

Implementation of Low-Fat, Low-Sugar, and Portion-Controlled Nutrition Guidelines in Competitive Food Venues of Maine Public High Schools

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ABSTRACT

BACKGROUND: The prevalence of childhood “overweight” and “at risk for overweight” has become a major public health concern. School food environments can affect key nutritional risk factors, especially in high schools where foods of poor nutrient value are pervasive in à la carte and vending programs. This study examines à la carte and vending programs in Maine public high schools at baseline and following implementation of low-fat (defined as items $\leq 30\%$ of total calories from fat), low-sugar (defined as items $\leq 35\%$ of sugar by weight), and portion-controlled (LFLS) guidelines.

METHODS: Four high schools implemented LFLS guidelines and 3 made no changes to à la carte and vending programs for a period of 1 school year.

RESULTS: Findings revealed no significant change in food and beverage offerings in control schools. Whereas, in intervention schools, the proportion of items meeting the LFLS nutrient criteria increased from 32.8% to 81.8% in à la carte items, increased from 22.5% to 84.0% in snack vending, and increased from 48.0% to 98.9% in beverage vending from baseline to follow-up. However, these increases were mitigated when LFLS portion size criteria were applied.

CONCLUSIONS: These findings demonstrate the successful implementation of LFLS guidelines similar to recommendations recently proposed by numerous organizations. School food service personnel were identified as key stakeholders in the successful implementation of the LFLS guidelines. Furthermore, these findings emphasize an important role the food and beverage industry will have in providing foods and beverages that meet proposed nutrient and portion guidelines.

Keywords: competitive foods; school food services; adolescents; school food policies.

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LITERATURE REVIEW

The prevalence of “overweight” and “at risk for overweight” in children and adolescents has risen rapidly in the past few decades and has become a major public health concern nationally¹ and in Maine.² Schools can play a major role in the prevention of overweight in children, in part, because they have the capacity to influence the eating behavior of their students.³⁻⁵ A wide variety of foods and beverages are available at school through federally regulated National School Lunch Program (NSLP) and School Breakfast Program (SBP) as well as competitive food and beverage venues such as à la carte, vending, snack bars, and school stores. Approximately 83% of all public and private schools in the United States participate in the NSLP and approximately 50% in the SBP.⁶ In 2001, it was found nationally that 90% of schools offered à la carte programs; 76% of high schools, 55% of middle schools, and 15% of elementary schools had vending machines available to students; and 41% of high schools, 35% of middle schools, and 9% of elementary schools had other school food venues such as school stores or snack bars.⁷

The NSLP and SBP have nutrition standards;⁸ however, at present, competitive foods and beverages are only restricted from being sold during meal times if the foods are of minimal nutritional value, defined as those providing less than 5% of the recommended daily intake of each of 8 specified nutrients per serving (eg, protein, vitamin A, vitamin C, niacin, riboflavin, thiamine, calcium, and iron).⁹ Furthermore, the NSLP and SBP set appropriate portion sizes,⁸ whereas no guidelines are established for competitive foods. Documentation of portion sizes in competitive foods is scarce and warrants further research.

Limited data on the nutrient content of competitive foods and beverages suggest that the majority of items available are of poor nutrient value.¹⁰⁻¹³ French et al¹⁰ reported that 64% of à la carte and 65% of vending machine items did not meet low-fat criteria defined as ≤ 5.5 fat grams per serving in 20 secondary schools. Furthermore, research suggests that the availability of competitive foods may negatively impact children’s diets.^{14,15} Kubik et al¹⁵ reported that fruit and vegetable consumption was lower and total and saturated fat was higher in seventh grade students when à la carte programs were available. Similarly, fruit consumption was lower when snack vending machines were available.

Some schools and/or school districts have implemented policies regarding the sale of competitive foods and beverages.¹⁶ Furthermore, recent recommendations for nutrient standards and portion sizes of competitive foods sold in schools have been proposed by several organizations.^{4,17-21} Recommendations include decreasing fat and added sugar and moderate portion sizes for each individual food or beverage sold within the school environment.

