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Convergent and divergent validity between the KTK and MOT 4-6 motor tests in early childhood

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Abstract

The aim of this study was to investigate the convergent and divergent validity between the Körperkoordinationstest für Kinder (KTK) and the Motoriktest für Vier- bis Sechsjährige Kinder (MOT 4-6). A total of 638 children (5-6 years) took part in the study. The results showed a moderately positive association between the total scores of both tests ($r_s = .63$). Moreover, the KTK total score correlated higher with the MOT 4-6 gross motor score than with the MOT 4-6 fine motor score ($r_s = .62$ vs. .32). Levels of agreement were moderate when identifying children with moderate or severe motor problems, and low at best when detecting children with higher motor competence levels. This study provides evidence of convergent and divergent validity between the KTK and MOT 4-6. However, given the moderate to low levels of agreement, either measurement may lead to possible categorisation errors. Therefore, it is recommended that a child's motor behaviour should not be judged based on the result of a single test.

Introduction

Daily life activities challenge children to master different motor skills, i.e. goal-directed well-coordinated movement patterns of one or several muscle groups (Burton & Miller, 1998). The ability to perform a wide variety of gross and fine motor skills has been defined by some authors as motor competence (e.g. Fransen et al., 2014; Haga, 2008). As early childhood is a sensitive period to learn and develop motor skills, acquiring a certain level of motor competence during pre-school years increases the chance to become proficient in various sports and games in later life (Gallahue, Ozmun, & Goodway, 2012). Accordingly, adequate motor competence facilitates children's engagement and participation in physical activity (Barnett, van Beurden, Morgan, Brooks, & Beard, 2009; Lopes, Rodrigues, Maia, & Malina, 2011; Stodden et al., 2008).

In contrast, children with low levels of motor competence demonstrate lower levels of physical fitness and physical activity over time. For instance, the study of Green et al. (2011) showed that the low levels of motor competence in children with Developmental Coordination Disorder (DCD) at the age of seven contributed to the low levels of moderate-to-vigorous physical activity at the age of twelve [see also Barnett et al. (2009) and Hands (2008)]. In their model, Stodden et al (2008) refer to a negative spiral of disengagement in physical activity with low actual and perceived motor competence, low levels of physical activity, and low health-related fitness, leading to increased weight and obesity which in turn will stimulate further disengagement in physical activity.

Considering the importance of motor competence on health and well-being, there is a need to adequately identify and monitor the motor development in early childhood, especially in populations 'at risk' for motor delay or disorder, e.g. developmental disorders [DCD (Cairney, Hay, Faught, & Hawes, 2005), autism spectrum disorder (ASS; Gowan & Hamilton, 2013), or attention deficit hyperactivity disorder (ADHD; Piek & Dyk, 2004)]. Once motor problems are identified, adapted activity programs can be implemented to (partly) eliminate motor delays (e.g. Apache, 2005; Bardid et al., 2013; Goodway & Branta, 2003). Furthermore, good quality test batteries are also invaluable for monitoring progress after therapeutic practice.

To examine the level of motor competence in preschool children, several test batteries have been developed (for a review see Cools et al., 2009). Most test batteries are aimed at identifying children with motor problems (Barnett & Peters, 2004; Yoon, Scott, & Hill, 2006). These assessment tools can be product- and / or process-oriented; product-oriented tools measure the outcome of motor tasks (e.g. number of sideway jumps in a limited time) while process-oriented instruments focus on the quality of motor skills based on selected criteria (e.g. arm-leg coordination during running). It has been shown that the results of different tests do not always agree, despite the fact that those tests claim to measure the same construct (i.e., motor competence). For example, the study of Smits-Engelsman, Henderson, and Michels (1998) revealed a moderate association between the Movement Assessment Battery for Children (M-ABC; Henderson & Sugden, 1992) and the Körperkoordinationstest für Kinder (KTK; Kiphard & Schilling, 1974, 2007) in children aged 5-13 years. Obviously, this may hamper communication between researchers and/or practitioners and has important implications with respect to diagnosing children with motor difficulties. By means of validity research it is determined to what extent two measures assess the same construct (i.e. convergent validity) and to what extent they evaluate different characteristics, hence refer to different constructs (i.e. divergent validity; Portney & Watkins, 2009). This type of research can provide valuable information and is required for test batteries that are widely adopted.

