The effect of a healthy school tuck shop program on the access of students to healthy foods

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Abstract

The objective of this study was to evaluate the effect of a healthy school tuck shop program, developed as a way of creating a healthy and nutritional school environment, on students’ access to healthy foods. Five middle schools and four high schools (775 students) participated in the healthy school tuck shop program, and nine schools (1,282 students) were selected as the control group. The intervention program included restriction of unhealthy foods sold in tuck shops, provision of various fruits, and indirect nutritional education with promotion of healthy food products. The program evaluation involved the examination of students’ purchase and intake patterns of healthy foods, satisfaction with the available foodstuffs, and utilization of and satisfaction with nutritional educational resources. Our results indicated that among of the students who utilized the tuck shop, about 40% purchased fruit products, showing that availability of healthy foods in the tuck shop increased the accessibility of healthy foods for students. Overall food purchase and intake patterns did not significantly change during the intervention period. However, students from the intervention schools reported higher satisfaction with the healthy food products sold in the tuck shop than did those from the control schools (all P < 0.001), and they were highly satisfied with the educational resources provided to them. In conclusion, the healthy school tuck shop program had a positive effect on the accessibility of healthy food. The findings suggest that a healthy school tuck shop may be an effective environmental strategy for promoting students’ access to healthy foods.

Key Words: School tuck shop, healthy eating, intervention program, fruits and vegetables

Introduction

The rate of obesity in children and adolescents has increased dramatically worldwide over the past several decades, leading to increased attention to the role of schools in the promotion of healthier diets for children and adolescents [1-3]. The school environment has a strong effect on students’ food choices and dietary behaviors [4-9]. Among several environmental factors, the availability and accessibility of foods low in nutritional content were found to be key issues contributing to poor dietary habits during school hours [5,10,11]. Foods high in added sugars, fat, calories or sodium are commonly sold in school vending machines, tuck shops and other school locations, creating an environment in which students can easily consume unhealthy foods [12,13]. Thus, in recent years, several environmental interventions have been conducted in schools to increase the availability and accessibility of healthy foods, such as fruit and vegetables. The results of these interventions indicate that increasing the availability and accessibility of healthy foods can lead to an effective change in intake [5,14].

A change in the eating environment of school tuck shops has been proposed as one strategy to improve the nutritional environment at school [15-23]. The school tuck shop is an opportunity for students who spend as much time at school as in any other environment to increase their nutrient intake and complement other meals. School tuck shops can also be places for children and adolescents to practice healthy eating behaviors that they have been taught in the classroom. Recently, school tuck shops have focused on promoting healthy foods such as fruits and vegetables [20,22,23] because of the beneficial effects of these foods in controlling obesity, which is a serious public health problem. Although the environment of school tuck shops may be an important factor in determining students’ eating behaviors, its effect on students’ eating behaviors has rarely been studied.

In Korea, tuck shops are located in many middle and high schools, but they are not under the schools’ supervision and are usually operated by a private retailer. School tuck shops...
frequently have low standards of food safety and quality, facilities, and sanitation. In addition, most of the food sold to students by tuck shops, such as high calorie snacks, breads, and sweets, is unhealthy [24]. Thus, in recent years, researchers have sought to change the environment of school tuck shops by focusing interventions on increasing the availability and accessibility of healthy foods by means of the Healthy School Tuck Shop Program. This study aimed to evaluate the effect of this program on the accessibility of healthy foods to students through improved provision of healthy foods.

Subjects and Methods

Study schools and subjects

Middle and high schools in Seoul with an existing tuck shop program were invited to participate in the healthy school tuck shop program. A total of nine schools (five middle schools and four high schools) participated in the intervention. Another nine schools that were matched with regard to geographic location and type of school were selected as the control group. Two classrooms from each grade level were randomly selected to complete baseline and post-intervention surveys in both intervention and control schools. All students provided informed consent, and this study was approved by the ethical review board at Hanyang University.

A total of 3,335 students (1,772 from intervention schools; 1,563 from control schools) completed the surveys at baseline. The proportions of middle school students and boys were lower in intervention schools than in the control schools. The sample of students in the intervention schools consisted of 67.7% middle school students, and 42.6% boys. The proportions of middle school students and boys were lower in the intervention schools than in the control schools.

