Fitness; Youth

Effect of a Park-Based After-School Program on Participant Obesity-Related Health Outcomes

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Abstract

Purpose. *The objective of this study was to examine the effect of a structured after-school program housed in a large county parks system on participant health and wellness outcomes.*
Design. *Longitudinal cohort study over one school year (fall 2011–spring 2012).*
Setting. *A total of 23 county parks in Florida.*
Subjects. *Children ages 5 to 16 (N = 349, 55% non-Hispanic black, 40% Hispanic, mean age 8.9 years).*
Intervention. *An after-school program called Fit-2-Play that integrates daily standardized physical activity and health and wellness education components.*
Measures. *Preintervention (August/September 2011) and postintervention (May/June 2012) anthropometric, systolic/diastolic blood pressure, fitness, and health and wellness knowledge measurements were collected.*
Analysis. *Comparison of pre-post outcome measure means were assessed via general linear mixed models for normal-weight (body mass index [BMI] < 85th percentile for age and sex) and overweight/obese (BMI ≥ 85th percentile for age and sex) participants.*
Results. *The overweight/obese group significantly decreased their mean (1) BMI z score (2.0 to 1.8, $p < .01$) and (2) subscapular skinfold measurements (19.4 to 17.5 mm, $p < .01$) and increased (1) mean laps on the Progressive Aerobic Cardiovascular Endurance Run test (10.8 to 12.5, $p = .04$) and (2) percentage with normal systolic blood pressure (58.1% to 71.0%, $p = .03$) from pretest to posttest. On average, participants significantly improved their health and wellness knowledge over the school year ($p < .01$). Normal-weight participants maintained healthy BMI ranges and significantly increased fitness levels.*
Conclusion. *Findings suggest that the Fit-2-Play after-school programs can be a significant resource for combating childhood obesity and instilling positive physical health in children, particularly among ethnic and socioeconomically diverse communities. (Am J Health Promot 0000;00[0]:000–000.)*

Key Words: Obesity, Overweight, Prevention, Fitness, Youth, Children, Adolescents, Physical Activity, Prevention Research. Manuscript format: research; Research purpose: intervention testing, program evaluation, obesity prevention; Study design: nonexperimental; Outcome measure: fitness, anthropometric, health and wellness knowledge; Setting: community-based parks; Health focus: obesity prevention; Strategy: fitness, health and wellness education; Target population age: youth; Target population circumstances: local community, ethnic minority, low income

PURPOSE

Recently the American Medical Association (AMA) adopted a new policy that officially labels obesity as a disease "requiring a range of medical interventions to advance treatment and prevention."[1] Indeed, the U.S. adult obesity rate increased almost 50% between 1997 and 2012 and significantly increased over the past decade (1999–2000 to 2009–2010) in boys ages 2 to 19.[2,3] Although there was no change in childhood obesity prevalence estimates (16.9%) between 2007–2008 and 2009–2010, ethnic group disparities remain; rates continue to be higher among non-Hispanic black (24.3%) and Hispanic (21.2%) children and adolescents than among non-Hispanic white (14.0%) youth.[3] For the first time in decades, the life expectancy of Americans is projected to decrease as a consequence of obesity alone.[4]

The AMA's recent obesity policy change calls for increased attention to the current childhood obesity epidemic, namely, its significance as one of the strongest risk factors for adult obesity.[5,6] Thus, preventing and treating childhood obesity should be a priority.[7,8] Major hindrances to controlling

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the current childhood obesity epidemic include access to prevention and/or treatment programs that are affordable, provide minimal barriers for participation, and are available to the general public. Effective, community-based health and wellness programs with a focus on physical activity and healthy eating could be a powerful referral resource for pediatricians and other health care professionals who have patients who are obese, at risk for obesity, or in need of obesity prevention tools. Indeed, previous research shows that aftercare or after-school programs have had a positive effect on school attendance, behavior, and academic performance.[9] Although school-based obesity prevention interventions have received much attention,[10,11] there has been far less documentation of rigorous assessment of aftercare or after-school programs on health and wellness outcomes associated with childhood overweight.[9,12,13] Yet thousands of children, many from low-income backgrounds, who are in turn at high risk for obesity attend aftercare programs during the school year, making this setting an ideal opportunity to provide obesity prevention strategies.[12]

Therefore, the purpose of this study was to conduct and test a longitudinal (over the 10-month 2011–2012 school year) cohort study to determine the effect of a park-based after-school program (Fit-2-Play) that integrates standardized physical activity and health and wellness education components on the prevalence of overweight and obesity among 5- to 16-year-olds. The results of the Fit-2-Play after-school program on all outcome measures over the 2011–2012 school year are reported here.

METHODS

Design

The design was a pilot, single-arm, pre-post 10-month (length of the 2011–2012 school year) study.

