PEER-REVIEWED ARTICLE

The Relationship Between Physical Fitness Levels, Physical Activity Levels and Academic Performance in a Hispanic Middle School

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ABSTRACT

This study examined the relationship between FitnessGram test results, self-reported physical activity levels (PAQ-C), CST scores, and cumulative GPAs of Hispanic middle school students in a large, inner city middle school. It was hypothesized that students who scored higher on the FitnessGram and reported higher levels of daily physical activity would also achieve higher academic performance levels. The results partially support the hypothesis because positive associations were found between fitness scores and academic performance for some of the subgroups. Similar to previous studies, the association between fitness and academics appeared to be stronger for females than males. Results varied by grade level with students in the 7th grade having a strong association between FitnessGram scores and academic performance, whereas there were only partial associations between those variables for the 6th and 8th grade students. In contrast with studies involving students in high socioeconomic areas, the results did not reveal a positive association between reported physical activity (PAQ-C results) and academic performance. This may be partially because academic performance was hampered by limited language skills. Higher levels of reported daily physical activity were positively associated with higher FitnessGram test scores.

Note: all tables cited in article can be viewed on pages 17—19.

It can be argued that students with high fitness levels tend to also perform at high academic levels (Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001). Studies have consistently shown there is a positive relationship between physical fitness test scores and academic achievement (Field, Diego & Sanders, 2001; Taras, 2005). Castelli, Hillman, Buck, and Erwin (2007) compared physical fitness test scores of 3rd and 5th graders and found them positively correlated to such academic achievement measures as math and reading standardized test scores and total Grade Point Average (GPA). A study conducted by Coe, Pivarnik, Womack, Reeves, and Malina (2006) also found a positive relationship between vigorous physical activity and higher grades in school. A study conducted by the California Department of Education (CDE, 2001), focused on 900,000 students enrolled in the 5th , 7th and 9th grades found another positive correlation between fitness test scores and academic accomplishments. Grissom (2005) compared the 2002 California FitnessGram scores of 5th, 7th, and 9th graders with their reading and mathematics scores on the Stanford Achievement Test and found a consistent, positive relationship. Further, Grissom (2005) found a higher correlation between physical fitness and academic test scores for females than males. Chomitz, Slining, McGowan, Mitchell, Dawson, and Hacker (2008) found, when examining the fitness, math, and English scores of 4th, 6th, and 8th grades in Massachusetts, the odds of passing both the Massachusetts Comprehensive Assessment System Mathematics test (MCAS) and the MCAS English test increased as the number of fitness tests passed increased ($p < .0001$ and $p < .05$, respectively). The results of these studies provide strong evidence regarding the potential of quality physical education programs to provide benefits for other academic subjects. Additionally, numerous studies have found differences in other demographic factors such as ethnicity and socioeconomics (Fahlman, Hall & Lock, 2006; Grieser, Neumark-Szteainer, Saksvig, Lee, Felton & Kubiki, 2008; Pangrazi & Corbin, 2008; Yoo, Lounsbery, Bungum & Gast, 2010).

In a study conducted by Johnson, Brusseau, Graser, Darst, & Kulinna (2010) adolescents in lower socioeconomic areas, have been shown to

be less physically active, in part, because they have less access to play and recreation areas than adolescents who live in more affluent areas). In addition, higher percentages of Hispanic adolescents are English Language Learners (ELL) than the statewide average and, as a group, Latino adolescents achieve below the state averages in California Standards Tests (CST) for English and Math (CDC, 2013). Consequently, while statewide studies have consistently shown a positive relationship between FitnessGram scores and other academic indicators, it appears to be important to determine whether that is also true for students at a predominately Hispanic, low socioeconomic school. In this study, FitnessGram test scores were compared to CST results in math, English, and GPA by self-reported physical activity levels using the Physical Activity Questionnaire for Older Children (PAQ-C) (Kowalski, Crocker & Donen, 2004). Fitness test scores were also compared by grade level and gender. Comparing results based on gender and grade level should provide a better understanding of the link between physical fitness, physical activity level, and academic performance for a predominantly Hispanic adolescent group.

Methodology

Participants: The data for this study was collected at a middle school (grades 6-8) located in Southern California. This particular middle school has an approximate enrollment of 2400 students and over 99% Hispanic. Approximately 24% were classified as ELL students and approximately 80% qualified for the free or assisted school breakfast/lunch program. Specifically, 232 middle school students, 119 boys and 123 girls ranging from the ages of 11-15 were evaluated and the sample size per grade level were as follows: 83 students in the 6th grade, 92 in the 7th grade and 57 in the 8th grade. One male physical education instructor taught all students and their scores were compared for the FitnessGram PAQ-C survey, CST-Math, and CST-ELA tests. Permission to utilize this data was provided by the school district IRB. Permission to complete the PAQ-C was achieved through a parent mailing that was sent to parent/guardians as part of a program information packet at the beginning of the school year. The FitnessGram scores were initially computed as part of the student assessment process.

