Fitness Assessment Comparison Between the “Jackie Chan Action Run” Videogame, 1-Mile Run/Walk, and the PACER

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Abstract

Objective: The purpose of this study was to examine whether a correlation existed among the scores of the “Jackie Chan Studio Fitness™ Action Run” active videogame (XaviX®, SSD Company, Ltd., Kusatsu, Japan), the 1-mile run/walk, and Progressive Aerobic Cardiovascular Endurance Run (PACER) aerobic fitness tests of the FITNESSGRAM® (The Cooper Institute, Dallas, TX) in order to provide a potential alternative testing method for days that are not environmentally desirable for outdoor testing.

Subjects and Methods: Participants were a convenience sample from physical education classes of students between the ages of 10 and 15 years. Participants ($n=108$) were randomly assigned to one of three groups with the only difference being the order of testing. The tests included the “Jackie Chan Action Run” active videogame, the 1-mile run/walk, and the PACER. Testing occurred on three different days during the physical education class. Rating of perceived exertion (RPE) was reported.

Results: Significant correlations ($r = -0.598$ to 0.312) were found among the three aerobic fitness tests administered ($P < 0.05$). The RPE for the “Jackie Chan Action Run” was lower than the RPE for the 1-mile run/walk and the PACER (3.81 ± 1.89 , 5.93 ± 1.77 , and 5.71 ± 2.14 , respectively).

Conclusions: The results suggest that the “Jackie Chan Action Run” test could be an alternative to the 1-mile run/walk and PACER, allowing physical education teachers to perform aerobic fitness testing in an indoor setting that requires less space. Also, children may be more willing to participate in the “Jackie Chan Action Run” based on the lower RPE.

Introduction

SCHOOL-BASED PHYSICAL FITNESS testing is an important component of monitoring the level of physical fitness of children. In a study examining enjoyment and its impact on school-based physical activity interventions, it was suggested that enjoyment had a positive effect on these types of interventions.¹ If enjoyment has an effect on physical activity interventions, might it also have an effect on participation in school-based physical fitness testing? In a review of the literature examining videogames and health-related behavior change, it was suggested that there is a very real possibility that playing videogames shows promise for promoting behavior change.² In a study examining the physiological cost and enjoyment of the “Wii Fit” active videogame (Nintendo®, Nintendo of America, Redmond, WA), the group enjoyment was greater for the Wii balance and aerobics games com-

pared with treadmill walking and jogging.³ This finding—that active videogames were found to be more enjoyable than traditional aerobic activities—might suggest that children would be more likely to participate in an activity that is more enjoyable when provided with a choice. Finding a method of physical fitness testing that is more enjoyable should increase participation based on the findings of these studies.^{1–3}

In a recently published report from the Robert Wood Johnson Foundation titled “School Policies and Practices to Improve Health and Prevent Obesity: National Secondary School Survey Results,” the percentage of students attending middle schools with any physical fitness testing in 2007 and 2008 was 73 percent and 75 percent, respectively.⁴ In a news release announcing a new program director, The Cooper Institute (Dallas, TX) stated that more than 86,000 schools nationwide and 14 countries use the FITNESSGRAM®

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fitness program that includes a variety of physical activity assessments.

In order to encourage children to participate fully in school-based physical fitness testing and to encourage them to adopt physical activity for life, it may be possible to utilize an active videogame ("exergaming") to assess aerobic capacity as an alternative to the 1-mile run/walk or the Progressive Aerobic Cardiovascular Endurance Run (PACER) included in the FITNESSGRAM fitness program. The option of exergaming to assess physical fitness instead of the 1-mile run/walk and/or the PACER would provide a test that would allow the testing to occur in an indoor environment that requires minimal space on days when the outdoor environment is not appropriate or available. The 1-mile run/walk requires the ability to cover a 1-mile distance, while the PACER requires the cones to be placed at a distance of 20 meters. A school may not have open indoor space adequate for either of these tests.

In addition, exergaming as an option may provide the opportunity for children to become more engaged in the physical fitness testing and may lead them to adopt a more active lifestyle throughout their lives. A study examining the concepts of fitness among middle school students suggested that their view of fitness was "fitness=looking good=being thin."⁵ In addition, the study suggested that students' knowledge of the type of exercise required for fitness was lacking. It is important that educators continue to establish curriculum to educate students about the benefits of physical activity for continued good health and to provide opportunities for students to establish habits that they can carry forward as they age. Exergaming may provide youth with such an opportunity.

