Original Research

The Impact of a Pilot Community Intervention on Health-Related Fitness Measures in Overweight Children

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ABSTRACT

Int J Exerc Sci 3(3): 150-156, 2010. The purpose of this study was to pilot a 5-week community-based intervention on improving measures of health-related fitness in overweight children. Data were obtained from 8 overweight and obese 8- to 14-year-old children. Measurements included muscular fitness (curl-ups and modified pull-ups), aerobic capacity (20 meter progressive aerobic cardiovascular endurance run [PACER] test), body composition (triceps and calf skinfolds), body mass index (BMI), and flexibility (back saver sit-and-reach). A significant reduction in BMI was observed at post-test compared to baseline (P=0.03). There was a significant decrease in body fat at post-test for boys (P=0.013).

KEY WORDS: pediatric, weight loss, fitness testing, physical activity

INTRODUCTION

The morbidity and numerous health problems associated with excess body weight in youth make it an issue of increasing public significance. The Centers for Disease Control (CDC) defines obesity as "having a very high amount of body fat in relation to lean body mass, or Body Mass Index (BMI) of 30 or higher" (4). The American College of Sports Medicine (ACSM) defines Body Mass Index as "a measure of an adult's weight in relation to his or her height, specifically the adult's weight in kilograms divided by the square of his or her height in meters" (1). Rather than using the BMI categories designed for adults, the CDC utilizes growth charts for children and adolescents (aged 2 – 20) to plot the BMI value to a corresponding percentile according to age and sex (3). Based on these growth charts, overweight is defined as having a BMI at or above the 85th percentile but below the 95th percentile, while obesity is defined as a BMI at or greater than the 95th percentile for age and sex (4).

The prevalence of overweight and obesity in the United States has increased

dramatically in recent years. The incidence rate of overweight youth alone has tripled within the last thirty years. Children 6 to 11 y of age have a prevalence of overweight of 33.3%, while that prevalence is 34.1% for children aged 12-19 y (11). Regarding parents of obese children, evidence suggest that a mere 13% with children ages 6 to 11 y and only 31% with children ages 12 to 17 y accurately perceive their children as very overweight. Less than 10% of parents of obese 6 to 11 year-olds are very concerned about their child's weight (5).

It has been well established that persons who fit the medical criteria for overweight or obese are at risk for potentially deadly obesity-related health problems later in life. According to the CDC, the overweight and obese condition is a major public health issue, with comorbidities including coronary heart disease, type 2 diabetes, certain cancers, stroke, osteoarthritis, asthma, sleep apnea, and gynecological problems (4). Many of these conditions may begin in childhood but not present until later in life. One longitudinal study determined that in adults with Metabolic Syndrome (a collection of risk factors for cardiovascular disease) compared to those without, differences began to be evident in BMI at ages 8 and 13, and ages 6 and 13 for waist circumference (14). Excess body fat has also been documented as an independent predictor of triglyceride levels and diastolic blood pressure (DSB) in both sexes, and of systolic blood pressure (SBP) in girls (15).

Many complex factors contribute to overweight and obesity in youth, including genetic susceptibility, lack of physical activity, and excess caloric intake. Effective interventions are needed that will reduce sedentary behavior and equip children with the tools needed to make long-term healthy choices. A meta-analysis to determine effective weight loss interventions for children revealed that more structured clinical interventions, such as specific dietary or exercise training programs, resulted in greater weight loss (12). However, the demanding regimen typical of clinical programs can result in low adherence rates (10). Others researchers have recommended community-based interventions as a viable alternative to a clinical approach (6). A community environment presents a unique opportunity to incorporate physical activity, nutrition, education, behavioral therapy, and parental involvement. The purpose of the present study was to determine the effects of a 5-week multidisciplinary community-based intervention on measures of health-related fitness in overweight and obese 8- to 14-year-old children.

METHODS

Participants and Setting

Children (3 boys, 5 girls), ages 8 to 14 y, who were physician-referred, based on a BMI at the 85th to 95th percentile for age and sex participated in this study. Two referred participants did not meet the clinical criteria for overweight or obesity, but were siblings of other participants and approached the 75th percentile, which is considered at risk for overweight (7). While parents participated in some components of the program, no measures were obtained for the adults.

