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Effects of extension of the Youth Fit For Life intervention program by video vs. instructor supervision.

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Objective: Youth Fit For Life is a physical activity intervention program administered during after-school care that has been tested in the U.S. and Canada. It has demonstrated reliable improvements in body composition, endurance, and strength in children ages 5-12 years. The aim of this research was to contrast any additional improvements associated with extensions of the program with other physical activity modalities during its off days. ***Design:*** Two types of physical activity modalities - instructor-supervised physical activity (n=121) and the HopSports® video-based exercise system (n=171) - were administered to children (M_{age} =7.3 years) for 2 days/week during their after-school care as a supplement to the existing 3-day/week, 45-minute/session Youth Fit For Life program. ***Results:*** Mixed-model repeated measures analysis of variance (ANOVA) indicated statistically significant within-group improvements over 12 weeks in body mass index (BMI), distance covered in a 6-minute walk/run test, and number of push-ups completed in 1 minute, in both groups. There were no significant differences in improvements between the 2 groups, and effect sizes were similar to research incorporating Youth Fit For Life alone. When data from subsamples of overweight and obese children were evaluated, only BMI scores significantly improved—again with no difference by group. Greater effect sizes for BMI change were found in children who were overweight and obese. ***Conclusion:*** No short-term benefits from the supplementation of the Youth Fit For Life intervention program by either video-based or instructor-supervised physical activity were identified. Future research should test extensions of the existing curriculum in other ways to improve effects.

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Key Words: youth, after-school care, Youth Fit For Life, video, physical activity, body mass index

INTRODUCTION

There has been a consistent and considerable increase in youth overweight (body mass index [BMI; kg/m^2] in the 85th to 94.9th percentile, based on sex- and age-adjusted norms) (27) and obesity (BMI ≥ 95th percentile) in the United States and other industrialized countries (18, 21). This is important because health risks such as diabetes and hypertension increase with obesity, and obesity in youth predicts obesity throughout the lifespan (15). Interventions focused on preventing and treating high weight in children have been completed internationally and have generally focused on increased physical activity, improved nutrition, and reduction in screen time (12, 25). Unfortunately, there has been limited success.

Stice and colleagues (25) found a significant reduction in BMI in only about one-fifth of the 61 treatments since the mid-1980s that met the inclusion criteria for their meta-analysis. The average effect size (Cohen's d) for the elementary school ages of 5 to 12 years was the lowest at 0.02.

Although improving and increasing physical education during the school day has been a focus of many experimental treatments directed at youth obesity, along with their minimal effects, they have often been difficult to implement in practical settings as they require a specialized staff (25). Their required reduction in time away from traditional academic activities has often been viewed as problematic for school administrators (26). As a response to these concerns, Youth Fit For Life was developed as a

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structured program that could be administered during after-school care by existing after-school instructors who were typically unfamiliar with physical education methods (5). The intervention program, intended for elementary school ages, is based on tenets of social cognitive and self-efficacy theory (7, 8) and correlates of physical activity in children (24) and has components of self-regulatory skills training (e.g., goal setting, cognitive restructuring), along with cardiovascular exercises, strength training, and nutrition information. A 2010 meta-analysis of 16 trials of Youth Fit For Life (3) demonstrated effects on BMI (mean effect size, d=0.14) to be greater than most other interventions with similar goals, but still small by Cohen's standards (9). Youth Fit For Life was shown to have effects associated with overweight and obese children that were larger than children of a healthy weight (1). Although it was indicated that effect sizes for interventions incorporating children of both healthy and unhealthy weights may have an absolute ceiling of approximately d=0.40 (less than a moderate effect based on Cohen's standards) (3, 9), research on improving outcomes of the existing Youth Fit For Life program appeared warranted. Youth Fit For Life has also consistently been associated with improvements in measures of cardiorespiratory endurance and strength (2, 4, 5).

Increasing the number of days of treatment was considered as an initial option in attempts to improve effects—extending the 3-day per week Youth Fit For Life intervention to all 5 weekdays. Because daily lesson plans were purposely limited in their variety so that instructors unfamiliar with exercise and health education methods would not feel overburdened, simply extending the existing Youth Fit For Life program to 5 days was considered unacceptable. Pilot research suggested that such redundancy in activities would be unappealing to participants. Because administration of physical activities may now be completed through video projected on a large screen or wall, it was decided that, as a 2-day per week extension of the Youth Fit For Life program, this method would be contrasted with unstructured physical activity supervised by the after-school instructors for the same amount of time. Although a commercially available video format such as HopSports® (14), which includes celebrities and sports figures demonstrating and encouraging participation in physical activities such as dance and the martial arts, has been present for several years, it (along with similar products) has been minimally tested by standard scientific methods (28, 29).