A few studies have implemented environmental changes to increase availability of low-fat items in all school food sources²² or have used pricing strategies to promote low-fat food purchases in à la carte programs.²³ School environmental changes, however, remain an understudied area, particularly at the high school level where availability of à la carte and vending programs are most pervasive. Previous studies have focused only on increasing availability of low-fat foods.^{22,23} To our knowledge, no study has examined the feasibility of implementing nutrient guidelines that aim to eliminate poor nutrient value foods from à la carte and vending programs in high schools.

Thus, the aim of this study was to examine the efficacy of implementing low-fat, low-sugar, and portion-controlled (LFLS) guidelines in à la carte and vending programs in Maine public high schools. The proportion of à la carte and vending items that met LFLS guidelines was examined at baseline and following implementation of LFLS guidelines for 1 school year.

METHODS

Study Design

This study is a prospective, quasi-experimental, nonrandomized design. High schools volunteered as intervention ($N = 4$) and implemented LFLS guidelines or control ($N = 3$) and made no changes to a la carte and vending programs for 1 school year. Baseline data collection occurred during the spring 2004 prior to implementation of LFLS guidelines. Implementation of LFLS guidelines occurred at the start of the 2004-2005 school year in intervention schools. Follow-up data collection occurred during the spring 2005, approximately 9 months after implementation of LFLS guidelines. Monitoring of compliance to the intervention and control occurred on a regular basis throughout the 2004-2005 school year. The research protocol was approved by Institutional Review Boards of the University of Southern Maine and Maine Center for Disease Control and Prevention, Maine Department of Health and Human Services.

Sample

All Maine public high schools were invited to participate. The Maine Department of Education sent an informational letter electronically to all superintendents ($N = 150$) in the state asking for voluntary participation. Approximately 50 high schools expressed interest. Interested high schools were screened by telephone for meeting study criteria, which included participation in the NSLP, offered an à la carte program, and had at least 1 snack and 1 beverage vending machine accessible to students. Four intervention and 3 control schools were identified. Schools were

located in 6 counties throughout southern and central Maine. All schools received an incentive to participate (\$1500 annually) and designated a school liaison to assist with internal processes. Table 1 shows characteristics of the control and intervention schools.

Procedure

The LFLS guidelines in intervention schools required food items offered to contain $\leq 30\%$ of total calories from fat (excluding fat from nuts, seeds, and peanut butter) and $\leq 35\%$ of sugar by weight (excluding sugar in fruit and dairy products). Requirements for beverages included offering only nonfat or 1% low-fat milk (including flavored milk), 100% juice, and water. Portion sizes were limited to 12 fl oz for beverages (excluding water), 3 fl oz for frozen desserts, 3 oz for bakery items, 2 oz for cookies or cereal bars, and 1.25 oz for snacks such as baked chips, crackers, pretzels. No portion criteria were recommended for entrées, fruits and vegetables, candy, or miscellaneous items like bread and cereal. The guidelines are consistent with recommendations of the Maine Dietetic Association and Maine School Food Service Association²⁴ as well as other organizations.^{4,17-21}

Trained personnel visited each school on 5 consecutive, scheduled, nonrandomly selected days at baseline and follow-up. Follow-up visits were during a similar time period as baseline. Observation and recording of the number of items offered through breakfast and/or lunch à la carte programs were completed. Methods similar to French et al¹⁰ was used, and à la carte items were defined as any food or beverage sold during breakfast and/or lunch programs in cafeterias. À la carte items did not include NSLP or SBP items sold as second servings, salad bar, or sandwich bar items that could not

be assessed for nutrient information of an individual serving. Vending data collection including the number of snack and beverage machines, number of items offered, and nutrition information for each item was completed at baseline and follow-up on one of the same days as à la carte program observation.

