water was to be available in a la carte lines and vending. No pilot school had snack vending, so only beverage vending changes were initiated, ie, reduced sweetened beverage size and increased water availability (goal nos. 12 and 13). The United States Department of Agriculture's ban on soda availability during meals was to be enforced.

Pilot Study

Each field center's research dietitian was responsible for working with the foodservice directors and managers to implement study goals. She conducted in-service training with the foodservice workers at each school to explain the changes and enlist support. Teachers in the participating schools received information sheets describing the changes. School food production and sales records were used to record the amount of foods sold in the NSLP and a la carte lines daily for 1 baseline week, and then daily during the 6-week pilot on study forms, from which goal achievement was determined. Each school received \$3,000 as partial compensation for implementing the foodservice changes.

The two North Carolina schools were in the same county district. The NSLP menus followed the traditional food-based menu planning system, with the offer-versus-serve option, whereby a student must take at least three of the five offered components for the meal to qualify as a reimbursable meal. Both North Carolina middle schools offered the self-serve type reimbursable meal and also sold a la carte items, such as chips and drinks, at the end of the main serving line. There were three beverage vending machines in the cafeteria: one juice drink machine with 12-oz sweetened beverages, a 16-oz-water machine, and a milk machine that offered 16-oz sweetened milk drinks, but only one lower-fat milk option, a fat-free chocolate milk.

The two Houston area schools were in the same district. The menus followed the NuMenu nutrient standard meal planning system, which utilized computer software to ensure the meals met specific nutrient standards. The menu consisted of at least two entrees, three side dishes (eg, fruit, vegetables) and milk. Offer-versus-serve was also in place, and the students had to select a minimum of an entrée, milk, and one side dish. Both schools had two NSLP lines and an a la carte window for purchases such as burgers, fries, chips, ice cream, and drinks. Prior to this study, the principal of school 1 banned chips, and the principal of school 2 banned all beverage vending.

The two California schools were in different districts. School 1 used the food-based menu planning system and offer-versus-serve. A daily salad bar was counted as a reimbursable meal item. There was one express NSLP line, three a la carte lines, and a chip/snack cart outside. A 4-oz fruit juice was available as a reimbursable meal item daily. A 20-oz sports drink vending machine was available during meal times. California school 2 used the NuMenu system and offer-versus-serve. A 4-oz fruit juice was available as a reimbursable meal item daily. There was one indoor NSLP line, four outdoor lines that included NSLP and a la carte sales, and two outdoor a la carte lines.

Success was defined as achieving 75% of unmet baseline goals (see Table 1). Six follow-up focus groups (two per field center) were conducted with sixth-grade students, typically ages

11 to 14 years, as were interviews with the foodservice directors, managers, and principals at each school to obtain feedback on the study changes. Sixth-grade students were included as the main study was planned as a 2.5-year longitudinal study enrolling sixth-grade students.

Statistical Analyses

Goal achievement was calculated per school and field center. Goals already met at baseline were excluded from this computation. The fruits and vegetables served with the NSLP meals were calculated per student enrolled in the school, as were sales of targeted a la carte items.

RESULTS

The majority of students were of minority ethnic populations (Table 2). Overall goal achievement was 92% at 6 weeks (Table 1). Only one California school did not meet the 75% goal achievement objective. For all schools, the water and smaller-sized sweetened beverage vending changes from contract vendors were the most difficult to attain. In California and North Carolina, the manager or principal turned off the beverage machines to achieve the goals. These schools did not sell soft drinks. At baseline, although five out of six schools met the lower-fat entrée goal, only the California schools met the NSLP fruits and vegetables goals. None of the a la carte fruits and vegetables goals were met at baseline. In the a la carte lines at baseline, only one North Carolina school served lower-fat chips and only one California school offered 20-oz water. The beverage vending goals were not met at baseline.

