

# School Gardens: Can a Hands-on Teaching Tool Affect Students' Attitudes and Behaviors Regarding Fruit and Vegetables?

Sarah E. Lineberger<sup>1</sup> and  
Jayne M. Zajicek<sup>2</sup>

---

ADDITIONAL INDEX WORDS. **nutrition, nutrition education, nutritional attitudes, nutritional behavior, school lunch program, elementary schools**

---

**SUMMARY.** Nutrition in the Garden is a garden program designed to help teachers integrate nutrition education into their classroom using a hands-on tool, the garden. The objectives of this research project were to 1) develop a garden activity guide to help teachers integrate nutrition education, specifically as it relates to fruit and vegetables, into their curricula, 2) evaluate whether students developed more positive attitudes towards fruit and vegetables by participating in the garden program, and 3) evaluate whether students developed better nutritional behavior by eating more fruit and vegetables after participating in the garden program. Students' nutritional attitudes regarding fruit and vegetables were measured with a fruit and vegetable preference questionnaire divided into three sections targeting vegetables, fruit, and fruit and vegetable snacks. Students' nutritional behaviors regarding fruit and vegetables were evaluated through 24-hour recall journals. After

gardening, students' attitudes towards vegetables became significantly more positive. In contrast, no differences were detected in attitudes towards fruit. Students also had more positive attitudes towards fruit and vegetable snacks after gardening, with female students and younger students having the greatest improvement in snack attitude scores. Even though school gardening improved students' attitudes towards vegetables, fruit and vegetable consumption of students did not significantly improve due to gardening. Overall, the average daily fruit and vegetable consumption of the students participating in the Nutrition in the Garden study was 2.0 servings per day. This falls short of the estimated national average for daily fruit and vegetable consumption for this age group (3.4 servings) and extremely short of the nationally recommended 5.0 servings per day.

---

Nutritional messages regarding the consumption of fruit and vegetables have become increasingly prevalent in our society due to new findings establishing a strong link between consumption and health. It has been known for some time that fruit and vegetables provide many essential vitamins and minerals (Dittus et al., 1995). In addition, recent studies show that fruit and vegetables may be associated with lower risks of cancer and coronary heart disease (McPherson et al., 1995). In order to take advantage of these health benefits, it is recommended that individuals consume at least five fruit and vegetables a day. Despite this new information, many Americans do not meet this recommended daily intake. As a result, a national campaign has been initiated called "5 a Day—for Better Health," which encourages the consumption of five or more fruit and vegetables a day (Domele et al., 1993a). Children are one of the targets of this campaign, since it is estimated that they consume an average of only 3.4 servings of fruit and vegetables a day (Foerster et al., 1998). On average, only 6.8% to 20% of all children and adolescents eat five or more servings of fruit and vegetables a day (Reynolds et al., 1999).

Nutrition plays a critical role in the life of a child because of the impact it can have on growth, development and the ability to learn (Byrd-Bredbenner et al., 1993). A child who

does not receive proper nutrition will not achieve maximum physical and mental potential (Lindeman and Chancy, 1990). Additionally, most personal food and exercise habits, that continue throughout life, are established by the age of 15 (DiNubile, 1993). Therefore, childhood is an important time to reach individuals with nutritional messages especially in regards to fruit and vegetables. Studies show that consumption of fruit and vegetables, as a habit in childhood, is an important predictor of higher fruit and vegetable consumption as adults (Heimendinger and Van Duyn, 1995).

Because children spend much of their time in the school setting, schools have the opportunity to influence nutritional attitudes and behaviors through education. In addition to nutritional messages children learn at home, much of the nutritional information that children acquire comes from schools. One study indicated that 95% of children reported that they learned about nutrition from their school, 86% learned from parents, and 73% learned from doctors and nurses (McPherson et al., 1995). A number of curricula and teaching strategies can be used to present nutritional messages including school gardens. Gardening has been an effective tool to teach nutrition to various populations. A senior gardening program resulted in improved nutritional attitudes and consumption in the participants (Hackman and Wagner, 1990). Another nutrition study of an urban garden program found that individuals who gardened ate more vegetables than those who did not garden (Blair et al., 1991). School gardens may be effective tools for teaching nutrition education to children, particularly in presenting information about fruit and vegetables.

One objective of this research project was to develop an activity guide to help teachers integrate nutrition education, specifically as it relates to fruit and vegetables, into their curricula. School gardens provide opportunities for hands-on learning activities that are vital in nutrition education (Contento et al., 1995). Gardens can be used to teach children about the origin of fruit and vegetables and give them opportunities to practice preparing and eating fruit and vegetables. They also increase children's exposure to fruit and vegetables which impacts

---

Department of Horticultural Sciences, Texas A&M University, College Station, TX 77843-2133.