Sample

Children ages 5 to 16 who participated in the Miami Dade County Parks, Recreation, and Open Spaces (MDCPROS) Fit-2-Play after-school program (conducted in a total of 23 Miami Dade County parks daily from 2 to 6 P.M.; all parks are either directly adjacent to an elementary and/or middle school or K-8 center) and whose parents signed an informed consent to have their pre-post outcome measurements analyzed are included in this report (N = 349, out of a total of 1008 total participants). These Fit-2-Play participants completed a baseline (August and September, 2011) and posttest (May and June, 2012) assessment that included the measures described below. All children included here had both pre and post data available for analysis. The study was approved by the University of Miami Institutional Review Board.

Although a significant proportion of the sample was overweight/obese at the beginning of the school year, the purpose of this analysis was to examine the health and wellness effects of this program for all participants, regardless of weight status. Moreover, because this is a community-based program, the emphasis is on health and wellness and prevention of obesity rather than strictly weight loss, which is typically emphasized in a treatment approach, and thus most appropriate in a clinical setting. Therefore, the aggregate sample was stratified into two groups for analysis: normal-weight (body mass index [BMI] $<$85th percentile for age and sex) and overweight/obese (BMI $\geq$85th percentile for age and sex) participants.

Measures

University of Miami faculty and staff members trained a core team of 12 MDCPROS staff with physical education backgrounds (e.g., exercise physiology, kinesiology) on appropriate anthropometric, blood pressure, and physical fitness data collection methods and techniques. In turn, this trained measurement team was responsible for collecting all pre-post data in each participating park. Additionally, MDCPROS bachelor's- and master's-level recreation directors with education backgrounds in health and wellness and exercise physiology oversaw on-site measurement procedures and collection of all pre-post data to ensure measurement fidelity. Data was then uploaded to a shared (parks and university) database via a data management team.

Anthropometric Measures. Anthropometric outcome measures included height and weight, which were then converted to a BMI. Weight was collected at each park site on calibrated scales (Seca Model 869, Seca North America East Medical Scales & Measuring Devices, Hanover, Maryland). Children did not wear their shoes, were asked to empty their pockets, and wore only light clothing (e.g., shorts, T-shirt). Height was measured using a stadiometer (Seca 217 Mechanical Telescopic; Seca North America East Medical Scales & Measuring Devices). BMI was calculated as weight (kilograms) divided by height (meters) squared and was then converted to an age-and sex-adjusted percentile and z score.[14] BMI has been shown to be a reliable and valid measure of both total body fat and percentage of body weight as fat among children in previous studies.[14–16]

Waist circumference[17] and its relationship to both height[18] and hip circumference[19] are simple yet valid surrogate measures of cardiometabolic disease risk (e.g., cardiovascular disease and/or type 2 diabetes).[20,21] Waist, hip, and midarm circumferences were measured with a tape measure (Gulick model 1098990; Mabis, Jesup, Georgia). Waist circumference was measured in the horizontal plane at a point marked just above the right ileum on the mid-axillary line at minimal respiration.[22]

Skinfold thickness measurements are another traditional technique that can be applied easily and are stated to provide a reliable estimate of obesity and regional fat distribution.[22–24] Biceps, triceps, suprailiac, and subscapular skinfold measurements were collected in triplicate on the right side of the body and recorded to the nearest .1 mm with skinfold calipers using standard procedures[25] (model 12–1110; Baseline Evaluation Measures, Plains, New York), and age, sex, and ethnicity-adjusted mean values for both individual and sum of the four skinfold measures were used in the analysis.

Blood Pressure. Systolic and diastolic blood pressures were measured with electronic sphygmomanometers (model 9005; American Diagnostic Corporation, Hauppauge, New York) using either a child or adult cuff, depending on the girth of the upper arm, a widely accepted and valid technique.[26] A total of three diastolic and systolic measurements were taken successively with 1 minute in between each measure. For analysis, the first value was dropped and the subsequent two averaged and then assessed for age- and sex-adjusted normotension, prehypertension, or hypertension based on standardized values from the Update on the Task Force for High Blood Pressure in Children and Adolescents working group on hypertension control in children and adolescents from the National High Blood Pressure Education Program.[27]

***Physical Fitness*.** Physical fitness refers to those components of fitness that have a relationship with health, such as (1) cardiorespiratory fitness, (2) musculoskeletal fitness, and (3) motor fitness.[28] The following components of the validated President's Council on Exercise's standardized testing protocol were used to test physical fitness.[29,30] Flexibility was assessed with the modified sit and reach test (Flex Tester sit and reach box model 00004; Novel Products, Rockton, Illinois) that has recently been validated for hamstring flexibility in both children and adolescents.[31] The test was repeated three times and the best value was recorded

