

ORIGINAL RESEARCH

Validity and Reliability of Skill-Related Fitness Tests for Wheelchair-Using Youth With Spina Bifida



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Abstract

Objectives: To determine content validity of the Muscle Power Sprint Test (MPST), and construct validity and reliability of the MPST, 10×5 Meter Sprint Test (10×5MST), slalom test, and One Stroke Push Test (1SPT) in wheelchair-using youth with spina bifida (SB).

Design: Clinimetric study.

Setting: Rehabilitation centers, SB outpatient services, and private practices.

Participants: A convenience sample of children and adolescents (N=53; 32 boys, 21 girls; age range, 5–19y) with SB who use a manual wheelchair. Participants were recruited through rehabilitation centers, SB outpatient services, pediatric physical therapists, and the BOSK (Association of Physically Disabled Persons and their Parents).

Interventions: Not applicable.

Main Outcome Measures: Construct validity of the MPST was determined by comparing results with the arm-cranking Wingate Anaerobic Test (WAnT) using paired *t* tests and Pearson correlation coefficients, while content validity was assessed using time-based criteria for anaerobic testing. Construct validity of the 10×5MST, slalom test, and 1SPT was analyzed by hypothesis testing using Pearson correlation coefficients and multiple regression. For reliability, intraclass correlation coefficients (ICCs) and smallest detectable changes (SDCs) were calculated.

Results: For the MPST, the mean ± SD exercise time of 4 sprints was 28.1±6.6 seconds. Correlations between the MPST and arm-cranking WAnT were high ($r > .72$, $P < .01$). Excellent correlations were found between the 10×5MST and slalom test ($r = .93$, $P < .01$), while correlations between the 10×5MST or slalom test and MPST and 1SPT were moderate ($r = -.56$ to $-.70$; $r = .56$, $P < .01$). The variation of the 1SPT was explained for 38% by wheelchair mass ($\beta = -.489$) and total upper muscle strength ($\beta = .420$). All ICCs were excellent (ICCs > .95), but the SDCs varied widely.

Conclusions: The MPST is a valid and reliable test in wheelchair-using youth with SB for measuring anaerobic performance. The 10×5MST and slalom test are valid and reliable for measuring agility. For the 1SPT, both validity and reliability are questionable.

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Assessment and optimizing physical fitness in youth with chronic conditions such as spina bifida (SB) are important goals in pediatric rehabilitation.¹ About 50% of children with SB use a wheelchair as their main mobility, and a large number of

ambulatory children use a wheelchair for community mobility or sports.^{2,3} While several physical fitness tests have been developed for ambulatory youth with disabilities, evidence for wheelchair-using youth is lacking.^{4,5} Skill-related fitness is part of physical fitness as defined by Caspersen et al,⁶ and consists of power, speed, agility, coordination, balance, and reaction time. In daily life of wheelchair-using youth, skill-related fitness is reflected in activities such as playing outside or playing wheelchair sports.⁷ Since participation in outside play and sports is an essential goal in pediatric rehabilitation, assessment of skill-related fitness

