

Research Paper

Reliability and convergent validity of the 6-min run test in young adults with Down syndrome

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Abstract

Background: There is limited evidence about the psychometric properties of field tests to measure cardiorespiratory fitness in people with Down syndrome.

Objective: This study aimed at analyzing the reliability and convergent validity of the 6-min run test when performed by young adults with Down syndrome (DS).

Methods: In a cross-sectional design fifty-one young adults with DS (mean age 26.20 ± 7.14 years; 54% women) performed the 6-min run test and the 16-min shuttle run test twice with a one week-interval between test and retest.

Results: The 6-min run test offered high reliability for the distances covered (ICC: 0.974; 95% CI: 0.955–0.985) and good reliability when comparing peak heart rate values obtained in the test and retest (ICC: 0.870; 95% CI: 0.772–0.926). A significant correlation between the 6-min run test and the 16-min shuttle run test was observed for the test ($r = 0.705$; Sig = 0.001), and retest phases ($r = 0.651$; Sig = 0.001). The relationship between the estimated maximal oxygen consumption (VO_2 max) peak after the performance of the 16-min shuttle run test and the distance covered by the 6-min run test was statistically significant ($r > 0.7$). No significant differences were found between the equations that estimate VO_2 peak for both tests.

Conclusions: These findings suggest that the 6-min run test shows high test/retest reliability and moderate to moderately high convergent validity when performed by adults with DS. © 2016 Elsevier Inc. All rights reserved.

Keywords: Disability; Fitness; Measurement

People with Down syndrome (DS) usually present high levels of physical inactivity,¹ as well as various anomalies at the cardiovascular and metabolic levels, in addition to the regulation and control of the autonomous nervous system.² All of these factors have many negative consequences for their cardiorespiratory fitness.³ Taking into account that cardiorespiratory fitness is an important marker of health,⁴ it seems advisable to measure its levels periodically and to use specific tests that are adequate, feasible and whose effectiveness has been proved for these particular populations. In this respect, laboratory tests are considered to be the gold standard of supervised research trials, since they allow for the identification of cardiorespiratory fitness under controlled conditions without overlooking the importance of other statistical dimensions such as validity and reliability.⁵

Nevertheless, to carry out these types of tests presupposes that material resources are available, which means that incurring high costs and requiring the expertise of specialized personnel to take responsibility for administering them and controlling their appropriate performance participant by participant are unavoidable prerequisites. For this precise reason, field tests tend to be a widely employed alternative to assess cardiorespiratory fitness given their simple application, lower cost of administration, and the possibility of gathering several individual profiles simultaneously in a relatively short period of time.⁶ In spite of the clear advantages of this alternative testing methodology in people with DS, the use of field tests to measure cardiorespiratory fitness are not abundant, and their psychometric properties have mainly been studied in young children and adolescents.^{7,8} Indeed, to the authors' knowledge there have only been reports concerning the validity and reliability of two cardiorespiratory fitness field-based tests in adult populations with DS: the 6-min walking test and the 16-m shuttle run test (16-MSRT).^{9–11} Therefore, it seems that further research on the potential applicability of these tests for this population is required. In this regard,

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the 6-min run test (SMRT),¹² also known as 6-min walking run test, 6-min jog-walk test Mini-Cooper or Reduced Cooper test is a cardiorespiratory fitness field based test whose potential administration in adult populations deserves to be analyzed. This is due to the incontrovertible benefits that the test presents: ease of administration, short duration and self-regulation of the pace of execution. Consequently, this test has commonly been utilized to measure cardiorespiratory fitness levels in populations for which motivation is a limiting factor as regards assessment of top performance.¹³

A pilot research of recent publication¹⁴ confirmed the feasibility of the SMRT in adults with DS, but no study so far has analyzed its reliability and validity in this particular population. For this reason, the aim of the present study is to provide information about the reliability and convergent validity of the SMRT when it is administered to a sample population of adults with DS.

Methods

Participants

Participants were recruited from two DS associations located in a region of the Spanish northwest. A purposive sample of 51 young adults (27 female, 24 male; age range 19–47 years old) was invited to take part in the study. They were required to meet the following inclusion criteria: (a) presenting trisomy 21; (b) being over 18 years old; (c) not attesting any gross visual or organic defect; and (d) being able to follow simple instructions. Participants who showed associated motor or sensory disabilities or any kind of documented medical contraindications to perform strenuous exercise were automatically excluded. Participant associations did not disclose individual intellectual quotient (IQ) scores, even though all individuals had to be classified with mild ID, as determined by qualified personnel, to be selected for the trials. The participants' characteristics are described in Table 1. The research ethics committee of the University of Vigo approved the protocols that were designed for this study. All parents or legal guardians of the participants were informed in advance about the objectives and methodology of the tests to be performed, and they were requested to provide a signed consent, which included information related to the chronological age and gender of the participants.

Measurements

Anthropometry

Height and weight were measured with participants in light clothing using a standard stadiometer (model 217, Seca, GE). Body mass index (BMI) was calculated as weight divided by height squared (i.e.: kg/m²). In accordance with the standard BMI classification for people with ID, participants were categorized as normal (BMI =

18.5–24.9 kg/m²), overweight (BMI = 25–29.9 kg/m²) or obese (BMI ≥ 30 kg/m²).¹⁵

6-Min run test

The SMRT is a modified version of the “Cooper Test” which has been judged as valid to assess cardiorespiratory fitness in healthy young adult populations.¹⁶ To perform the SMRT, participants were instructed to move as fast as possible around a quadrangular course (16 × 16 m), which was marked by plastic cones, for a period of up to 6 min. Participants had to cover as much distance as possible running, walking or alternating both. Distances were registered in meters once the set time was up.

The 16-MSRT is a modified version of the 20-m shuttle run test,¹⁷ which has shown high reliability (ICC = 0.99) and good criterion-related validity ($r = 0.87$) against VO₂ peak when assessing aerobic capacity in adults with DS.^{9,10} The 16-MSRT is an incremental test with a starting speed (8.5 km/h) that increases in 0.5 km/h for each interval of 1 min (said intervals are also known as levels) until exhaustion. To perform the test, a 16-m course was marked using two strips of tape at opposite ends of the course. A 16-m-long measuring tape was placed alongside the course to one side, later adding perpendicular dotted lines to quantify the distance covered by each of the participants more easily. Participants were instructed to run and shuttle back between the two lines according to the pace set by a sound signal, which was played from a CD. The test ended when the participant was unable to complete the 16-m course for two consecutive times before the sound signals were heard. For the purposes of this study, the total number of laps (complete runs performed between the lines), levels and meters achieved when the participants finished the test were all registered.

Procedures

The present study was carried out over a period of four weeks. During the first week, anthropometric data were gathered and the protocol of both tests carefully explained. A practice session was organized with the aim of making participants more familiar with the appropriate test execution. This was done with the intention of providing pacing training and avoiding a “learning effect” in subsequent stages. Week two (test) saw the participants carry out SMRT and, 48 h later, they performed the 16-MSRT. After an assessment-free week, both tests were administered once again during week four (retest). Thus, the participants were tested twice with a one week-interval between test and retest. The performance of both tests followed the same protocol. Participants were classified in small groups (3–5 people) after a supervised warm-up phase consisting in 5 min of gentle stretching and joint mobility exercises. A group of assistants collaborated by giving verbal reference pace in order to motivate and encourage participants to perform each test at full capacity. In both tests, the protocol

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