Muscular endurance was evaluated by the sit-up test. When instructed, the subjects initiated the test and performed as many complete sit-ups as they could during a 60-second timed period.[29] Muscular strength was assessed by maximal right-angle push-up. When instructed, each subject performed as many complete right-angle push-ups until volitional exhaustion. Absolute values were recorded.[29,30]

Aerobic fitness was assessed with a timed 400-m run and a Progressive Aerobic Cardiovascular Endurance Run (PACER) test. The PACER is a valid, multistage fitness test adapted from the 20-m shuttle run test.[32,33] The test is progressive in intensity—easier at the beginning with increasing difficulty at the end, with the objective to run as many laps as possible. In the 400-m run, children were instructed to run a lap as fast as possible and their time was recorded.[29,30]

***Health and Wellness Knowledge*.** Health and wellness knowledge was assessed using the EmpowerMe4Life[34] nine-item scale. Specifically, participants were asked the following seven true/false questions at both pretest and posttest: (1) I try to eat fruits and vegetables at every meal; (2) Fruits and vegetables are full of nutrients and vitamins that help you grow, keep you from getting sick and heal you when you are injured; (3) I usually get physically active for at least an hour (or 60 minutes) every day; (4) It is ok for me to watch TV, play video games, or use the computer a lot instead of being physically active; (5) I limit the amount of screen time (TV, video games, computer) I watch to 1–2 hours every day; (6) I primarily drink water, 1% or fat-free milk, and 100% juice with no added sugars; and (7) Being physically active is only for athletes. Two additional multiple choice items were as follows: (8) How does being physically active help your body? (choices included keeps your muscles, heart, lungs and bones strong; allows you to keep a healthy weight; all of the above); and (9) One of these is a drink that is not as good for you as the other drinks. Which one is it? (choices included fat-free milk, sports drink, water, 100% juice).

Individual items and total of all nine items (composite score) were analyzed as outcomes measures. No psychometric property data is available at this time for this pre-post assessment tool.

Intervention

The Fit-2-Play program is comprised of (1) 60 minutes of physical activity that incorporates multiple sports (soccer, kickball, flag football) and activities from Sports, Play, and Active Recreation for Kids,[35] an evidence-based,[36] outcome-oriented, structured active recreation program for children with a focus on developing and improving motor skills, movement knowledge, and social and personal skills; and (2) 20- to 30-minute nutrition education lessons one or two times per week that incorporate EmpowerMe4Life,[34] a health and wellness curriculum aligned with the National Health Education Standards for fifth grade and grounded in the American Heart Association's scientific recommendations in promoting heart-healthy lifestyles. Based on the Alliance for a Healthier Generation's five steps kids can take to live healthier, this curriculum promotes being physically active for 60 minutes every day; water as the primary beverage choice, followed by 1% or fat-free milk and 100% juice with no added sugars; consuming fruits and vegetables with every meal; and limiting screen time to 1 to 2 hours a day.

Children are exposed to the Fit-2-Play program and curriculum on a daily basis after homework is completed. Park "coaches" introduce different physical activities for at least 1 hour each afternoon. Nutrition education sessions are conducted weekly (and biweekly some weeks) on Fridays in the place of homework hour. Children are grouped by age for all activities. Parents pay a maximum of $35 per week for their child to participate in the after-school program, but the fees are offered on a sliding scale and the program is no cost for families that can document the need for financial assistance. Children cannot miss more than 10 days of school during the year; thus, the Fit-2-Play attendance rates remain stable (>95%) throughout the school year. Several of the larger parks provide daily transportation from a number of surrounding schools to the program.

Analysis

Means and standard deviations were generated for all continuous data (age, anthropometric measures), and categorical data (gender, ethnicity) are reported as frequencies and percentages. All outcome measures were dichotomized by weight status: normal-weight (BMI <85th percentile for age and sex) and overweight/obese participants (BMI ≥85th percentile for age and sex).[13] Normally distributed outcome variables, including BMI z score, hip circumference, waist circumference, midarm circumference, waist-hip ratio, bicep skinfold, triceps skinfold, subscapular skinfold, suprailiac skinfold, sum of skinfold thicknesses, sit and reach test, 400-m run, systolic blood pressure, diastolic blood pressure, and the health and

Table 1
Baseline Characteristics of 349 Fit-2-Play After-School Program Participants by Normal or Overweight/Obese Group Status, 2011–2012 School Year*

