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PEDAGOGY

Active and Healthy Schools

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Abstract

The Active and Healthy School Program (AHS) can be used to alter the culture and environment of a school to help children make healthier choices. The purpose of this study was to determine the effectiveness of AHS to increase physical activity while decreasing total screen time, increase healthy food choices, and improve knowledge about physical activity and nutrition among students. Pedometry quantified physical activity time and steps in 150 children (fifth to eighth grades). Children's Attraction to Physical Activity (CAPA) and Youth Risk Behavior Surveillance Survey (YRBSS) dietary behavior questions were also administered. Students participated in 80 ± 10 min of television viewing and/or computer and video game usage per day with no change in behavior observed following the intervention. No differences in step counts at home (prestudy: 5,728 ± 343 steps/day vs. poststudy: 6,583 ± 634 steps/day; $p = 0.17$) or school (prestudy: 5,405 ± 184 steps/day vs. poststudy: 5,613 ± 533 steps/day; $p = 0.17$) were observed following the intervention. However, physical activity time during school increased by 10 ± 1 min ($p < 0.001$) following the intervention. The CAPA score decreased slightly (prestudy: 35.4 ± 1.2 au; poststudy: 33.4 ± 1.4 au, $p < 0.01$). The frequency of consuming fruit ($p < 0.03$) and vegetables other than salad ($p < 0.03$) increased by 31% ± 8% and 43% ± 10%, respectively. AHS is an effective school-based intervention that positively impacts contributing factors of obesity. School administrators should consider implementing many of the AHS components to improve the health of their students.

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According to the most recent National Health and Nutrition Examination Survey data, almost one third of American young people are overweight or obese (Ogden, Carroll, Kit, & Flegal, 2012). Children who are overweight and obese have increased cardiovascular disease risk factors, such as elevated lipid concentrations, high cholesterol, and high blood pressure (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007); they also are at a greater risk of developing type 2 diabetes (Li, Ford, Zhao, & Mokdad, 2009). Approximately 80% of youth who are obese will become overweight and obese adults if left to their own accord (Guo, Roche, Chumlea, Gardner, & Siervogel, 1994; Serdula et al., 1993). It is critical to identify novel strategies to treat this disease.

School-Based Interventions

Because children are at school for almost half of their waking hours and also eat there, it is a valuable place to initiate physical activity (PA) and nutrition behavior change that may impact childhood obesity. Typically, school officials have relied on physical education (PE) to get kids moving and keep them lean and fit (Lee, Burgeson, Fulton, & Spain, 2007). Unfortunately, this model has mostly failed, as more kids are overweight than ever before (Ogden et al., 2012). Recently, several multifaceted school-based PA and nutrition programs have been implemented that help change the culture of a school to encourage healthy behaviors (Kelly & Melnyk, 2008).

Kelly and Melnyk (2008), in a systematic review of 17 multicomponent interventions with overweight middle school adolescents, concluded that a structured program targeting physical education, nutrition, and behavioral skills is the most effective type of program for reducing risk factors of overweight and obesity. Other researchers have found an effective school-based intervention includes PA, dietary, healthy lifestyle education, and parental involvement and should be implemented at the earliest grade level possible (Zenzen & Kridli, 2009). Of the 16 studies reviewed by Zenzen and Kridli (2009), only nine programs had all four components (PA, dietary, healthy lifestyle education, and parental involvement).

One school-based program that has all four major components of an effective program and shows promise as a sustainable intervention is the Active and Healthy School Program (AHS) developed by Dr. Bob Pangrazi at Arizona State University. The program is based on the premise that meaningful change will come from providing children accurate information with which to make healthy choices

and changing their surrounding environment to support healthier choices. Children are educated on what healthy choices are, and the altered environment makes those choices easier.

Through our unpublished pilot data (Ball & Kovarik, 2012) of an investigation of AHS in a single school ($n = 28$) pre- and postprogram, we found increased PA via pedometry, improved knowledge about PA (Children's Attraction to Physical Activity Survey), and improved nutritional habits and knowledge (Youth Risk Behavior Surveillance Survey). Although the results of the pilot data are positive, additional research is needed. To our knowledge, the efficacy of this program has not been systematically investigated. Therefore, the purpose of this study was to determine the efficacy of the AHS program. Specifically, we examined the effectiveness of AHS to increase PA time and steps (via pedometry) while decreasing total screen time, increase healthy food choices, and improve knowledge about PA and nutrition among students.