Support for this work was provided by the Office of Vice President for Research and Associate Provost for Graduate Studies through the Interdisciplinary Research Initiatives Program, Texas A&M University. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

<sup>1</sup>Graduate student.

<sup>2</sup>Professor.

development of attitudes and eating behaviors (Birch et al. 1995).

Additional objectives of this study were to evaluate whether students developed more positive attitudes about fruit and vegetables and better nutritional behaviors by eating more fruit and vegetables after participating in the garden program.

## Materials and methods

**GARDEN ACTIVITY GUIDE.** A garden activity guide, *Nutrition in the Garden* (Lineberger and Zajicek, 1998), was developed to help teachers integrate nutrition education into their curricula. The activities in this guide are divided into 10 units that combine horticulture and nutrition subjects with detailed background information for teachers. In total, 34 different activities are included in the 10 units, with each activity requiring an average of 20 min to complete. The guide can be used year round; however, some of the activities require use of a garden or an indoor grow lab.

For this study, teachers were required to introduce information from each of the 10 units to their class. They were free to adapt the material to accommodate their class and to choose any of the activities they wanted to complete, but they did have to discuss the subject matter in each of the 10 units in their class to participate in the study.

**SAMPLE POPULATION.** This study was conducted during the spring semester of 1998 through spring semester of 1999. Third and fifth grade teachers from five elementary schools in Texas volunteered their classes to participate. One hundred and eleven students completed a pretest questionnaire and journal before gardening and a posttest questionnaire and journal after the garden program was completed. Between the testing, the children participated in gardening and lessons from *Nutrition in the Garden*. Only students who completed all of the testing were included in the data and analysis.

**INSTRUMENTATION.** Students' nutritional attitudes regarding fruit and vegetables were measured with a fruit and vegetable preference questionnaire developed by Dr. Tom Baranowski, Professor of Behavioral Science, University of Texas M.D. Anderson Cancer Center (Domel et al., 1993b). The Fruit and Vegetable Preference Ques-

tionnaire is comprised of three distinct sections. The first section consists of a list of 17 commonly consumed vegetables and the second section consists of a list of 13 commonly consumed fruit. These two sections of the questionnaire measured questions on a Likert-type scale (Likert, 1967). The three possible responses to each statement and the points associated with each response included: 2 = I like this a lot, 1 = I like this a little, and 0 = I do not like this. The last section is made up of 13 snack preference questions. Students were asked to make a choice between two snack items. One of the items is a fruit or vegetable and the other is a nonfruit or nonvegetable snack (e.g., ice cream). On the snack preference questions, a student received one point for choosing the fruit or vegetable snack and zero points for choosing the other option. The points within each section were summed and then averaged so that each student had a vegetable preference and fruit preference score that ranged from 0 to 2 and a snack preference score that ranged from 0 to 1. The higher the score, the better the fruit or vegetable preference/attitude. A Cronbach's alpha reliability test (Gall et al., 1996), indicated that for this sample and study, the reliabilities of each of the sections of the Fruit and Vegetable Preference Questionnaire resulted in coefficients of 0.80 for the vegetable section, 0.87 for the fruit section and 0.79 for the snack section, showing them to have an acceptable level of reliability (Sapp and Jensen, 1997).

Students' nutritional behaviors regarding fruit and vegetables were evaluated through 24-h recall journals. This is a specific type of food intake tool that asks individuals to remember and record all of the food and beverages that they consumed the previous day and has been found to be a valid testing instrument in past studies (Jendrysik, 1991). Each 24-h recall food journal included a cover page for students to record their names and also gave them an example of how to fill out the recall. Additional pages provided space for students to write down what they ate for breakfast, lunch, dinner and snacks on the previous day. It also asked them to record how much of each item they consumed. Results of the 24-h recall journals were used to describe the consumption of fruit and vegetables by the students.

Each Fruit and Vegetable Preference Questionnaire had a cover sheet that asked the students for demographic information. It included questions about their gender, ethnicity, age, place of residence, and previous gardening experience. After the questionnaires and journals were returned to the researcher, they were matched according to student name, coded with a different identification number for each student, and coversheets were removed to provide confidentiality.

**DATA ANALYSIS.** The data collected from the treatment groups was analyzed using the Statistical Package for the Social Sciences, (SPSS) for Windows Release 7.5 (SPSS, 1997). Statistical procedures included frequencies, paired *t* tests and ANOVA tests to show any differences or relationships between scores.

