Journal of Human Sciences and Extension

Volume 1 | Number 2 Article 5

10-31-2013

The Impact of Extension Gardening Programs on Healthy Attitudes and Behaviors

Erica Odera
University of Florida, ericalin@ufl.edu

Alexa J. Lamm
University of Florida, alamm@uga.edu

Courtney Owens
University of Florida

Sandra Thompson
Florida A&M University

Lawrence Carter
Florida A&M University

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Erica Odera
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Gardening programs have been increasing in popularity since 1995 when California enacted legislation with the goal of putting a garden in every school. Research has shown positive benefits of gardening programs include increasing a child's academic skills, environmental awareness, and social skills, but little is known about their impact on healthy attitudes and behaviors. Considering childhood obesity rates are rapidly increasing, understanding how educational programs, such as gardening, can impact health has become important. The purpose of this study was to assess the impact Extension gardening programs had on participants' healthy attitudes and behaviors. Using a pretest/posttest research design with a control group, the researchers found that only slight changes were occurring in participants' attitudes and behaviors. However, when staff member open-ended responses were reviewed qualitatively, it was found that more is occurring within the program than was uncovered by the quantitative instrument. Recommendations for enhancing the school-based garden program as a result of the findings included teaching participants how to prepare and eat the vegetables they have produced in the garden, increasing instruction on how gardening is a physical activity, and including journaling about the nutritional values of fruits and vegetables to develop positive attitudes about health.

Keywords: Extension, youth, gardening, health

School-based gardening programs have historical roots and are believed to impact students in many ways (Hillison, 1998). Nationally, the implementation of school gardens has been on the rise since 1995 when California enacted legislation with the goal of putting a garden in every school (California Department of Education, 2007). Since then, other states have also created school gardening programs, many run by Extension programs. These programs incorporate hands-on gardening on the school grounds either during or directly after the school day.

Direct correspondence to: Erica Odera at ericalin@ufl.edu

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Gardening programs are believed to have many positive impacts on students. Recent research has shown some of the positive benefits of school gardening programs include increasing children's academic skills, environmental awareness, and social skills (Armstrong, 2000; Blair, 2009; Ozer, 2007; Pigg, Waliczek, & Zajicek, 2006). In addition, school gardening programs increase students' knowledge of how food is produced, which may be of particular importance to young students with limited knowledge of the origins of food production (Hess & Trexler, 2011).

School gardens have also been shown to increase a child's healthy attitudes and behaviors, including their willingness to taste, and consequently eat, different types of vegetables (Beckman & Smith, 2008; Hermann et al., 2006; McAleese & Rankin, 2007). Morris, Neustadter, and Zidenberg-Cherr (2001) found that first grade students who participated in a school gardening project were more likely to taste different vegetables when compared to students who had not participated. A similar study found older children in fourth to sixth grade reported being more interested in trying new vegetables after participating in a school gardening program (Heim, Stang, & Ireland, 2009). Gardening programs also provide a venue for physical activity, as the students spend time outside engaged in planting, weeding, and harvesting (Ratcliffe, Merrigan, Rogers, & Goldberg, 2011).

Since they encourage healthy choices, school-based garden programs may assist in the battle against childhood obesity. Current childhood obesity rates are about 17% for children from ages 2-19 (Ogden & Carroll, 2010). This is a major concern because overweight or obese children are at a much higher risk for many complications, such as high blood pressure, type 2 diabetes, breathing difficulties, and joint problems (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007; Han, Lawlor, & Kimm, 2010; Sutherland, 2008; Whitlock, Williams, Gold, Smith, & Shipman, 2005). In addition, being overweight or obese as a child also increases the risk of being so as an adult (Biro & Wien, 2010; Serdula et al., 1993; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997). Those most likely to be overweight and/or obese often come from economically disadvantaged backgrounds and are overrepresented by racial minorities. Hispanic boys and African American girls have the highest rates amongst their gendered groups (Ogden & Carroll, 2010). Therefore, this group is of special concern and may benefit the most from school gardening programs.