Methods

Subjects

One hundred fifty students in fifth to eighth grades from two schools participated in the project. Schools were selected that were similar in size, demographics, and location. University of Missouri Institutional Review Board reviewed this research and granted a waiver of consent. Students were thus not required to sign an informed consent or obtain parental permission to participate. Parental notes were sent home allowing parents to refuse student participation. All students in the two schools in fifth to eighth grades participated in the project. Data were collected in the fall (preprogram) and in the spring (postprogram) of the same school year during the school day.

Experimental Design/AHS Program

This is a study of school-aged children to assess the changes in select PA and nutrition parameters at baseline and following 20 weeks of the AHS program. Prior to the fall semester, a 1-day training occurred for school faculty and staff. Specifically, teachers learned their role, how to implement classroom activity breaks, and how to use pedometers. Teachers were trained by our research staff on how to encourage discussion about PA and nutrition among students. Ideas for incorporating activity and nutrition into their curriculum

were shared. The PE teacher was identified as the "Program Leader" and was additionally trained on data collection methods, how to zone playgrounds, and how to display AHS signage. Last, all faculty and staff learned how they could become more physically active and improve their own nutrition choices. At this time, school faculty received AHS materials, which included AHS manual, activity cards, pedometers, signs, newsletters, balls, cones, volleyball nets, bean bags, among other items. After the initial data collection period, changes to the school environment were implemented. To increase PA, the playground was "zoned" for more structure and supervision. Examples of zones included sports, new game, new skill, low intensity, parachute games, long jump rope, scoops and balls, and a walking trail. The playground was renamed to "Activity Zone" and recess was renamed "Activity Time" to remind students to be active during recess. Point of Decision Prompts, part of the AHS materials, were placed throughout the school to remind students about PA choices. Classroom teachers integrated 3- to 5-min PA breaks using the AHS activity cards. Activity cards are laminated lesson plans that teachers can use to implement movement in the classroom with little or no equipment. Students tracked PA using pedometers and attempted to reach individual step count goals.

Letters were sent home to parents explaining healthier celebratory food options and nonfood options. Healthier dietary selections were available in the school cafeteria, and to encourage better nutrition choices, students were rewarded for healthy choices with fruit and vegetable stickers. Educational materials were sent home to encourage healthy brown bag lunches, and nutrition messages were shared over the intercom or by classroom teachers.

Physical Activity

Pedometers (Walk4Life™ model Duo BB02) were used to measure students' PA change. After initial training (1 week) by the PE teacher, students recorded activity time and steps, at school and at home, for 5 consecutive school days and recorded total activity time and steps per day for one weekend (Saturday and Sunday) following the consecutive schools days. The protocol is similar and consistent with previous research (Rowe, Mahar, Raedeke, & Lore, 2004). During the same time, students recorded screen time (including television, computer, and video game use) in minutes.

The Children's Attraction to Physical Activity (CAPA) inventory (survey) was used to measure children's attraction to PA. The

CAPA is a validated measure of children's attraction to PA (Rose, Larkin, Hands, Howard, & Parker, 2009) and was administered by AHS Program Leaders (on-site manager) during physical education class. University of Missouri researchers were present for the completion of the CAPA for pre- and postprogram data collection.

Nutrition Behavior

Youth Risk Behavior Surveillance Survey (YRBSS) dietary behavior questions were used to assess dietary behaviors such as fruit, vegetable, soda pop, and milk consumption. The YRBSS survey was given during physical education class by the AHS Program Leaders on the same day as the CAPA. University of Missouri researchers were present for the completion of YBRSS nutrition questions for pre- and postprogram data collection.

Data Analysis

A repeated measures ANOVA was applied to identify main effects of time (pre- vs. poststudy changes) for screen time, PA steps, PA time, CAPA scores, and nutrition data (100% fruit juice, fruit, green salad, potatoes, carrots, non-salad vegetables, glasses of milk, and soda pop consumption) for both schools. Analyses were conducted using the Statistical Package for the Social Sciences (SPSS, version 21.0, Chicago, IL, USA). Statistical significance was $p < 0.05$. Data are reported at $M \pm SEM$.

