A COMPARISON OF HISPANIC MIDDLE SCHOOL STUDENTS’ PERFORMANCE, AND PERCEIVED AND ACTUAL PHYSICAL EXERTION, ON THE TRADITIONAL AND TREADMILL ONE-MILE RUNS

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Summary.—The purpose of this study was to assess whether a treadmill mile is an acceptable FitnessGram® Test substitute for the traditional one-mile run for middle school boys and girls. Peak heart rate and perceived physical exertion of the participants were also measured to assess students’ effort. 48 boys and 40 girls participated, with approximately 85% classified as Hispanic. Boys’ mean time for the traditional one-mile run, as well as peak heart rate and perceived exertion, were statistically significantly faster and higher, respectively, than for the treadmill mile. Girls’ treadmill mile times were not statistically significantly different from the traditional one-mile run. There were no statistically significant differences for girl’s peak heart rate or perceived exertion. The results suggest that providing middle school students a choice of completing the FitnessGram mile run in either traditional one-mile run or treadmill one-mile format may positively affect performance.

Fitness testing has been an integral component of most K–12 physical education programs since the creation of the President’s Council on Physical Fitness during the 1950s (Morrow, Weimo, Franks, Meredith, & Spain, 2009). The FitnessGram is one of the most frequently implemented youth fitness test programs in the United States (Keating & Silverman, 2004; National Association for Sport and Physical Education (NASPE), 2004; Cooper Institute, 2010). One of the six subtests of the FitnessGram is the one-mile run which is used, along with students’ Body Mass Index (BMI) scores, to assess whether a student has achieved a time within the “healthy zone,” a criterion-based standard that varies by age, gender, and body composition (Cooper, 2010). Performance on the one-mile run has been shown to have a strong correlation with VO2 max (Buono, Roby, Micale, Sallis, & Shepard, 1991; George, Vehrs, Allsen, Fellingham, & Garth-Fisher, 1993; Hunt, 1995). Consequently, satisfactory performance on the one-mile run by a high percentage of students is considered to be an important goal of the National Association of Sport and Physical Education (NASPE, 2004). Traditionally, most one-mile runs are administered in groups with students’ times clearly visible to all other students.

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DOI 10.2466/03.06.PMS.116.2.505-511  ISSN 0031-5125
Because the one-mile run is normally conducted in a large class setting without provisions for confidentiality, the experience may be demotivating and/or embarrassing for some students (Hopple & Graham, 1995; Kerner, Kurrant, & Kalinski, 2004). The PACER, a shuttle run, which has been used as a substitute for the one-mile run, allows slower runners to drop out as soon as they cannot keep up with the cadence. The PACER does not provide confidentiality and the experience resembles an elimination match, with only the top performers still running at the end. An alternative to both the traditional one-mile run and the PACER is for students to complete the run on a computerized treadmill. Potential advantages of the treadmill run include constant air resistance, temperature, uniform surface conditions, and confidentiality.

Previous research regarding the correlation between treadmill and traditional distance running performance is mixed. McNaughton, Hall, and Cooley (1998) reported that for a group of adult males ($M$ age = 20 yr.) the 1.5-mile run had a correlation of .87 with VO$_2$max, whereas the correlation of a treadmill jogging test with VO$_2$max was .50. In contrast, Tolfrey, Hansen, Dutton, McKee, and Jones (2009) found a strong correlation between a traditional 2-mile run and treadmill running endurance for adult men ($M$ age = 28 yr.).

The current study had two aims: firstly, to compare middle school boys’ and girls’ times for the traditional and treadmill one-mile runs, and secondly to compare peak heart rate and perceived physical exertion of the participants to assess students’ efforts in the two tests. Given the dearth of studies in this area, it was hypothesized that both middle school boys and girls would be successful in achieving comparable times on the treadmill and the traditional one-mile runs.

**Method**

Middle school students enrolled in four different physical education classes in a southern California middle school ($N = 120$; 6th–8th graders) were asked to return a completed Physical Activity Readiness Questionnaire (PAR–Q) and a signed informed consent form from a parent or guardian (Kennedy & Yoke, 2005). Prior permission to conduct the study was secured through both the school district and university Institutional Review Boards. Forty-eight boys and 40 girls returned completed Questionnaires and were included in the study. The published student ethnic percentages for the middle school were 84.7% Hispanic, 7.9% Caucasian/White, 3.1% African American, 2.4% Asian American, and 2.0% other. The age of the girls ranged from 11–15 years (11 yr., $n = 7$; 12 yr., $n = 10$; 13 yr., $n = 10$; 14 yr., $n = 10$; 15 yr., $n = 2$). The age of the boys ranged from 11–14 years (11 yr., $n = 6$; 12 yr., $n = 16$; 13 yr., $n = 21$; 14 yr., $n = 6$; 15 yr., $n = 2$).
Each student was given a 5-min. practice run or walk on the treadmill, with a quick tutorial regarding how to adjust the platform speed. Students were also provided instruction and practice in using the Borg Perceived Exertion Scale to estimate their RPE after both the traditional treadmill one-mile runs (Borg, 1970; Pfeiffer, Pivarnik, Womack, Reeves, & Malina, 2002; Mielke, Housh, Malek, Beck, Schmidt, & Johnson, 2008). Past research has shown that girls and boys as young as 7 years of age can use a perceived exertion scale (RPE) accurately (Groslambert, Monnier, Grange, & Rouillon, 2005; Eston, Lambrick, & Rowlands, 2009).