Overall, total NSLP fruits and vegetables served increased from 1.10 to 1.42 servings across the six schools; vegetable servings increased from 0.65 to 0.79 serving, and fruit servings increased from 0.23 to 0.42 serving (Table 3). At baseline, both California schools served 1/2 to 3/4 serving of 100% fruit juice per student at lunch, and one school had a salad bar and served almost three servings of fruit, 100% juice, and vegetables per student per day, with 1.75 servings from vegetables. A slight decrease in total fruit and vegetable servings was noted for both California schools and one Texas school. The other three schools reported total fruit and vegetable serving increases of 0.31 to 1.45 servings. One California and one Texas school showed decreases in vegetables served, and the California schools showed decreased fruit servings. All schools met the variety goals.

Large-sized drinks and chips were eliminated from a la carte lines in all schools. Overall, ounces of sweetened beverages and chips sold declined by 28% and 16%, respectively; ounces of water sold increased (51%); and sales of low-fat/reduced-fat chips increased (775%) (Table 4). Some school and state differences were noted. Both North Carolina schools increased sweetened-beverage sales, only one increased water sales, and sales of reduced-fat chips were minimal. Both California schools reported increased sales of regular chips. The only goal not met by all schools was increasing sales of reduced-fat/baked chips to 25% of total sales.

Two student focus groups per school, and interviews with the school foodservice managers, administrators, and principal were conducted at study end. Students noticed more variety of fruits and vegetables. In the a la carte lines, North Carolina students noted more fruit variety and the large-sized bottled water. However, the price for the larger bottled water, compared with the smaller sweetened beverage, was a concern, as was reduced access to beverage vending at lunch.

The 11 foodservice managers and directors were supportive of the changes. However, they noted that labor and food costs and lost revenues were potential concerns that could influence implementation. The six principals had fewer comments; the majority ate in the cafeteria less than two times per week. They noted changes like reduced-size chip bags, more water, and

more fruits and vegetables. Positive comments were reported to them by teachers, parents, and students.

DISCUSSION

This pilot study documented that school foodservice changes (lower-fat entrees, increased fresh fruits and vegetables and bottled water, and reduced portion sizes of snack chips and sweetened beverages) can be successfully implemented for a 6-week period and be acceptable to middle school students.

The number of fruits and vegetables served in the NSLP meal increased for three schools. Although the number of fruits and vegetables served was not an individual measure of consumption, there is evidence that food offered impacted foods served because all the schools utilized the offer-versus-serve option (ie, students only had to select three menu components for the meal to be reimbursable). In previous work among elementary school students, lunch consumption of fruits and vegetables was significantly related to their availability in the cafeteria (12). Future studies should measure meal-specific student dietary intake to assess the impact of school foodservice changes on consumption.

Greater increases in overall fruit servings, compared with vegetables, may be related to preferences. In previous research, youth reported higher preferences for fruits than vegetables (13). In an elementary school cafeteria intervention, substantial increases in student consumption of fruits, but not vegetables, were obtained (14). The higher servings of vegetables in one Texas and two North Carolina schools are more difficult to explain, but could be related to regional or individual school differences in preferences. It is also difficult to explain the large drop in vegetables served in one Texas school that was accompanied by an increase in fruit served. However, this again could be related to preference, as the school foodservice incorporated a large amount of fresh fruit in their menu during the intervention period. Perhaps students selected the available fruit instead of the vegetables. This could also be related to supply issues. Perhaps the vegetable menu items were not delivered and substitutions were not made.

The two schools with the highest baseline servings of fruits and vegetables (2.93 total and 1.75 vegetables for California school 1 and 1.60 total and 1.1 vegetables for Texas school 2) reported decreases at 6 weeks. However, the 6-week total fruit and vegetable servings of those two schools were still higher than the 6-week totals of all but Texas school 1. Although vegetables served decreased, Texas school 2 increased fruit servings by 78%. Perhaps the baseline servings from those two schools represented the maximum feasible amount served per student, and with more fruit variety, students selected more fruit. California school 1 saw a slight decrease in all fruits and vegetables served. The type of choices made by students, when confronted by a variety of fruits and vegetables, is an area that warrants additional study.

All of the a la carte line fruit and vegetable and sweetened beverage goals were successfully achieved. The increased reduced-fat/baked chips results were similar to an intervention study that promoted low-fat foods in high school snack bars (15). In future interventions within school food environments, all a la carte line items should meet nutrition standards, and sales of all items should be monitored. Whether students compensate by buying double servings, by buying other snack foods, or compensate outside of school should be investigated.

