Impact of the Use of Produce Grown in an Elementary School Garden on Consumption of Vegetables at School Lunch

NANCY COTUGNA, CAROLYN K. MANNING, and JAMES DIDOMENICO

Department of Behavioral Health & Nutrition, University of Delaware, Newark, Delaware, USA

Low consumption of fruits and vegetables has been implicated as a factor in the increasing childhood obesity seen over the past 2 decades. The use of school gardens is a relatively new nutrition education strategy that may provide some additional benefit in getting children to consume the recommended amount of vegetables. Previous research into the effectiveness of school gardens has shown that they have positive impacts on children's vegetable preferences, and they can have a positive impact on children's consumption of vegetables at school lunch. However, no research has examined using school garden produce at school lunch to determine whether that tactic would have an additional impact on children's consumption of vegetables at school lunch, so that is the purpose of this study. A quasi-experimental design was used along with cafeteria observations. The results showed that offering garden produce at school lunch had a small positive impact on children's food choices.

KEYWORDS school gardens, nutrition, life skills, school-community partnerships

Address correspondence to Nancy Cotugna, DrPH, RD, LDN, Professor, Department of Behavioral Health & Nutrition, 26 North College Avenue, University of Delaware, Newark, DE 19716. E-mail: ncotugna@udel.edu
INTRODUCTION

Data from the National Health and Nutrition Examination Surveys show that the prevalence of obesity in children 6 to 11 years old has increased from 6.5% in the period 1976–1980 to 19.6% in 2007–2008.\(^1,2\) This rise in obesity has been linked to the rise of other health concerns in children, including cardiovascular disease,\(^3\) asthma,\(^4\) sleep apnea,\(^5\) and type 2 diabetes.\(^6\) Several factors identified as contributors to this rise include low consumption of fruit and vegetables, the nutritional quality and desirability of the foods offered in school feeding programs, and decreased time engaging in physical activity during the school day.\(^7\)

The school lunch environment has been suggested as a site that can be integrated with health education programs operating independently within the school to promote the consumption of nutrient-dense foods.\(^8\) Food consumed at school accounts for over 35% of calories consumed by elementary school students.\(^9\) However, though 88 ± 2% of elementary schools where the National School Lunch Program (NSLP) is operating offer vegetables other than french fries at school lunch, only 31.6 ± 3.0% of students in those schools consume these vegetables. This amounts to an average consumption of 0.10 ± 0.01 cup-equivalents of vegetables per day at school lunch.\(^10\) So, though schools are offering vegetables as a healthy choice for lunch, not many students are choosing to include vegetables in their meals.

School gardens are a relatively new educational strategy for influencing children’s food habits and preferences.\(^11\)–\(^13\) A study of 122 sixth-grade students examined the effect of a school garden education program, independent of traditional nutrition education.\(^14\) Daily consumption of vegetables was unchanged in the control group, with no nutrition education or gardening, and in the first treatment group, with nutrition education but no gardening. However, in the second treatment group, students who had participated in a program of both nutrition education and gardening increased their vegetable consumption from 1.2 servings per day to 2.6 servings per day (\(P < .001\)), when measured by the 24-h recall method. The researchers concluded that the standard nutrition education provided students the knowledge necessary to make a dietary change, and the gardening activities reduced a barrier to making that change by helping to expose subjects to new, unfamiliar vegetables. This was achieved both by working with the vegetables and by tasting them.

Only one study was found that investigated whether a link exists between participation in a school gardening program and increased consumption of vegetables at school lunch. Parmer and colleagues\(^15\) reported that after a nutrition education program containing a gardening component, second graders were more likely to choose a vegetable at school lunch than those who participated in traditional nutrition education alone.
or in the control group. In the nutrition education with gardening group, choosing a vegetable at school lunch increased from pretest to posttest by 55% ($P < .01$), whereas participants in the nutrition education alone group ($P = .08$) and control group ($P = .47$) failed to show a significant change. Though this study did examine the effect of gardening education on students’ choices at school lunch, the researchers did not attempt to use the vegetables grown in the school garden in the school’s cafeteria.

The research available shows that those who participate in school gardening programs increase their preferences for vegetables. Consequently, the American Dietetic Association, the Society for Nutrition Education, and the American School Food Service Association have recommended the use of school gardens as a useful nutrition education strategy. Furthermore, using school garden produce in school foodservice programs has been suggested as a means to improve the nutritional quality of food served at school lunch, integrate foodservice with nutrition education, and possibly reduce the cost of school lunches.

No studies have been found examining the effect of programs that use school garden produce in their foodservice programs. Our study examined a school gardening program in Delaware to determine whether offering school garden produce as a vegetable choice for school lunch resulted in a greater proportion of participants choosing that vegetable.