Measurements: A total of four measurements were used to gather data for the study.

1. The FitnessGram test was administered to all the students using the standard testing procedure. The state of California requires that all students in the 5th, 7th, and 9th grade be tested using the fitness gram test. The FitnessGram uses criterion-referenced standards to determine whether a student is in the healthy fitness zone (HFZ) for aerobic capacity, body composition, muscular strength, muscular endurance, and flexibility. A student scoring in the healthy fitness zone achieved one point for each of the six tests that were passed. Overall PFT scores ranged from zero (none of the standards met), to six (all standards met or exceeded).

2. The Physical Activity Questionnaire for Older Children (PAQ-C) was filled out by all the students to determine their levels of physical activity. The PAQ-C was created to assess physical activity in school-aged children in grades 4-8, approximately ages 8-14. The questionnaire consists of 10 questions that require students to recall the amount of physical activity they performed in the past seven days. A score of 1 indicates the students' recent physical activity level was very low and a score of 5 indicates that students' recent physical activity level was very high.

3. Students in grades 2-11 are required to take the CST-Math and CST-English Language Arts portion of the STAR test. The CST-English Language Arts portions consist of 75 multiple-choice questions and the CST-Math consist of 65 multiple-choice questions. The test is scored by the state of California and scores range between 150 (low) and 600 (high).

4. Grade Point Averages (GPA's) were collected for the first semester of the school year. The GPA's calculations were based on all six classes the students took for that same semester. The scores have a possible range of 0.0 (lowest) to 4.0 (highest).

Procedures: The FitnessGram data was obtained by the physical education teacher testing all of the students during the month of March and then evaluating the results using the guidelines specified by the Cooper Institute (Cooper Institute, 2014). The physical activity levels of the students were collected by having all of the students complete the PAQ-C questionnaire. The questionnaire was calculated by hand, using the specifications required by the PAQ-C (Kowalski, Crocker, & Donen, 2004). The CST and GPA data were collected for the school by logging into a program known as "My Data". All of the data was then uploaded into an Excel spreadsheet.

Data Analysis: The data was analyzed using Excel and SPSS. One-way ANOVA was used to determine the significance ($p < .05$) between the means of the variables involved in the study.

Results

Table 1 shows a comparison of the mean scores of male and female students who passed and did not pass the FitnessGram. In addition, the means scores of

CST-Math, CST-ELA, GPA and PAQ-C are compared by gender. The results indicate that boys and girls who passed five or more subtests had higher mean scores in every academic category compared to the students who did not pass the Fitness gram test. The difference was significant ($p < .05$) for seven of the 12 categories. Compared to the boys, the girls FitnessGram scores had a stronger association with their academic scores for all four variables. The results also revealed a positive significant relationship between FitnessGram scores and PAQ-C scores for both boys and girls.

Table 2 shows the mean scores for the CST Math, CST ELA, GPA and PAQ-C by grade level between the students who passed at least five subtests of the FitnessGram test compared to the students who passed less than five subtests. While the 7th and 8th grade students who passed five or more FitnessGram subtests had significantly higher mean scores on all three academic variables compared to the students who passed less than five subtests, no significant differences were found at the 6th grade level. Self reported physical activity scores (PAC-Q) were significantly higher for students who passed five or more FitnessGram subtests.

Student mean scores for the CST-Math, CST-ELA, GPA and the FitnessGram are shown in Table 3. The scores are divided into three categories, depending on their PAQ-C results. The PAQ-C scores are divided into three categories: students who scored between 1-2.4, students who scored 2.5-3.4 and students who scored between 3.5 and 5. The results indicate that students who reported higher levels of daily physical activity scored significantly higher on the Fitness gram test, however there was no association with their scores on the academic indicators.

Discussion

This study examined the relationship between FitnessGram test results, self-reported physical activity levels, and academic performance of Hispanic middle school students in a large inner city middle school. It was hypothesized that students who scored higher on the FitnessGram and reported higher levels of daily physical activity would also achieve higher academic performance levels. The results partially support the hypothesis because positive associations were found between fitness scores and academic performance for some of the subgroups. Similar to the studies by Grissom (2005) and Coe et al. (2006) the association between fitness and academics appeared to be stronger for females than males. Specifically, girls who passed five out of six subtests of the FitnessGram had significantly higher scores for the CST-Math, ELA, and GPA than girls who passed fewer of the subtests (see Table 1). It is interesting that the results varied by grade level. Specifically, students in the 7th grade had a strong association between FitnessGram scores and academic performance, whereas there were only partial associations between those variables for the 6th and 8th grade students (see Table 2). These results contrast with those of statewide studies (CDE,2001; Castelli, 2007). A possible reason for the grade level differences may have been that group dynamics and motivation within specific classes affected the scores (Domangue & Solmon, 2010).