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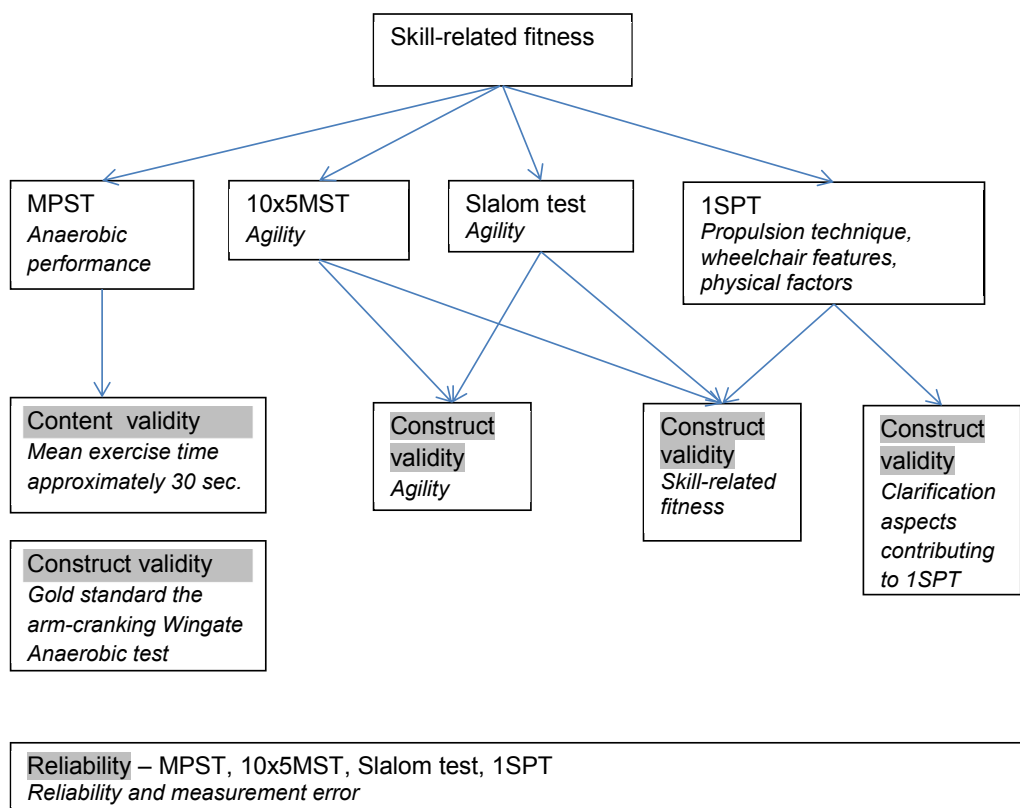


Fig 1 Overview of testing for field-based skill-related fitness tests in wheelchair-using youth with SB.

is important. This assessment enhances clinical reasoning and supports evaluation of training programs.

Field-based testing does not require expensive equipment, is task specific, and children use their own wheelchair, which is of great importance because it takes into account the wheelchair-user interface integration.^{4,8-12} For wheelchair-using people, several field-based tests have been developed in which aspects of skill-related fitness, such as power, speed, agility, and coordination, play an important role.

The Muscle Power Sprint Test (MPST), combining both power and speed, measures anaerobic performance during 15-m sprints.^{5,9,11,13} Content and construct validity of the MPST have been established for children with cerebral palsy (CP).^{9,11,13} Content validity is defined as “the degree to which the content of a measurement instrument is an adequate reflection of the construct to be measured.”^{14(p743)} Anaerobic performance contains short-term high-intensity exercise, with adenosine triphosphate, phosphocreatine, and glycogen being the dominant fuel

sources.^{13,15} Therefore, high-intensity exercise should be performed for a maximum of 30 seconds. In ambulatory youth with CP this results in 6 sprints, while for wheelchair-using youth with CP the total number of sprints is 3.^{9,11,13} Construct validity is “the degree to which the scores of a measurement instrument are consistent with hypotheses, for instance relationships to scores of other instruments.”^{14(p743)} The arm-cranking Wingate Anaerobic Test (WAnT) is the criterion standard laboratory assessment for anaerobic capacity in wheelchair-using people and is thus suitable to determine the construct validity of the MPST.¹⁵

Agility refers to acceleration, deceleration, and turning and is reflected by the 10×5 Meter Sprint Test (10×5MST) and slalom test.^{5,11,16} The One Stroke Push Test (1SPT) measures aspects of coordination (propelling technique) and also wheelchair features and physical factors (eg, strength).^{10,17} No criterion standards are available for the 10×5MST, slalom test, and 1SPT. However, identifying the relationships between these different skill-related fitness tests contributes to clarification of the underlying constructs.

Reliability concerns “the degree to which the measurement is free from measurement error” and consists of both reliability and measurement error.^{14(p743),18} While there is some evidence for validity and reliability of the MPST, 10×5MST, and 1SPT, evidence is lacking for wheelchair-using youth with SB. Therefore, the aims of this study were to determine (1) the content and construct validity of the MPST; (2) the construct validity of the 10×5MST, slalom test, and 1SPT; and (3) the reliability of the MPST, 10×5MST, slalom test, and 1SPT in wheelchair-using youth with SB.

Concerning content validity, we hypothesized that the total number of sprints of the original ambulatory version of the MPST (6 sprints)

List of abbreviations:

CP	cerebral palsy
ICC	intraclass correlation coefficient
MP	mean power
MPST	Muscle Power Sprint Test
1SPT	One Stroke Push Test
PP	peak power
SB	spina bifida
SDC	smallest detectable change
10×5MST	10×5 Meter Sprint Test
WAnT	Wingate Anaerobic Test

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