

Providing Daily Physical Education to Improve the Health and Fitness Levels of African American Youth

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Abstract

Background: The purpose was to examine the effects of 45 minutes of daily physical education on the fitness performance of African American elementary and middle school youth.

Methods: A pre/post-test design was used with repeated measures analysis of variance. Experimental and control school participants were pre-tested (September 2010) and post-tested (May 2011) on the *FitnessgramR* physical fitness items (e.g., aerobic capacity, muscular strength and muscular endurance).

Results: Experimental elementary school females and males significantly improved on all sections of *FitnessgramR*'s fitness battery at the post-test assessment; whereas, there were no significant improvements among control elementary school females. Experimental elementary school females improved on aerobic capacity and push-ups significantly more than control elementary school females ($P=0.025$, $P<0.0001$, respectively). Experimental elementary school males improved on aerobic capacity, curl-ups, and push-ups significantly more than control elementary school males ($P=0.048$, $P=0.0002$, $P=0.048$, respectively). Consequently, experimental middle school females improved on these two assessments significantly more than control middle school females ($P<0.0001$, $P<0.0001$, respectively). Experimental middle school males significantly improved on all sections of *FitnessgramR*'s fitness battery at post-assessment; control middle school males only significantly improved on push-ups.

Conclusions: Providing 45 minutes of daily physical education can increase the fitness levels of African American youth.

Keywords: Physical education; Fitness levels

Introduction

Two decades ago a seminal paper entitled: Physical Education's Role in Public Health [1], clearly defined the role of public health in regards to the importance of daily physical education [1]. Twenty years later, the authors re-examined the rationale and goals of their original work in Physical Education's Role in Public Health: Steps Forward and Backward over 20 Years and HOPE for the Future [2].

Apparent from this retrospection is the continued importance of quality physical education to reduce society's ills linked to obesity, inactivity and physical education's role to improve the health and fitness of youth. Furthermore, the fitness levels of youth impact their ability to be physically active and low levels of fitness are linked to diabetes and cardiovascular disease [3]. However, the physical activity levels of youth continue to decline and childhood obesity remains a dangerous health threat. More than 33% of adolescents, approximately 25 million American children, are overweight or obese [4]. Overweight children and adolescents, compared to their non-obese peers, are more likely to have high blood pressure, high cholesterol, and diabetes [5]. These overweight children are more likely to become obese adults [6,7]. Moreover, a disparity in obesity exists between minority and

non-minority youth. Overweight and obesity rates are disproportionately higher among African American and Hispanic children and adolescents compared to White children and adolescents, putting minority populations at more risk for health complications associated with obesity [8]. Due to the disproportionate rates of obesity among minority groups, reducing disparities in obesity across racial groups has been identified as a major public health goal [9].

Participating in regular physical activity, a widely accepted preventive behavior, not only contributes to the overall health of youth but can also improve fitness and reduce the prevalence of obesity. Unfortunately, physical activity levels decline precipitously once children enter adolescence [6,7]. Females of all ages are less active than males--with adolescent girls less likely to meet the 60-minute per day activity recommendation compared to boys [7,10].

Physical education is where youth learn essential skills to become physically active adults--yet less than 4% and 8% of US public elementary and middle schools, respectively, provide daily physical education [11]. Evidence has demonstrated that increasing physical education by 60 minutes can substantially lower child body mass index (BMI) and odds of becoming obese [12]. Legacy Charter School is the only public school in South Carolina to provide all children, in all grade levels, 45 minutes of physical education, five days a week.

The primary purpose of the present study was to examine the effects of providing 45 minutes of daily physical education on the health and fitness performance of African American elementary and middle school youth attending a Title I charter school in South Carolina. The following purpose statement guided this study: a) purpose of the present study was to evaluate the effects of 45 minutes of daily physical education on *FitnessgramR* physical fitness tests [e.g., aerobic capacity (PACER), muscular strength and muscular endurance (Push-up and Curl-up)] [13]. One Title I elementary control school and one Title I middle control school were identified and utilized as comparisons.

Methods

Background on legacy charter school and title I

Legacy Charter School is a public Title I school. The purpose of Title I is to improve the academic achievement of the disadvantaged and to ensure that all children in the US have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging state academic achievement standards and state academic assessments [14]. Ninety-percent of all children attending Legacy Charter School are African American.

