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Association Between Perceived and Actual Motor Competence in Portuguese Children

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The aim of this study was to examine the relationship between actual (AMC) and perceived (PMC) motor competence in Portuguese children. A total of 200 children (111 [0.55%] girls) aged 5–9 years old participated in the study. The Pictorial Scale of Perceived Movement Skill Competence (PMSC) and the Test of Gross Motor Development-2 (TGMD2) were used to assess PMC and AMC, respectively. Mann-Whiney U was used to test the differences between sexes and age groups. The association between TGMD2 and PMSC scores was analyzed through Spearman correlation. Boys and girls of all ages showed to have high PMC. Independent of sex, mean values for each TGMD2 subtest increased throughout the age groups with older children having significantly higher mean scores than younger ones. In general, boys and girls showed similar PMC and AMC, independent of age. Weak to moderate and some negative correlations ($0.24 < r < -0.40$) were found between PMC and AMC scores for all age and sex groups. In conclusion, there appears to be little relationship between actual and perceived motor competence in Portuguese young children.

Keywords: motivation, motor coordination, motor development, physical activity

Results from the latest research have shown that actual motor competence development is associated with positive health trajectories, particularly regarding physical activity and weight status (e.g., Lopes, Maia, Rodrigues, & Malina, 2011,

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2012; Lopes, Stodden, & Rodrigues, 2014; Robinson et al., 2015; Rodrigues, Stodden, & Lopes, 2016). Nevertheless, according to the Stodden et al. (2008) developmental model, this relationship between actual motor competence and physical activity is mediated by children's perceived motor competence. In fact, this has been reported by a recent study (Khodaverdi, Bahram, Stodden, & Kazemnejad, 2016). Babic et al. (2014) found that perceived competence had the strongest relationship to physical activity when compared to other aspects of self-concept, and that age had a positive role in moderating this relationship (Babic et al., 2014). According to the competence motivation theory (Harter, 1978; White, 1959), an individual's judgment of his or her degree of competence can influence performance in achievement settings. As such, children with high levels of perceived competence are more likely to engage in physical activity and sports than children with low levels. In fact, Khodaverdi et al. (2016) found that children who are less competent and have lower perceived competence, are less likely to be physically active.

The identification of perceived motor competence as an explanatory factor of how actual motor competence can influence children's physical activity levels led researchers to focus their attention on the relationships between actual and perceived motor competence during childhood.

Higher skilled children are hypothesized to develop more accurate self-perception of their actual motor competence, which could result in additional physical activity engagement leading to the improvement of motor competence (Stodden et al., 2008). This relationship is expected to strengthen as children become older (Stodden et al., 2008). Rose, Larkin, and Berger (1997) demonstrated that children with poor motor competence had lower perceived motor competence than children with higher motor competence. Barnett, Ridgers, and Salmon (2015) as well as Liong, Ridgers, and Barnett (2015) found a positive association between perceived and actual motor competence in early and middle childhood. In middle childhood (De Meester, Stodden, et al., 2016; Vedul-Kjelsås, Sigmundsson, Stensdotter, & Haga, 2012) and adolescence (Barnett, Morgan, van Beurden, Ball, & Lubans, 2011) positive associations have also been found between perceived motor competence and actual motor competence.

The study of the association between perceived and actual motor competence is fundamental to understand children's motivation for physical activity (Barnett, Ridgers, & Salmon, 2015; Slykerman, Ridgers, Stevenson, & Barnett, 2016), as well as to guide future intervention programs aiming to increase children and adolescents' commitment to physical activity.

In this context, it is important to identify the influence of sex and age on both actual and perceived motor competence and also on the relationship between them. Therefore, if sex and age differences exist, the strategies in promoting the development of motor skills and physical activity should be suitable and adequate for both boys and girls at different ages.