Table 1. Characteristics of schools and students

| Type of schools (n)          | Total | Intervention schools | Control schools |
|------------------------------|-------|----------------------|-----------------|
| N                            | 18    | 9                    | 9               |
| School                       |       |                      |                 |
| Middle                       | 10    | 5                    | 5               |
| High                         | 8     | 4                    | 4               |
| Funding source               |       |                      |                 |
| Public                       | 4     | 2                    | 2               |
| Private                      | 14    | 7                    | 7               |
| School type                  |       |                      |                 |
| Boys                         | 4     | 2                    | 2               |
| Girls                        | 7     | 4                    | 3               |
| Mixed                        | 7     | 3                    | 4               |
| Student demographics (n/%)   | 2,057 | 775                  | 1,282           |
| Grade                        |       |                      |                 |
| Middle                       | 1,392 | (67.7)               | 477 (61.6)      |
| High                         | 665   | (32.3)               | 298 (38.4)      |
| Sex                          |       |                      |                 |
| Boys                         | 877   | (42.6)               | 277 (35.7)      |
| Girls                        | 1,180 | (57.4)               | 498 (64.3)      |

Table 2. Components of the healthy school tuck shop program

| Component                          | Content                                                                 |
|------------------------------------|-------------------------------------------------------------------------|
| Improving the availability of healthy foods | Provision of a variety of fruits at lower prices                          |
|                                    | Restriction of the high-calorie foods with low nutritional value provided in accordance with the nutritional standards of Article 8 of the Special Act on Safe Food for Children |
| Increasing accessibility to healthy foods | Provision of health and nutritional information via leaflets, brochures, newsletters, and electronic display panels |
|                                    | Indirect nutritional education through websites                           |
|                                    | Use of marketing strategies to promote fruit products                     |
| Evaluation of the program          | Satisfaction with the healthy food products sold in the healthy school tuck shop |
|                                    | Pattern of purchase of food products including fruits, and frequency of food intake |
|                                    | Extent of use of, and satisfaction with, the nutritional education resources |
and high-sugar drinks, was inexpensive and low in nutritional value [24]. The products sold in the school tuck shops were reviewed, and alternatives were provided in accordance with the nutritional standards of Article 8 of the Special Act on Safe Food for Children [25].

Increasing accessibility to healthy food

As a strategy for encouraging students to make healthy food choices, indirect nutritional education was provided using various educational resources. Leaflets, brochures and newsletters about “color foods” (i.e., fruits and vegetables), healthy eating, food safety and general health information were regularly provided. Health and nutritional information was also displayed on an electronic display panel at the school tuck shop. We also developed a healthy school tuck shop website to communicate with students and to provide information about health and healthy eating behaviors.

In addition, a number of other methods were employed to promote healthy food consumption. Fruit, for example, was displayed attractively in a refrigerated display case by the front counter where it could be easily seen. An opening ceremony for the healthy school tuck shop was held, and free fruit was provided to teachers, students and parents. Some schools had fruit week specials during which they discounted the prices. Free fruit was also given as an incentive to students who participated in a leaflet quiz or other events through the healthy school tuck shop website.

Evaluation of the school tuck shop program

The effects of the school tuck shop program were assessed across four variables, related to accessibility to healthy food [6,14,26,27]: 1) satisfaction with the healthy food products sold in the healthy school tuck shop, 2) the purchase pattern of food products including fruits, 3) the food intake pattern, and 4) the extent of utilization of, and satisfaction with, nutritional education resources. Satisfaction with healthy food products, and patterns of food intake, were evaluated by comparing the extents of the changes in the subjects in the intervention schools with those in the control schools over the intervention period, as well as the differences pre- and post-intervention within each school (intervention and control schools). The purchase pattern of food products was evaluated by comparing the changes between fruit buyers and non-buyers in the intervention schools and differences between post- and pre-intervention within each group (fruit buyers and non-buyers).

Satisfaction with food products was evaluated using a questionnaire with items rated on a five-point Likert scale ranging from “very dissatisfied” to “very satisfied.” The items included an assessment of the price, variety of products, credibility of the tuck shop, and health- and environmental-friendliness of the tuck shops.