## Results and discussion

Each section of the Fruit and Vegetable Preference Questionnaire was analyzed separately to investigate differences in fruit, vegetable and snack preferences.

**VEGETABLE PREFERENCE.** Significant differences were found in vegetable preference scores of children before and after participating in the garden program (Table 1). After participating in gardening and activities from *Nutrition in the Garden* activity guide, children responded that they liked vegetables more than before gardening. The effect size calculations ( $r^2$ ) show that 47.6% of the variation in scores was due to gardening (Table 1). Due to this finding, additional comparisons were made to investigate the differences between pretest and posttest scores.

Before gardening, children's attitudes about vegetables were significantly different depending on what school they attended (Table 2). However, after gardening, these differences were no longer apparent. The  $\eta^2$  effect size calculations, which are analogous to  $r^2$  in paired *t* tests or multiple regression (Kirk, 1996), show that 13.8% of the variance in nutritional attitude pretest scores was due to the school attended. After gardening, this variance was reduced to 3.3%. These results indicate that initial differences between schools were equalized with the treatment and the students with lower scores showed more improvement than students with higher scores.

**Table 1. Paired *t* test comparison of pretest and posttest Fruit and Vegetable Preference Questionnaire scores of students participating in the Nutrition in the Garden study.**

Group	Students (no.)	Mean score <sup>z</sup>	SD	df	<i>t</i>	<i>P</i> (two-tailed)	<i>r</i> <sup>2</sup>
Vegetable preference							
Pretest	111	0.979	0.419	110	-2.195	0.030*	0.476
Posttest	111	1.046	0.394				
Fruit preference							
Pretest	111	1.499	0.479	110	-0.529	0.598	0.168
Posttest	111	1.525	0.461				
Snack preference							
Pretest	111	0.395	0.284	110	-2.658	0.009*	0.377
Posttest	111	0.456	0.271				

<sup>z</sup>Scores range from 0.000 to 1.000.

\*Statistically significant at *P* = 0.05.

Greater improvement in nutritional attitudes by students with initially lower scores has been found by previous research (Shannon and Chen, 1988), and provides additional indication that nutritional programs, including gardening and Nutrition in the Garden, have a positive effect on students, especially those with the most need for improvement.

**FRUIT PREFERENCE.** In contrast, fruit preference scores of children did not significantly improve after participating in gardening activities (Table 1). Both the pretest and posttest fruit preference scores were high, indicating that children had a positive attitude towards fruit before and after participating in the gardening program. The existing positive attitudes towards fruit, and the fact that children grew mainly vegetables in the school gardens, may help to explain the lack of improvement in the fruit preference scores.

**FRUIT AND VEGETABLE SNACK PREFERENCE.** Along with the increase in attitudes regarding vegetables, there was a statistically significant increase in snack preference scores of children after participating in the garden program (Table 1). The effect size calculations show that 37.7% of the variation in scores was due to gardening (Table 1). After gardening, children were more apt to choose a fruit or vegetable as the preferred snack item over other snack items, compared to before gardening. Further analyses were conducted to explore the difference between the pretest and posttest scores.

Significant differences were found in snack preference scores based on grade level (Table 3). Third grade students had a statistically significantly lower pretest mean score than the fifth grade students by 0.668 points. At the posttest this difference was no longer

evident and third grade students' mean score was only 0.066 points lower than the fifth grade score. This indicated that the third grade students had a greater increase in their snack preference attitude scores. Greater improvement in students' nutritional attitudes from education programs in lower grade levels has been reported (Shannon and Chen, 1988; Domel et al., 1993b). Younger students may be more open to new ideas and experiences and have more flexible opinions and attitudes. This is an important finding and supports the need to increase nutrition education programs, particularly those that target fruit and vegetables, at a young age.

In addition to differences based on grade level, there were also differences based on gender (Table 4). Female students had higher snack preference scores than male students at the pretest, and the difference was even

**Table 2. ANOVA comparison of the pretest and posttest vegetable preference scores of the students participating in the Nutrition in the Garden study.**

School	Students (no.)	Mean score <sup>z</sup>	SD	df	F	<i>P</i>	Eta <sup>2y</sup>
Pretest							
School 1	28	1.206	0.312	4	4.247	0.003*	0.138
School 2	10	0.883	0.357				
School 3	41	0.832	0.424				
School 4	16	0.915	0.530				
School 5	16	1.085	0.308				
Posttest							
School 1	28	1.147	0.385	4	0.896	0.469	0.033
School 2	10	0.988	0.480				
School 3	41	1.000	0.372				
School 4	16	0.967	0.479				
School 5	16	1.103	0.310				

<sup>z</sup>Scores range from 0.000 to 1.000.