Nutrient information recorded for all food and beverage items included brand name, portion size (ounces or fluid ounces), total calories, sugar (g), and total fat (g). Information was obtained from labels of packaged foods; recipes were collected and analyzed for nutrition information using the Food Processor (version 7.0; ESHA Research, Salem, Ore); and vendors were contacted to obtain nutrition information from products that did not contain nutrition labels.

Percent fat of total calories and percent sugar by weight were calculated for each food item, with the exception of frozen novelties and beverages. Food items were categorized into 2 groups based on meeting percent fat criteria and percent sugar criteria or not meeting criteria of the LFLS nutrient guidelines. Nonfat milk, 1% milk, 100% juice, and water were categorized as meeting LFLS nutrient guidelines. Food and beverage items were further categorized into groups based on meeting or not meeting portion size criteria of the LFLS guidelines.

Following baseline visits to intervention schools, strategies were developed to implement the LFLS guidelines. Strategies included visits by research personnel to each school's food and beverage supplier to identify items that met the LFLS guidelines. Subsequently, food service directors were given lists of available vendor as well as government commodity products that met LFLS guidelines to aid in selection of LFLS items (ie, baked potato chips with 10% of total calories from fat were selected rather than regular potato chips with 58% of total calories from fat). Suppliers who stocked vending machines were also given lists of their available LFLS items or required beverages and were expected to only stock these items in their machines starting in the fall 2004. Of note, 1 intervention school stopped providing snack vending machines in the fall 2004 due to lack of interested vendors willing to and/or able to provide a sufficient variety and/or quantity of LFLS items. In addition, only 1 major beverage vendor had 100% juice packaged in required 12 oz size, and because high schools had "pouring" contracts with beverage vendors, 20 oz, 100% juice remained available in à la carte and vending programs.

Modification of recipes and preparation techniques was developed by research and food service personnel to decrease fat, sugar, and portion size of items (ie, chocolate chip cookie recipe was modified by reducing the portion size from 2.2 to 1.6 oz and replacing added butter with applesauce to reduce fat content

Table 1. Characteristics of Schools and Food Environments

Characteristics	Intervention (N = 4)			
	Control (N = 3)			
No. students, mean \pm SD	756 \pm 295	749 \pm 418		
Percentage of students eligible for free/reduced-price meal, mean \pm SD	20.0 \pm 15.8	32.9 \pm 5.5		
Closed campus policy during lunch	3*	4*		
Offered a la carte breakfast	2	4		
	Baseline	Follow-Up	Baseline	Follow-Up
No. vending machines, mean \pm SD				
Snack	1.0 \pm 0.0	1.0 \pm 0.0	2.5 \pm 1.7	1.3 \pm 1.0
Beverage	6.0 \pm 3.0	4.7 \pm 2.1	6.5 \pm 2.5	6.0 \pm 2.2
No. vending machines with restricted access				
Snack	2	1	5	0
Beverage	3	2	4	0

*One school had open campus for 12th grade only.

from 47% of total calories to 27%). Increased offerings of fresh fruits and vegetables in à la carte programs (ie, individual servings of carrot or celery sticks with low-fat dip, fresh fruit, and vegetable pizza) were encouraged.

Presentations describing the LFLS guidelines were made to school administrators, faculty, and/or staff at the start of the 2004-2005 school year in intervention schools. Furthermore, letters from schools were sent home to inform students and parents of changes in vending and à la carte programs. Additional descriptions of responses to changes in intervention schools can be found elsewhere.²⁵

DATA ANALYSIS

Chi-square analysis was used to determine differences in the proportion of à la carte and vending items that met LFLS nutrient guidelines and LFLS nutrient and portion guidelines at baseline between control and intervention schools. Paired *t* test was used to determine differences in the proportion of à la carte and vending items that met LFLS nutrient guidelines and LFLS nutrient and portion guidelines between baseline and follow-up in control and intervention schools. An independent *t* test was used to determine differences in the change in the proportion of à la carte and vending items that met LFLS nutrient guidelines and LFLS nutrient and portion guidelines between control and intervention schools from baseline to follow-up. Type I error rate was $p = .05$ for all analysis, and data analysis was completed using SPSS (version 12.0; SPSS Inc., Chicago, Ill).

