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Advantages of Gardening as a Form of Physical Activity in an After-School Program

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Abstract: Children who normally abstain from physical activity may view gardening as a viable non-competitive alternative. The study reported here evaluated the effect of an Oklahoma Cooperative Extension Service after-school gardening program on self-reported physical activity level of children in 3rd through 5th grade using the ACTIVITY self-report instrument. The ACTIVITY instrument described and demonstrated three physical activity levels; non-moving, moving, and fast-moving. A significant difference between pre- and post-test scores of children's self-reported physical activity level was observed. The results of the study indicate gardening was an effective non-competitive way to increase children's self-reported physical activity level in an after-school setting.

Overweight among children is a leading health concern in the United States, with 33.3% of children 6-11 years of age being classified as overweight or obese in 2003-2006 (Ogden, Carroll, & Flegal, 2008).

Childhood obesity has major health consequences, including high blood pressure, high cholesterol, and type 2 diabetes (Centers for Disease Control and Prevention, 2009).

It is the position of the American Dietetic Association that children two to eleven years of age achieve a healthy weight and lower their risk of chronic diseases through healthful eating and regular physical activity (Nicklas & Hayes, 2008). The 2005 Dietary Guidelines for Americans recommends children and adolescents participate in at least 60 minutes of physical activity on most, if not all, days of the week (United States Department of Health and Human Services and United States Department of Agriculture, 2005). Reducing sedentary activities is reportedly helpful in treating as well as lowering the risk of overweight among children (United States Department of Health and Human Services and United States Department of Agriculture, 2005).

Both inside and outside the classroom, schools provide opportunities for children to participate in regular physical activity (Institutes of Medicine, 2004). School-based gardening programs provide opportunities for children to decrease sedentary behavior. This is particularly important because children are spending more of their time away from home and more time in school, after-school programs, or daycare (Sturm, 2005a). As time spent in structured settings increases, so does the value of physical activity in these settings (Sturm, 2005a). Although the value of physical education programs during school has been widely promoted, there is a deficit of health-related data for after-school programs and daycares (Sturm, 2005b). Because these are structured settings where children are spending far more time than in the past, studies exploring physical activity in after-school programs and daycares are equally as important (Sturm, 2005b).

Although school-based gardening programs have been evaluated as to the impact on nutrition knowledge, fruit and vegetable intake, and fruit and vegetable preferences, or willingness to try fruits and vegetables, there is limited information on the impact of school-based gardening programs on children's physical activity levels (Robinson-O'Brien, Story, & Heim, 2009). Expanding understanding of how environment shapes behavior will aid in creating programs that facilitate positive behavior change (Sheehy & Dharod, 2008).

The purpose of the study reported here was to evaluate the effect of an Oklahoma Cooperative Extension Service (OCES) after-school gardening program on self-reported physical activity level among children in 3rd through 5th grade using a young children's activity assessment video and questionnaire self-report instrument. This purpose directly addressed the research question: Could an after-school gardening program increase physical activity levels of children who may otherwise be sedentary? The goal of the study was to decrease sedentary behavior among children participating in an after-school program.

Program Description

Oklahoma Cooperative Extension Service (OCES) collaborated with a rural school to provide a food, nutrition, and physical activity education program to children in Kindergarten through 8th grade participating in the after-school program. The racial distribution of the children at the school was 73% Native American, 25% White, and 2% Asian/Pacific Islander. Seventy-two percent of youth attending the school were classified as low income (Oklahoma State Department of Education, 2009). The after-school program operated Monday through Friday for 90 minutes each day.

Participatory Action Research (PAR) was a strategy used to determine the direction of the after-school food, nutrition, and physical activity program at this school. Basic principles of PAR include commitment to reducing disparities; co-learning, where academic and community partners learn from one another; and capacity building, where community members are engaged in the research process (Wallerstein & Duran, 2006). Based on the input of community members, which was gathered through interview and focus group sessions, a garden was incorporated as a method to actively involve children in hands-on food, nutrition, and

physical activity education in the after-school program. When registering their children for the 2004-2005 school year, parents had the option of giving consent for their children to participate in the after-school garden project.