In general, boys tend to be more proficient than girls (Goodway, Robinson, & Crowe, 2010; Junaid & Fellowes, 2006; Spessato, Gabbard, Valentini, & Rudisill, 2012), especially in object control skills (Barnett, Lai, et al., 2016; Barnett, Morgan, van Beurden, & Beard, 2008; Goodway & Rudisill, 1997; LeGear et al., 2012; Robinson, 2011). However, boys' locomotor proficiency has been reported as lower (Barnett et al., 2008; van Beurden, Zask, Barnett, & Dietrich,

2002), similar (Goodway & Rudisill, 1997), higher (Robinson, 2011), or similar to girls (Barnett, Lai, et al., 2016). Very few studies in the area of perceived motor competence and self-esteem have directly examined gender differences. Regardless of some contradictory results LeGear et al. (2012), girls have generally shown lower perceived motor competence than boys (Barnett et al., 2008; Dunn & Watkinson, 1994; Raudsepp & Liblik, 2002), particularly in perceived object control competence (Barnett, Ridgers, & Salmon, 2015).

According to the Stodden et al. (2008) model, the relationship between perceived and actual motor competence is expected to increase with age. For example, positive associations have been demonstrated in adolescence (Barnett et al., 2011) and late childhood (Vedul-Kjelsås et al., 2012). In younger children, there is some evidence about these associations (Barnett, Ridgers, & Salmon, 2015; Robinson, 2011), although one study in young children reported no association at all (Spessato, Gabbard, Robinson, & Valentini, 2013). Brian, Goodway, Stodden, and Tsuda (2014) found that the correlation between actual and perceived motor competence increased with age (4–5 years, $r = 0.074$; 7–8 years, $r = 0.133$; 10–11, $r = 0.364$). Thus, it appears that a positive relationship between motor competence and perceived motor competence occurs in older children. However, in young children the relationship is less clear.

So far, most of the studies examining the association between perceived and actual motor competence used instruments with low similitude between each other. Perceived motor competence has been assessed mainly with generic tools, namely the Child and Youth Physical Self-Perception Profile (CY-PSPP; Whitehead, 1995), or the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (PSPCSA) (Harter & Pike, 1984). CY-PSPP aims to assess body self-esteem and the PSPCSA is intended to evaluate four distinct areas of perceived competence (Cognitive Competence, Physical Competence, Peer Acceptance, and Maternal Acceptance).

The recent development of a perceived motor competence scale in fundamental movement skills, the Pictorial Scale of Perceived Movement Skill Competence (PMSC) (Barnett, Vazou, et al., 2016), which is aligned with accepted measures of actual motor competence, such as the Test of Gross Motor Development version 2 (TGMD-2), has allowed the association between these two concepts to be examined with two consonant instruments. Both instruments (TGMD-2 and PMSC) use the same motor skills' construct and this could lead to more enlightening results about the subject. The PMSC was recently validated for Portuguese children (Lopes, Barnett, Saraiva, et al., 2016).

Therefore, the purposes of this study were (1) to analyze the association between actual and perceived motor competence in middle childhood in Portuguese children, using TGMD-2 and PMSC; and (2) to understand the effect of age and sex in the association between actual and perceived motor competence.

Methods

Participants

Participants belonged to five primary schools from two regions in Portugal (three schools from the inland, and two schools from the coastal area). Depending on

availability, schools were contacted and all of them agreed to participate. All children (n = 205) from these schools were invited to participate in the study. Inclusion criteria included: i) Portuguese nationality; ii) absence of any known intellectual, physical or emotional disabilities; and iii) absence of special educational needs. After obtaining this information through teachers, 200 children (girls n = 111); 5 to 9 years of age (7.6 ± 1.4) who met the criteria were included in the study. Permission was obtained from the school director. The parent or guardian gave informed consent and children assented. After some parents' refusals a 98% consent rate was obtained. This study was approved by the ethics committee of the institution of the first author.

Participants were grouped in two groups according to their age: 5 to 7 years and 8 to 9 years.

Measures

All children were evaluated in their attending school. Trained technicians, supervised by one of the researchers, tested the participants. Children were assessed inside a schoolroom, one at a time, first with the perceived motor skills competence test and then with the motor skills competence test.