	Entire Sample (N = 349)			Normal Weight† (N = 210)		Overweight/ Obese‡ (N = 139)	
	N (%)	Mean (SD)	Range (Minimum-Maximum)	N (%)	Mean (SD)	N (%)	Mean (SD)
Sex							
Boys	173 (50)			118 (56)		58 (42)	
Girls	176 (50)			92 (44)		81 (58)	
Ethnicity							
Hispanic	139 (40)			74 (35)		65 (47)	
Non-Hispanic black or African American	183 (55)			125 (60)		68 (49)	
Non-Hispanic White	14 (4)			10 (5)		4 (3)	
Other	3 (1)			1 (0)		2 (1)	
Age, yr		8.9 (2.1)	(5.1 to 16.6)		8.8 (2.0)		9.1 (2.1)
Anthropometric Measurements§							
Weight, kg		36.2 (14.5)	(15.5 to 100.4)		29.3 (8.2)		46.6 (15.8)
Weight, z score		0.1 (1.1)	(−3.7 to 3.3)		−0.1 (1.1)		0.5 (1.1)
Weight, percentile		53.9 (30.5)	(0.0 to 100.0)		47.4 (29.2)		63.8 (29.8)
Height, cm		133.2 (13.4)	(103.5 to 166.1)		131.2 (13.5)		136.2 (12.7)
Height, z score		0.7 (1.2)	(−2.9 to 3.6)		0.0 (0.8)		1.8 (0.8)
Height, percentile		66.5 (29.3)	(0.2 to 100.0)		49.4 (24.8)		92.3 (11.1)
BMI, kg/m^2		19.8 (5.2)	(14.0 to 47.4)		16.6 (1.5)		24.5 (5.3)
BMI z score		0.8 (1.0)	(−1.4 to 3.0)		0.1 (0.6)		1.9 (0.5)
BMI percentile		70.9 (25.8)	(8.1 to 99.9)		54.5 (20.5)		95.6 (4.2)
Waist circumference, cm		63.1 (12.4)	(47.1 to 114.6)		56.1 (5.4)		73.6 (12.6)
Hip circumference, cm		74.1 (12.9)	(8.0 to 116.7)		68.5 (8.6)		82.6 (13.7)
Waist-to-hip ratio, %		88.0 (45.2)	(65.4 to 106.3)		85.2 (50.2)		92.2 (35.9)
Waist-to-height ratio, %		47.3 (7.5)	(37.2 to 74.9)		42.9 (2.7)		54.0 (7.5)
Mid arm circumference, cm		20.7 (5.7)	(5.3 to 82.4)		18.6 (5.4)		23.8 (4.6)
Biceps skinfold, mm		13.3 (7.2)	(2.0 to 48.0)		9.6 (3.9)		19.2 (7.4)
Triceps skinfold, mm		18.8 (7.9)	(5.0 to 49.3)		15.3 (5.3)		25.0 (7.8)
Subscapular skinfold, mm		12.7 (7.9)	(4.0 to 55.7)		9.1 (4.0)		19.2 (9.1)
Suprailiac skinfold, mm		13.9 (8.7)	(3.3 to 41.7)		9.7 (4.6)		21.6 (9.2)
Sum of thicknesses of four skinfolds, mm		54.7 (25.7)	(16.0 to 146.3)		43.6 (15.2)		78.3 (27.7)
Overweight (85th ≤ BMI percentile < 95th)	94 (27)	–			–		–
Obese (≥ 95th BMI percentile)	45 (13)	–			–		–

* BMI indicates body mass index.
† BMI <85th percentile for age and sex.[14]
‡ BMI ≥85th percentile for age and sex.[14]
§ Adjusted for age, sex, ethnicity, and park.

wellness composite scores, were analyzed with a general linear mixed model to generate means and standard errors. Outcomes with a binary distribution, including systolic prehypertension, diastolic prehypertension, systolic hypertension, diastolic hypertension, systolic normotension, diastolic normotension, and correct responses for the health and wellness knowledge items, are presented as percentage and standard error. Data with a Poisson distribution, including sit-ups, push-ups, and the PACER test, are presented as means and standard errors. Both types of data are analyzed with a generalized linear mixed model. All models included fixed effects for BMI group, time, and the interaction of group and time. When appropriate, covariates for age, sex, and ethnicity were included to control for their possibly confounding effects. For example, all physical fitness variables were adjusted for age, sex, ethnicity, and park location in the analysis. A random intercept was included with parks as a subject to account for between-park variation, and another random effect is included for the repeated-measure time with participants nested within parks to account for the nesting of participants within parks. Contrasts were used to determine the significance of the change over time in each group and the significance of the difference between groups in the changes. The link function for binary data was the logit, and for Poisson data was the natural logarithm. The .05 significance level determined statistical significance. SAS 9.3 (SAS Institute, Inc., Cary, North Carolina) was used for all analyses.

