

Development, inter-rater and intra-rater reliability of the modified resistance training skills battery

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The purpose of this study was to develop and assess the inter-rater and intra-rater reliability of a modified version (mRTSB) of the Resistance Training Skills Battery (RTSB)¹ for children with varying levels of motor proficiency.

Adequate muscular strength is required to perform fundamental movement skills (FMS) proficiently². The 'mastery' of FMS is described as contributing to the physical and social development of children³. Therefore, those who do not increase their strength and movement skill proficiency in the early years may not develop the motor skills needed to successfully participate in physical activities with confidence and enjoyment in the later years – a key aspect of developing and maintaining optimal health².

Children are more frequently being prescribed resistance training (RT) to improve fitness and health. Whilst research is indicating the role of RT in enhancing motor function in those with movement difficulties⁴⁻⁵, it is important to assess whether they are competent in basic RT skills before appropriate prescription can occur.



On two occasions children aged 6-12 years performed the mRTSB. In order to determine inter-rater and intra-rater reliability three raters independently evaluated the 6 RT skills. The test administrator assessed movement live, whilst additional raters scored performance based on video footage from frontal and sagittal plane. Before analysis, raters were given test instructions and video samples to establish what is considered 'acceptable' for each performance criteria for the 6 RT skills.

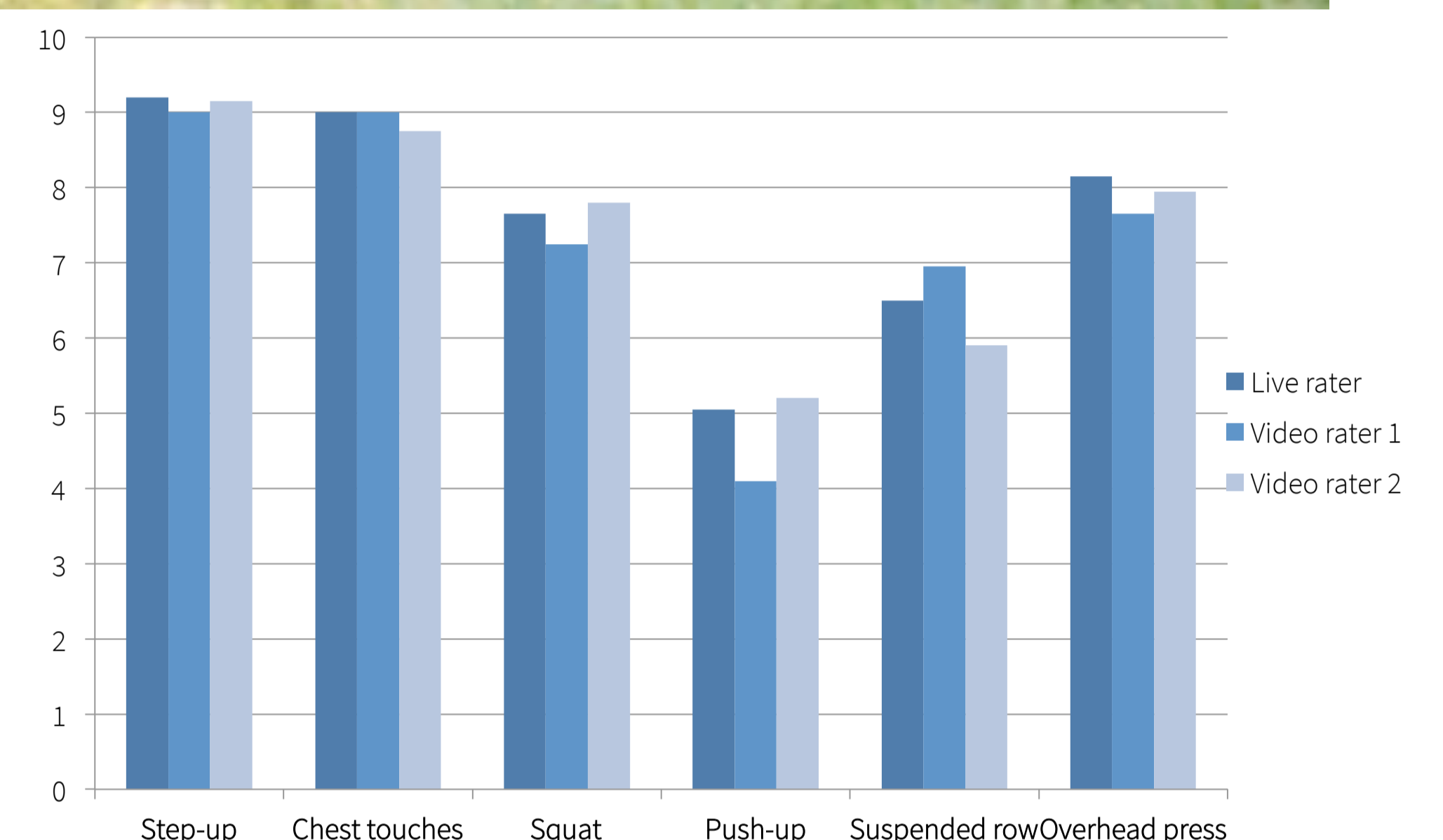


Figure 2. Mean for individual RT skills of the mRTSB for 3 raters for session 1.