Many investigators have examined the validity and the reliability of the 1-mile run/walk and the PACER, the two options for assessing aerobic capacity as part of the FITNESSGRAM.⁶⁻¹³ This work was done with children of a variety of ages, including middle school students. The test-retest reliability r values for the 1-mile run/walk varied for combined female and male data from >0.83 to >0.90 for children older than third grade level.^{7,9} Other studies suggested r values for females and males of 0.82 and 0.92, respectively. For younger students such as second graders, first graders, and kindergarteners, r values ranged from ≥ 0.70 to ≤ 0.56 .¹³ The test-retest reliability values for the PACER was $r=0.89$ for combined female and male data.¹⁰ For females, the r varied from 0.82 to 0.87, and for males the r varied from 0.83 to 0.91.^{8,11} The 1-mile run/walk and the PACER are easy to administer but do require a measured distance for both tests. Environmental conditions might require a teacher to conduct the tests indoors. Although it is possible to administer the PACER test indoors, it does require a large open space to set up a 20-meter shuttle run.

According to a recent *Morbidity and Mortality Weekly Report* from the U.S. Department of Health and Human Services, only 18.4 percent of students nationwide were physically active at a level that increased their heart rate or made them breathe hard for at least 60 minutes per day on all 7 days of the week.¹⁴ In addition, the report stated that 23.1 percent of the students nationwide did not participate in at least 60 minutes of any type of exercise that increased their heart rate or made them breathe hard at least 1 day out of the last 7 days. The report also stated that 24.9 percent of the students

played videogames or computer games for 3 or more hours per day on an average school day and that 32.8 percent watched television 3 or more hours per day.

As a result of the statistics associated with the lack of physical activity, the level of computer use to play videogames, and television viewing in the youth today, many investigators have examined the energy expenditure, level of intensity, and ability to increase levels of physical activity of active videogames referred to as exergaming.^{2,3,15-21} Most studies have suggested these videogames provide a level of activity equal to moderate or vigorous activity. Studies that have examined the health-related benefits of exergaming suggest that more research is required to draw concrete conclusions about the efficacy.²¹ However, there have been no investigations into the value of utilizing an active videogame as an alternative way to test physical fitness.

The purpose of this study was to examine whether the score (exergaming) from the "Jackie Chan Studio Fitness™ Action Run" active videogame (XaviX™, SSD Company, Ltd., Kusatsu, Japan) would correlate with the 1-mile run/walk and/or the PACER to provide yet another alternative that would require less space indoors for aerobic fitness testing and possibly be perceived as less strenuous.

Subjects and Methods

Participants

A convenience sample from physical education classes from a local school was recruited to participate. All students were between the ages of 10 and 15 years and free of diabetes, uncontrolled asthma, thyroid, heart or pulmonary disease, or a history of seizure. Descriptive data are presented in Table 1. In addition, all students had normal blood pressure, heart rate, and vision. An informed consent and a health survey were signed by all parents or legal guardians, and a child assent was signed by each participant. This study was approved by the Institutional Review Board of the University.

Materials and procedure

The participants were randomly assigned to one of three groups. The only difference between the groups was the order of testing. The groups included the following: Group A, "Jackie Chan Action Run," 1-mile run/walk, PACER; Group B, 1-mile run/walk, PACER, "Jackie Chan Action Run"; and Group C, PACER, "Jackie Chan Action Run," 1-mile run/walk. Testing was performed on three different days. A researcher was assigned to monitor each testing area. All researchers were cleared via the Federal Bureau of Investigation Live Scan prior to any contact with the participants. All participants reported to their regular Physical Education

TABLE 1. DESCRIPTIVE DATA

Variable	Females (n=60)	Males (n=48)	All (n=108)
Age (years)	11.90±1.22	12.10±1.08	11.99±1.16
Height (cm)	152.86±7.32	155.32±10.21	153.95±8.76
Weight (kg)	47.48±11.79	47.51±11.14	47.50±11.45
BMI (kg/m ²)	20.14±3.91	19.48±3.10	19.85±3.57

Data are mean±standard deviation values.

BMI, body mass index.

class on testing days. After taking roll, the teacher separated the students into one of three groups (A, B, or C). The students were then led by the researchers to their designated testing area.

1-mile run/walk. All participants in the 1-mile run/walk group ran the test at the same time. The participants were allowed to warm-up using the same protocol typically used in their Physical Education class. This protocol included walking to the track and a self-selected stretching routine. All participants were assigned an identification number. This number was put on a label and attached to his or her shirt. Upon the start signal, the participants were encouraged to run the 1-mile course as quickly as possible. They were encouraged with positive feedback as they ran such as “good job,” “keep it going,” “you are doing great,” etc. When they crossed the finish line, the number was removed from their shirt, and their total time was recorded on the label. Following the test, the participants were free to walk around to cool-down as they would normally do during their Physical Education class. Once all participants had completed the 1-mile run/walk and had ample time to cool-down, they joined the rest of the Physical Education class for the remainder of the period. No participant was left unattended at any time during the warm-up, testing, or cool-down. They were always accompanied by a researcher or the Physical Education teacher.