Multiple curricula were used as the foundation for the development of the gardening and education program component, including gardening, physical activity, food, and nutrition education activities. Lessons from Junior Master Gardeners (Texas Cooperative Extension Service, 2005), Oklahoma Ag in the Classroom (Oklahoma Cooperative Extension Service, 2006), and USDA Team Nutrition (United States Department of Agriculture Team Nutrition, 2006) curricula were incorporated. These curricula provided helpful guidance for use of gardening produce in culturally specific ways, basic gardening practices, and basic nutrition and physical activity information and activities.

The gardening and education program component was offered for 3 of the 5 days of the week during the after-school program throughout the school year. Students were divided into three groups according to school grade level, with one group per day participating in the garden and education program component. The three groups were as follows: kindergarten through 2nd grade, 3rd grade through 5th grade, and 6th grade through 8th grade.

Children actively participated in planting, fertilizing, mulching, watering, weeding, and harvesting as a means to increase physical activity. Equipment, such as hoes, garden trowels, and watering cans, was shared by the children so that each child had the opportunity to use each piece of garden equipment. Prior to and on days when children were not participating in the gardening and education program component, children in the after-school program were allowed to participate in free play outside or remain inside and do homework, visit with friends, or participate in other inside activities.

Methodology

Level of physical activity during the after-school gardening program was evaluated using the Assessment of Young Children's Activity Using Technology (ACTIVITY) self-report instrument (Tremblay, Inman, & Willms, 2001). The ACTIVITY self-report questionnaire assesses the previous day's physical activity level during 10 distinct time periods, with one time period being after-school. For each time period, the ACTIVITY showed three levels of physical activity (non-moving, moving, and fast-moving). Each physical activity level was described by a short, approximately 5-second, video clip of children participating in an activity demonstrating the level of physical activity. Demonstrated activities, including sitting and reading, walking with friends, and playing tag with friends functioned as reference activities with which children could compare and rate their own levels of physical activity.

After all three levels of physical activity were described and demonstrated, the ACTIVITY questionnaire asked children to identify the physical activity level at which they participated during the identified time period. To decrease systemic answering or bias, the order of physical activity levels presented varied between questions.

Because the ACTIVITY self-report instrument was developed for children in 3rd grade, children in the 3rd through 5th grade group were selected for evaluation. In August, 1 week before the gardening program started, children in 3rd through 5th grade participating in the after-school program completed a pre-test ACTIVITY self-report questionnaire. Eight weeks later, in October, during the gardening program, the same children completed a post-test ACTIVITY self-report questionnaire the day after participating in the gardening program for that week.

Data Analysis

For the purpose of the study reported here, only data for the after-school time period were analyzed. Data were coded as 1 = non-moving, 2 = moving and 3 = fast moving. The nonparametric Wilcoxon signed rank test for a matched sample was used to analyze the difference between pre- and post-test scores of children's self-reported physical activity level. Statistical significance was considered at $p \leq 0.05$. Data were analyzed using the PC Statistical Analysis System (SAS) for Windows, Version 9.1 (SAS, Inst. Inc., Cary N.C.). Only data for children who completed the ACTIVITY self-report questionnaire at both data collections were analyzed.

Results

Thirty-one children in 3rd through 5th grade completed the ACTIVITY self-report questionnaire at both time periods. Seventeen were females, and 14 were males. There was a statistically significant difference between pre- and post-test scores of children's self-reported physical activity level (Table 1). There were a greater proportion of children moving at the post-test period compared to the pre-test period.

Table 1.