Physical education at experimental school and control schools

In the fall of 2009, Legacy Charter School in Greenville, South Carolina implemented a policy to provide 45 minutes of daily physical education to all students, kindergarten through high school. The physical education requirement for Greenville County School District for elementary schools (i.e., control) is 45 minutes-one day a week for grades 2nd-5th. Middle schools (i.e., control) provide 50 minutes of daily physical education for one semester in grades 6th-8th. Physical education at Legacy Charter School and both control schools were taught by certified physical education instructors. Elementary school physical education content at both the experimental school and control school utilized a developmental curriculum with an emphasis on fundamental skills. Middle school physical education at both the experimental school and control school utilized a multi-activity sport theme curriculum. Control middle school students in grades 6th-8th received 50 minutes of daily physical education daily for the fall semester only. Elementary control school students in grades 2nd-5th received only 45 minutes of physical education one day per week for the entire school year. All teachers and Legacy Charter School and both controls were certified by the state to teach physical education and are in good standing from the State's Department of Education.

Testing physical fitness using *FitnessgramR*

All participants completing the Informed Consent at the experimental and control schools enrolled in grades 2nd-8th participated in the present study. Internal Review Board (IRB) procedures were strictly followed. A pre/post-test design was utilized in the present study. Legacy Charter School and control school participants were pre-tested on *FitnessgramR* physical fitness test items during the first week of September, 2010. Study participants were post-tested at the end of the school year during the last two weeks of May, 2011. *FitnessgramR* physical fitness test items were administered by each school's physical educator(s) assisted by the research staff.

Measures of Physical Fitness Using *FitnessgramR*

FitnessgramR was developed by the Cooper Institute [13] in an effort to provide physical educators with a tool that would facilitate communicating fitness testing results to students and to parents. *FitnessgramR*'s physical fitness assessment program includes a variety of health related physical fitness tests designed to assess aerobic capacity (PACER), muscular strength, and muscular endurance (Push-up/Curl-up). There are several types of standards commonly used with fitness tests. *FitnessgramR* uses criterion-referenced health standards or standards associated with good health. Scientific information is used to determine the amount of fitness needed to meet minimum health levels. PACER (time in seconds to complete a 15-meter shuttle run for elementary school and a 20-meter shuttle run for middle school), push-ups (total no. possible), and curl-ups (total no. possible with a maximum of 75) are all evaluated as three separate continuous outcomes.

Institutional testing of *FitnessgramR*

Institutional Testing per *FitnessgramR* manual is designed to help teachers and educators determine the fitness level of groups of participants at the experimental and control schools. It is important to note that fitness scores will typically be higher at the end of the school year than they are at the beginning of the school year because the students are $\frac{3}{4}$ of a year older. Older students do better on fitness tests than younger students [13] Furthermore, a significant amount of fitness test performance can be explained by heredity [15-17]. Although maturation and heredity contribute to physical fitness, so does frequency and duration of physical education time.

Statistical Analysis

All analyses were performed with SAS version 9.2. Descriptive statistics were computed for the experimental and control schools by demographics using chi-square tests and t-tests. 2×2 repeated measures analysis of variance (ANOVA), a mixed effect linear model, was used to evaluate the effectiveness of 45 minutes of daily physical education on fitness performance (e.g., aerobic capacity, muscular strength and muscular endurance). Each analysis was stratified by gender and grade level (elementary school/middle school) and adjusted by age to help control for baseline differences by school. The mean change within school (experimental/controls) across time (pre/post), between schools at each time point, and the interaction between time and school was estimated for each outcome. The unstructured, compound symmetry or first-order autoregressive correlation structure was controlled for serial autocorrelation. Akaike's Information Criterion and Bayesian Information Criterion were used to select among correlation structures. The data met all assumptions required of a mixed effect linear model. All P-values are two sided with $\alpha=0.05$.

Results

Participants

Two Title I schools (one elementary and one middle) were identified as controls; however, the demography of the student population at the two control schools differed from the experimental school. Therefore, oversampling techniques were utilized to identify a representative comparison sample of participants at both control schools. Control school administrators oversampled by grade level to provide additional

classes with African American youth in grades 2nd-8th to serve as comparisons. The differences in demographics among the participants in grades 2nd-8th from the experimental and control schools are listed in Table 1.