Theoretical Framework

The theoretical framework for this study was Social Cognitive Theory (SCT; Bandura, 1986). SCT explains individuals' behavioral patterns as a function of their environmental influences, personal attributes, and behavior, with feedback from each aspect affecting all the others (Bandura, 1986). Personal attributes include one's attitudes and knowledge. Environmental factors include situations external to an individual that can influence him/her in some way. Behavioral factors are how an individual acts in a specific situation. Past research has used SCT to understand children's vegetable consumption behavior (Perry et al., 1990; Reynolds, Hinton,

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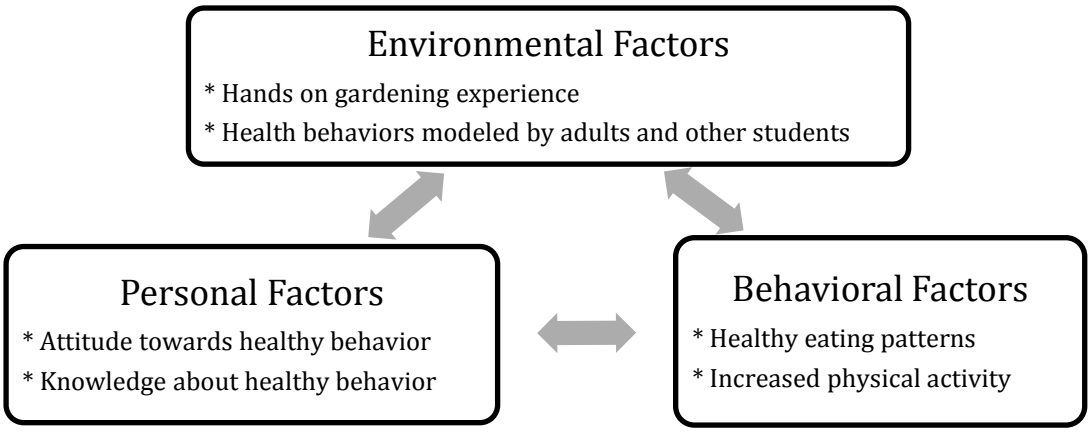
Shewchuk, & Hickey, 1999) and has been recommended in nutrition education and interventions (Glanz & Eriksen, 1993; Perry et al., 1990; Sims, 1987). More recently, it has been used as the foundation for developing an understanding of the impacts of school-based gardening interventions (Ratcliffe, 2007; Ratcliffe et al., 2011).

This study's theoretical framework borrows from Ratcliffe's (2007) descriptions of SCT constructs related to school gardening and environmental awareness and have been adjusted for this study, which focuses specifically on health-related attitudes and behaviors (See Figure 1).

Figure 1. SCT Constructs and Relationship with School Gardening and Health



In the case of school gardening and its impact on health, students' personal attributes are their attitudes towards health, nutritious eating, and physical activity, along with their knowledge base surrounding those subjects. The environmental factors include the hands-on gardening experience, the opportunity to engage in healthy behavior (such as physical activity involved in gardening or consuming the vegetables when harvested), and any health behaviors the students see displayed by adults and their classmates. These environmental and personal factors will then lead to increased healthy eating and physical activity, which is the behavioral goal. The process of these interactions is cyclical and self-sustaining. As more students engage in healthy behaviors, younger students will see these behaviors modeled more often, and the attitudes towards being healthy will improve and normalize with time.

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Purpose and Research Questions

The purpose of this study was to assess the impact of a school-based gardening project on participants' healthy attitudes and behaviors. The purpose was guided by the following research questions:

1. What are the health attitudes and behaviors of participants prior to and after a school-based gardening project?
2. Do health attitudes and behaviors of participants change as a result of participating in a school-based gardening project?
3. Do the health attitude or behavior changes associated with participation differ across age, gender, and site location?
4. What are the perceptions of staff regarding the intervention and the health attitudes and behaviors of the participants?

Methods

This study used a pretest/posttest survey research design with a control group along with an open-ended staff assessment to answer the research questions.

Participant Survey

A survey instrument was designed and disseminated in written form to participants at four program sites. A control group consisting of a class of students who were of comparable age, grade, and other demographics to students engaged in the gardening project were also given the survey instrument before and after the program. A control group was used to ensure any notable changes were due to the program and not confounding factors, such as typical classroom education throughout the year.

The survey included 53 questions about the gardening project participants' attitudes, knowledge, and behaviors associated with specific gardening-related topics. Of the 53 questions, six focused on healthy behaviors and attitudes and were used in this study. An instrument previously developed by Ratcliffe (2007), and found to be valid and reliable, was used as the foundation. Questions were phrased as statements with a five-point Likert-type scale with 1 = *Never*, 2 = *Occasionally*, 3 = *Sometimes*, 4 = *Most of the Time*, 5 = *Always*. The "Attitude towards Health" and the "Preference towards Healthy Food" index each included three questions. Scores within each area were combined and averaged to create overall index scores. Prior to use, a panel of experts specializing in survey design for young audiences, school-based gardening techniques, and health attitudes and behaviors reviewed the instruments to ensure validity.