Perceived Motor Skills Competence Test

Perceived motor skills competence was assessed with the Pictorial Scale of Perceived Movement Skill Competence for Young Children (PMSC) developed by Barnett, Ridgers, Zask, and Salmon (2015) and validated for Portuguese children by Lopes, Barnett, Saraiva, et al. (2016). This validation included a face validity which demonstrated most children correctly identified the skills and understood most of the pictures. Test–retest reliability (agreement ration between 0.99 and 1.02) and internal consistency were good (ordinal alpha values ranged from acceptable [object control 0.73, locomotor 0.68] to good [all FMS 0.81]). Construct validity was also tested, using a Bayesian Structural Equation (BSEM) approach, and the hypothesized model showed an adequate fit (posterior predictive p-value = 0.12).

This instrument assesses children's perceived fundamental skills competence in the same six object control (i.e., striking a stationary ball, stationary dribble, kick, catch, overhand throw, and underhand roll) and six locomotor (i.e., run, gallop, hop, leap, horizontal jump, and slide) skills as the TGMD–2 (Ulrich, 2000). The concept of perceived motor competence in children and the oral formulation in each item was adapted from "The Pictorial Scale of Perceived Competence and Acceptance for Young Children" (Harter & Pike, 1984). Perceived motor competence for each skill is rated on a four-point scale ('really good at . . .' [four points], 'pretty good at . . .' [three points], 'sort of good at . . .' [two points], 'not that good at . . .' [one point]). Scores for each skill were summed into object control and locomotor subscales (scores range: 6–24). Skills were demonstrated whenever children could not identify the skill from the picture and verbal cue (Lopes, Barnett, Saraiva, et al., 2016).

Motor Skills Competence Test

Actual motor skill competence was assessed with the Test of Gross Motor Development, 2nd edition (TGMD2; Ulrich, 2000). This tool was previously translated into Portuguese, and its validity and reliability was confirmed for Portuguese children (Lopes, Saraiva, & Rodrigues, 2018). The TGMD-2 is a process-oriented instrument, consisting of two subtests with six gross motor skills each: object control skills (catch, striking a stationary ball, stationary dribble, overhand throw, underhand roll and kick) and locomotor skills (hop, run, gallop, slide, horizontal jump and leap). It was designed to assess the gross motor development of children from 3 to 10 years old.

The TGMD-2 is a motor assessment tool that requires observational techniques. Each gross motor skill includes three to five behavioral components presented as performance criteria. If the child performs a behavioral component correctly, the examiner scores one, otherwise the score is zero. Each participant performed one practice trial, followed by two trials which were then rated. The sum of the observed criteria for each subscale comprises the total raw score (0–48 points). The raw scores can be converted into percentile ranks and standard scores, being compared with the ranks of age-matched peers. A gross motor quotient (GMQ) could also be obtained by adding the subtest standard scores and converting the sum to a age related quotient (Ulrich, 2000).

Each skill performance was videotaped for later scoring, this was done by two researchers. One camera was positioned laterally with an angle that permitted the vision of all body movements during the skills' execution (for further information see Lopes, Saraiva, and Rodrigues (2018).

Data Analysis

Kappa statistical analysis was used to determine inter-rater reliability for each skill in TGMD2 and interpreted as follows (McHugh, 2012): $K < .20$, none; $.21 < K < .39$, minimal; $.40 < K < .59$, weak; $.60 < K < .79$, moderate; $.80 < K < .90$, strong, and $K > .90$, almost perfect.

Normality of the variables' distribution was analyzed with the Kolmogorov-Smirnov test. We found that several distributions were not normal, therefore we opted for nonparametric tests.

Mann-Whitney U was used to test the differences between boys and girls in each age group and between age groups within each sex, in actual and perceived motor competence.

The Spearman correlation coefficient was used to analyze the association between actual and perceived motor competence by sex and age group.

All statistical tests were considered significant for $p < .05$. All the analyses were done with SPSS 20.

Results

Reliability

Inter-rater reliability analysis for TGMD2 varied between 1.00, 95% CI (0.4, 1.6) for catch, striking a stationary ball, stationary dribble, kick, overhand throw, run,

gallop, horizontal jump, leap and slide, and 0.70, 95% CI (0.2, 1.2) for hop and underhand roll.

Table 1 presents the descriptive results for each TGMD2 subtest (object control and locomotor) by age group and sex.