Demographics	Experimental N=374	Control N=290	P-value
Gender, n (%)			
Male	194 (51.9)	151 (52.2)	0.960
Female	180 (48.1)	139 (47.9)	
Age (years), mean (std)	10.5 (2.1)	11.4 (1.8)	<0.0001
Grade Level, n (%)			
Elementary school	185 (49.5)	77 (26.6)	<0.0001
Middle school	189 (50.5)	213 (73.5)	

Table 1: Participants from experimental school and control schools by demographics, N=664.

***FitnessgramR* Findings: Aerobic Capacity, Muscular Strength, and Muscular Endurance**

Elementary school

Experimental elementary school females significantly improved on all sections of *FitnessgramR's* fitness battery at the post-test assessment;

whereas, there were no significant improvements among the control elementary school females (Table 2). Furthermore, experimental elementary school females who received 45 minutes of daily physical education improved on aerobic capacity and push-ups significantly more than the control elementary school females (P=0.025, P<0.0001, respectively).

<i>FitnessgramR</i> Tests	ES & Female				ES & Male			
	Experimental	Control	Experimental - Control	P-value†	Experimental	Control	Experimental - Control	P-value†
Pacer-Pre	20.7	25.3	-4.6 (-9.4, 0.1)	0.025	17.4	16.7	0.7 (-3.2, 4.7)	0.048
Pacer -Post	28.5	27.9	0.6 (-4.8, 6.0)		22.0	17.6	4.4 (0.3, 8.5)*	
Pacer - Post-Pre	7.8 (5.4, 10.2)*	2.6 (-1.3, 6.5)			4.6 (2.8, 6.4)*	1.0 (-2.2, 4.1)		
Curl up-Pre	18.8	31.0	-12.3 (-18.3, -6.2)*	<0.0001	12.6	22.0	-9.4 (-14.2, -4.6)*	0.0002
Curl up -Post	29.3	28.7	0.6 (-5.7, 6.9)		21.1	22.0	-0.9 (-5.8, 4.0)	
Curl up - Post-Pre	10.5 (7.3, 13.8)*	-2.4 (-7.6, 2.8)			8.6 (6.4, 10.8)*	0.1 (-3.7, 3.8)		
Push up-Pre	12.4	6.7	5.7 (2.8, 8.5)*	0.328	6.9	7.8	-1.0 (-3.3, 1.4)	0.048
Push up -Post	15.0	8.0	7.1 (4.1, 10.0)*		11.1	9.3	1.8 (-1.5, 5.0)	
Push up - Post-Pre	2.7 (1.2, 4.2)*	1.3 (0.1, 3.7)			4.2 (2.9, 5.6)*	1.5 (-0.8, 3.8)		
<i>FitnessgramR</i> Tests	MS and Female				MS and Male			
	Experimental	Control	Experimental - Control	P-value†	Experimental	Control	Experimental - Control	P-value†
Pacer-Pre	27.7	23.6	4.1 (-0.1, 8.4)	<0.0001	18.4	14.4	4.0 (1.4, 6.6)*	<0.0001
Pacer -Post	38.2	15.7	22.5 (17.8, 27.3)*		28.7	7.5	21.2 (18.2, 24.2)*	
Pacer -Post-Pre	10.5 (7.4, 13.5)*	-7.9 (-10.8, -5.1)*			10.3 (8.0, 12.6)*	-6.9 (-8.9, -5.0)*		

Curl up-Pre	36.5	38.6	-2.2 (-8.9, 4.6)	<0.0001	21.3	24.0	-2.7 (-7.2, 1.7)	<0.0001
Curl up -Post	52.7	24.0	28.7 (20.6, 36.9)*		33.4	14.0	19.4 (14.2, 24.6)*	
Curl up -Post-Pre	16.2 (9.5, 22.9)*	-14.6 (-20.8, -8.6)*			12.1 (7.9, 16.3)*	-10.0 (-13.6, -6.4)*		
Push up-Pre	13.7	6.3	7.4 (5.3, 9.4)*	0.141	6.1	5.7	0.4 (-1.4, 2.3)	0.184
Push up -Post	14.7	5.7	8.9 (6.9, 11.0)*		10.2	11.4	-1.2 (-3.7, 1.3)	
Push up -Post-Pre	1.0 (-0.6, 2.5)	-0.6 (-2.0, 0.8)			4.1 (2.2, 5.9)*	5.7 (4.1, 7.3)*		
†Test for an interaction between school and time. Differences may vary due to rounding. *P<0.05. †Test								

Table 2: Age-adjusted *FitnessgramR* test scores.