Two motor tests that are widely used in West-European countries, are the KTK (Kiphard & Schilling, 1974, 2007) and Motoriktest für vier- bis sechsjährige Kinder (MOT 4-6; Zimmer & Volkamer, 1987). Both tests have good psychometric properties, are user friendly and are used in clinical and educational settings (Cools et al., 2009; Wiart & Darah, 2001). The KTK was developed to identify children with motor problems but is also suitable for the determination of motor competence in typically developing children. The test measures gross motor coordination in children from 5 to 14 years old and consists of four dynamic balance tasks. The KTK has been used in different populations with disabilities, e.g. children with hearing problems (Gheysen, Loots, & Van Waelvelde, 2008), heart disease (Stieh, Kramer, Harding, & Fischer, 1999), obesity (D'Hondt et al., 2011), and hypermobility (Hanewinkel-van Kleeft, Helders, Takken, & Engelbert, 2009). The test is considered robust as the tasks are not easily mastered and therefore useful for follow-up (Kiphard & Schilling, 1974, 2007). The MOT 4-6 was designed to assess the gross and fine motor skills of preschool children (4 to 6 years old) and allows early identification of children with motor delay. The test features 18 test items, which are grouped in gross motor skills, including locomotor, object control and balance skills, and fine motor skills (Vandaele et al. 2011; Zimmer & Volkamer, 1987; see also Table 1). The MOT 4-6 has also been used in different populations with disabilities, e.g. children with hypothyroidism (Arenz, Nennstiel-Ratzel, Wildner, Dörr, & von Kries, 2008). Due to its pedagogical approach (many items have a playful character), this test is considered very suitable for the preschool age group.

For both tests, the psychometric properties have been established and are discussed in the manual (Kiphard & Schilling, 2007; Zimmer & Volkamer, 1987). For the KTK, high explained variances of total score by the item scores (ranging from 80.9% to 97.7%) indicated excellent content validity. Construct validity was shown through factor analysis and known groups method. Factor analysis demonstrated that all subtests load on one factor. With the known groups method, 91% of children with brain injury were differentiated from typically developing children. Furthermore, the test manual reports excellent test-retest and inter-rater reliability (all r-values > 0.85), and good intraclass correlations among test items (ICC = 0.80 - 0.96). For the MOT 4-6, construct and content validity have been described based on movement skill literature. In addition, the MOT 4-6 manual reports good internal consistency (Cronbach's alpha coefficient = 0.81) and a high test-retest and inter-rater reliability (r = 0.85 and 0.88 respectively). The KTK and the MOT 4-6 have shown moderate to strong correlations with motor tests, such as the M-ABC and Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2; Bruininks & Bruininks, 2005), that have been frequently used to identify children with DCD (Blank, Smits-Engelsman, Polatajko, & Wilson, 2012; Cools, De Martelaer, Vandaele, Samaey & Andries, 2010; Fransen et al., 2014; Smits-Engelsman et al., 1998).

The KTK and the MOT 4-6 are both used to measure motor competence in young children aged 5 to 6 - an age group in which accurate and early identification of motor problems is very important. Up to now, only one analysis of convergent validity between KTK and MOT 4-6 has been reported in the MOT 4-6 manual (Zimmer & Volkamer, 1987). It is, however, limited both in sample size and in scope of the analyses. Further independent research is needed to examine the similarities and differences between the KTK and MOT 4-6, and to investigate the extent to which these tests detect the same atypically developing children. Therefore, the aim of the present study was to assess the convergent and divergent validity between the KTK and MOT 4-6 in a large sample of 5 to 6-year old children. Convergent validity was examined by evaluating the relationship between the standardized total scores or Motor Quotients (MQ) of both tests. Divergent validity was examined by evaluating the relationship between the KTK MQ and the different components of the MOT 4-6, as documented in the manual and by Vandaele, Cools, De Decker, and De Martelaer (2011; see also Table 1). A second aim of the study was to assess the level of classification agreement between the two test batteries over the whole motor competence continuum. We hypothesized that the MQs of the KTK and MOT 4-6 would be positively correlated (with $r \geq 0.60$), based on earlier validity studies (Fransen et al., 2014; Cools et al., 2010; Smits-Engelsman et al., 1998; Van Waelvelde, Peersman, Lenoir,

& Smits-Engelsman, 2007). In addition, the KTK MQ would exhibit stronger correlations with the MOT 4-6 MQ and its gross motor component than with the MOT 4-6 fine motor component.