Table 2
Change in Anthropometric Measurements Over the 10-Month 2011–2012 School Year by Weight Status Group*

	Normal Weight (N = 210)†				Overweight and Obese (N = 139)‡			
	Baseline Mean (SE)	10-mo Mean (SE)	Change (95% CI)§	*p*	Baseline Mean (SE)	10-mo Mean (SE)	Change (95% CI)	*p*
Primary end point								
BMI z score	0.2 (0.1)	0.3 (0.1)	−0.1 (−0.1 to 0.0)	0.19	2.0 (0.1)	1.8 (0.1)	0.2 (0.1 to 0.3)	<0.01
Secondary end points‖								
Hip circumference, cm	69.3 (1.4)	70.1 (1.4)	−0.9 (−2.5 to 0.7)	0.28	82.3 (1.5)	83.6 (1.5)	−1.4 (−3.4 to 0.6)	0.16
Waist circumference, cm	57.1 (1.3)	56.5 (1.4)	0.6 (−0.2 to 1.5)	0.14	73.5 (1.3)	73.5 (1.4)	0.0 (−1.0 to 1.1)	0.94
Midarm circumference, cm	19.0 (0.7)	18.7 (0.7)	0.4 (−0.4 to 1.1)	0.33	24.1 (0.7)	24.2 (0.7)	−0.1 (−1.1 to 0.8)	0.80
Waist-to-hip ratio	88.5 (6.1)	82.4 (6.3)	6.1 (−3.9 to 16.1)	0.22	95.5 (6.4)	97.8 (6.8)	−2.2 (−14.5 to 10.1)	0.71
Waist-to-height ratio	42.9 (0.9)	42.4 (0.9)	0.5 (−0.2 to 1.1)	0.13	53.7 (0.9)	53.5 (1.0)	0.3 (−0.5 to 1.0)	0.46
Biceps skinfold, mm	9.1 (1.0)	9.1 (1.0)	0.0 (−0.8 to 0.7)	0.98	18.4 (1.1)	17.9 (1.1)	0.4 (−0.5 to 1.4)	0.34
Triceps skinfold, mm	14.6 (1.2)	13.4 (1.2)	1.2 (0.3 to 2.1)	0.01	24.6 (1.2)	24.1 (1.2)	0.5 (−0.6 to 1.7)	0.35
Subscapular skinfold, mm	8.7 (1.1)	7.9 (1.1)	0.7 (0.0 to 1.4)	0.05	19.4 (1.2)	17.5 (1.1)	1.9 (0.9 to 2.9)	<0.01
Suprailiac skinfold, mm	9.2 (1.3)	8.3 (1.3)	0.9 (0.1 to 1.8)	0.03	21.6 (1.3)	21.2 (1.3)	0.4 (−0.7 to 1.5)	0.48
Sum of thicknesses of four skinfolds, mm	41.6 (4.0)	38.6 (4.0)	3.0 (0.7 to 5.3)	0.01	80.1 (4.2)	77.2 (4.2)	2.9 (−0.4 to 6.2)	0.08

* BMI indicates body mass index; CI, confidence interval.
† BMI <85th percentile for age and sex.[14]
‡ BMI ≥85th percentile for age and sex.[14]
§ Change represents difference between baseline and 10-month mean percentage. All outcome variables analyzed with a general linear mixed model.
‖ Adjusted for age, sex, ethnicity, and park.

RESULTS

Anthropometrics

At baseline, 60% of the sample (mean age 8.9 years, range 5.1–16.6 years, 50% male) were normal weight, 13% were overweight, and 27% were obese. Over half (55%) of the sample were non-Hispanic black and 40% were Hispanic (Table 1). Among the overweight/obese group (BMI ≥85th percentile for age and sex) mean BMI z score decreased significantly from baseline (2.0) to posttest (1.8; .2 decrease, 95% CI .01–.03, $p < .01$). Mean BMI z score remained stable among the normal-weight group (.2 at baseline, .3 at posttest, no significant change), indicating healthy weight maintenance (versus unhealthy growth and/or weight gain) over the school year. The normal-weight group showed significant decreases in several mean skinfold measures from the beginning to the end of the school year: triceps (14.6 to 13.4 mm, $p = .01$), suprailiac (9.2 to 8.3 mm, $p = .03$), and sum of four skinfold thicknesses (41.6 to 38.6 mm, $p = .01$). Similarly, the overweight/obese group also showed significant decreases in mean subscapular skinfold measurements (19.4 to 17.5 mm, $p = .001$). Although not statistically significant ($p = .08$), the overweight/obese group also showed pre-post decreases in the sum of four skinfold thicknesses (80.1 to 77.2 mm) and all individual skinfold measures (Table 2).