Results

The students participated in approximately 80 ± 10 min of television viewing and/or computer and video game usage per day with no change in behavior observed following the intervention (Figure 1). Change in PA was assessed through measures of step count and time in PA. No differences in step counts at home (prestudy: 5,728 ± 343 steps/day vs. poststudy: 6,583 ± 634 steps/day, $p = 0.17$) or school (prestudy: 5,405 ± 184 steps/day vs. poststudy: 5,613 ± 533 steps/day, $p = 0.17$) were observed following the intervention. However, as shown in Figure 2, PA time during school increased by 10 ± 1 min ($p < 0.001$) following the intervention. No pre- to poststudy change in PA time at home was observed. Although a slight decrease in the CAPA score was observed following the intervention (prestudy: 35.4 ± 1.2 au; poststudy: 33.4 ± 1.4 au, $p < 0.01$), the ratings were still well within the positive range for this test outcome. Also of interest is the finding that this slight reduction was driven

by gender such that girls displayed a significant reduction in CAPA ($p < 0.01$), whereas the boys did not. Last, the change in dietary habits was also assessed throughout the intervention (Table 1). The frequency of consuming fruit ($p < 0.03$) and vegetables other than salad ($p < 0.03$) was found to increase by 31% ± 8% and 43% ± 10%, respectively, following the intervention. However, soda consumption also increased by 37% ± 8% ($p < 0.05$).

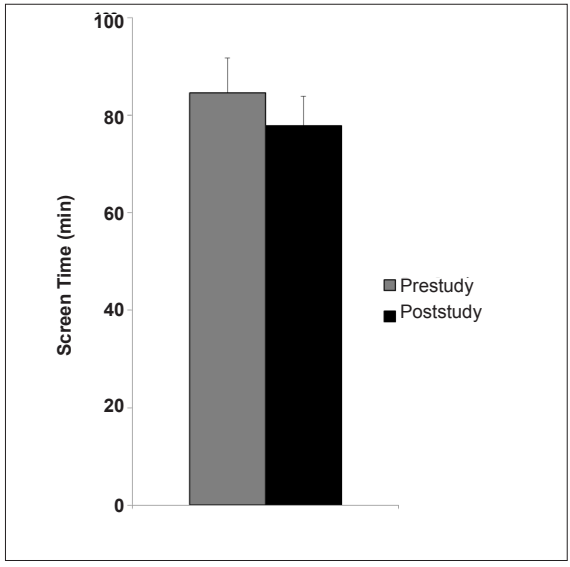

Figure 1. Change in screen time (n = 114 students).

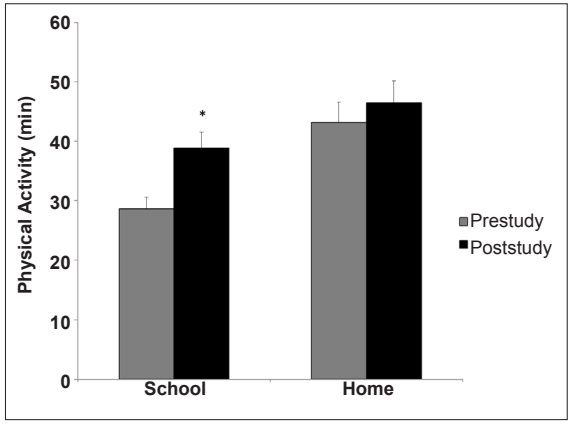

Figure 2. Change in physical activity time during school and at home (n = 150 students).

Table 1
Change in Dietary Habits (n = 136 students)

Dietary component	Frequency of consumption		
	Prestudy (au)	Poststudy (au)	Percent change (%)
100% fruit juice	2.42 ± 0.13	2.65 ± 0.13	+40 ± 10
Fruit	3.46 ± 0.12	3.80 ± 0.13	+31 ± 8*
Green salad	2.06 ± 0.11	2.01 ± 0.10	+24 ± 8
Potato	2.04 ± 0.10	2.29 ± 0.12	+42 ± 10
Carrot	2.03 ± 0.12	2.14 ± 0.12	+38 ± 10
Other vegetables	3.02 ± 0.12	3.42 ± 0.13	+43 ± 10*
Milk	4.01 ± 0.15	4.04 ± 0.14	+24 ± 9
Soda pop beverages	2.45 ± 0.12	2.77 ± 0.15	+37 ± 8

*Repeated measures ANOVA; pre vs. post; $p < 0.05$.