Method

Participants

A total of 638 young children (323 boys and 315 girls, aged between 5 and 6 years) took part in this cross-sectional study. Children were recruited from 49 settings (i.e. schools, sports clubs, local councils and day care centers) in Flanders, Belgium. To obtain a representative sample, these settings were selected from all Flemish provinces and the Brussels Capital Region. Written informed consent was provided for each participant by a parent or guardian. This study was approved by the ethics committee of Ghent University Hospital.

Procedure

All children were assessed with the two test batteries on the same day in the following order: MOT 4-6 and KTK. A break of 5-10 minutes was provided between the tests. Tests were performed barefooted in an indoor facility with sufficient rest given after each test item. The KTK and the MOT 4-6 were administered by trained assessors and in accordance with the manual guidelines. All assessors had a Physical Education background, received a detailed instruction manual and participated in a half-day assessment training. Tests were conducted between September 2012 and November 2012.

Instruments

Körperkoördinationstest für Kinder (KTK)

The KTK includes 4 subtests: (1) walking backwards along balance beams of different widths, (2) hopping for height, (3) jumping sideways over a slat, and (4) moving sideways on boards (Kiphard & Schilling, 1974). Scores per subtest were converted into standardized Motor Quotients (MQ) based on normative data of 1128 German children. These standardized scores are adjusted for age (all subtests) and gender (hopping for height and jumping sideways over a slat). MQs of all four subtests were then summed and transformed into a total KTK MQ. Finally, this standardized total score was expressed as a percentile score to classify the motor performance into categories, based on the percentile cut-off points of the test manuals: lower than or equal to percentile 2 (“impaired”) and 16 (“poor”), between P16 and P84 (“normal”), and higher than P84 (“good”) and P98 (“high”).

Motoriktest für vier- bis sechsjährige Kinder (MOT 4-6)

The MOT 4-6 consists of 1 practice item and 17 test items that are divided into 4 subtests: (1) Locomotor: jumping sideways over a rope, moving balls from box to box, passing through a hoop, jumping jacks, jumping over a cord, rolling sideways over the floor, twist jump in/out of a hoop; (2) Object Control: catching a stick, throwing a ball at a target disk, catching a tennis ring; (3) Stability: balancing forward on a line, balancing backwards on a line, jumping on one leg into a hoop, standing and sitting while holding a ball; and (4) Fine motor skills: placing dots on a sheet, grasping a tissue with toes, transferring matches (Cools et al., 2009; Vandaele et al., 2011; Zimmer & Volkamer, 1987). Performance on each test item was converted into a score ranging from 0 to 2 where a higher score represents a better performance. The sum of all item scores was converted into a standardized MQ based on normative data of 548 German children. This age-adjusted standardized score was also transformed into a percentile score to classify the motor score, based on the percentile cut-off points of the test manuals: lower than or equal to percentile 2 (“impaired”) and 16 (“poor”), between P16 and P84 (“normal”), and higher than P84 (“good”) and P98 (“high”). In addition to the conversion of raw score to norm-referenced score specified in the manual, we calculated a separate gross and fine motor component of MOT 4-6 to investigate convergent and divergent validity with the KTK. The procedure for this was adopted from previous validity studies (Van Waelvelde et al., 2007; Cools et al., 2010). According to the muscle groups involved, two cluster scores were calculated: gross and fine motor score. For the gross motor component, we also calculated the sum of the item scores for the locomotor, object control and stability subtest. The scores of the fine motor test items were summed to obtain the fine motor cluster score. Table 1 shows a brief description for all subtests and test items of the MOT 4-6.

Data analysis

All data were analysed using SPSS version 20 for Windows. Values of $p < 0.05$ were considered statistically significant. Descriptive statistics (i.e. means and standard deviations) were computed for the KTK MQ, and MOT 4-6 MQ, gross motor cluster score (locomotor, object control and stability) and fine motor cluster score. Distribution of all children classified in the five performance categories was also reported for both the KTK and MOT 4-6. Since some performance scores did not demonstrate normal distribution, Spearman's rank correlations were used to examine the convergent and divergent validity between the KTK MQ and MOT 4-6 MQ, MOT 4-6 gross motor cluster score (locomotor, object control and stability) and MOT 4-6 fine motor cluster scores. Cohen's kappa statistics were performed to determine the level of agreement in classification between both tests.

