Concurrent Validity and Test-retest Reliability of a Submaximal Exercise Test in Adolescents with Autism Spectrum Disorder

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Background

Cardiorespiratory fitness (CRF) is a component of health-related physical fitness and is defined as the ability of the circulatory and respiratory systems to supply oxygen to the working muscles during sustained physical activity [1]. Therefore, CRF is also regarded as a reflection of total body health [2] and is considered as a vital health sign [2-4]. In adolescents, higher CRF levels are inversely associated with cardiovascular and metabolic risk factors as well as increased risk of premature cardiovascular morbidity. [3, 5-7]. In addition, recent literature indicates that higher CRF levels are inversely associated with depressive symptoms in adolescents [8]. However, research indicates that adolescents with Autism Spectrum Disorder (ASD) have lower CRF levels compared to their typically developing peers [9-11], increasing their risk to develop adverse health outcomes. Despite the importance of CRF assessment, to our knowledge, no CRF tests have been validated in adolescents with ASD.

Purpose

To examine the concurrent validity and test-retest reliability of a submaximal exercise test on a bicycle (Astrand-Rhyming Test (ART)) in adolescents with ASD.

Methods

46 adolescents with ASD (n=23 boys, 12-18 years) will be included. Participants will perform the ART twice (test-retest reliability) and execute a maximal exercise test (Cardio Pulmonary Exercise Test (CPET)), which will be used as the criterion method (concurrent validity). The ART [12] is a single-stage cycle ergometer test to measure CRF levels, assessed as an estimation of VO₂ max. It is designed to elicit a steady-state heart rate over a six-minute period. The CPET is a maximal exercise test and includes regular respiratory gas exchange measurements during graded exercise up to maximal exercise. The determination of these gas exchanges is regarded as the gold standard to define VO₂ max.

Statistical Analysis

Preliminary analyses were conducted. Spearman's correlations, Intraclass Correlation Coefficients (ICC) and Bland-Altman plots with 95% limits of agreement (LOA) were produced to examine the association and level of agreement between ART 1 and ART 2 (test-retest reliability) and between the estimated VO₂ max (ART) and measured VO₂ max (CPET) (concurrent validity).



Preliminary Results

A high correlation (r = .820, p < .01) and good ICC (.720, p = .013) between the estimated VO₂ max values of ART 1 and ART 2 were found. The Bland-Altman plot was shown, with a mean bias of 0.02 ml/min/kg and -15.19 ml/kg/min – 15.23 ml/kg/min as 95% LOA. A moderate correlation (r = .580, p < .05), but poor ICC (.381, p = .014) between the estimated VO₂ max (ART 1) and measured VO₂ max (CPET) were found. The Bland-Altman plot was shown, with a mean bias of 11.56 ml/min/kg and -8.04 ml/kg/min – 31.15 ml/kg/min as 95% LOA.

Preliminary Conclusion

The ART seems to be reliable, but less valid to examine CRF in adolescents with ASD. However, this is an ongoing study and therefore, no firm conclusions can be made yet.

Ethical Approval

This study was approved by the Ethics Committee Research UZ/KU Leuven (s65474).

Informed Consent

All parents and participants give their informed consent and assent.

Competing Interests

None

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