The patterns of purchase and food consumption were assessed by the proportion of each food purchase or intake frequency to total food purchase or intake frequency using a short food frequency questionnaire. The questionnaire asked students to report the types of foods they purchased from the tuck shop and how often they consumed them. Foods listed in the questionnaire were snacks frequently sold in school tuck shops, as determined by our previous pilot study [24]. Such food items included confectionary, buns and pastries, candy and chocolate, ice cream, fruits, vegetables such as salads, milk, chocolate or strawberry flavored milk, soy milk, yogurt, coffee, soft drinks, sports drinks and nuts.

The extent of utilization, and overall satisfaction with, the nutritional education resources were measured in two areas: 1) content of the materials (usefulness, understanding, importance, interest, credibility) and 2) technical aspects of the materials (accessibility, graphics and design format). Students responded using a five-point Likert scale.

Statistical analysis

The chi-squared test was used to examine differences in the use of the school tuck shop, and the purchase frequency of fruit by gender among the intervention schools. The differences between intervention and control schools, buyers and non-buyers of fruit, and pre- and post-intervention time points within each group were assessed using a general linear model across three outcome variables: food intake frequency, frequency of tuck shop purchases, and satisfaction scores for the tuck shop food products.

An overall satisfaction score for nutritional education resources was calculated by summing the moderate, satisfied and very satisfied responses. The percentage of overall satisfaction scores was calculated to reflect the proportion of students who rated the resources at an adequate level of satisfaction. All statistical tests were performed using SAS version 9.1 (SAS Institute Inc., Cary, NC, USA), and results were considered significant at the $P < 0.05$ threshold.

Results

Table 3 shows the proportions of students using the school tuck shop and buying fruit among students in intervention schools. Most of the students in the intervention schools were aware of the sale of fruit (95.2%) and used the school tuck shop during the intervention period (83.6%). Of the students who used the school tuck shop (n = 643), 40.7% purchased fruit. The proportion of girls who purchased fruit (45.1%) was significantly higher than that of boys (32.7%) ($P = 0.0023$). The students seemed to more often purchase 500 won worth of fruit (55.7%) than 1,000 won worth of fruit (43.1%). Regarding the purchase frequencies of fruits, 33.5% and 20.7% purchased 500 won and 1,000 won worth of fruit twice a week, and 15.1% and 14.5% purchased those fruits three and more than three times per week, respectively. The results were not significantly different between
The extents of satisfaction with products sold in the healthy school tuck shop are shown in Table 4. Compared to pre-intervention, the intervention group reported an increase in satisfaction scores, but the control group did not ($P < 0.0001$ intervention vs control). Among the evaluated items, environ-
Table 6. Proportion of each food intake frequency to total food intake frequency comparing the pre- and post-intervention time points in the intervention and control schools