RESULTS

À La Carte

A total of 378 at baseline and 559 at follow-up à la carte items were offered in control schools. At baseline, $29.8 \pm 8.9\%$ and at follow-up $32.3 \pm 5.0\%$ of items met LFLS nutrient guidelines (ie, low fat and low sugar) and decreased to $22.4 \pm 6.1\%$ at baseline and to $23.3 \pm 7.6\%$ at follow-up when portion criteria were applied (ie, ≤ 2 oz for cookies or cereal bars, etc.) to à la carte items in control schools. The large increase in the number of offerings in control schools from baseline to follow-up was the result of one school moving to a larger cafeteria and their ability to increase the number of à la carte items offered. A total of 371 at baseline and 294 at follow-up à la carte items were offered in intervention schools. At baseline, $32.8 \pm 5.8\%$ and at follow-up $81.1 \pm 6.0\%$ of items met LFLS nutrient guideline and decreased to $28.7 \pm 7.7\%$ at baseline and to $69.2 \pm 3.7\%$ at follow-up when portion criteria were applied to à la carte items in intervention schools.

Vending

Table 1 shows the number and type of vending machines at baseline and follow-up in schools. Five machines in control and 9 in intervention schools at baseline, whereas 3 in control and 0 in intervention at follow-up had restricted access during the school day.

A total of 122 at baseline and 118 at follow-up of snack vending items were offered in control schools. At baseline, $24.2 \pm 28.0\%$ and at follow-up $19.7 \pm 3.3\%$ of items met LFLS nutrient guidelines and decreased to $12.6 \pm 4.7\%$ at baseline and to $6.7 \pm 0.8\%$ at follow-up when portion criteria were applied to snack vending items in control schools. A total of 358 at baseline and 142 at follow-up of snack vending items were offered in intervention schools. At baseline, $22.5 \pm 20.0\%$ and at follow-up $84.0 \pm 8.1\%$ met LFLS nutrient guidelines and decreased to $12.3 \pm 4.1\%$ at baseline and to $34.4 \pm 12.1\%$ at follow-up when portion criteria were applied to snack vending in intervention schools.

A total of 455 at baseline and 446 at follow-up of rows of beverage vending were offered in control schools. At baseline, $36.1 \pm 28.0\%$ and at follow-up $46.5 \pm 34.3\%$ rows of beverage vending were allowable LFLS guideline beverages and decreased to $32.0 \pm 31.7\%$ at baseline and to $42.7 \pm 38.0\%$ at follow-up when portion criteria were applied in control schools. A total of 610 at baseline and 571 at follow-up of rows of beverage vending were offered in intervention schools. At baseline, $48.0 \pm 19.4\%$ and at follow-up $98.9 \pm 2.2\%$ rows of beverage vending were allowable LFLS guideline beverages and decreased to $41.8 \pm 18.2\%$ at baseline and $68.2 \pm 26.5\%$ at follow-up when portion criteria were applied in intervention schools.

Control Versus Intervention

No baseline difference ($p > .05$) between intervention and control schools was found in the proportion of à la carte, snack vending, and beverage vending items that met LFLS guidelines. However, change from baseline to follow-up in the proportion of à la carte items that met LFLS nutrient guidelines ($48.4 \pm 11.0\%$ vs $2.2 \pm 4.2\%$) and when portion criteria were applied ($40.5 \pm 6.9\%$ vs $0.8 \pm 2.0\%$) were significantly greater ($p < .05$) in intervention schools versus control schools, respectively. Similarly, change from baseline to follow-up in the proportion of snack vending items that met LFLS nutrient guidelines ($56.2 \pm 13.6\%$ vs $-4.4 \pm 4.6\%$) and when portion criteria were applied ($22.1 \pm 14.5\%$ vs $-5.8 \pm 5.1\%$) was significantly greater ($p < .05$) in intervention schools compared to control schools, respectively. In contrast, only change from baseline to follow-up in the proportion of beverage items that were allowable LFLS beverages was significantly greater ($p < .05$) in the

intervention schools ($50.9 \pm 18.8\%$) compared to the control schools ($10.5 \pm 6.5\%$).