Vending changes were the most difficult to achieve (Table 1). To meet the goals in four of the schools, the vending was turned off when it was obvious that the vendor was not going to increase water and decrease sweetened beverage size. In most of the schools, vending selection was the responsibility of the principal, and the districts had contracts with a beverage company. The two goals most difficult to change involved structural machine changes: replacing the

beverage machines with ones that held 20-oz water bottles, and reducing sweetened beverage size to 12 oz. Perhaps more lead time is needed to negotiate with the beverage companies and the principals to obtain these changes. Some schools were unable to provide the number of items sold from each machine. Potential loss of revenue from vending was voiced as a concern by administrators and could be a potential barrier to future changes. Future research needs to address vending changes that do not result in a loss of revenue to the principal/school.

In this study, the vending machines were made inaccessible for the students in some schools to meet the goals. The feasibility of this intervention approach for longer than 6 weeks is unknown. If all school food environments are not serving similar foods, student purchases could shift to other sources. Such a shift was seen in a previous study, where the school foodservice removed chips, beverages, and candy from the snack bar, but vending food selections did not change (16). Student overall consumption did not change, but the proportion of candy and snack chip intake from vending increased substantially (16). Future research should investigate the procedures needed to implement vending changes, because access to vending does influence student intake (17).

Feedback from the foodservice managers and administrators identified costs as an issue. School foodservice departments are expected to meet yearly budgets and not experience losses. Future projects need to minimize costs of such a program, ie, find alternative sources of income, particularly if these changes were implemented for all the schools in a school district.

Foodservice administrators' concerns about the negative influence of vending on student food choices were reported in previous studies (18,19). Middle school students reported similar concerns about healthful food offerings in the lunch line, snack bar, and vending (19). Student feedback in this study supported the changes, particularly increased fruit and vegetable availability. Whether students consume new foods is an issue for further study.

Several limitations should be noted. This was a 6-week pilot study conducted in just three states with only six schools. Therefore, the generalizability and durability of changes are limited. No individual student consumption data were obtained to measure the impact on student intake. It is possible that foods were purchased, but not eaten, and foods may have been brought from home.

CONCLUSIONS

This pilot study documented that school cafeteria and a la carte line changes can be implemented in the short term and were acceptable to staff and students. However, vending changes proved difficult and future research should investigate how to better negotiate such changes, and will need to be addressed in the main study. Future work should implement longer interventions, expand the goals to reduce portions of all snack/dessert food items to one serving sizes, assess cost issues, and measure student dietary intake at school and out of school to assess whether school food environmental change was reflected in student dietary change, and ultimately biologic risk factors. The 3-year Studies to Treat or Prevent Pediatric Type 2 Diabetes Prevention Study Group middle school study will include these important issues in the school foodservice intervention.

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Table 1
Pilot study goals and goal achievement for improving the food environment in middle schools

| Primary outcome | Goal | Overall Goal Achievement | |
|-------------------------------------------------------------------|-----------------------------------------------------|--------------------------|--------|
| | | Baseline | Week 6 |
| National School Lunch Program food | | | |
| 1. Fruit and vegetable menu items ^a | At least 3/day | 2/6 | 6/6 |
| 2. Fruit and vegetable variety | At least 10 different items over each 3-week period | 1/6 | 6/6 |
| 3. Lower fat entrée ^b | At least 2/week | 5/6 | 6/6 |
| Non-National School Lunch Program, nonvending food | | | |
| 4. At least 1 fruit offered per day ^a | 1/day every day | 0/6 | 6/6 |
| 5. At least 1 vegetable offered per day ^a | 1/day every day | 0/6 | 6/6 |
| 6. Fruit and vegetable variety | At least 7 different items over each 3-week period | 0/6 | 6/6 |
| 7. Chip snack food bag size ≤1 ounce | 100% of time | 0/5 | 5/5 |
| 8. Number of bags of low-fat chip snack food alternatives offered | Increase by 25% | 1/5 | 4/5 |
| Non-National School Lunch Program, nonvending beverage | | | |
| 9. Bottled water offered in at least 20-oz size at lunch | 100% of time | 1/6 | 6/6 |
| 10. Sweetened beverages ≤12 oz | 100% of time | 1/6 | 6/6 |
| Vending beverage | | | |
| 11. Soda machines off/unavailable during meals | 100% of time | 0/1 | 1/1 |
| 12. Number of water slots increased | At least 25% | 0/5 | 3/5 |
| 13. Sweetened beverages ≤12 oz | 100% of time | 0/5 | 3/5 |

^a 50% of items are delivered raw and prepared to adhere to 5 A Day for Better Health Program guidelines, eg, foods prepared by frying, such as french fries, do not count.