Thus, based on previous research on Youth Fit For Life (3-5), it was expected that both the conditions of Youth Fit For Life plus HopSports and Youth Fit For Life plus instructor-supervised physical activity would be associated with significant within-group improvements in BMI, cardiorespiratory endurance, and strength. It was also expected that due to the increased amount of physical activity per week, effects on BMI would be greater in each of these 5-day conditions than were previously found with Youth Fit For Life alone. Whether effects associated with the two treatment conditions being tested here significantly differed was, however, left as a research question without hypotheses as either the features of video- or teacher-support could feasibly be more effective (e.g., video being a more novel exercise-support system; teacher supervision allowing for more personal interaction). Because after-school care has been deemed an important venue for youth obesity prevention (15), it was hoped that findings would further inform methods to improve health promotion within that setting.

MATERIAL AND METHODS

Participants

Participants were enrolled in 12 weeks of YMCA-based after-school care at one of a total of 14 elementary schools (Youth Fit For Life plus HopSports group, n=171; Youth Fit For Life plus instructor-supervised physical activity group, n=121). No participant was in more than one group. Ethics committee approval, written consent from each participant's parent or guardian, and assent from each child were obtained. Procedures were in accord with guidelines from the Declaration of Helsinki. Because the physical activity treatment was outlined in general terms to parents and guardians, and it was only one part of a comprehensive after-school care program that also included homework completion and tutoring, biasing of data due to self-selection to a particular treatment group was considered unlikely. The groups did not significantly differ on age (overall mean [M] ± standard deviation =7.3±1.7 years), sex (overall 55% female), ethnicity (overall 55% African-American, 31% Euro-American, 6% Hispanic, and 10% of other groups), and proportion classified as overweight or obese (overall 25%). Based on locations of residences and utilization of the free- and reduced-cost meal program, socioeconomic strata were generally lower to lower-middle and did not differ by group.

Measures

Body Mass Index (BMI): A digital scale and stadiometer were used to measure BMI - a ratio of weight to height (kg/m^2). BMI estimates health risks associated with body fat and, based on convention, may be converted to a sex- and age-adjusted percentile based on norms from 2000 (27). Correlations with a

precise measure of body fat, dual energy x-ray absorptiometry, were 0.80-0.90 in previous studies (10). It should be noted, however, that even dual energy x-ray absorptiometry has limitations in accuracy when obesity is present.

Push-Up Test: Number of push-ups completed at a 3-second pace within 1 minute was used as the measure of muscular strength. Participants started in an upright position and lowered the body using the arms until the elbows were at a 90° angle. The required pace was indicated by a recording. When either the required form or pace was not kept, the number of properly completed push-ups was recorded. Test-retest reliability was reported to be 0.90-0.91 for ages 7-11 years. (19). Validity was previously suggested through significant correlations of ≥0.70 with combined bench press, latissimus pull-down, and arm curl results (22).

Six-Minute Walk/Run Test: To estimate cardiorespiratory endurance, each participant ran/walked as far as possible in 6 minutes. The distance covered was recorded in meters. Concurrent validity was suggested through significant correlations of 0.71-0.82 with VO_2 max treadmill test results in children of ages 9-11 years (16). Pilot testing indicated test-retest reliability over 3 weeks of 0.83 for elementary school ages.

Procedure

Participants were enrolled in 12 weeks of after-school care that administered the Youth Fit For Life intervention program on Mondays, Wednesdays, and Fridays, along with either (i) after-school instructor-supervised physical activity for 45 minutes on the remaining 2 days per week (Youth Fit For Life plus instructor-supervised physical activity group) or (ii) HopSports use on the remaining 2 weekdays (Youth Fit For Life plus HopSports group). No participant or instructor was with both groups. The 45-minute per day duration was based on a mandated amount of time set aside from academic activities (e.g., homework completion) by after-school care administrators. The participant-to-instructor ratio for all groups was approximately 15:1, which was standard for after-school care programs in the state of Georgia. Instructors were recruited by after-school administrators well in advance of this investigation.