Change in the Distribution of Self-Reported Physical Activity Levels Between Pre- and Post-Test for 3rd and 5th Grade Children Participating in the Afterschool Gardening Program

	Activity Level*					
	Non-Moving		Moving		Fast-Moving	
	n	%	n	%	n	%
Pre-Test	16	52	6	19	9	29
Post-Test	5	16	19	61	7	23

$p \leq 0.05$ Indicates a statistically significant difference in the distribution of reported physical activity levels, with an increase in overall movement pre to post.

Discussion

Physical activity is classified as moderate to vigorous activity (Katzmarzyk et al., 2008). Moderate and vigorous physical activities have been shown to provide similar health benefits (Jacobson, Strohecker, Compton, & Katz, 2005). A commonly accepted coding system of classifying specific physical activities by rate of energy expenditure is based on the concept of Metabolic Equivalents or METs (Ainsworth et al., 2000). A MET is defined "as the ratio of work metabolic rate to a standard resting metabolic rate of 1.0 (4.184 kJ)·kg⁻¹·h⁻¹," with 1 MET representing a resting metabolic rate attained while sitting quietly (Ainsworth et al., 2000). Typically moderate to vigorous physical activity refers to an increase in resting metabolism of a least 3 METs (Katzmarzyk et al., 2008). Gardening is classified as a moderate activity (3.0 to 6.0 METs) (Ainsworth et al., 2000). Depending on individual weight, 30 minutes of gardening activities can burn between 128 and 205 calories (Harvard Health Publications, 2006).

Regular physical activity is important for children and can provide numerous health benefits related to body weight, metabolic syndrome, blood cholesterol, blood pressure, and bone strength (Strong et al., 2005). Physical activity has also been shown to have a positive impact on children's academic performance (Strong et al., 2005; Taras, 2005). Even modest changes in physical activity can lead to health benefits (Meriwether, Lee, Lafleur, & Wiseman, 2008). Reducing sedentary behaviors is particularly emphasized as having health benefits for children (Bar-Or, 2000; Kien & Chiodo, 2003).

An advantage of gardening as a form of physical activity in an after-school program is that it does not require athletic skill. At this rural school, children who were not involved in school-sponsored sporting activities regularly found themselves sitting on the sidelines rather than taking part in any physical activities. Previous research has indicated that children who normally abstain from physical activity may view gardening as a viable non-competitive alternative (Kien & Chiodo, 2003). Children participating in this project commented that they enjoyed the gardening activities. In guidelines for school and community programs related to increasing physical activity, recommendations are to broaden the focus of physical activity from competitive sports towards an active lifestyle, including participation in enjoyable physical activity (Johnson, 2000; Kien & Chiodo, 2003). Children participating in this project stated that they began gardening at home as well, which is indicative of incorporating physical activity into their lifestyle.

Conclusion

Many other studies have established that gardening is useful in exposing children to healthful and tasty fruits and vegetables. The study reported here indicates that a dual advantage might be offered: to increase children's physical activity. Because children spend a large proportion of their day in school environments, Extension educators have an opportunity to bring about environmental changes in school-based settings that can positively affect physical activity levels of children. Creating positive changes in school-based settings may facilitate a change in school environment that promotes healthful behavior change (Sheehy & Dharod, 2008).

Extension can be instrumental in facilitating environmental changes in school-based settings that reduce children's sedentary activities. By bringing individuals and community organizations together to address health concerns of the community, Extension can help establish sustainable efforts that promote healthful behavior change (DeMarco, Relf, & McDaniel, 1998; Dart, Frable, & Bradley, 2008). The grass-roots nature and community embeddedness associated with Extension staff position Extension as a conduit for channeling resources for the betterment of community members. By engaging community members in the research process, Extension can facilitate development of projects that address community needs.

Participatory Action Research is a time-consuming process that requires input from multiple community perspectives, but the programs developed through this process have the potential to impart sustainable impact due to community involvement from the inception of the project. The results of the study reported here indicate that gardening was an effective and non-competitive way to increase children's self-reported physical activity levels in an after-school setting.

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