^b Item modified to be 10% lower in fat or a lower-fat substitute is used (ie, at least 10% lower in fat than regular item).

Table 2
Demographics of schools participating in a pilot study to improve the food environment in middle schools

| | 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 |
| % Receiving free and reduced price meals | 97 | 55 | 75 | 57 | 93 | 94 |

Table 3

National School Lunch Program fruits and vegetables served per student per day during the baseline week and during week 6

| | Total Fruits and Vegetables | | Vegetables | | Fruits | | Juice (California Only) | |
|-----------------------|-----------------------------|---------|------------|---------|----------|---------|-------------------------|---------|
| | Baseline | 6 Weeks | Baseline | 6 Weeks | Baseline | 6 Weeks | Baseline | 6 Weeks |
| California | | | | | | | | |
| School 1 | 2.93 | 2.67 | 1.75 | 1.59 | 0.39 | 0.37 | 0.79 | 0.71 |
| School 2 | 0.83 | 0.82 | 0.11 | 0.13 | 0.21 | 0.12 | 0.50 | 0.58 |
| North Carolina | | | | | | | | |
| School 1 | 0.50 | 0.81 | 0.42 | 0.66 | 0.08 | 0.15 | | |
| School 2 | 0.26 | 0.82 | 0.21 | 0.58 | 0.05 | 0.24 | | |
| Texas | | | | | | | | |
| School 1 | 0.45 | 1.90 | 0.33 | 1.15 | 0.12 | 0.75 | | |
| School 2 | 1.60 | 1.51 | 1.10 | 0.62 | 0.50 | 0.89 | | |
| Overall change | 1.10 | 1.42 | 0.65 | 0.79 | 0.23 | 0.42 | | |

Table 4

Mean daily sales of beverages and chips per day per student school enrollment from the a la carte lines at baseline and week 6 for the six participating schools

| | Sweetened Beverages (oz) | | | Water (oz) | | | Regular Chips (oz) | | | Reduced-Fat Chips (oz) | | |
|------------------------|--------------------------|---------|----------|------------|---------|----------|--------------------|---------|----------|------------------------|---------|----------------|
| | Baseline | 6 Weeks | % Change | Baseline | 6 Weeks | % Change | Baseline | 6 Weeks | % Change | Baseline | 6 Weeks | % Change |
| California | | | | | | | | | | | | |
| School 1 | 1,117 | 169 | -85 | 61 | 146 | 139 | 240 | 293 | 22 | 13 | 47 | 261 |
| School 2 | 1,808 | 1,142 | -37 | 763 | 1,213 | 59 | 257 | 275 | 7 | 0 | 191 | ∞ ^a |
| North Carolina | | | | | | | | | | | | |
| School 1 | 1,630 | 2,202 | 35 | 240 | 351 | 46 | 92 | 14 | -85 | 0 | 13 | ∞ |
| School 2 | 1,435 | 1,575 | 10 | 468 | 298 | -36 | 20 | 19 | -05 | 25 | 24 | -04 |
| Texas | | | | | | | | | | | | |
| School 1 | 2,008 | 699 | -65 | 0 | 205 | ∞ | NA ^b | NA | NA | NA | NA | NA |
| School 2 | 3,414 | 2,373 | -30 | 105 | 267 | 154 | 218 | 93 | -57 | 0 | 77 | ∞ |
| Overall average | 1,902 | 1,360 | -28 | 273 | 413 | 51 | 165 | 139 | -16 | 8 | 70 | 775 |

^a ∞=not able to compute because denominator was zero.

^b NA=not applicable.