The survey instrument was administrated as a pretest one week before the participants engaged in the gardening project and as a posttest on the last day of the program. Both tests were administered in written form by the program staff.

Descriptive and inferential statistics were used to analyze the data in SPSS. Descriptive statistics were used to describe attitude and behavior levels before and after the gardening project. Dependent *t*-tests were conducted to assess whether changes in before and after scores were statistically significant. Cross tabulations were conducted to determine whether participant changes differed based upon age, gender, and site location. Last, an Analysis of Covariance (ANCOVA) was used to assess whether differences in scores were related to whether or not the participant was in the control or experimental group. A significance level of .05 was established *a priori*.

Project Site Description and Implementation

The Extension program used three schools and a community-based site, all located in the Florida Panhandle. Sites were chosen for four main reasons: (1) high levels of local poverty, (2) Title 1 designation, (3) high levels of free and reduced lunch recipients, and (4) site administrative support in hosting the gardening project and activities. Two sites were located at elementary schools, one was an afterschool program serving elementary through middle school-aged children, and one was an afterschool program serving just middle school-aged children. Each site had its own coordinator that visited the site and provided instruction to the participants on managing the garden. Site coordinators followed a gardening curriculum to cover different topics throughout the program. The curriculum covered (a) the importance of agriculture, (b) what is a garden and how to keep a gardening journal, (c) importance of composting, (d) fertilizers and pesticide benefits for plants, (e) elements needed for plant growth, (f) climate change, and (g) nutrition. The program took place over one academic year, from September until May.

Participants engaged in the gardening project twice a week, except for the middle school site, which participated once every three weeks. The participants prepared the garden, chose vegetables, planted, weeded, watered, harvested, and either sold the produce to local residents or took the harvest home to their families. The participants learned about various plant/science topics, nutrition and health, and how to set and follow through with personal goals (see Table 1 for a description of the topics covered at each site). Keeping a gardening journal and giving a presentation to others about their gardening experiences were other planned activities.

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Table 1. Demographics and Educational Topics Covered at Four School-based Gardening Sites

Topic	Site 1: Community-Based	Site 2: Elementary School	Site 3: Middle School	Site 4: Elementary School
# of participants	8	22	5	36
Age range	6-9	9-12	12-14	10-12
Plant identification	✓	✓✓	✓	✓✓
Plant classification		✓		✓
Plant physiology		✓✓		✓✓
Plant life cycle		✓	✓	✓
Soil structure	✓	✓		✓
Water cycle		✓		✓
Nutrients		✓		✓
Photosynthesis		✓✓✓	✓	✓✓✓
Harvesting strategies		✓		✓
Following plant label instructions		✓		✓
Nutrition/Health		✓✓		✓✓✓✓
Communication skills		✓		✓
Goal setting		✓✓		✓✓
Acting responsibly		✓		✓

Note: ✓ indicates each time the associated topic was covered at the site.

Participant Demographics

The communities in which the gardening program took place had a higher than average poverty rate, ranging from 19.8% to 23.8%, when compared to the state average of 13.8% (U.S. Census Bureau, 2012). The eligibility levels for free and reduced lunches within the communities were also high, ranging from 43.4% to 81.7% (The Annie E. Casey Foundation, 2010). A total of 71 students participated in the Extension gardening program. The participants were primarily 4th and 5th grade students (85.5%) between the ages of 8-11 years old (83.1%) and predominately African American (74.6%). Demographics of the participants can be seen in Table 2 with a breakdown of age categories at each site listed in Table 1.

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Table 2. Demographics of Participants at Four School-based Gardening Sites (N = 71)

	n	%
Grade		
1st-3rd	6	8.6
4th	23	33.3
5th	36	52.2
6th-9th	4	5.7
Age		
7 and under	4	5.6
8-9	17	23.9
10-11	42	59.2
12 and older	8	11.3
Gender		
Male	45	63.4
Female	26	36.6
Race		
African American/Black	53	74.6
Hispanic	13	18.3
Caucasian/White	4	5.6
Native American	1	1.4

Staff Assessment

In addition to surveying the program participants, a 15-question open-ended online survey was administered to staff members and individual teachers whose classrooms participated in the gardening program. Out of the fourteen staff members and teachers who were given the survey, twelve responded (85.7% response rate). The questions asked participants to describe the challenges they faced and the value they saw in the gardening program. The survey also asked participants to describe how they felt the students reacted to the program and whether they thought that community awareness about nutrition and health had changed as a result of the program.