Physical Fitness

Overall, both normal-weight and overweight/obese Fit-2-Play participants showed improvement in physical fitness. Specifically, the normal-weight group mean number of laps on the PACER test increased from 13.3 at baseline to 15.7 at follow-up (mean change 2.5 laps, $p = .01$) and the overweight/obese group mean number of laps increased from 10.8 at baseline to 12.5 at follow-up (mean change 1.7 laps, $p = .04$; Table 3).

Blood Pressure

The overweight/obese group significantly increased the number of participants who had normal systolic blood pressure from the beginning to the end of the school year (from 58.1% to 71.0%, $p = .03$). Although the pattern was similar for diastolic blood pressure (80.3% to 86.7%), it was not statistically significant (Table 3).

Health and Wellness Knowledge

Fit-2-Play participants significantly improved on their health and wellness knowledge assessment from baseline to posttest (mean change from 6.8 to 7.6 questions correct in the normal-weight group, $p < .01$; mean change from 7.0 to 7.9 questions correct in the overweight/obese group, $p < .01$; Table 4).

DISCUSSION

We report here multiple key findings that have direct implications for the current childhood obesity epidemic. Results show that (1) normal-weight participants maintained healthy BMI ranges and (2) overweight participants significantly decreased both BMI z scores and subscapular skinfold measurements over the 2011–2012 school year. Furthermore, participants significantly improved their health and wellness knowledge over one school year. These results suggest that participation in the program is an effective health promotion strategy regardless of weight status. Moreover, these findings show that parks that incorporate afterschool programs can be a significant community and public health referral

Table 3
Change in Physical Fitness Measures, Blood Pressure (BP), and Pulse Over the 10-Month 2011–2012 School Year by Weight Status Group*

	Normal Weight (N = 210)†				Overweight and Obese (N = 139)‡			
	Baseline	10-mo	Change§	*p*	Baseline	10-mo	Change	*p*
Fitness test mean (SD)‖								
Sit-ups, No.	21.1 (2.1)	24.3 (2.3)	−3.2	0.13	18.1 (1.8)	20.6 (2.0)	−2.5	0.18
Push-ups, No.	18.3 (2.2)	20.5 (2.4)	−2.3	0.09	15.7 (1.9)	18.3 (2.2)	−2.5	0.09
PACER test, laps	13.3 (2.0)	15.7 (2.4)	−2.5	0.01	10.8 (1.6)	12.5 (1.9)	−1.7	0.04
Sit and reach, cm	27.8 (1.1)	26.7 (1.0)	1.0	0.04	26.4 (1.1)	25.7 (1.0)	0.7	0.26
400-m run, s	175.7 (20.1)	179.3 (20.1)	−3.6	0.45	217.1 (20.3)	213.7 (20.3)	3.4	0.57
BP mean (SD)‖								
Mean systolic BP, mm Hg	107.2 (1.6)	108.3 (1.6)	−1.2	0.10	113.7 (1.6)	112.8 (1.6)	0.8	0.33
Mean diastolic BP, mm Hg	67.2 (1.2)	66.9 (1.2)	0.3	0.65	69.1 (1.2)	68.0 (1.3)	1.2	0.13
% Systolic prehypertension¶	11.4 (2.2)	10.0 (2.1)	1.4	0.65	12.3 (2.8)	7.3 (2.2)	5.0	0.18
% Diastolic prehypertension¶	7.5 (1.8)	5.7 (1.6)	1.9	0.44	9.3 (2.5)	7.2 (2.3)	2.1	0.54
% Systolic hypertension#	7.4 (1.8)	9.3 (2.1)	−1.9	0.49	29.2 (4.2)	21.5 (3.8)	7.8	0.14
% Diastolic hypertension#	7.8 (1.9)	4.4 (1.4)	3.3	0.15	10.4 (2.7)	6.1 (2.1)	4.3	0.20
% Systolic normotension	81.5 (2.8)	81.0 (2.9)	0.5	0.89	58.1 (4.6)	71.0 (4.2)	−12.9	0.03
% Diastolic normotension	84.8 (2.6)	90.0 (2.1)	−5.2	0.11	80.3 (3.6)	86.7 (3.1)	−6.3	0.16

* Sit-ups, push-ups, and PACER tests analyzed with a generalized linear mixed model. Sit-and-reach, 400-m run, systolic and diastolic BP analyzed with a general linear mixed model. Systolic and diastolic normotensive, prehypertension, and hypertension, diastolic analyzed with a generalized linear mixed model. PACER indicates Progressive Aerobic Cardiovascular Endurance Run.
† Body mass index <85th percentile for age and sex.[14]
‡ Body mass index ≥85th percentile for age and sex.[14]
§ Change represents difference between baseline and 10-month mean percentage.
‖ Adjusted for age, sex, ethnicity, and park.
¶ Prehypertension is defined if either systolic or diastolic values are above the 90th percentile, adjusted for age, sex, and height.[15]
# Hypertension is defined if either systolic or diastolic values are above the 95th percentile, adjusted for age, sex, and height.[15]

resource for families and health care professionals.