**METHODOLOGY**

**Subjects**

Study participants included 359 fourth- and fifth-grade students at 3 elementary schools in a school district in Delaware. These 3 schools were chosen because their students have a similar demographic makeup. Human subjects review exemption was obtained from the University of Delaware Human Subjects Review Board.

**Procedure**

Students in the 2 treatment groups participated in a gardening education program that consisted of classroom lessons and trips to the school vegetable garden to plant, tend, and harvest the vegetables being grown there. While working in the garden, students were given the opportunity to taste the vegetables being grown and harvested.

Each school was assigned to be one control or treatment group based on the number of academic years in which the garden program was operating at that school. The fourth- and fifth-grade classes at School A comprised the control group and were not chosen randomly but based on similar demographics to the treatment groups. Two treatment groups were included to
determine the effect of students’ participation in the garden education program a second time. For one treatment group, the fourth grade at School B, the time period in which the study operated was the students’ first exposure to the garden education program. Students at School C, the second treatment group, were participating in the program for a second time during the study. The treatment groups are summarized in Table 1.

To determine the effect of participating in the gardening program on students’ choices at school lunch, the fourth- and fifth-grade students were observed during their lunch periods on 3 separate days as they purchased their lunches from the cafeteria. On the days that the participants were being observed, the schools offered a 3/4-cup romaine lettuce salad with dressing packets on the side. The treatment groups were offered a salad made from garden-produced lettuce on one day, and during all other observations the salad that was offered was made from lettuce purchased through the school’s normal vendors. On the days when school garden produce was offered in the cafeteria, an 8.5-inch × 11-inch sign was displayed advertising to the children that the salads were made from school garden produce. Furthermore, on the days when participants were observed, no other salad was offered to participants. A summary of the salad choices at each observation is reported as Table 2.

Observers, including the primary researcher and 2 community nutrition students trained by the primary researcher, stood by the cash register at the end of the line and observed the foods participants left the line with. Participants who had left the line with a salad were tallied separately from participants who left the line without a salad.

Observation 1 was the preprogram observation; its purpose was to establish a consumption baseline. Observations 2 and 3 were performed after participants had completed the garden education program, with only observation 3 using garden produce (and only then with the treatment

<table>
<thead>
<tr>
<th>School</th>
<th>Observation 1</th>
<th>Observation 2</th>
<th>Observation 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Purchased ingredients</td>
<td>Purchased ingredients</td>
<td>Purchased ingredients</td>
</tr>
<tr>
<td>B</td>
<td>Purchased ingredients</td>
<td>Purchased ingredients</td>
<td>Garden produce</td>
</tr>
<tr>
<td>C</td>
<td>Purchased ingredients</td>
<td>Purchased ingredients</td>
<td>Garden produce</td>
</tr>
</tbody>
</table>

TABLE 1 Design of a Study to Determine the Impact of Participation in a School Garden Program on Children’s Choices at School Lunch

<table>
<thead>
<tr>
<th>School</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gardening program exposures</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

TABLE 2 Source of Salad Ingredients for Cafeteria Observations
groups). A significant difference between observations 1 and 2 would suggest that the gardening education program had an effect on students’ food choices. A significant difference between observations 2 and 3 would suggest that students’ food choices were affected by using garden produce in the school foodservice program. Finally, a significant difference between observations 1 and 3 would suggest that a combination of the gardening program and the offering of garden produce in the cafeteria had an effect on students’ food choices.

Data Analysis

The statistics software package JMP (version 8.0.1, 2009, SAS Institute Inc., Cary, NC) was used to analyze the data. Descriptive and difference of proportion tests were computed for the observation data.

RESULTS AND DISCUSSION

Subject demographic data, as reported by the school district, are presented as Table 3. The percentages of students who purchased a salad at each of the observations are reported as Table 4.

At School A, the control group, there was no significant change in the percentage of participants who chose a salad between observations 1 and 2 ($z = 0.261$; one-tailed $P = .26$), between observations 1 and 3 ($z = 0.416$; one-tailed $P = .42$), or between observations 2 and 3 ($z = 0.694$; one-tailed $P = .69$). School B showed an increase of 11% of participants between observations 1 and 3, with $P = .04$ ($z = 1.813$; one-tailed); however, it did not show a significant increase between observations 1 and 2 ($z = 1.176$; one-tailed $P = .13$) or between observations 2 and 3 ($z = 0.702$; one-tailed $P = .24$). School C showed an increase of 39% of participants between observations 1 and 3, with $P < .0001$ ($z = 6.59$; one-tailed).