A brief data analysis shows that the mean raw values for each TGMD2 subtest increased throughout the age groups. Independent of sex, older children in both subtests had significantly higher mean scores than younger children (all $p < .05$). In the locomotor subtest, there were no significant differences between boys and girls in any age group, while for object control the differences occurred in the 8- to 9-year-old age group with boys scoring significantly better than girls ($p < .05$). Percentile ranks for both boys and girls in both age groups are low in both object control and locomotor skills, and particularly in object control skills.

Table 2 shows the descriptive results of each PMSC subscale (object control and locomotor) by age group and sex.

Girls in the upper age group had lower perceived motor competence than girls in the lower age group ($p < .05$). The only significant difference between boys and girls occurred at the 8- to 9-year-old age group in object control, with boys showing significantly higher perceived motor competence than girls ($p < .05$).

Table 1 Mean and Standard Deviations for Each TGMD-2 Subtest by Age Group and Sex for Raw Scores and Percentile Rank

	Girls	Boys	Object Control		Locomotor	
Age Group	n	n	Girls	Boys	Girls	Boys
5–7 years	28	23	22.1(7.2)	26.1(9.3)	34.4(5.5)	33.4(6.7)
8–9 years	71	55	29.9(6.5) ‡	33.2(6.9)* ‡	38.2(4.5) ‡	37.5(4.4) ‡
	Percentile rank					
5–7 years			19.2(16.3)	17.3(16.3)	36.0(19.2)	30.6(21.0)
8–9 years			19.4(18.9)	13.1(15.5)	26.1(21.1)	25.6(16.8)

Note. Maximum possible score for each subtest is 48 points.
*Significant differences ($p < .05$) between boys and girls.
‡Significant differences ($p < .05$) between age groups.

Table 2 Mean Raw Scores and Standard Deviations, for Each PMSC Subscale by Age Group and Sex

	Girls	Boys	Object Control		Locomotor	
Age Group	n	n	Girls	Boys	Girls	Boys
5–7 years	28	23	20.5(2.9)	20.9(2.8)	21.3(2.4)	21.4(2.2)
8–9 years	71	55	19.4(3.1)‡	20.1(2.5)*‡	20.6(2.7)	20.0(2.8)

Note. Maximum possible score for each subscale is 24 points.
*Significant differences ($p < .05$) between boys and girls.
‡Significant differences ($p < .05$) between age groups.

Correlations

Table 3 presents the Spearman correlation coefficients between actual (TGMD2 age adjusted percentile) and perceived motor competence (PMSC) in girls and boys by age. The only correlations that showed significance were for the locomotor skills subtest (–0.40), and for total skills (–0.34), in girls in the 8- to 9-year-old age group, both negative and low to moderate. All other results, including all the boys' results, do not show any association between perceived and actual motor competence.

Discussion

The aim of this study was to analyze the relationship between actual and perceived motor competence in middle childhood Portuguese children. Secondly, age and sex effects in actual and perceived motor competence were explored.

All correlations values were moderate to weak; some were negative and others positive, but no particular pattern could be linked either to age or sex. There was only two significant correlation and they were negative (younger girls locomotor skills, and total skills). The remainder were non-significant.

Results from other studies are somewhat contradictory. Some studies have reported no associations; found a very low correlation; or the association occurred only in some few skills (Barnett, Ridgers, & Salmon, 2015) or the association occurred only in one skill type (i.e., object control) (Liong et al., 2015). But other studies have found a positive association between perceived and actual motor competence in early and middle childhood (Barnett, Ridgers, & Salmon, 2015; De Meester, Stodden, et al., 2016; Toftegaard-Stoeckel, Groenfeldt, & Andersen, 2010). A reason could be the age of the samples used, since studies that have failed to find association were typically studies performed in younger children (4–7 years old) (Lopes, Barnett, & Rodrigues, 2016; Robinson, 2011; Spessato et al., 2013).

Table 3 Correlations Between Actual (TGMD2 Age-Adjusted Percentile) and Perceived Motor Competence (PMSC) in Girls and Boys by Age Group in Locomotor and Object Control Skills

	5–7 years	8–9 years
All skills		
Girls	–0.19	–0.34*
Boys	0.11	0.05
Locomotor skills		
Girls	–0.30	–0.40*
Boys	0.11	0.04
Object control skills		
Girls	–0.15	–0.03
Boys	–0.13	0.24

*Significant correlation ($p < .05$).