Prior to each run, students were asked to give their best effort throughout the activity. Students in Group 1 (20 girls, 24 boys) performed the traditional one-mile run in Week 1 and the Treadmill one-mile run exactly 7 days later (Week 2); students in Group 2 (20 girls, 24 boys) performed the Treadmill one-mile in Week 1 and the traditional one-mile run exactly 7 days later (Week 2). All students wore Polar E-600 Heart Rate Monitors during both traditional one-mile and treadmill one-mile runs. Each participant recorded their perceived exertion on the Perceived Exertion Questionnaire (Borg, 1970; Pfeiffer, et al., 2002; Mielke, et al., 2008) immediately after completing the treadmill and traditional one-mile run runs.

Students performed the traditional one-mile run on an outdoor, 440-yard grass track. Researchers measured all student times on a Seiko System Stop Watch S149. For the treadmill one-mile run, treadmills were adjusted to a 1% grade to equalize the energetic cost of running on a traditional grass mile track (Jones & Doust, 1996). Approximately 10 students at a time performed the one-mile run/walk on Trotter 545 Super Trainer Treadmills. At any time, participants were allowed to change speed to run at a sustainable pace. Participants were required to maintain a minimum speed of 3 mph unless unable to physically continue. Students were asked to give their best efforts; however, they were allowed to stop the treadmill and terminate their test for any reason.

All treadmills had spotters to insure that the participants were using the treadmills properly. Three research assistants monitored the performance of each student participant during the testing periods and recorded both time and heart rate monitor data. Researchers used SPSS to compare results for boys and girls for each variable using paired, one-tailed t tests (p < .05).

**Results**

The girls’ times were not statistically significantly different for the treadmill mile than for the traditional one-mile run. Boys’ times were statistically significantly faster for the traditional one-mile run than for the
treadmill one-mile run (Table 1). Results indicate the boys had statistically significantly lower peak heart rates for the treadmill run than for the traditional one-mile run and statistically significantly lower perceived exertion scores for the treadmill mile in comparison to the traditional one-mile run. In contrast, there were no statistically significant differences between girl’s scores for either peak heart rate or perceived exertion.

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**DISCUSSION**

The boys’ traditional one-mile run test times may have been enhanced because of participants’ familiarity with the protocol as compared to the treadmill run; given additional practice on the treadmill, their times might have improved. It is also possible the variance in boys’ traditional and treadmill one-mile run times in this study was at least partially due to non-physiological factors. The boys may have found treadmill running to be an isolated and much less motivational environment than running in an outdoor environment in which they could measure, while running, their performance against their peers (Frick, 2011). The boys’ lower peak heart rates and perceived exertion scores during the treadmill mile appear to affirm lower motivation compared to when they performed the traditional one-mile run. Given that males have been shown to respond more positively to a comparative or competitive environment than females, the results suggest that working individually on a treadmill may have negatively affected boys’ motivation to perform at their highest ability (White, Duda, & Keller, 1998).

The results support the hypothesis that the girls would achieve comparable times on the treadmill and traditional one-mile runs. In contrast
to the boys, the girls had statistically non-significantly faster times and higher peak heart rates for the treadmill one-mile run than for the traditional one-mile run; the effect size of the differences were small. These results suggest the girls either adapted more quickly than the boys to the functioning of a treadmill, or felt more comfortable than the boys in the treadmill-testing environment. These results also suggest the treadmill one-mile test is an acceptable substitute for the traditional-mile run for middle school girls. It is noteworthy that Mahar, Rowe, Parker, Mahar, Dawson, and Holt (1997) also found differences when comparing boys’ and girls’ scores on the PACER vs the traditional one-mile run.

Limitations and Conclusions

These results are limited to middle school students. In addition, given that almost 85% of the participants were Hispanic, the results may not be generalizable to other ethnic groups (Fahlman, Hall, & Lock, 2006).

Based on the results, it appears important to provide all middle school students a choice of completing the one-mile run in either a traditional or treadmill format. In addition to helping students feel comfortable and motivated in the testing environment, a choice between the two formats would provide a confidential environment for those who do not want their performances scrutinized by others. In addition, since many fitness clubs provide treadmills, familiarizing students with treadmills during middle and high school fitness assessments might increase the likelihood they will utilize a treadmill once they reach adulthood.

Further studies should examine treadmill running performances for other age groups and with various ethnic compositions in K–12 schools. The participants in this study were not asked detailed questions about their feelings and preferences for the traditional and treadmill one-mile runs. This information could be extremely valuable in understanding students’ motivation and performance. Finally, because the FitnessGram mile is a criterion-based test in which students strive to achieve results in the Healthy Zone, a practical use of treadmills for middle school fitness testing would be to preset the treadmill to a specific time depending on the gender, age, and BMI of the student and require them to elevate their heart rates to a productive level for an entire mile to meet the criterion-based FitnessGram standard. Given the results of this study, this type of alternative-testing environment could benefit some students, particularly girls. Secondary physical education departments should be encouraged to solicit grants and donations to secure treadmills for use with their students, not only for fitness assessment, but for use during daily physical education activities.
REFERENCES


Accepted January 30, 2013.