Due to scheduling issues, observation 2 was not conducted at School C. The day that this observation was scheduled to be performed at School C

<table>
<thead>
<tr>
<th>TABLE 3 Demographic Characteristics of Study Participants</th>
</tr>
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<tbody>
<tr>
<td>Control group</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>School name</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>White (%)</td>
</tr>
<tr>
<td>Black (%)</td>
</tr>
<tr>
<td>Asian American (%)</td>
</tr>
<tr>
<td>Hispanic (all races, %)</td>
</tr>
<tr>
<td>Low income (%)</td>
</tr>
</tbody>
</table>
was the last day of foodservice at the school before summer break, but the observers did not know that the study participants would be on a field trip and not be present during the lunch service that day.

The cafeteria observations showed a significant increase in participants choosing a salad between observations 1 and 3 at both experimental group schools. In both schools with school gardens there was a significant increase in the percentage of students who consumed a salad between observations 1 and 3, so it is possible to conclude that the garden education program and the offering of garden produce at lunch together caused an increase in students’ choices to take a vegetable at school lunch. There was no statistically significant difference between observations 1 and 2 or between observations 2 and 3, though, so the data cannot tell us whether it was the program or the offering garden produce at lunch that provided more of an impact on students’ food choices.

In the cafeteria observations, only the taking of a salad in the lunch line was recorded; no data were collected about whether students ate those salads. This study assumed that the amount of salad actually consumed was similar to that reported by the School Nutrition Dietary Assessment Study.8 Further research should include a plate waste study to determine whether participants actually ate what they purchased from the lunch line.

The novelty effect was not controlled for in this study. It may be that more participants took a garden produce salad simply because it was something new and they wanted to try it. Further research should perform several observations with the garden produce to determine whether it truly increases participants’ food choices over the long term or whether participants’ food choices regress to where they were before the program because the novelty of eating produce grown in the school garden has worn off.

The study did not find a significant increase in salad consumption at school lunch from a second exposure to the program; however, it did find a small increase that approached significance. It may be that repeated

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**TABLE 4** Observation of School Lunch to Determine Whether Using School Garden Produce in School Lunch Has an Effect Upon Children’s Food Choices

<table>
<thead>
<tr>
<th>Observation number</th>
<th>School</th>
<th>N</th>
<th>Participants who chose a salad (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>68</td>
<td>22.1</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>92</td>
<td>17.4</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>126</td>
<td>22.2</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>74</td>
<td>20.3</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>96</td>
<td>24.0</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>76</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>95</td>
<td>28.4*</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>111</td>
<td>61.3**</td>
</tr>
</tbody>
</table>

*P < .05 difference from observation 1.

**P < .001 difference from observation 1.
exposures to the program provide diminishing returns, so further research should include more program exposures to determine whether and when the trend of increasing vegetable consumption levels off. This will allow school garden programs to determine where to best devote their resources to promote children's vegetable consumption, whether providing another program exposure to previous participants or beginning to educate a new set of children.

Limitations

The data from this study are not generalizable to children of other age groups, such as middle school and high school students. In general, children become less likely to try new foods as they age. Thus, there may be different effects for older children. Further research should be done to determine what effects school gardens have on high school students.

Observation 2 was not performed at School C due to the challenges inherent in community nutrition research. Therefore, this study cannot draw a conclusion about whether a second exposure to the garden education program influences the participants' choices at lunch. In general, the closeness of the end of the gardening program to the end of the school year introduced a number of scheduling challenges. This study design might work better in the autumn growing season, at the beginning of the academic year, because only one observation needs to be made at each school before the program begins, whereas 2 observations need to be made at the end.

CONCLUSIONS AND APPLICATION

In this study, fourth and fifth graders at 3 schools in Delaware were studied to determine what impact using school garden produce at school lunch has upon students' food choices. Students were examined in the cafeteria line to determine whether more students chose a lettuce-type salad offered for lunch when that salad was made primarily from garden produce ingredients. This study found that using school garden produce as a hook to get children who have worked in the garden to consume that produce at school lunch is a successful tactic to promote vegetable consumption. The knowledge gained from this research can be used to increase the effectiveness of school garden programs to promote vegetable consumption among children.

School lunch presents a useful opportunity to increase children's vegetable consumption. Research into the NSLP has shown that students eat over 35% of their daily food intake, as measured by energy content, at school. However, only 31.6% of students consume a vegetable in NSLP schools. Encouraging vegetable consumption at school lunch presents a way to increase children's overall vegetable consumption. Using school
garden produce in the school lunch program has been an understudied approach to attempt to increase children's vegetable consumption during school hours.

Following the example of California, school gardens have seen a resurgence over the past 10 years as a way to extend the educational environment of the school. School gardens have long been associated with science education, but educators are now starting to realize their potential for nutrition education as well, specifically as a way to demystify unfamiliar vegetables, so that students would be more apt to incorporate those vegetables into their food preferences.

REFERENCES