The responses were coded for dominant themes by a researcher who had minimal contact with the gardening project and was viewing the data from an outside perspective. Initially, all statements referring to any aspect of health (physical activity, nutrition, or eating and consuming vegetables) were identified. Quotes were then placed into emergent themes depending on the type of health activity to which the statement most closely pertained. Finally, quotes were examined only within their dominant theme to determine subthemes and finalized. The researcher kept an audit trail, used peer debriefing with two faculty members with extensive Extension programming experience, and then member checked the data with staff members from the program to ensure the trustworthiness of the findings (Lincoln & Guba, 1985).

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Results

Health Attitudes and Behaviors

The results of the Attitude towards Health index scores showed no statistical changes in the overall index score and only a slight increase from the initial index score of 4.20 to the score of 4.29 at the end of the school year (Table 3). Also, none of the individual questions making up this averaged index had statistically significant changes. Out of all three questions that made up the Attitude towards Health index, students felt always living in a healthy community was the most important.

Table 3. Participant Attitude towards Health (N = 71)

	Pretest ***M (SD)***	**Posttest** ***M (SD)***	**Δ *M***
Overall Attitude towards Health	4.20 (.75)	4.29 (.75)	+.09
I go to the doctor for a checkup every year	4.00 (1.32)	4.18 (1.21)	+.18
I do physical exercises every day	3.99 (1.12)	4.08 (1.09)	+.09
Living in a healthy community is important	4.61 (.73)	4.59 (.82)	-.02

Note: Scale: 1 = *Never*, 2 = *Occasionally*, 3 = *Sometimes*, 4 = *Most of the Time*, 5 = *Always*

Prior to engagement in the gardening program, participants scored an average of 3.47 on the Preference towards Healthy Food index (Table 4). At the end of the school year, this score had decreased .07 points to 3.41. This was not a statistically significant change and represents only a slight shift in agreement level and frequency of performing specific activities. The item regarding eating fast food was reverse coded into the index, and the decrease in response to this statement represents a healthy change, but this is also not statistically significant.

Table 4. Participant Preference towards Healthy Food (N = 71)

	Pretest ***M (SD)***	**Posttest** ***M (SD)***	**Δ *M***
Overall Preference towards Healthy Food	3.47 (.82)	3.41 (.73)	-.07
I eat fast food every day (RC)	2.99 (1.24)	2.63 (1.28)	-.36
I eat green vegetables every day	3.28 (1.15)	3.41 (1.12)	+.13
I think it is important to eat green vegetables	4.15 (1.20)	4.18 (1.03)	+.03

Note: Scale: 1 = *Never*, 2 = *Occasionally*, 3 = *Sometimes*, 4 = *Most of the Time*, 5 = *Always*; RC = Reverse Coded

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Changes Based on Age, Gender, and Site Location Differences

Crosstabulations were conducted to determine whether index changes related to health differed among key demographic factors and/or location. Table 5 exhibits changes in participant index scores based on age category (7 years and under; 8-9 years; 10-11 years; and 12 years and above). The indices with the highest positive change occurred within the 8-9 year old group.

Table 5. Mean Index Changes from Pretest to Posttest by Participant Age Group

	7 and under (*n* = 4)	**8-9 (*n* = 17)**	**10-11 (*n* = 42)**	**12 and above (*n* = 8)**
Attitude towards Health	-.17	+.18	+.10	0
Preference towards Healthy Food	-.92	+.02	-.04	+.04

Changes in scores over time were examined by gender (Table 6). Females had slightly higher positive changes to their index scores after the intervention than males.

Table 6. Mean Index Changes from Pretest to Posttest by Gender

	Male (*n* = 45)	**Female (*n* = 26)**	**Difference (Male–Female)**
Attitude towards Health	+.07	+.12	-.05
Preference towards Healthy Food	-.13	+.04	-.17

Changes in scores were compared across the four different locations, showing the programming at the different locations each had strengths and weaknesses (Table 7). Site 4 had the highest positive changes while Site 2 had a moderate positive increase.