Results

The test scores on the KTK (i.e. total MQ and item MQ) and MOT 4-6 (i.e. MQ and gross and fine motor cluster scores) for the total sample and the sample divided into age groups and gender groups are reported in Table 2. The distribution of all children across the 5 classes of motor competence for each test battery is presented in Table 3.

Table 4 shows the correlations between the KTK MQ and MOT 4-6 MQ, gross and fine motor cluster scores for the total sample and for each age group separately. For the total sample, moderately strong positive correlations were found between the KTK MQ and MOT 4-6 MQ ($r_s = 0.63$) and between the KTK MQ and MOT 4-6 gross motor cluster score ($r_s = 0.62$). Within the MOT 4-6 gross motor component, a moderately positive correlation was found between the

KTK MQ and MOT 4-6 locomotor score (r_s = 0.56) and low positive correlations were found between the KTK MQ and MOT 4-6 stability score (r_s = 0.43) and object control score (r_s = 0.37). A significant but low positive correlation was found between the KTK MQ and MOT 4-6 fine motor cluster score (r_s = 0.32).

For each age group (5 and 6 years), strong or moderately strong positive correlations were found between the MQs of both tests (r_s = 0.61 - 0.67), and the KTK MQ and MOT 4-6 gross motor score (r_s = 0.62 - 0.72). Within the MOT 4-6 gross motor component, moderately positive correlations were found between the KTK MQ and MOT 4-6 locomotor score (r_s = 0.53 – 0.68) and low positive correlations between the KTK MQ and MOT 4-6 stability score (r_s = 0.42 – 0.49) and object control score (r_s = 0.31 – 0.44) for each age group. Low correlations were found between the KTK MQ and MOT 4-6 fine motor cluster score for each age cohort (r_s = 0.20 - 0.47).

The total number of children classified in each percentile category (P2, P16, P84 and P98) is shown in Table 5. The Cohen's kappa statistics showed moderate levels of agreement between the KTK and MOT 4-6 at P2 (κ = 0.50) and P16 (κ = 0.52), a fair level of agreement at P84 (κ = 0.23) and no agreement at P98 (κ = 0.00). For the P2 cut-off, 56% of the children classified in the < P2 category by the KTK, falls within the same category when tested by the MOT 4-6. For the P16, P84, and P98 cut-off this proportion is 61%, 23% and 0% respectively.

Discussion

Early identification and appropriate monitoring of motor problems are key to a tailored approach in PE or therapeutic practice, where the activities are adapted to the needs of the individual. For this, practitioners are dependent on quality motor test batteries, with adequate psychometric properties and known relationships with other test batteries. The purpose of this study was to investigate the convergent and divergent validity between the KTK and MOT 4-6 in children aged 5 to 6 years. Our second aim was to assess the level of agreement between these tests across the motor competence continuum. In agreement with our hypothesis, we found a moderately positive association between the KTK and MOT 4-6 MQs. Moreover, the KTK MQ demonstrated stronger correlations with the MOT 4-6 MQ and its gross motor component than with the MOT 4-6 fine motor component. Finally, the level of agreement in classification was moderate at the low end of the continuum and absent at the high end.

The moderate correlation coefficients identified between the KTK and MOT 4-6 MQs indicate that both test batteries measure a similar construct, which is in keeping with the results of the small study mentioned in the MOT 4-6 manual ($r = 0.78$; $N = 181$). Furthermore, the results are consistent with prior research by Smits-Engelsman et al. (1998) on the relationship between the KTK and M-ABC ($r_s = 0.61$), and Fransen et al. (2014) on the relationship between the KTK and BOT-2 (rs = 0.62). Further, Cools et al. (2010) found a correlation of 0.68 between the MOT 4-6 and M-ABC total scores. While these moderate associations are considered to be typical within the field of motor assessment, they do suggest that each test battery tends to measure a different aspect of a similar construct, i.e. motor competence. Clearly, the correlation coefficient is primarily dependent on the nature of the tasks. In this respect, it is reassuring that the present study provides evidence of divergent validity through stronger positive associations between the KTK and the MOT 4-6 gross motor cluster score than between the KTK total score and the MOT 4-6 fine motor cluster score. These findings are in accordance with previous studies where the gross motor scales of two test batteries correlate better than the gross motor scale of one battery and the fine motor scale of the other (Cools et al., 2010; Fransen et al., 2014; Van Waelvelde et al., 2007). In addition, within the MOT 4-6 gross motor component, stronger positive correlations were found between the KTK total score and MOT 4-6 locomotor and stability scores than between the KTK total score and MOT 4-6 object control score. Surprisingly, the MOT 4-6 locomotor score correlated higher with the KTK total score compared with the MOT 4-6 stability score. A possible explanation is that the locomotor items include agility and coordination, which are also present in the KTK test battery. Since both gross and fine motor skills play a key role in children's cognitive, physical and social development (Hill, 2010), motor assessment should take both components into account when measuring motor competence.