The intervention consisted of approximately 120-min of physical activity followed by 60-min of dietary education and counseling three days per week for 5 weeks. Classes were structured to include

activity-based exercise in addition to education on nutrition, exercise, cardiovascular disease, and healthy lifestyles. The parent-child education component emphasized establishing a family environment conducive to healthy choices. Concepts included positive communication, role modeling, goal setting, and family activities. Parents participated in two one-on one nutritional counseling sessions with a dietician, in addition to one behavioral counseling session with a psychologist. Two cooking demonstrations were included in which children worked with adult mentors on all aspects of meal preparation, including measuring, mixing, and cooking to prepare meals for themselves and their parents. Other experiential learning activities included making orange soda to demonstrate sugar content, learning to read nutritional labels, and monitoring serving sizes.

A variety of facilities within a Southeastern state university were utilized, including the university exercise science laboratory, the recreation center, and the university nutrition laboratory. Institutional review board approval of the protocol was obtained, and all children and their parents completed written assent and informed consent forms, respectively. Activities, educational sessions, and fitness testing were facilitated by experienced and certified Exercise Science and Nutrition faculty and students, as well as medical center personnel.

Height and Body Mass

Height (cm) was measured using a stadiometer (Invicta Plastics Limited, Leicester, England) and body mass (kg) was measured with a digital scale (SECA model 770, Vogel & Halke, Hamburg, Germany). BMI was subsequently calculated (kg/m^2).

FITNESSGRAM®

The FITNESSGRAM® battery of tests is a commonly used fitness assessment and reporting program for youth, which measures health-related components of fitness including body composition, cardiorespiratory endurance, muscular fitness, and flexibility (9).

Skinfolds

Skinfold thickness was measured at the triceps and calf on the right side of the body using a calibrated Lange caliper (Beta Technology Incorporated, Cambridge, Maryland). Two measures were taken at each site within 1 mm, or a third measure was obtained. These measures were entered into FITNESSGRAM® software (version 8.3) to determine percent body fat.

Cardiorespiratory Fitness Measures

Aerobic capacity was assessed via a 20-meter progressive aerobic cardiovascular endurance run [PACER] test. The test gets progressively faster each minute, as indicated by the FITNESSGRAM® audio compact disc. The score recorded is the total number of laps, or each 20-meter distance completed.

Curl-up and Modified Pull-up (Muscle Strength/Endurance)

Participants were assessed on the number of curl-ups and modified pull-ups they were able to perform. These tests were administered according to the instructions given in the FITNESSGRAM® Test Administration Manual (9). Curl-ups were performed with knees flexed and feet unanchored, and were performed at the pace dictated by the FITNESSGRAM®

audio compact disc. The modified pull-up test was performed lying flat with the bar positioned 1 to 2 inches above the participant's reach, with an elastic cord 7 to 8 inches below the bar.

Back-saver sit-and-reach (Flexibility Measurement)

Participants were assessed without shoes using a sit-and-reach box (ACUFLEX 1, Novel Products, Inc., Rocton, Illinois) on both their dominant and non-dominant leg to determine flexibility.

Statistical Analysis

All data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 17.0 (Chicago, IL). Means and standard deviations were calculated for each variable. Univariate repeated measures analysis of variance (RM ANOVA) was used to determine the effect of time (1, 2) on the dependent variables. One-way RM ANOVA was also utilized to examine the effect of time individually for both boys and for girls. An alpha level of <0.05 was determined to establish statistical significance.

RESULTS

Descriptive Statistics

Descriptive statistics for the dependent variables are summarized in Tables 1 and 2.

Table 1. Descriptive Statistics of Study Participants, % or Mean ± SD (N = 8)

	Pre-test	Post-test
Body Mass (kg)	62.4 (20.3)	62.5 (20.0)
BMI (kg/m^2)*	29.1 (5.0)	28.5* (4.6)
% Body Fat	38.8 (8.3)	38.8 (7.1)
PACER	13.0 (6.0)	12.3 (8.2)
Curl-up	50.6 (35.5)	61.1 (61.5)
Pull-up	0.6 (1.2)	1.5 (1.8)
SRL(in)	8.8 (3.2)	8.3 (3.3)
SRR(in)	8.8 (3.1)	8.5 (2.8)

Note. BMI = body mass index (kg/m^2); SRL = back saver sit and reach left leg; SRR = back saver sit and reach right leg; PACER = progressive aerobic cardiovascular endurance run; * $p < .05$.

Table 2. BMI Outcomes of Individual Study Participants from Pre-test to Post-test.