Table 7. Mean Index Changes from Pretest to Posttest by Location

	Site 1: Community Program (*n* = 8)	**Site 2: Elementary School (*n* = 22)**	**Site 3: Middle School (*n* = 5)**	**Site 4: Elementary School (*n* = 36)**
Attitude towards Health	-.13	+.02	-.20	+.22
Preference towards Healthy Food	-1.17	+.14	+.07	+.04

An ANCOVA was conducted to assess whether the difference in scores between the pretest and posttest were related to whether or not the participant was in the control group or in the experimental group. The ANCOVA test allowed the researcher to control for external factors likely to be highly correlated to the dependent variable. A *p*-value of less than .05 represented a significant difference between the control and experimental group. There was not a significant difference between the control and experimental groups on the Attitude towards Health index or the Preference towards Healthy Food index (Table 8).

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Table 8. ANCOVA Results Comparing Index Changes between Experimental and Control Groups

	Δ *M* Control (*n* = 13)	**Δ *M* Experimental (*n* = 71)**	***F***	***p***
Attitude towards Health	-.26	.09	2.06	.155
Preference towards Healthy Food	-.21	-.07	.242	.624

Staff Assessment

The open-ended responses were coded into dominant themes related to health. Four themes emerged including (1) Consumption of Vegetables, (2) Physical Activity, (3) Nutrition Education, and (4) Extending the Lessons to the Home Environment.

The Consumption of Vegetables theme had four subthemes, *preference for vegetables*, *consumption of vegetables by nonstudents*, *consumption by students' families*, and *direct consumption by students* themselves. The first subtheme was *preference for vegetables*. Staff and teachers reported the students increased their preference to eat vegetables, especially those grown in the garden. One respondent mentioned, "When the children grow green foods, their desire to eat them increases." Another described that the students showed an increased desire to eat the vegetables that they grew. On the other hand, one respondent stated, "The children already know what is healthy and what is not. They still choose candy."

The second subtheme was *consumption of vegetables by nonstudents*. Produce grown in the various sites' gardens was consumed by community members, and in one case, a teacher. One respondent reported, "The students shared what they grew with the adults in the community." One teacher was given vegetables by students and said, "My most valuable learning experience with the Red Clay garden project was harvesting and then eating the vegetables my own students had a hand in planting."

The third subtheme was *consumption of vegetables by students' families*. A very common use of the vegetables across the various sites was to be harvested and taken home with the children to be shared with their families. Respondents reported the children "had the chance to take home some of the crops" and that they "shared their produce with their families." The children enjoyed taking the vegetables home, and one respondent noted that the children "thought this was quite grown up."

The fourth subtheme was *consumption of vegetables by students.* In one site, "vegetables from the gardens were prepared at the schools with some parents participating." Another respondent reported that students "tried new [vegetables]" as a result of the program.

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The second dominant theme was Physical Activity. Respondents reported the students engaged in activities related to *preparing the garden for planting*, *planting vegetables*, *caring for the garden*, and *harvesting*. While preparing the garden for planting, students "removed any rocks or debris left from the last garden." Another respondent reported that "after harvesting, the team and students [worked] on tilling and turning the soil with the compost left from last semester, to prepare them for the upcoming planting season." They then helped plant the vegetables and took care of the plants as they grew. The students watered, weeded, and removed insects that could be harmful to the plants. When it came time to harvest the plants, the respondents noticed that the students "loved to pick crops" and followed directions well, "The adults would show [the students] how to pick a crop then they would go behind them and do it themselves."

The third dominant theme was Nutrition Education. The two subthemes emerging within the nutrition education theme were *awareness about healthy eating* and *ability to identify vegetables*. Students and community members were more aware of the benefits of healthy eating, mostly as a result of students communicating to friends and family. For example, "This project may have complimented…information [to] help the students learn how to communicate issues concerning good nutrition to their parents" and "Many students [shared] what they learned with family and friends." Also, students learned how to identify different vegetables by "knowing which vegetables were which and how to tell them apart."

The final dominant theme was Extending the Lessons to the Home Environment. In some cases, respondents reported students expanded their gardening program by starting gardens of their own at home with their parents. For example "Some students shared that they had started a garden at home as a result of the project" and "One student's parents decided to grow a garden to help with the cost of groceries."

Discussion

SCT explains how the environment surrounding an individual influences attitude and behavioral changes (Bandura, 1986). The school gardening intervention described in this study aimed to change the environment by introducing an Extension gardening program into schools and community-based sites. Results from the *t*-test showed that the two health-related indices, Attitude towards Health and Preference towards Healthy Food, did not change significantly when measurements taken before and after the intervention were compared. The lack of significant results around Attitudes towards Health and Preference towards Healthy Food may suggest that the environment was not altered enough to result in significant attitude and behavioral changes.