In keeping with Van Waelvelde et al. (2007), these findings indicate that test results should only be interpreted in relation to the specific tasks used in the test. Netelenbos (2001a, 2001b) commented that a test instrument with a large amount of motor tasks could provide a solution for mutually independent motor skills. However, such a test battery can by definition become time consuming and therefore be less suitable for children, particularly when they are young. The purpose of the assessment, the age appropriateness, the proportion of each item in relation to the overall test time and the user-friendliness should be considered when selecting an assessment tool for young children (Cools et al., 2009). Although the time to administer the motor tasks is similar between MOT 4-6 and KTK (15 – 20 min), the MOT 4-6 consists of 18 tasks as opposed to the KTK, which only contains 4 tasks. Finally, an important factor that is often overlooked when measuring motor competence is physical fitness. As argued by Fransen et al. (2014), the degree to which a motor test depends on the level of physical fitness may partly explain why the correlation between the tests is only moderate. In the current study at least two items of the KTK (hopping for height and jumping sideways over a slat) require particular levels of strength and endurance that appear less important in the MOT 4-6.

Regarding the level of agreement on classification between the KTK and MOT 4-6, Cohen's kappa indicates moderate levels of agreement for P2 and P16, but low level of agreement for children scoring for P84. No agreement was reported for P98. Closer inspection of the data shows that 56% and 61% of the children classified in the < P2 and < P16 category by the KTK respectively, fall within the same category when tested by the MOT 4-6. In contrast, for P84 and P98 cut-off this proportion is 23% and 0% respectively. A possible explanation for the higher agreement at the lower end of the motor competence continuum, is that the KTK and MOT 4-6 tests were designed with the aim to detect children with motor delay (Kiphard & Schilling, 1974, 2007; Zimmer & Volkamer, 1987). Furthermore, it is worth noting that the rate of development may vary considerably amongst individuals of this age. Therefore, caution is warranted when categorizing them into subgroups indicating level of motor competence, and regular follow-up is recommended to check whether development is deviant.

In addition, a decline in motor competence of the study sample is observed in comparison with the reference population (KTK MQ: 95.8 versus 100; MOT MQ: 96.8 versus 100), which is accompanied with a general shift of the distribution of the sample towards the lower ends of the continuum (see Table 3). For both tests a rather high proportion of the children scored below the 16th percentile (23% and 22% for KTK and MOT 4-6 respectively), and only 9% and 6% (KTK and MOT 4-6 respectively) scored above P84. This decrease in childhood motor competence as compared to the norm samples tested in the 1970s (KTK) and 1980s (MOT 4-6) is consistent with previous studies (Bös, 2003; Darrah, Magill-Evans, Volden, Hodge, & Kembhavi, 2007; Sigmundson & Rostoft, 2003; van Beurden et al., 2002; Vandaele et al., 2011; Vandorpe et al., 2011). Since the levels of agreement between the KTK or MOT 4-6 are low to moderate, practitioners should be aware of possible categorisation errors when using one of these tests. Therefore, as proposed by Fransen et al. (2014), it is advised that judgement of motor competence during childhood should not be based on performance of a single motor assessment battery.

The main strength of this study is its use of a large sample. Previous validity research (Cools et al., 2010; Smits-Engelsman et al., 1998; Van Waelvelde et al., 2007) included relatively small sample sizes, ranging from 31 to 208 children. One exception is the study of Fransen et al. (2014) in which 2485 participants performed the KTK and BOT-2 Short Form. There are some limitations to the present study that need to be addressed. First, the order of administering the two tests was not counterbalanced due to logistical constraints; the MOT 4-6 takes longer to set up compared to the KTK and was therefore administered first. Second, point scores were used for the gross and fine motor cluster scores for the MOT 4-6 as the manual does not provide separate standardized subscales. Still, we would argue that this division into two cluster scores has enhanced the comparison between the MOT 4-6 and KTK.