<sup>y</sup>Eta<sup>2</sup> effect size calculations are analogous to *r*<sup>2</sup> in paired *t* tests or multiple regression.

\*Statistically significant at *P* = 0.05.

**Table 3. ANOVA comparison of the pretest and posttest snack preference scores of the students participating in the Nutrition in the Garden study based on grade.**

Group	Students (no.)	Mean score <sup>z</sup>	SD	df	F	P	Eta <sup>2y</sup>
Pretest							
Grade 3	95	0.417	0.298	1	3.972	0.049*	0.035
Grade 5	16	1.085	0.115				
Posttest							
Grade 3	95	1.037	0.276	1	0.642	0.425	0.006
Grade 5	16	1.103	0.239				

<sup>z</sup>Scores range from 0.000 to 1.000.

<sup>y</sup>Eta<sup>2</sup> effect size calculations are analogous to  $r^2$  in paired  $t$  tests or multiple regression.

\*Statistically significant at  $P = 0.05$ .

**Table 4. ANOVA comparison of the pretest and posttest snack preference scores of the students participating in the Nutrition in the Garden study based on gender.**

Students Gender	Mean (no.)	score <sup>z</sup>	SD	df	F	P	Eta <sup>2y</sup>
Pretest							
Female	65	0.438	0.288	1	3.779	0.054*	0.035
Male	46	0.333	0.270				
Posttest							
Female	65	0.522	0.265	19.883	0.002*	0.083	
Male	46	0.364	0.255				

<sup>z</sup>Scores range from 0.000 to 1.000.

<sup>y</sup>Eta<sup>2</sup> effect size calculations are analogous to  $r^2$  in paired  $t$  tests or multiple regression.

\*Statistically significant at  $P = 0.05$ .

greater at the posttest, echoing a gender difference in food preferences, with girls tending to have better nutritional attitudes (Worsley et al., 1984). Females may be more receptive to nutrition and health education because they are more concerned about physical appearances (Perry et al., 1998).

FRUIT AND VEGETABLE BEHAVIORS. No significant differences were found

**Table 5. Frequency of number of fruit and vegetables consumed for one day by children participating in gardening with Nutrition in the Garden study.**

Fruit and vegetables consumed (no.)	(no.)	Percent
0	19	17.1
1	29	26.1
2	29	26.1
3	16	14.4
4	6	5.4
5	8	7.2
6	1	0.9
7	2	1.8
8	1	0.9
Total	111	100

between the pretest and posttest fruit and vegetable behavior/intake of children participating in the garden program. Changing consumption patterns is hard to accomplish due to the complex nature of eating behaviors and therefore the absence of change is not surprising (Howison et al., 1988). A more intense, comprehensive program with special emphasis on behavioral change may be needed to increase fruit and vegetable consumption.

ADDITIONAL FINDINGS. Comparisons were made between the mean fruit and vegetable intake data from this study and data from national surveys (Table 5). The mean of the total fruit and vegetable intake for the students in this study was 2.0. This mean is well below the estimated national average for daily fruit and vegetable consumption of 3.4 servings and the nationally recommended five a day (Foerster et al., 1998). The number of students that consumed the recommended five or more fruit and vegetables a day in this study was also low in comparison to national data. Only 10.8% of the students who participated in the garden program ate five or more fruit and vegetables a day, falling at the lower end of the national range of 6.8% to

20% (Reynolds et al., 1999). This information emphasizes the need for positive nutritional messages regarding fruit and vegetables to be delivered to these students. Although this research found that gardening, with directed activities, could improve nutritional attitudes, additional programs and interventions are needed to increase fruit and vegetable consumption.

## Literature cited

- Birch, L.L., S.L. Johnson, and J.A. Fischer. 1995. Children's eating: The development of food-acceptance patterns. *Young Children* 50:71-78.
- Blair, D., C.C. Giesecke, and S. Sherman. 1991. Dietary, social and economic evaluation of the Philadelphia Urban Gardening Project. *J. Nutr. Educ.* 23:161-167.
- Byrd-Bredbenner, C., M.L. Marecic, and J. Bernstein. 1993. Development of a nutrition education curriculum for Head Start children. *J. Nutr. Educ.* 25:134-139.
- Contento, I., G.I. Balch, Y.L. Bronner, L.A. Lytle, S.K. Maloney, C.M. Olson, and S.S. Swadener. 1995. The effectiveness of nutrition education and implications for nutrition education policy, programs and research: A review of research. *J.*