There were not many staff members who reported the participants had actually consumed the vegetables even though they participated in hands-on activities. This finding is in direct

opposition to previous studies that have shown school gardening programs increased participants' willingness to try vegetables grown in the garden (Heim et al., 2009; Morris et al., 2001). Using SCT theory, participants' attitudes about consuming vegetables should have increased as a result exposure to peer modeling.

In addition, participants did not report being more physically active after engaging in the program. However, the staff and teachers reported that the participants were very involved in all aspects of planting, caring for, and harvesting the gardens. It is possible that the participants did not consider gardening activities to be physical activity, and therefore, did not report a large change over time in their activity level.

When pretest and posttest scores were compared, participants' knowledge about nutrition did not change significantly. After the program, the participants had a moderately neutral perspective about the importance of eating green vegetables every day, implying that targeted nutrition information may be needed for participants to understand the importance of regular vegetable consumption.

Although it was a proposed activity, only 22% (n = 15) of the participants reported keeping a gardening journal. The SCT framework would suggest that, had it been done, journaling would change the environment (by creating a new activity for the participants) and require a specific behavior (writing in the journal), which could lead to increased knowledge and positive attitudes around good nutrition.

Finally, some participants planting their own gardens at home suggests that the participants were able to gather enough knowledge and practice working in all stages of gardening to feel confident in implementing their own garden with the help of their parents. It also suggests that these participants had high positive attitudes around gardening that made them interested in beginning their own at home.

This study does have limitations. Due to lack of detailed records about individual attendance and low levels of engagement in specific gardening supplemental activities (such as keeping a journal or giving a verbal presentation to others), researchers were not able to examine how these activities may have impacted overall participant learning and behavioral outcomes. Secondly, while there was a gardening curriculum that guided instruction, it was not known how closely site coordinators followed the curriculum and the specific order of topical instruction they chose.

Recommendations

The findings of this study show that participants did not engage in eating more vegetables. Perhaps Extension educators need to consider building in vegetable preparation and consumption

as part of the on-site curriculum. Including a taste test during class could introduce participants to new vegetable and fruit choices to which limited resource students are not normally exposed, starting them off on the right food practices. Should this be implemented, research could be conducted examining participants' willingness to try fruits and vegetables, both before and after the program, to see if exposure and preparation lessons changed their healthy eating behaviors.

While the participants did not believe they had increased their level of physical activity by working in the garden, the program staff disagreed and believed it had increased. It is possible that the participants did not consider the gardening activities to be physical activity. Extension educators should emphasize and discuss the different types of physical activity in which the participants engage while gardening, such as bending, pulling, and lifting. This could increase the participants' knowledge of different types of physical activity. In addition, a research study tracking participant activity during a set time period while engaged in the gardening program would be a way to objectively measure the actual physical activity carried out by participants. A study of this kind could be used to accurately report the physical benefits of garden programs.

Last, participant nutrition knowledge levels did not increase as expected. Targeted nutritional information about vegetable consumption needs to be shared throughout the program to maximize participant increases in nutritional knowledge. Extension educators could incorporate game show style questions about nutritional information as part of the curriculum when planting and harvesting. Assignments could also be included where students are encouraged to discuss their attitudes towards vegetables and fruits in their gardening journals. Based on Social Cognitive Theory (Bandura, 1986), expressed attitudes are strong drivers of behavior and will interact positively with the learning experience. By encouraging participants to explore their attitudes towards fruits and vegetables and to reflect upon what they like and do not like about them including nutritional value, they will be more likely to retain information. Research examining the impacts of journaling as part of a gardening project would also assist in understanding the direct impact of reflection on knowledge and attitude changes within at-risk youth. With obesity levels increasing among minority populations, it is more important than ever to prepare at-risk children to make healthy lifestyle and nutritional choices to assist them in living longer and healthier lives.

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Journal of Human Sciences and Extension Volume 1, Number 2, 2013

Erica Odera is a research analyst in the Center for Public Issues Education at the University of Florida.

Alexa J. Lamm is an assistant professor focused on Public Issues Education in the Department of Agricultural Education and Communication at the University of Florida.

Courtney Owens is a graduate assistant focused on Extension Education in the Department of Agricultural Education and Communication at the University of Florida.

Sandra Thompson is the Community Resource Development Program Leader for the Cooperative Extension Program at Florida A&M University.

Lawrence Carter is the Associate Dean of Extension and Outreach for the Cooperative Extension Program at Florida A&M University.