| Food               | Subjects in intervention schools (n = 775) | Subjects in control schools (n = 1,282) | P-value<sup>2)</sup> |
|--------------------|------------------------------------------|----------------------------------------|----------------------|
|                    | Pre-intervention | Change<sup>1)</sup> | Pre-intervention | Change |
| Confectionary      | 7.5 ± 6.6 | 0.6 ± 7.2<sup>2</sup> | 7.5 ± 6.1 | 0.9 ± 8.2<sup>2</sup> | 0.41 |
| Buns and pastries  | 8.2 ± 7.3 | 0.7 ± 9.6<sup>2</sup> | 7.7 ± 6 | 1.2 ± 9.1<sup>2</sup> | 0.72 |
| Ice cream          | 8.2 ± 7.3<sup>a</sup> | -3.0 ± 7.8<sup>b</sup> | 9.0 ± 7.7 | -3.9 ± 6.4<sup>b</sup> | 0.04 |
| Candy/Chocolate    | 5.7 ± 6.2 | 1.1 ± 8.1<sup>a</sup> | 5.2 ± 5.8 | 1.5 ± 7.7<sup>b</sup> | 0.96 |
| Fruits             | 15.0 ± 11.6 | 1.0 ± 12.4<sup>a</sup> | 15.1 ± 12.1 | 1.5 ± 12.5<sup>b</sup> | 0.08 |
| Vegetables such as salad | 11.3 ± 10.1 | 1.0 ± 10.3<sup>a</sup> | 11.5 ± 10.8 | 1.2 ± 10.5<sup>b</sup> | 0.22 |
| Milk               | 12.5 ± 12.2 | -1.5 ± 11.5<sup>ab</sup> | 12.6 ± 12.3 | -0.8 ± 11.7<sup>b</sup> | 0.07 |
| Chocolate milk     | 4.0 ± 5.0<sup>a</sup> | -0.1 ± 5.2 | 3.4 ± 4.3 | -0.1 ± 5.1 | 0.83 |
| Strawberry milk    | 2.8 ± 4.1 | -0.04 ± 4.1 | 2.6 ± 3.6 | -0.1 ± 3.9 | 0.54 |
| Soy milk           | 2.5 ± 4.7 | 0.4 ± 5.1<sup>a</sup> | 2.2 ± 4.4 | 0.3 ± 5.2<sup>b</sup> | 0.71 |
| Yogurt             | 7.2 ± 8.1 | -0.7 ± 8.1<sup>b</sup> | 6.9 ± 8 | -0.6 ± 8.5<sup>b</sup> | 0.25 |
| Coffee             | 3.9 ± 6.4 | 0.2 ± 5.8 | 4.0 ± 6.6 | -0.1 ± 6.8 | 0.25 |
| Soft drinks        | 4.0 ± 5.6 | -0.03 ± 5.3 | 4.3 ± 5 | -0.4 ± 5.1<sup>b</sup> | 0.10 |
| Sports drinks      | 3.7 ± 4.2<sup>a</sup> | -0.1 ± 4.7 | 4.4 ± 5.1 | -0.7 ± 5.6<sup>b</sup> | 0.12 |
| Nuts               | 2.7 ± 4.0 | 0.5 ± 5.4<sup>a</sup> | 3.0 ± 4.5 | 0.1 ± 6.2 | 0.30 |

Values are given as the means ± SDs for the proportion of each food intake frequency to total food intake frequency.
<sup>1)</sup> Difference between post-intervention proportion and pre-intervention proportion.
<sup>2)</sup> Significance of the difference between the change during the intervention period in intervention schools and control schools.
<sup>a</sup> P < 0.05 for the difference of pre-intervention proportion between intervention schools and control schools.
<sup>b</sup> P < 0.05 for the difference between the post- and pre-intervention within a group.

The extent of use of and satisfaction with the nutritional and health resources and the website in intervention schools

| Utilization (n = 775) | Brochure/Newsletter | Leaflet | Electronic panel | Home page |
|----------------------|----------------------|---------|------------------|-----------|
| Non-users            | 445 (56.3)           | 659 (84.5) | 573 (73.2)      | 736 (94.8) |
| Users                | 330 (43.7)           | 116 (15.5) | 202 (26.8)      | 39 (5.2)  |

Satisfaction<sup>2)</sup> among users

| Usefulness       | 81.9 | 84.2 | 83.9 | 85.8 |
|------------------|------|------|------|------|
| Understanding    | 62.9 | 69.0 | 67.1 | 86.2 |
| Importance       | 88.7 | 85.1 | 85.8 | 97.1 |
| Interesting      | 92.8 | 89.9 | 92.0 | 90.9 |
| Credibility      | 84.7 | 87.0 | 85.9 | 91.2 |
| Accessibility    | 90.1 | 89.8 | 88.3 | 84.9 |
| Graphics and format | 85.9 | 84.0 | 89.6 | 97.1 |

Values are given as percentages of the intervention group (n = 775).
<sup>2)</sup> Values are the percentages of moderate, satisfied, or very satisfied responses among users of the information resources.

Table 7. The extent of use of and satisfaction with the nutritional and health resources and the website in intervention schools

mental friendliness achieved the highest increase in satisfaction score and health friendliness the second-highest. The control group reported decreased satisfaction with credibility. The results were not different between genders.