DISCUSSION

The LFLS guidelines implemented in this study were consistent with recommendations to establish nutrient and portion standards for foods and beverages sold in schools. To our knowledge, this study represents one of the first studies to examine the efficacy of implementing such standards. Moreover, the use of a percent sugar and portion size criterion in this study is novel and provides important data to better understand the quality of competitive foods and beverages offered in à la carte and vending programs in public high schools.

Few healthy food items were offered at baseline as indicated by findings shown in Table 2. Across all schools, approximately 31% of items in à la carte and approximately 23% of snack vending items met LFLS nutrient guidelines, and approximately 42% of beverage items were recommended. Findings are similar to those in previous studies that have also reported foods and beverages available in secondary schools^{10,11} that do not meet dietary fat criteria.¹⁰ Previous studies have reported that the largest proportion of à la carte and vending item offerings included chips, snack candies, candy bars, fruit drinks, and carbonated drinks. Of interest were the findings across all schools at baseline that applying the portion size criteria resulted in a decrease to approximately 26% of à la carte, approximately 12% of snack vending, and approximately 37% of beverage vending meeting LFLS guidelines.

Findings at follow-up reveal that control schools made no changes in their à la carte and vending programs (Table 2). In contrast, dramatic increases from baseline to follow-up in the proportion of items meeting LFLS nutrient guidelines were found in intervention schools. That is, the proportion of items meeting LFLS nutrient criteria increased from 32.8% to 81.1% in à la carte items, an increase from 22.5% to 84.0%

in snack vending, and an increase from 48.0% to 98.9% in beverage vending. However, these dramatic increases were mitigated when the LFLS portion size criteria were applied. Indeed, findings show only the proportion of à la carte items at follow-up was significantly different from baseline when both the LFLS nutrient and portion criterion was applied. Nevertheless, the change from baseline to follow-up for the proportion of items meeting nutrient and portion size was significantly different between control and intervention schools, with the exception of beverage vending.

Barriers to implement LFLS guidelines existed and resulted in not achieving complete elimination of high-fat, high-sugar, nonportioned foods and beverages. The primary barrier was the inability to meet LFLS portion size criterion. This was especially true for prepackaged foods and beverages. For example, 100% fruit juice was readily available; however, some brands were only packaged in 20 oz sizes. Likewise, numerous low-fat, low-sugar, salty snacks and crackers were available (eg, pretzels, animal crackers). However, most single-size packages were greater than the 1.25 oz portion criteria. Of note is the total number of items offered in snack vending at baseline ($N = 358$) compared to follow-up ($N = 142$) in intervention schools. While this data show that a large number of offerings were still available, it does suggest that fewer items were available that met LFLS nutrient and portion sizes guidelines. These barriers highlight the difficulty in schools' ability to provide healthy food and beverage choices in some competitive food venues. Moreover, these barriers underscore the importance of enlisting the food and beverage industry to successfully implement school nutrition policies that reflect recent nutrient and portion standards proposed by numerous organizations.^{4,17-21} Other barriers existed and are described elsewhere.²⁵ For example, support by administrators, faculty, and food service staff varied within each intervention school, 2 schools had active support of changes and 2 had minimal support of the

Table 2. Proportion of Items Meeting Nutrient Criteria and Nutrient and Portion Criteria at Baseline, Follow-Up, and Change From Baseline to Follow-Up (Δ): Control Schools and Intervention Schools*