- Nutr. Educ. 27:287-380.
- DiNubile, N. 1993. Youth fitness—Problems and solutions. *Preventive Medicine* 22:589-594.
- Dittus, K.L., V.N. Hillers, and K.A. Beerman. 1995. Benefits and barriers to fruit and vegetable intake: Relationship between attitudes and consumption. *J. Nutr. Educ.* 27:120-126.
- Domel, S.B., T. Baranowski, H. Davis, W.O. Thompson, S.B. Leonard, P. Riley, J. Baranowski, B. Dudovitz, and M. Smyth. 1993a. Development and evaluation of a school intervention to increase fruit and vegetable consumption among 4th and 5th grade students. *J. Nutr. Educ.* 25:345-349.
- Domel, S., T. Baranowski, H. Davis, S. Leonard, P. Riley, and J. Baranowski. 1993b. Measuring fruit and vegetable preferences among 4th and 5th grade students. *Preventive Medicine* 22:866-879.
- Foerster, S.B., J. Gregson, D.L. Beall, M. Hudes, H. Magnuson, S. Livingston, M.A. Davis, A.B. Joy, and T. Garbolino. 1998. The California children's "5 a Day-Power Play!" campaign: Evaluation of a large-scale social marketing initiative. *Family Community Health* 21:46-64.
- Gall, M.D., W.R. Borg, and J.P. Gall. 1996. *Educational research: An introduction*. Longman Publishers, White Plains, N.Y.
- Hackman, R.M. and E.L. Wagner. 1990. The senior gardening and nutrition project: Development and transport of a dietary behavior change and health promotion program. *J. Nutr. Educ.* 22:262-270.
- Heimendinger, J. and M.A.S. Van Duyn. 1995. Dietary behavior change: The challenge of recasting the role of fruits and vegetables in the American diet. *Amer. J. Clinical Nutr.* 61:1397S-1401S.
- Howison, D., F. Nidermyer, and R. Shortridge. 1988. Field testing a fifth-grade nutrition education program designed to change food-selection behavior. *J. Nutr. Educ.* 20:82-86.
- Jendrysik, B.L. 1991. A comparison of children's dietary information using a work-book recall method to reported intake and observation. MS thesis. Va. Polytech. Inst. State Univ., Blacksburg.
- Kirk, R. 1996. Practical significance: A concept whose time has come. *Educ. Psych. Meas.* 56:746-759.
- Likert, R. 1967. The method of constructing an attitude scale. In: M. Fishbein (ed.). *Readings in attitude theory and measurement*. Wiley, New York.
- Lindeman, A.K. and K.L. Chancy. 1990. Assessment of breakfast habits and social/emotional behavior of elementary school children. *J. Nutr. Educ.* 22:226-231.
- Lineberger, S. and J.M. Zajicek. 1998. *Nutrition in the garden: Teaching healthy living through horticulture*. Texas Agr. Ext. Serv., College Station.
- McPherson, R.S., D.H. Montgomery, and M.Z. Nichaman. 1995. Nutritional status of children: what do we know? *J. Nutr. Educ.* 27:225-234.
- Perry, C.L., D.B. Bishop, G. Taylor, D.M. Murray, R.W. Mays, B.S. Dudovitz, M. Smyth, and M. Story. 1998. Changing fruit and vegetable consumption among children: The 5-a-Day Power Plus program in St. Paul, Minnesota. *Amer. J. Public Health* 88:603-609.
- Reynolds, K.D., A.W. Hinton, R.M. Shewchuk, and C. Hickey. 1999. Social cognitive model of fruit and vegetable consumption in elementary school children. *J. Nutr. Educ.* 31:23-30.
- Sapp, S.G. and H.H. Jensen. 1997. Reliability and validity of nutrition knowledge and diet-health awareness tests developed from the 1989-1991 diet and health knowledge surveys. *J. Nutr. Educ.* 29:63-72.
- Shannon, B. and A.N. Chen. 1988. A three-year school-based nutrition education study. *J. Nutr. Educ.* 20:114-124.
- Statistical Package for the Social Sciences. 1997. *SPSS 7.5 for Windows*. Prentice Hall, Englewood Cliffs, N.J.
- Worsley, A., P. Baghurst, A.J. Worsley, W. Coonan, and M. Peters. 1984. Australian ten year olds' perceptions of food: I. Sex differences. *Ecol. Food Nutr.* 15:231-246.