Skill Depiction	Performance Criteria	Set 1	Set 2	Score
	<ol style="list-style-type: none"> Takes a step onto the box in one movement Torso is kept upright and stable throughout movement Knee of front leg is fully extended at the top of the movement Returns to starting position in a controlled manner, flexing through the lead knee in one movement No excessive valgus/varus movement of knee relative to hip and ankle 			
	<ol style="list-style-type: none"> Hands are shoulder width or slightly wider apart Head, back and hips are held in a straight line throughout the movement Body is lowered until elbows are at a 90 degree angle Shoulders are held down and away from ears (shoulders are not shrugged) 			

Participants performed 2 sets of 4 repetitions for 6 RT skills (step-up, front support with chest touches, squat, push-up, suspended row and overhead press). The best repetition performance score in each set was summed for a total RT skill score. RT skill scores were then summed for the modified resistance training skills quotient (mRTSQ).

Data analysis was performed using SPSS, with descriptive statistics calculated as mean values with standard deviation. Intra-class Correlation Coefficients (ICCs) were computed to determine the inter-rater and intra-rater reliability of the mRTSQ and individual RT skills of the mRTSB. Clinical significance was defined as good for an ICC 0.75 or above, moderate for 0.50–0.75, and poor for below 0.50⁷.

RESULTS

Twenty children between 6-12 years (mean age = 8.15, SD ± = 1.79) were recruited across a range of motor proficiency levels (MABC-2 range = 1-91).

Inter-rater reliability for the 3 raters (session 1) was very good for the mRTSQ (ICC = 0.97), step-up (ICC = 0.91), front support with chest touches (ICC = 0.93), squat (ICC = 0.92), push-up (ICC = 0.86), suspended row (ICC = 0.89) and overhead press (ICC = 0.87).

Intra-rater reliability of the live rater (session 1 & 2) was very good for the mRTSQ (ICC = 0.99), step-up (ICC = 0.97), front support with chest touches (ICC = 0.99), squat (ICC = 0.97), push-up (ICC = 0.93), suspended row (ICC = 0.90) and overhead press (ICC = 0.97).

DISCUSSION

The mRTSB has demonstrated very good inter-rater and intra-rater reliability, indicating it is a reliable tool to assess movement competency in selected RT skills in 6-12 year old children. Furthermore, reliability and feasibility was demonstrated in children with varied levels of motor proficiency, therefore increasing the ease of application across both clinical and community based paediatric populations.

Reliable measures for assessing RT skill competency and evaluating intervention effects have now been established for both adolescents (12-16 years)^{1,6} and children with varying levels of motor proficiency. In consultation with the original authors, cut-offs were also developed to determine competency in individual RT skills and overall readiness to begin a structured RT program. Competency in individual RT skills is achieved if 3/4 or 4/5 performance criteria are satisfied and competency across all 6 RT skills is required to be considered 'ready' to begin RT.

Therefore, the mRTSB has the potential to (a) evaluate the efficacy of school and community based RT programs, (b) assess individual progress and provide feedback in RT programs, (c) be used as a measurement tool in research focusing on movement skill competency, and (d) determine readiness for RT.

Further research is currently investigating the association between muscular fitness and RT skill competency in order to assess the construct validity of the mRTSB.

METHODS

The original RTSB was reviewed and age-appropriate amendments were made to make it suitable for children with various levels of motor proficiency¹. Development of the mRTSB was made in consultation with the original authors and a panel of experts in paediatric exercise. Modifications included: replacement of the lunge with the step-up and front support with chest touches was performed against a wall, as opposed to on the ground.

Key feedback from expert panel included minor wording changes to performance criteria and instructions. For example "back is kept straight and stable through the movement" was reworded to "neutral spine is maintained throughout the movement" as this allows the trunk to forward lean through hip flexion during the squat. Instructions were made easier to understand and supplemented with additional points regarding desired movement speed, to avoid participants dropping quickly during the return phase of each RT skill.

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