PACER. The PACER is a 20-meter multistage shuttle run where the participants run the 20-meter length in a gradually increasing pace following a prerecorded cadence. The cadence was set to music and increased every minute. Marks were placed 20 meters apart on the gymnasium floor, and participants were required to run from one line of marks to the other line of marks in time with the prerecorded cadence. All participants performed a short trial run to help them understand how to pace themselves. As with the 1-mile run/walk, a label was placed on the shirt of each participant. The participants all stood on the starting line, and the first beep indicated the beginning of the test. During the test, all participants were encouraged with positive feedback such as “good job,” “keep it going,” “you are doing great,” etc. When the participant was unable to make it to the marks on two consecutive beeps, the test was terminated. The score was recorded on the label from his or her shirt. When the test concluded, the participants were instructed to walk around to cool-down. Once all participants had completed the PACER and had ample time to cool-down, they joined the rest of the class for the remainder of the period. No participant was left unattended at any time during the warm-up, testing, or cool-down. They were always accompanied by a researcher or the Physical Education teacher.

“Jackie Chan Action Run.” This test was administered in an empty classroom. Before participation in the testing, the participants were taken to one of three stations (television with the “Jackie Chan Studio Fitness” installed) and were allowed time to familiarize themselves with the game. The “Jackie Chan Action Run” is a test that allows the participant to run on a mat, simulating a run through the streets of Hong Kong. The mat is 1,260 × 33 × 465 mm (width × height × depth), and it is required to be approximately 91–1,067 cm from the television and game module. The system requires a

television, the XaviX system, and the mat. During the 5-minute run, the participants must move side to side and jump to avoid obstacles. The game provides a score and the total number of steps taken during the 5-minute time period. On the day of testing, researchers reminded the participants of the procedures and then assisted by placing the game in the beginner mode for testing. The game was started and continued for 5 minutes. During the test, all participants were encouraged with positive feedback such as “good job,” “keep it going,” “you are doing great,” etc. Each participant's number of steps and total score on the game were recorded. When the test concluded, the participants were instructed to walk around to cool-down while other students finished the game. Once all participants had completed the “Jackie Chan Action Run” and had ample time to cool-down, they joined the rest of the class for the remainder of the period. No participant was left unattended at any time during the warm-up, testing, or cool-down. They were always accompanied by a researcher or the Physical Education teacher.

Body mass index

Before participating in the “Jackie Chan Action Run” videogame, all participants had their height measured to the nearest 0.50 cm using a standard stadiometer and were weighed to the nearest 0.10 kg using a balance scale. Height and weight were used to calculate body mass index (BMI). All height and weight measurements were assessed in a private area of the room such that only the participant and the investigator saw the value, in order to protect the participant's privacy. Measured height and weight were used to calculate BMI (weight in kilograms divided by height in meters squared). The participants were then assigned to one of two groups based on BMI: Those who had a BMI greater than the 85th percentile based on Centers for Disease Control and Prevention recommendations were classified as overweight, whereas those who were under the 85th percentile were classified as non-overweight.

Rating of perceived exertion

All participants reported their rating of perceived exertion (RPE) at the end of each of the three fitness assessments. The Children's OMNI scale of perceived exertion was used for this data collection.²² The scale had a numerical response range of 0 to 10. The words associated with the numeric values are 0=not tired at all, 6=tired, up to 9=very, very tired. This scale had been correlated with oxygen uptake and heart rate in children from 8 to 12 years of age with *r* values from −0.94 to 0.85.²³

Statistical analyses

All data were analyzed using the Statistical Package for the Social Sciences (SPSS version 17, SPSS, Inc., Chicago, IL). Descriptive data were calculated and are all reported as mean ± standard deviation (SD) values. A Pearson product-moment correlational analysis was used to examine the association of the 1-mile run/walk, the PACER, and the total steps taken during the “Jackie Chan Action Run.” An analysis of variance was used to determine if a difference among the RPEs reported for each of the three assessments existed. Participants were also divided by gender and weight

TABLE 2. GAME TESTING DESCRIPTIVE DATA

Variable	Females (n=60)	Males (n=48)	All (n=108)
1-mile run/walk (minutes)	9.46 ± 2.25	9.00 ± 2.14	9.26 ± 2.20
PACER (<i>n</i> shuttles)	34.40 ± 16.05	37.46 ± 15.50	35.76 ± 15.81
"Jackie Chan Action Run" (<i>n</i> steps)	1,184.90 ± 241.83	1,358.73 ± 206.58	1,262.16 ± 241.91
RPE			
1-mile run/walk	5.69 ± 1.78	6.23 ± 1.74	5.93 ± 1.77
PACER	5.34 ± 1.88	6.18 ± 2.38	5.71 ± 2.14
"Jackie Chan Action Run"	3.48 ± 1.86*	4.22 ± 1.87*	3.81 ± 1.89*

Data are mean ± standard deviation values.