Table 5 displays the purchase frequency of each of the food products as a proportion of the purchase frequency of all products comparing buyers and non-buyers of fruit, and pre- and post-intervention time points within groups among users of the healthy tuck shop in the intervention schools. Generally, fruit buyers did not have a different pattern of purchase of other food products from non-buyers. During the intervention period, the purchase frequency of ice cream and sports drinks significantly decreased for both fruit buyers and non-buyers (P < 0.05), and the purchase frequency of ice cream decreased more in non-buyers of fruit than buyers of fruit (P = 0.001). The purchase frequency of candy/chocolate and soy milk increased during the intervention period among both fruit buyers and non-buyers (P < 0.05). The purchase frequency of confectionary increased significantly during the intervention period among non-buyers of fruit, but not among buyers of fruit. The results were similar for boys and girls.

Regarding confectionary, non-buyers of fruit had a significant increase in proportion of the purchase frequency during the intervention period, but buyers of fruit did not. Both boys and girls had a similar pattern of the results.

In order to examine the effect of the healthy school tuck shop program on food intake, we compared the change during the intervention period in proportion of each food intake frequency to total food intake frequency between intervention and control schools (Table 6). We detected a significant decrease during the intervention period for ice cream, milk and yogurt in both intervention and control schools, and for soft drinks and sports drinks in control schools only (P < 0.05). The proportions of confectionary, buns and pastries, candy/chocolate, fruit, and vegetables such as salad and soy milk increased significantly during the intervention period in both intervention and control schools (P < 0.05). A significant difference in change in proportion of food intake frequency between intervention and control schools was only shown for ice cream (P = 0.04). Boys and girls did not much differ with regard to these results.

Table 7 shows the extent of use of and satisfaction with the nutritional education resources. Among these, the brochure/
Discussion

In recent years, increased attention has been paid to developing healthy school tuck shop programs as a way of creating a healthier school nutritional environment, yet few studies have examined the effects of such programs on children’s eating behaviors. The objective of this study was to evaluate the effect of the healthy school tuck shop program on students’ access to healthy foods. Among students who used the healthy tuck shop, about 40% purchased fruit products, showing that the availability of healthy foods in a tuck shop increased students’ access to healthy foods. However, overall intake patterns of healthy foods were not significantly improved during the intervention period. Students were highly satisfied with the healthy food products sold in the tuck shop and the education resources provided to them.

As more research has focused on the development of successful strategies for changing eating behaviors in children and adolescents, increased attention has been paid to the effects of the school setting on food choices, and on educational techniques to increase individual knowledge and awareness of healthy eating [3,5,6,9,11,26,28,29]. Many studies have reported that the availability of healthy food, promotion and advertising of healthy eating behaviors, and the availability of educational resources, are effective strategies to improve the accessibility of healthy food and thus increase their consumption [11,12,30-33]. Previous intervention programs for healthy eating in schools have focused mostly on changing school meals or food service programs through the school cafeteria or vending machines [5]. Although existing interventions have included changes in school tuck shops [15-23], few studies have asked whether these are effective in changing students’ eating behaviors. One recent study examined the effect of a school fruit tuck shop on children’s food consumption and found that it did not significantly alter the children’s intake of fruit or other snacks, even though children did report that they often ate fruit as a snack at school [23]. We also examined school tuck shops as a means of increasing students’ healthy food intake by improving access to healthy foods. We restricted unhealthy snacks and provided healthier foods, and thus increase their consumption [11,12,30-33]. Previous intervention programs for healthy eating in schools have focused mostly on changing school meals or food service programs through the school cafeteria or vending machines [5]. Although existing interventions have included changes in school tuck shops [15-23], few studies have asked whether these are effective in changing students’ eating behaviors. One recent study examined the effect of a school fruit tuck shop on children’s food consumption and found that it did not significantly alter the children’s intake of fruit or other snacks, even though children did report that they often ate fruit as a snack at school [23].

In conclusion, when fruit products were provided in the school
tuck shop, they were purchased by a considerable proportion of the students who used the tuck shop implying that the availability of healthy foods such as fruit in the tuck shop leads to an increase in the accessibility of healthy foods among the students. However, there was no significant change in students’ overall patterns of food purchase and intake during the short intervention period. These findings indicate that a healthy school tuck shop could be part of an environmental strategy to increase healthy food choices among the young but it should be consistently operated and supported to have a long-term impact.

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