Surprisingly, the results did not reveal a positive association between reported physical activity (PAQ-C results) and academic performance. This may be partially due to the fact almost a quarter of the students at this school were reported as being ELL students and the average CST Math and English-Language Arts scores for these students were approximately 30 points below the statewide average (CDE, 2013). Consequently, regardless of their level of physical activity, their academic performance may have been hampered by limited language skills. It is important to note, however, that FitnessGram results were significantly associated with scores on the Physical Activity Questionnaire for Children (PAQ-C). That is, higher levels of self-reported daily physical activity were positively associated with higher FitnessGram test scores (see Table 3). These results contrast with Morrow & Freedsom (1994) who found a low relationship between fitness scores and physical activity among youth.

Limitations and Recommendations

A limitation of the results of this study may be student motivation. Higher or lower levels of student motivation may have impacted the scores for all of academic tests, the PAQ-C reporting, and the FitnessGram. In addition, the socioeconomic status may have impacted the results; other studies, based on state wide data, show that students with higher socioeconomic status generally perform better academically (Evans, 2004). Since many of the students were classified as being ELL students, their academic performance may have been hampered by limited language skills. In the future, examining other factors related to physical fitness such as aerobic capacity or body composition might result in more specific knowledge as to which components of physical fitness are most specifically related to higher academic performance. Identifying these specific components physical education programs may be able to provide more relevant and specific help to students who typically do not perform well on the FitnessGram test.

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TABLES

Table 1. Table 1 CST Math, CST ELA, GPA and PAQ-C Means by Gender for Middle School Students Who Passed 5 or More Fitness Gram Sub-Tests vs. Students Who Passed Less than 5 Subtests.

Academic score Variable (N)	Mean scores of students who passed less than 5 tests	Mean scores of students who passed 5 or 6 tests
CST-Math		
Boys (109)	327 (51)	339 (58)
Girls (123)	336 (60)	346 (63)
Total (232)	332 (111)	343 (121)
CST- ELA		
Boys (109)	314 (51)	327 (58)
Girls (123)	332 (60)	347 (63) *
Total (232)	324 (111)	337 (121) *
G.P.A.		
Boys (109)	2.22 (51)	2.26 (58)
Girls (123)	2.63 (60)	2.85 (63)*
Total (232)	2.44 (111)	2.57 (121) *
PAQ-C		
Boys (109)	2.57 (51)	2.95 (58)*
Girls (123)	2.40 (60)	2.62 (63) *
Total (232)	2.48 (111)	2.78 (121)*

*significant differences, $p < 0.05$

Table 2. Table 2 CST-Math, CST-ELA, GPA and PAQ-C Means by Grade Level for Students Who Passed 5 or More FitnessGram Sub-Tests vs. Students Who Passed Less than 5 Subtests

Academic Variables	Mean scores - passed less than 5 subtests	Mean scores – passed 5 or 6 subtests
CST-Math		
6th graders (84)	342 (50)	336 (34)
7th graders (92)	343 (35)	355 (57)*
8th graders (57)	301 (27)	326 (30)*
Total (232)	332 (112)	343 (121)*
CST-ELA		
6th graders (84)	323 (50)	326 (34)
7th graders (92)	341 (35)	352 (57)*
8th graders (57)	301 (27)	322 (30)*
Total (232)	324 (112)	337 (121)*
G.P.A.		
6th graders (84)	2.42 (50)	2.47 (34)
7th graders (92)	2.61 (35)	2.86 (57)*
8th graders (57)	2.27 (27)	2.10 (30)
Total (232)	2.44 (112)	2.57 (121)
PAQ-C		
6th graders (84)	2.49 (50)	2.76 (34)*
7th graders (92)	2.51 (35)	2.80 (57)*
8th graders (57)	2.42 (27)	2.75 (30)*
Total (232)	2.48 (111)	2.78 (121)*

*significant differences, $p < 0.05$

Table 3. A Comparison of CST-Math, CST-ELA and G.P.A. Mean Scores with Self-Report Physical Activity Level (PAQ-C)

Academics	PAQ 1-2.4 n=98	PAQ 2.5-3.4 n=109	PAQ 3.5-5 n=25
CST-Math	335	341	331
CST-ELA	332	330	329
GPA	2.34	2.68	2.45
FitnessGram	3.80	4.70	5.12*

*significant differences, $p < 0.05$