The significant decreases in BMI z score in the overweight/obese group and the stability of BMI z scores shown in the normal-weight group coupled with significant decreases in skinfold thicknesses in both groups over the school year are particularly encouraging. First, if normal childhood growth trajectories such as those shown here in the normal-weight group can be maintained, especially during critical years such as those when adiposity rebound (period of increasing BMI after the early childhood nadir) should occur (ages 5–7) the risk of later onset overweight and obesity decreases. Specifically, adiposity rebound has been found to predict both adult BMI[37,38] and adult obesity,[39–41] and the earlier the overweight occurs, the higher the chance for obesity later in life.

Second, although some have criticized using only BMI to measure improved health in this age group,[42] others have suggested that simply conducting BMI measures independently of other intervention components constitutes an effective public health obesity prevention strategy by drawing the attention and awareness of the public, schools, and parents to the results.[43] Indeed, BMI for age has been shown to be a more valid measurement tool than others (Rohrer index) for predicting overweight in children.[44] Additionally, skinfold thickness measurements may not be practical for some community-based interventions because of lack of availability of professional staff resources to support a train-the-trainer model for measurement oversight like the one here, as well as time constraints, experience of the staff, or scope of the assessment.

Our next key findings show that although not statistically significant, several strength (sit-ups and push-ups) and cardiovascular physical fitness tests (PACER test, significant improvement) improved for both weight groups, and the percentage of participants with normal systolic blood pressure significantly increased in the overweight group. There are emerging data to suggest that cardiovascular fitness may attenuate some of the factors contributing to metabolic syndrome in adolescence independent of excess weight.[45,46] Adult studies have shown that higher levels of fitness provide greater protection against early morbidity and mortality attributable to cardiovascular disease.[47] The findings here suggest that lifestyle interventions such as Fit-2-Play that incorporate daily physical activity can be the cornerstone of both preventing and treating childhood obesity while simultaneously improving cardiovascular health outcomes as children grow.

The after-school setting in particular can provide an alternative setting for obesity prevention and wellness activities with potential for significant impact (8 million children attend after-school programs in the United States[12]). Yet this setting, and the park setting in particular, has remained relatively understudied as an alterna-

Table 4
Change in Health and Wellness Knowledge Over the 10-Month 2011–2012 School Year by Weight Status Group*

	Normal Weight (N = 210)‡				Overweight/Obese (N = 139)§			
Test Items/Variables†	Baseline % Correct, Mean (SE)	10-mo % Correct, Mean (SE)	Change, %‖	p	Baseline % Correct, Mean (SE)	10-mo % Correct, Mean (SE)	Change %	p
Being physically active is only for athletes	84.6 (3.6)	90.2 (2.7)	−5.6	0.10	85.5 (4.0)	90.8 (3.1)	−5.3	0.22
It is healthy to eat fruits and vegetables at every meal	80.1 (4.5)	90.1 (2.9)	−10.0	0.01	79.5 (5.2)	92.2 (2.9)	−12.6	0.01
Fruits and vegetables are full of nutrients and vitamins	84.1 (4.7)	92.7 (2.7)	−8.6	0.01	80.8 (5.9)	93.3 (2.9)	−12.4	<0.01
It is good to exercise an hour a day	80.8 (5.2)	87.3 (3.9)	−6.5	0.10	85.3 (4.9)	87.7 (4.3)	−2.4	0.62
Watch TV instead of exercise	82.1 (5.2)	85.4 (4.5)	−3.4	0.40	77.1 (6.6)	89.6 (3.9)	−12.5	0.02
I should limit the amount of TV	74.1 (4.9)	80.0 (4.2)	−5.9	0.19	81.1 (4.7)	84.5 (4.1)	−3.4	0.50
How does being physically active help your body	71.1 (6.0)	83.2 (4.3)	−12.1	<0.01	68.2 (6.8)	80.6 (5.2)	−12.3	0.04
Identify the activity that is most physically active	81.6 (4.4)	88.6 (3.2)	−7.0	0.07	86.7 (4.1)	91.1 (3.2)	−4.4	0.32
Identify the bad drink	67.0 (6.4)	81.4 (4.6)	−14.4	<0.01	66.4 (7.0)	82.7 (4.8)	−16.3	<0.01
Overall composite	6.8 (0.1)	7.6 (0.1)	−0.8	<0.01	7.0 (0.2)	7.9 (0.2)	−0.9	<0.01

* Items analyzed with a generalized linear mixed model. Composite analyzed with a general linear mixed model.
† Adjusted for age, sex, ethnicity, and park.
‡ Body mass index <85th percentile for age and sex.[14]
§ Body mass index ≥85th percentile for age and sex.[14]
‖ Change represents difference between baseline and 10-month mean percentage.

tive to school-based intervention efforts. Those studies that have occurred in school-based and YMCA after-school settings show that in general, this time of day can successfully promote health and wellness[48,49] and even treat obesity successfully[50,51] among participants. Our parks-based results here confirm these previous studies while offering a new setting in terms of a community-based resource available to address the health-related consequences of the current childhood obesity epidemic.