Despite these contradictory results in early and middle childhood, it seems that in late childhood (Rose et al., 1997), and in adolescence (Barnett et al., 2011; De Meester, Stodden, et al., 2016) there is a positive association between perceived motor competence and actual motor competence. Thus, it seems that, as children grow older, the association between actual and perceived motor competence becomes stronger. For instance, in the Spessato et al. (2013) study, the correlation varied between 0.06 at 4 years to 0.28 at 7 years. Although an association between actual and perceived motor competence has been found in older ages, correlation values are still moderate. For example, in middle childhood De Meester, Stodden, et al. (2016) found a correlation of $r = 0.20$, and Khodaverdi et al. (2016) reported a correlation of $r = 0.11$ for object control skills, and $r = 0.22$ for locomotor skills; while in adolescents, De Meester, Maes, et al. (2016) found a correlation of $r = 0.30$.

The only two significant correlations found in this study were negative and of a moderate strength in the younger girls. This finding is contradictory to previous literature. Theoretically, children with a good actual motor competence should perceive themselves as good and not the reverse (Stodden et al., 2008). In our study the TGMD2 mean rank percentile for both boys and girls of both age groups were low, particularly in object control skills. So, maybe the children of this sample were simply unaware of their poor skills. Another reason could be that children from this sample are too young to make accurate self-judgments. In fact, according to Harter and Pike (1984) and Ruble (1983), children under 9 years of age may have some cognitive limitations that interfere with their ability to make realistic self-judgments.

Thus, it appears that in older children (late childhood), there is an established relationship between actual and perceived motor competence. However, in younger children the relationship is less clear. One reason can be the lack of motor competence consolidation resulting in children's weak and inconsistent motor competence levels (Goodway & Smith, 2005). Young children, besides having low accuracy in perceiving their motor competence, also usually show inflated levels of perceived motor competence relative to their actual motor competence (Goodway & Rudisill, 1997; Harter, 1999). This exact phenomenon can be seen in our results, with the younger children showing very high levels of perceived motor competence although they are inconsistent with their real motor competence.

Our results also show almost no differences between boys and girls in both TGMD2 and PMSC scores throughout the years, and in that matter they are not fully aligned with the literature. For instance Robinson (2011) stated that boys were more proficient in gross motor skills, and reported higher perceived physical competence compared with girls. In the present study only at 8–9 years of age boys indicated higher perceived motor competence than girls for object control, suggesting that there was no noticeable sexual differentiation in perceived motor competence in young children. Concerning actual motor competence, sex differences were only found in object control skills also in the 8- to 9-year-old age group. This is consistent with the findings of previous studies reporting boys' superiority in object control and its increase with age (Barnett, Lai, et al., 2016). The explanation for this motor competence differentiation has been based on arguments such as social and environmental effects, opportunities for motor experiences, sex stereotyped games and toys, besides parental and social expectations (Barnett, Hinkley, Okely, & Salmon, 2013; Cools, De Martelaer, Samaey, & Andries, 2011).

As expected, participants of this study showed an increase in motor competence with age, that is, older children of both sexes exhibited higher motor competence. In relation to perceived motor competence, despite its decrease throughout the age groups, boys and girls of all ages perceived themselves as having high motor competence.

The study was limited in that data collection which was not longitudinal. Furthermore, despite the large number of total children studied (200), after sex and age stratification the numbers in each group become smaller (ex: 23 boys at 5–7 years of age) lowering the power of the analysis and conclusions. Therefore, we advocate the use of longitudinal or mix-longitudinal samples for future works on this matter.

The relationship between actual and perceived motor competence has been treated as a linear, one to one, simple relationship that changes with age and competence level. Our results do not seem to be consistent with this idea, and by analyzing all the other studies on the matter, we tend to reach a similar conclusion. Probably a better way of understanding the relationship between perceived and actual competence is to take into account other influencing factors. Even when looking only at perceived motor competence and actual motor competence it is not clear what drives what; when; or why. We think our results can help to further improve the overall knowledge about this relationship, but we still are a long way from fully understanding it.

In conclusion, little relationship was found between actual and perceived motor competence in middle childhood Portuguese children.

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