Youth Fit For Life had components of cardiovascular physical activity, strength training, behavioral skills training, and health/nutrition education (20). Moderate- to high-intensity cardiovascular activities in the form of non-competitive, mastery-focused games and tasks were completed each day for 20 minutes. Strength training was completed utilizing age-appropriate resistance bands for 20 minutes, 2 days per week. The behavioral skills component consisted of instruction in various self-management and self-regulatory skills (e.g., goal setting, self-monitoring, self-talk/cognitive restructuring) for 1 session per week for 20 minutes. Health and nutrition information topics (e.g., "Fruits and Vegetables," "Heart Health") were addressed for 5-7 minutes each session, supported by corresponding posters. All Youth Fit For Life components were completed in multi-purpose areas of elementary schools.

The HopSports video system consisted of the projection of a moving image on a large screen that directed participants through physical activities derived from a variety of sports and physical activities (e.g., martial arts, modern dance) (14). Popular sport figures, actors, and cartoon figures served as instructors on the videos. Instructors rotated different videos intended for the elementary school age group.

Instructor-supervised physical activity consisted of oversight of safe and age-appropriate activities and promoting a fun and non-threatening environment for all participants. Although more structured than free-play, these activities were only minimally structured (e.g., "tag" games).

All instructors received a 4-hour training taught by certified wellness specialists in the Youth Fit For Life intervention program and a brief training in either (i) how to set-up the HopSports system or (ii) how to supervise the additional physical activity time (based on which condition was assigned to them). To ensure treatment fidelity, YMCA wellness directors completed structured quality-control assessments and reported to study administrators to promptly correct any problems.

Just prior to the start and at the end of the 12-week treatments, participants completed the assessments administered by a team of certified wellness specialists. Participants' identification data were not retained. Because field designs have been specifically advocated (11) and analyses of community-based treatments capable of large-scale dissemination were considered essential to expedite (17), the present design was considered acceptable for the purposes of this applied research.

Statistical analysis

To detect a small effect size at the statistical power of 0.80, α=0.05 (2-tailed), an overall minimum sample size of 274 was required. A one-way analysis of variance (ANOVA) was first used to test for significant group differences at baseline in BMI, distance covered in a 6-minute walk/run, and number of push-up completed. Consistent with previous research (4), scores at week 12 were adjusted to account for changes associated with maturation (adapted from normative data on BMI (27), the

Table 1: Means ± standard deviations and changes in physiological measures over 12 weeks

Measure	Baseline M	Week 12 M	Score change M	Expected change M	d
All Participants					
Youth Fit For Life plus instructor-supervised physical activity group (n=121)					
Body mass index	17.10±3.02	17.10±2.89	0.00±0.87	0.22	0.07
6-minute walk/run	907.21± 287.78	935.87±252.58	28.66±153.48	13.00	0.10
Push-ups	6.60±6.42	7.98±6.20	1.38±3.93	0.36	0.21
Youth Fit For Life plus HopSports (n=171)					
Body mass index	17.13±2.89	17.05±2.85	-0.08±0.65	0.22	0.10
6-minute walk/run	872.72±211.18	914.26±222.65	41.54±125.11	13.00	0.20
Push-ups	5.46±5.35	7.02±5.71	1.56±2.98	0.36	0.29
Overweight and Obese Participants Only					
Youth Fit For Life plus instructor-supervised physical activity group (n=33)					
Body mass index	20.75±2.96	20.53±2.91	-0.22±0.89	0.28	0.17
6-minute walk/run	842.58±272.94	853.17±214.77	10.59±152.68	13.00	0.04
Push-ups	6.12±5.80	6.09±5.49	-0.03±3.67	0.36	-0.01
Youth Fit For Life plus HopSports (n=41)					
Body mass index	21.05±3.05	20.86±2.95	-0.19±0.71	0.28	0.15
6-minute walk/run	799.21±246.11	821.55±248.40	22.34±113.03	13.00	0.09
Push-ups	3.83±3.68	5.12±4.12	1.29±3.19	0.36	0.35

M= mean ± standard deviation; d= Cohen's measure of effect size for within-group changes: $M_{week\ 12(adjusted)}$-$M_{baseline}$/standard $deviation_{baseline}$. Results were from a mixed-model repeated measures analysis of variance (ANOVA) applied separately for body mass index (BMI), 6-minute walk/run, and push-ups.

walk/run test (13), and the push-up test (22)), before being entered into subsequent analyses. Mixed-model repeated measures ANOVAs were then used to assess if there were significant changes over 12 weeks in the above measures and if those changes significantly differed between the Youth Fit For Life plus instructor-supervised physical activity and Youth Fit For Life plus HopSports groups. Where appropriate, effect sizes were expressed as either partial eta-squared (η^2_p), where 0.01, 0.06, and 0.14 represent small, moderate, and large effects; or Cohen's d, where 0.20, 0.50, and 0.80 represent small, moderate, and large effects. Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 15.0.