In summary, the present study showed some evidence of convergent validity between the KTK and MOT 4-6 MQ. Divergent validity between both tests was also established by means of stronger associations between the KTK MQ and the MOT 4-6 gross motor score in comparison with lower associations between the KTK MQ and the MOT 4-6 fine motor score. However, only moderate levels of agreement on classification of children with low motor competence and low to no agreement at the higher end of the motor competence spectrum were found. Considering the importance of providing optimal support to children with motor problems and preventing the development of health-related problems (Jongmans, 2005), it is advised to use of at least two motor competence test batteries when evaluating motor competence in early childhood. Moreover, it is desirable to take both product (e.g. using KTK and MOT 4-6) and process [e.g. using the Test of Gross Motor Development – 2nd edition (TGMD-2; Ulrich, 2000)] into account when assessing young children's motor competence, especially given the large differences in rate of development at this stage. With regard to the latter, researchers and practitioners need to consider the purpose and suitability of a motor assessment when selecting a test battery for young children and use caution when categorizing young children into groups to indicate their level of motor competence. Regular follow-ups can provide additional valuable information to determine if a child's motor competence deviates from its normal developmental trajectory. Finally, a multitude of different tests are used in clinical and educational settings to assess motor competence or identify motor problems. Still, it remains unclear to what extent some tests actually measure the same construct. To ensure communication between researchers and practitioners, and to optimize the identification and support of children with motor difficulties, continuous efforts are needed to determine convergent and divergent validity between popular test batteries.

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Table 1

Tests used for the Motoriktest für Vier- bis Sechsjährige Kinder (MOT 4-6).

Subtests	Items
GROSS motor skills	
Locomotor	Jumping sideways over a rope
	Moving balls from box to box
	Passing through a hoop
	Jumping jacks
	Jumping over a cord
	Rolling sideways over the floor
	Twist jump in/out of a hoop
Object control	Catching a stick
	Throwing a ball at a target disk
	Catching a tennis ring
Stability	Balancing forward on a line
	Balancing backwards on a line
	Jumping on one leg into a hoop
	Standing and sitting while holding a ball on the head
FINE motor skills	Placing dots on a sheet
	Grasping a tissue with toes
	Transferring matches

Table 2

Means (M) and standard deviations (SD) of performance on the KTK (standardized total score and item scores) and MOT 4-6 (standardized total score and cluster scores).

Variable	5-year-old			6-year-old			Total		
	M		SD	M		SD	M		SD
KTK total MQ									
Boys	97.1	±	15.2	98.4	±	12.4	97.7	±	13.9
Girls	95.2	±	13.9	92.3	±	15.3	93.8	±	14.6
Total	96.2	±	14.6	95.4	±	14.3	95.8	±	14.4
KTK Walking backwards MQ									
Boys	85.7	±	11.3	86.9	±	12.7	86.3	±	12.0
Girls	88.8	±	12.0	88.9	±	13.3	88.9	±	12.6
Total	87.2	±	11.7	87.9	±	13.0	87.6	±	12.4
KTK Hopping for height MQ									
Boys	100.4	±	16.9	102.2	±	12.5	101.2	±	15.0
Girls	95.1	±	15.0	88.3	±	17.6	91.9	±	16.6
Total	97.8	±	16.2	95.3	±	16.7	96.6	±	16.5
KTK Jumping sideways MQ									
Boys	109.4	±	19.0	108.5	±	12.8	109.0	±	16.4
Girls	104.1	±	14.3	101.7	±	16.9	103.0	±	15.6
Total	106.8	±	17.0	105.1	±	15.4	106.0	±	16.3
KTK Moving sideways MQ									
Boys	96.1	±	12.3	98.0	±	14.1	97.0	±	13.2
Girls	97.7	±	12.8	97.6	±	14.2	97.6	±	13.5
Total	96.9	±	12.6	97.8	±	14.1	97.3	±	13.3