Sex	Pre-test BMI	Post-test BMI	% Change
Female	26.2	25.2	-3.8
Female	28.8	27.8	-3.5
Female	35.9	34.6	-3.5
Male	37.4	36.2	-3.2
Male	24.6	24.2	-1.7
Female	28.3	28.3	0.0
Female	27.9	27.8	0.0
Male	23.7	23.9	1.0

Note. BMI = body mass index (kg/m^2).

A main effect for time (1, 2) was a significant predictor of BMI ($F_{1,7}$=7.343, MSE=0.185, P=0.030, η^2 =0.512). Specifically, BMI decreased between 1.7 and 3.8% from pre- to post-test. No other variables significantly changed from pre- to post-test.

Gender Analysis

No significant effects were found between genders; however, we acknowledge that these may be due to the limited statistical power associated with the small sample size used in the present study.

DISCUSSION

The impact of excessive weight in childhood is of tremendous importance to an individual's health status in adulthood. The health benefits of physical activity and the detrimental effects of inactivity and excess weight are well documented (13). Based on evidence that physically active children will become physically active adults, early interventions are needed that focus on increasing physical activity levels in children (8). The present study was conducted to determine the effectiveness of a short-term, community-based intervention on measures of health-related fitness in 8- to 14-year-olds.

The results indicated a significant reduction in BMI at post-test. Because children are continually growing both in stature and in body mass, it is difficult to observe a change in BMI. The present findings

suggest that there may have been sufficient height gains combined with body mass stability resulting in the observed decrease in BMI. Not only was this change statistically significant, it could also be considered clinically significant due to the known association between BMI and disease risk classification (1). Enough of a decrease in BMI at specific age could potentially result in moving into a healthier percentile on the clinical growth charts. The results also demonstrated a significant reduction in body fat in boys, while no significant change was observed for girls. While these findings may be explained in part by the intervention, they may also be interpreted in light of the fact that boys within this age range begin to see substantial increases in lean mass, whereas girls are beginning to present with significant increases in fat mass (2).

While a formal evaluation was not conducted, program personnel were asked to provide a written assessment of the program. Responses indicated that parental involvement was thought to be an essential component, providing opportunities for both children and parents to learn new information together, perhaps allowing them to continue to be comfortable communicating about the topics outside of the program. The wide variety of physical activities, the cooking demonstrations, and the low participant to staff ratio (2:1) were all described as positive aspects of the program. In evaluating the program, program personnel noted that more careful initial screening of participants would help ensure a more homogenous group. This particular group included two individuals who could be considered at risk for overweight, but were not clinically overweight. One individual possessed considerable athletic ability, which may have detracted from the experience of some of the children.

There were certain limitations to the study that should be addressed and noted for future studies. The lack of a control group eliminates the ability to infer cause and effect, making it difficult to ascertain whether observed significance was due to the intervention or to some extraneous variable. The inclusion of more than one group could have helped to determine whether the inclusion of parental involvement, education, or other components of the intervention were beneficial by comparing them to groups without those aspects. The wide range of ages included in this study could have been a limitation. There can be a great deal of difference in biological maturity between 8 and 14 year-old. Furthermore, while a longer intervention period would be more financial demanding and time-intensive, a short-term program may not provide adequate time to cause the behavior change necessary for long-term success. Since increasing physical activity levels among youth of concern, this research study should have included a measure of physical activity levels prior to and following the intervention.

Future research in the area of obesity in children and adolescents should focus on the development of similar community programs that address the multifaceted nature of the problem (12). Investigators should seek to determine whether a community-based approach to the issue of excess weight in childhood is in fact superior to more intensive exercise-training program, particularly examining long-term effects. Recommendations for future

research with community-based programs include measuring physical activity levels, attitudes toward physical activity, sedentary behavior (such as screen time), and the inclusion of parents as participants. Future research should also include follow-up measures to determine if interventions are successful in facilitating long-term changes in attitudes, behaviors, and overall health.

In conclusion, the increasing prevalence of overweight and obesity in children and the related health consequences highlight the need for interventions that address the collective causes of the problem. This pilot study revealed meaningful findings that contribute to the current knowledge of the development of successful interventions in this vulnerable population. Health professional have a responsibility to develop interventions that will address the complex issues surrounding childhood overweight and obesity and reduce the lifestyle-related risk factors for disease later in life.

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