RESULTS

Analyses of all participants

There was no significant difference in attendance in physical activity sessions between groups, which averaged 89% overall. No significant difference in BMI, walk/run, or push-up scores was found between the Youth Fit For Life plus instructor-supervised physical activity and Youth Fit For Life plus HopSports groups at baseline (Table 1). Mixed-model repeated measures ANOVAs indicated significant improvements in BMI ($F_{1,290}$=33.56, p<0.001, 95% CI=-0.35, -0.17, η^2_p=0.104), 6-minute walk/run ($F_{1,290}$=7.31,p=0.007, 95% CI=6.02, 38.18, η^2_p=0.025), and push-up ($F_{1,290}$=30.16, p<0.001, 95% CI=0.71, 1.51, η^2_p=0.094) scores over 12 weeks. However, no group × time differences in changes in BMI ($F_{1,290}$=0.83, p=0.36, η^2_p=0.003), walk/run distance ($F_{1,290}$=0.62, p=0.43, η^2_p=0.002), or push-ups completed ($F_{1,290}$=0.20, p=0.65, η^2_p=0.001), were found.

Analyses of overweight and obese participants only

Data from only participants in the overweight and obese ranges for the Youth Fit For Life plus instructor-supervised physical activity (n=33) and Youth Fit For Life plus HopSports (n=41) groups indicated a significant improvement in BMI ($F_{1,72}$=26.80, p<0 .001, 95% CI=-0.67, -0.30, η^2_p=0.222), but not walk/run ($F_{1,72}$=0.05, p=0.82, 95% CI=-27.34, 34.26, η^2_p=0.001) or push-up ($F_{1,72}$=0.46, p=0.50, 95% CI=-0.52, 1.07, η^2_p=0.006) scores. No group × time difference in changes in BMI was found ($F_{1,72}$=0.20, p=0.89, η^2_p=0.000).

DISCUSSION

Effects for changes in BMI for the Youth Fit For Life plus instructor-supervised physical activity group and the Youth Fit For Life treatment supplemented with

the HopSports exercise video system were significant and near (but not above) the median (i.e., d=0.12) of those in a recent meta-analysis of 16 applications of the Youth Fit For Life intervention program (3). For those participants in the overweight and obese categories, changes in BMI were promising, but will require continued progress at the observed trajectory before many will reach a healthy weight. Consistent with previous research (4, 5), associated improvements in cardiorespiratory endurance and strength tests were also significant. Their effect sizes also did not differ by group. Also consistent with previous research (1, 2), mean changes in BMI were more pronounced in participants who were overweight and obese initially than those who were not (0.16 vs. 0.09).

Although the HopSports video exercise system did not demonstrate added effects to the Youth Fit For Life program supplemented with instructor-supervised activity over the 12-week investigation, further analyses on this modality should be completed to assess its efficacy alone and over longer periods. Video is a convenient format where physical activity protocols, when identified as productive, may be efficiently delivered in a standard manner. Although longitudinal designs are, indeed, important, it should be noted that in a comprehensive review of youth obesity treatments, duration (in weeks) was (unexpectedly) inversely related to BMI improvements (25). Thus, the present analyses should not be considered lacking because of the research's rather limited duration.

Limitations of this research included its field design, which may minimize experimental control of variables such as the social support effects of instructors and other participants. Practical research designs are, however, presently encouraged because of their ability to rapidly generalize findings to real-world settings (11). Additionally, exercise outputs were not tracked. Thus, an estimation of exercise volume and physical exertion within the treatments was not attained. Advances in accelerometer technology may make this task easier in extensions of this research. Also, carry-over effects from increased physical activity to improved eating have been suggested (6) and should also be accounted for in assessing BMI changes in the future.

Although unsuccessful at improving the demonstrated effects of Youth Fit For Life alone, this research is one of the first attempts to test methods to improve an existing, evidence-based intervention. A continuation of such efforts may enable practitioners to maximize their efforts at health promotion and, hopefully, better respond to the need for more effective management of youth obesity in field settings.

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