	% Items Meeting Nutrient Criteria			% Items Meeting Nutrient and Portion Criteria		
	Baseline	Follow-Up	Δ	Baseline	Follow-Up	Δ
Control schools, mean \pm SD						
À la carte	29.8 \pm 8.9	32.3 \pm 5.0	2.2 \pm 4.2	22.4 \pm 6.1	23.3 \pm 7.6	0.8 \pm 2.0
Snack vending	24.2 \pm 7.9	19.7 \pm 3.3	-4.4 \pm 4.6	12.6 \pm 4.7	6.7 \pm 0.8	-5.8 \pm 5.1
Beverage vending	36.1 \pm 28.0	46.5 \pm 34.3	10.5 \pm 6.5	32.0 \pm 31.7	42.7 \pm 38.0	10.7 \pm 6.9
Intervention schools, mean \pm SD						
À la carte	32.8 \pm 5.8	81.1 \pm 6.0 ^a	48.4 \pm 11.9 ^b	28.7 \pm 7.7	69.2 \pm 3.7 ^a	40.5 \pm 6.9 ^b
Snack vending	22.5 \pm 20.0	84.0 \pm 8.1 ^a	56.2 \pm 13.6 ^b	12.3 \pm 4.1	34.4 \pm 12.1	22.1 \pm 14.5 ^b
Beverage vending	48.0 \pm 19.4	98.9 \pm 2.2 ^a	50.9 \pm 18.8 ^b	41.8 \pm 18.2	68.2 \pm 26.5	26.4 \pm 31.4

*Superscript "a" indicates statistically significant difference in the percent from baseline to follow-up within intervention schools ($p < .05$) and superscript "b" indicates statistically significant difference in the change from baseline to follow-up between the control and the intervention schools ($p < .05$).

LFLS program. Most critical was the cooperation of food service personnel in implementing changes. Concerns raised by food service personnel centered on the perceived loss of revenue with the elimination of popular high-fat, high-sugar, and nonportioned items. In addition, implementation of modified recipes and food preparation as well as ordering appropriate government commodity and vendor items varied among schools. Thus, continued technical assistance and education of food service personnel regarding implementation strategies appear essential for greater compliance to the LFLS guidelines.

Findings also revealed changes in the number of vending machines that were restricted from baseline to follow-up (Table 1). Although, both control and intervention schools decreased the total number of vending machines, it is important to note that no vending machines were restricted at follow-up in intervention schools. These findings show that the LFLS guidelines implemented were stronger than the state of Maine's requirements at the time of the study that schools apply the 5% minimal nutritional value rule to all competitive foods sold during the school day.

Limitations of the study should be considered. First, the study sample was small and included only 7 Maine public high schools; thus, generalizability of results is limited. Second, the nonrandomized design of the study is a limitation and should be considered in the interpretation of results. Third, revenue data for à la carte programs and vending machines were not obtained. However, anecdotally, food service directors reported no declines in food service program revenue. Sales of vending products were not available as they were considered proprietary by vending companies, and thus, revenue data were difficult to assess. Anecdotally, 1 school that replaced a soda vending machine with a milk vending machine reported significant increases in vending revenues. It would be important in future studies to examine revenues as the financial impact of limiting competitive foods has been viewed as a barrier for schools or school districts to adopt competitive food policies.²⁶

In conclusion, findings from examining the nutrient values of foods and beverages expand on the limited but growing body of literature that indicates that high school students have access to a wide variety of competitive foods, mainly of poor nutrient value through à la carte programs and vending machines. Examining the efficacy of implementing LFLS guidelines in à la carte and vending programs addresses a timely topic as numerous organizations have recently proposed similar recommendations for nutrient standards and portion sizes of competitive foods and beverages in school environments.^{4,17-21} Findings that complete elimination was not achieved emphasize the important role the food and beverage industry will have in providing foods and beverages that meet

proposed nutrient and portion recommendations. Moreover, school food service personnel are key stakeholders for compliance to implementing standard nutrient and portion guidelines, especially in à la carte programs. The dramatic increases in availability of low-fat and low-sugar foods and beverages in this study demonstrate the potential for successful implementation of school guidelines and/or policies that reflect recent recommendations of nutrient and portion standards for competitive foods and beverages.^{4,17-21}

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