Discussion

The AHS school environment and culture changes appear to have positively impacted the PA of students during the school day. The significant increase in activity time is partly attributed to increased activity time during recess. The reorganization or zoning of the playground allowed students to find equipment quickly and to select activities. Zoning encourages all students to be active, not just the athletic or the lean, and has been shown to increase PA during recess (Beighle, Morgan, Le Masurier, & Pangrazi, 2006; Ridgers, Stratton, Fairclough, & Twisk, 2007). On a typical playground, the strong dominate the weak and monopolize the best areas and equipment (Stanley, Boshoff, & Dollman, 2012). During a typical recess on an unzoned playground only about 20% to 45% of students are actively engaged in activity (Mota et al., 2005; Ridgers, Stratton, & Fairclough, 2005). In a separate unpublished study (Gillespie & Ball, 2012) of second and fifth graders ($n = 260$), we found that before zoning, only 17% of students were active; however, after zoning, 58% of students were active according the SO-PLAY observation tool.

Classroom activity breaks also may have led to the observed activity time. When used throughout the day, these short bursts of activity can contribute to increasing students' overall activity time (Donnelly et al., 2009; Edwards, Mauch, & Winkelman, 2011; Pan-

grazi, Beighle, Vehige, & Vack, 2003). Unfortunately, no data were collected on the frequency and duration of activity breaks during this study. We recognize this as a limitation. Another limiting factor of the current research is our data include recess, physical education class, activity breaks, and all other PA; future studies should separate PA time to determine where increases in PA time occurred. A better understanding of where PA is increased, and not increased, may improve AHS.

No statistical difference in steps was observed after implementing AHS for boys, girls, or the combination. The lack of significance with steps compared with activity time is likely due to the large variation in stride lengths among children. Other researchers have used PA time over steps counts as the objective measure of PA change (Wickel et al., 2007). Another alternative would be the use of accelerometers to measure PA time, speed, and intensity.

Children's attitudes, beliefs, and knowledge about PA determine how motivated they will be to engage in PA (Brustad, 1993). The CAPA likert scale is a validated tool used to determine children's interest and attitudes toward PA (Rose et al., 2009), with a higher score indicating a higher attraction to PA and likelihood to engage in PA. Previous literature has shown CAPA scores can vary greatly between schools. For example, Barry, Moore, Webb, Hill, and Kohl (2002), using another school-based intervention program called TAKE 10!, reported CAPA scores ranging from 15 to 60 among students Grades 3 to 5. Our data did not demonstrate an increase in attraction to PA postintervention despite being administered in the classroom setting by the same trained researcher. One possible explanation is many students scored high initially on the test. With a larger sample size, it may be possible to look at only students that scored low initially on the CAPA.

In addition to PA, a secondary component of AHS is to influence eating behavior. Nutrition information from the University of Missouri Extension was provided to classroom teachers, online resources were made available to teachers, staff learned ways to promote healthy foods at school events, and newsletters were sent to parents describing healthy brown bag lunches and celebratory foods. The YRBSS nutrition questions were used to assess consumption of fruit, fruit juice, vegetables, dairy, and soda pop. Monitoring intake of these foods can indicate if changes in nutrients such as calories, fiber, sugar, and calcium were influenced. Following programming, students significantly increased fruit consumption ($p = 0.026$) and

non-salad vegetable consumption ($p < 0.03$). Based on current evidence, children are still not meeting the World Health Organization goal of 400 g of fruit and vegetables per day (Krolner et al., 2011). Specifically, most children are consuming only half as many servings of fruits and half as many servings of vegetables than recommended (Guenther, Dodd, Reedy, & Krebs-Smith, 2006). Thus, based on our findings, we suggest that implementing nutrition-related school programs may increase the frequency of fruit and vegetable consumption. Other than soda pop consumption increasing, the other nutrition variables remained unchanged after AHS. One possible explanation for the increase in soda is the high number of end-of-the year celebrations typical of a normal school year. In the future, researchers may investigate this phenomenon and control for it.

Conclusion

Because children spend a significant amount of time at school, it is a logical place to influence behavior. Typically, School administrators have relied on PE to get kids moving and help keep youth fit and lean. Unfortunately, this model has failed miserably as more youth are overweight and unfit than ever before. New multifaceted approaches, such as AHS, that include PA, nutrition education, healthy lifestyle education, and parental involvement may prove to be more effective than traditional methods. Previously, the AHS program had not been systematically investigated. Our findings support AHS as an effective school-based intervention that positively impacts behaviors contributing to obesity. School-wide environmental and cultural changes provided through AHS help youth meet PA recommendations and improve eating behaviors. School administrators should consider implementing many of the AHS components to improve the health of their students.

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