Our last key finding was that Fit-2-Play participants significantly improved their knowledge of healthy lifestyle behaviors and nutrition choices. Other studies have shown that an increase in nutrition knowledge results in increased vegetable and fruit consumption,[52] whereas others have seen no effect.[53,54] The Fit-2-Play program will begin to pilot a healthy snack program in the 2013–2014 school year so acceptance and consumption of healthy snack choices can be incorporated into the evaluation moving forward.

Collectively, the findings here provide support for a current national "Park Prescriptions" movement to create a healthier population by strengthening the connection between the health care system and public lands across the country.[54] The goal of this movement is to increase the prescription of outdoor physical activity to prevent or treat health problems resulting from inactivity and poor diet. However, whereas Fit-2-Play is conducted in a climate where children can be outdoors year-round, this may not be feasible for other parts of the country, and in places where a significant proportion of the school year occurs during the winter months. Although outdoor play should be encouraged and conducted as frequently as possible, a modified version of the Fit-2-Play after-school program could reasonably take place in an indoor setting as well if adequate space (e.g., gymnasiums, gyms, large classrooms, large open spaces) were available for daily physical activity and a quieter, smaller space were available to conduct the health and wellness lessons once or twice a week. One of the particular benefits of a parks-based after-school program is that in many parks both outdoor and indoor settings (e.g., recreational centers) are available to conduct a health and wellness program such as Fit-2-Play in the case of inclement weather.

Limitations

The main limitation of the study was not including a randomized no-treatment control group. Although this study design is ideal, it is not always feasible in community-based programs such as this one. If resources can be focused on intervention and measurement fidelity rather than spreading staff and equipment across multiple control sites, this may be a more realistic approach to such efforts as this. A second limitation was not having a higher proportion of Fit-2-Play participant parents sign the consent form to have their child's data collected. This may be a reflection of parents' hesitancy to sign paperwork given the high mistrust levels of government in the county. However, pediatricians in our local community state that they are in need of community-based resources to which to send their families who either (1) ask for affordable, accessible and convenient programs for their children to participate in that will ensure their health and wellness or (2) have an overweight or obese child who could have immediate physical and mental health benefits from participating in a consistent obesity prevention program. Finally, a third limitation of the study was that physical activity was not directly measured (e.g., with accelerometers) during the program.

How the existence of community parks and health and wellness programming is related to overall physical activity levels and health of its residents is just now gaining traction in the literature. However, given the intersection of the current national economic climate and obesity crisis, it will be increasingly important to capitalize on existing resources such as our local, city, county, state, and national park systems to conduct prevention efforts. Recent studies show that among adults, parks play an important role in the ability of that community's residents to be physically active and to maintain a normal body weight in large metropolitan areas.[54] Our results here show promising outcomes among children as well and suggest parks may be a bountiful resource in addressing the health consequences of the current childhood obesity epidemic.

SO WHAT? Implications for Health Promotion Practitioners and Researchers

What is already known on this topic?

Childhood obesity continues to be a major public health and clinical challenge. Few evidence-based community prevention resources are available to which pediatricians and other health care professionals can refer their overweight and obese patients who are not yet in need of specialist care or their normal-weight patients and families seeking general health and wellness after-school programs.

What does this article add?

This is the first comprehensive evaluation of an after-school, park-based obesity prevention program that emphasizes physical fitness and health and wellness education. These results suggest that participation in the program is an effective health promotion strategy regardless of weight status.

What are the implications for health promotion practice or research?

Findings here show that parks that incorporate after-school programs can be a significant community and public health referral resource for ethnically diverse families and the health care professionals serving them who are seeking affordable and accessible obesity prevention programs.

Conclusions

Results here show that (1) normal-weight participants maintained healthy BMI ranges and (2) overweight participants significantly decreased both BMI z scores and subscapular skinfold measurements and (3) improved their fitness levels, cardiovascular health, and health and wellness knowledge over one school year. These results suggest that participation in a park-based program is an effective health promotion strategy regardless of weight status. Moreover, these findings show that parks that incorporate after-school programs can be a significant referral resource for families and health care professionals with ethnically diverse patients seeking affordable and accessible obesity prevention and treatment programs.

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