Similarly, experimental elementary school males significantly improved on all sections of *FitnessgramR*'s fitness battery at the post-test assessment; whereas, there were no significant improvements among the control elementary school males. In addition, experimental elementary school males who received 45 minutes of daily physical education improved on aerobic capacity, curl-ups, and push-ups significantly more than the control elementary school males ($P=0.048$, $P=0.0002$, $P=0.048$, respectively).

Middle School

Experimental middle school females significantly improved on aerobic capacity and curl-ups at the post-test assessment; whereas, there was a significant drop in aerobic capacity and curl-ups at the post-test assessment among control middle school females. Consequently, experimental middle school females who received 45 minutes of daily physical education improved on these two assessments significantly more than the control elementary school females ($P<0.0001$, $P<0.0001$, respectively).

Experimental middle school males significantly improved on all sections of *FitnessgramR*'s fitness battery at the post-test assessment; whereas, control middle school males only significantly improved on push-ups. Experimental control school males who received 45 minutes of daily physical education improved on aerobic capacity and curl-ups significantly more than the control middle school males ($P<0.0001$, $P<0.0001$, respectively). Moreover, there was a significant drop in aerobic capacity and curl-ups at the post-test assessment among the control middle school males.

Discussion

Fitness is essential to health [3] and participation in physical activity can improve the fitness levels of youth. Recent data demonstrates that low cardiorespiratory fitness is a greater contributor to mortality than traditional risk factors [18]. Regrettably, South Carolina is one of the nation's leaders in the percentage of children (50%) who do not participate in afterschool team sports or lessons and 83% of high school students currently do not attend daily physical education when in school [19]. Furthermore, 65% of high school students currently do not attend physical education classes in an average week [19]. The

CDC's State Indicator Report on Physical Activity for 2010 14 found that only 20% of high school students are physically active and 49% of middle school and 67% of high school students respectively, did not meet recommended levels of physical activity; and 38% of middle school and 66% of high school students, respectively do not attend physical education classes at least once a week [19].

Findings from the South Carolina Obesity Burden Report disseminated in 2011 found that 30% of all South Carolina high school students were either overweight or obese, with males (32.3%) more likely to be overweight or obese than females (26.8%). Although 16.3% of all high school students were considered overweight, the percent of female students who were overweight (18.4%) was greater than the percent of male students who were overweight (14.3%).

There were differences by race/ethnicity for both overweight and obese [8]. Though 16.3% of all SC high school students were considered overweight, the percent of African American high school students who were overweight (23.4%) was greater than the percent of overweight among their White counterparts (12.6%) [8]. This disparity increases when considering high school students who are obese. While 13.3% of all high school students are considered obese, the percent of African American students who were obese (17.6%) was also greater than the percent of overweight among their White counterparts (9.9%) [8].

The CDC provide several strategies schools can utilize to help students meet national physical activity recommendations-without negatively impacting academic performance that include increasing the amount of time students spend in physical education [7].

Conclusions

Findings from the present study demonstrate that providing 45 minutes of daily physical education can enhance fitness among African American youth. The US public school system functions as an egalitarian institution. Regardless of race, ethnicity, socio-economic status or gender, all children have the right to attend public school. For many children, it is their only opportunity to be physically active. The current emphasis on performance pedagogy and standardized testing such as the No Child Left Behind Act (NCLB), have led many school districts to reduce physical education offerings. In extreme cases the

amount of daily recess has also been drastically reduced or eliminated to increase classroom contact hours in an effort to boost test scores adversely affecting their overall health and their fitness levels [20].

Limitations

The primary limitation in the present study was the variability in sample sizes among the experimental and control schools. The experimental school in the present study is a small neighborhood Title I charter school with limited enrollment. A representative sub-sample of elementary and middle school control participants was re-analyzed following the initial analysis of the data. This analysis yielded similar results suggesting that sample size differential did not statistically affect the results.

The demography of the two control schools was also a limitation in the present study. Oversampling techniques were utilized to identify enough minority participants in grades 2nd-8th to serve as controls. Although the physical education curriculum at the experimental and control schools mirrored each other—the lessons were not identical.

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