MOT 4-6 total MQ									
Boys	94.3	±	15.8	98.1	±	12.8	96.1	±	14.6
Girls	97.3	±	14.8	97.6	±	18.4	97.5	±	14.1
Total	95.8	±	15.4	97.8	±	13.0	96.8	±	14.3
MOT 4-6 GROSS motor skills									
Boys	14.9	±	4.5	18.5	±	3.7	16.6	±	4.5
Girls	15.8	±	4.5	18.4	±	4.0	17.0	±	4.5
Total	15.3	±	4.5	18.4	±	3.8	16.8	±	4.5
Locomotor skills									
Boys	8.4	±	2.6	10.2	±	2.4	9.3	±	2.7
Girls	9.1	±	2.7	10.6	±	2.4	9.8	±	2.7
Total	8.7	±	2.7	10.4	±	2.4	9.5	±	2.7
Object control skills									
Boys	2.9	±	1.3	3.9	±	1.1	3.4	±	1.3
Girls	2.4	±	1.3	3.2	±	1.2	2.8	±	1.3
Total	2.6	±	1.3	3.6	±	1.2	3.1	±	1.4
Stability skills									
Boys	3.6	±	1.8	4.3	±	1.6	4.0	±	1.7
Girls	4.3	±	1.8	4.6	±	1.6	4.4	±	1.7
Total	3.9	±	1.8	4.4	±	1.6	4.2	±	1.7
MOT 4-6 FINE motor skills									
Boys	3.2	±	1.6	4.6	±	1.2	3.9	±	1.5
Girls	3.5	±	1.5	4.7	±	1.2	4.0	±	1.5
Total	3.4	±	1.5	4.6	±	1.2	4.0	±	1.5

Table 3

Proportions of children across classification categories based on the test manuals of KTK and MOT 4-6.

Classification		KTK MQ		MOT 4-6 MQ	
		N	%	N	%
Impaired	≤ P2	27	4.2	30	4.7
Poor	≤ P16	122	19.1	110	17.2
Normal	P16 - P84	429	67.2	459	71.9
Good	> P84	58	9.1	37	5.8
High	> P98	2	0.3	2	0.3

Note. MQ, Motor Quotient.

Table 4

Results of the Spearman correlations between KTK Motor Quotient (MQ) and MOT 4-6 Motor Quotient (MQ), gross and fine motor cluster scores.

Variable	KTK MQ					
	5-year-old		6-year-old		Total	
	r_s	p	r_s	p	r_s	p
MOT 4-6 MQ						
Boys	0.67	<0.001	0.61	<0.001	0.64	<0.001
Girls	0.66	<0.001	0.64	<0.001	0.65	<0.001
Total	0.65	<0.001	0.61	<0.001	0.63	<0.001
MOT 4-6 GROSS motor skills						
Boys	0.71	<0.001	0.62	<0.001	0.62	<0.001
Girls	0.72	<0.001	0.70	<0.001	0.64	<0.001
Total	0.70	<0.001	0.64	<0.001	0.62	<0.001
Locomotor skills						
Boys	0.65	<0.001	0.53	<0.001	0.57	<0.001
Girls	0.67	<0.001	0.68	<0.001	0.61	<0.001
Total	0.64	<0.001	0.56	<0.001	0.56	<0.001
Object control skills						
Boys	0.44	<0.001	0.31	<0.001	0.37	<0.001
Girls	0.41	<0.001	0.32	<0.001	0.31	<0.001
Total	0.43	<0.001	0.36	<0.001	0.37	<0.001
Stability skills						
Boys	0.49	<0.001	0.42	<0.001	0.46	<0.001
Girls	0.47	<0.001	0.45	<0.001	0.45	<0.001
Total	0.46	<0.001	0.40	<0.001	0.43	<0.001

MOT 4-6 FINE motor skills						
Boys	0.47	<0.001	0.40	<0.001	0.42	<0.001
Girls	0.38	<0.001	0.20	0.012	0.24	<0.001
Total	0.42	<0.001	0.28	<0.001	0.32	<0.001

Table 5
Results of the Cohen's Kappa (κ) analysis between KTK Motor Quotient (MQ) and MOT 4-6 Motor Quotient (MQ).

		KTK MQ			κ	p
		> P2	≤ P2	Total		
	> P2	596	12	608	0.50	<0.001
	≤ P2	15	15	30		
	Total	611	27	638		
		> P16	≤ P16	Total		
	> P16	440	58	498	0.52	<0.001
	≤ P16	49	91	140		
	Total	489	149	638		
MOT 4-6 MQ		> P84	≤ P84	Total		
	> P84	14	25	39	0.23	<0.001
	≤ P84	46	553	599		
	Total	60	578	638		
		> P98	≤ P98	Total		
	> P98	0	2	2	0.00	0.937
	≤ P98	2	634	636		
	Total	2	636	638		

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