* $P < 0.05$, lower than the 1-mile run/walk and the PACER.

PACER, Progressive Aerobic Cardiovascular Endurance Run; RPE, rating of perceived exertion.

category to see if differences existed. A Bonferroni post hoc analysis was used to determine where differences occurred. Statistical significance was set at $P \leq 0.05$.

Results

The number of steps during the "Jackie Chan Action Run" videogame correlated with the time on the 1-mile run/walk (-0.371 , $P < 0.01$) and the score on the PACER test (0.312 , $P < 0.01$). In addition, the 1-mile run/walk correlated with the PACER score (-0.586 , $P < 0.01$). When the female participants only were examined, the 1-mile run/walk correlated with the PACER (-0.571 , $P < 0.01$) but not with the "Jackie Chan Action Run." When the male participants were examined, the "Jackie Chan Action Run" correlated with the 1-mile run/walk (-0.524 , $P < 0.01$) and the PACER (0.402 , $P < 0.01$).

The RPE for the "Jackie Chan Action Run" was significantly lower than the RPE for the 1-mile run/walk and the PACER for the entire sample ($F_{2,108} = 39.16$, $P < 0.001$) and for both the females ($F_{2,108} = 25.34$, $P < 0.001$) and the males ($F_{2,108} = 15.47$, $P < 0.001$) separately (Table 2). When the data were examined by the weight groups (not overweight and overweight), the RPE was also lower for the "Jackie Chan Action Run" for both groups (mean ± SD, 3.89 ± 1.84 and 3.61 ± 2.01 , respectively). No differences were noted in the RPE between the PACER and the 1-mile run ($P > 0.05$).

Discussion

The "Jackie Chan Action Run" videogame correlated with the two aerobic assessment tools of the FITNESSGRAM: the 1-mile run/walk and the PACER. In addition, the RPE for the "Jackie Chan Action Run" videogame was significantly lower than the RPE for the 1-mile run/walk and PACER. Although the correlations were not as strong as expected, the results do provide information that should lead to further investigation of the "Jackie Chan Action Run" or another active videogame as a potential alternative to the 1-mile run/walk or the PACER for testing.

According to the results of this study, the "Jackie Chan Action Run" videogame could be a potential alternative to the 1-mile run/walk or the PACER. This could be a good alternative on days when it is not conducive to perform the assessments outside or when there is limited space available for assessments.

With the increasing number of children playing active videogames (exergaming), using the "Jackie Chan Action Run" to assess aerobic fitness may result in an increased participation

at a level that is sufficient for proper assessment. Using an active videogame may seem more fun than the 1-mile run/walk or the PACER. The RPE data in this study demonstrate that the students felt like they were doing less work while playing the game than while doing either the 1-mile run/walk or the PACER test. Therefore, the use of this type of game is seen as a possible alternative to the traditional testing that is done to examine fitness in youth. Also, a study examining a variety of exercise equipment and level of physical activity participation in children found that a greater variety of exercise choices appears to result in an increased level of exercise behavior.²⁴

Limitations of this study would include the limited age group and the omission of the comparison with actual measured maximal O_2 uptake. The next logical step of research would be to compare the results of an active videogame with an actual measured maximal O_2 uptake. This is difficult to accomplish with youth, but it would give more direct evidence to the functionality of this type of testing.

In conclusion, the findings of this study suggest that the "Jackie Chan Action Run" videogame is a potential substitute for the 1-mile run/walk and the PACER for assessment of aerobic fitness for middle school-aged children. The findings also suggest that this option of an active videogame would provide a good alternative on days when it is not feasible to take children outside and also when inside space is limited. In addition, based on the RPE findings of the study, it is suggested that children would be more willing to participate in aerobic fitness testing, as the perceived exertion is lower with the "Jackie Chan Action Run," regardless of BMI. Providing a variety of options for this type of testing may also result in a higher level of participation and, it is hoped, the establishment of a lifetime option for physical activity.

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Author Disclosure Statement

No competing financial interests exist for any of the authors.

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