

Differences in motor competence, enjoyment and weight status of young children (4-6 years)

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Published online: June 30, 2022

(Accepted for publication June 15, 2022)

DOI:10.7752/jpes.2022.06185

Abstract

Background: Although research on children's motor competence is a growing field of interest, especially among young children (4-6 years), several questions remain to be answered. Differences in children's motor competence and their determinants, must be made transparent since early childhood is a critical period for the development of fundamental movement skills, and thereby a lifelong active lifestyle and health. Objective: The purpose of this cross-sectional study was to determine differences in actual motor competence (AMC), perceived motor competence (PMC) and enjoyment of physical activity among young children with different weight status. Methods: AMC, PMC and enjoyment were measured among 1708 children (50.4% male, mean age: 5.34 ± 0.73 years) from 36 primary schools in The Netherlands. AMC was measured by using the Athletic Skills Track (AST-1). The Pictorial Scale of Perceived Movement Skill Competence for Young Children was used for determining PMC and enjoyment of physical activity was measured using a Visual Analogue Scale. The data were analyzed using a three-way ANOVA to examine the differences between AMC, PMC and enjoyment by sex (boys/girls), age (4, 5, 6 years) and weight status (normal, overweight, obesity). Results: Overall, AMC was ranked as 'average motor gifted'. Average PMC and enjoyment scores were 3.31 (SE 0.01) (1-4 scale) and 4.41 (SE 0.02) (1-5 scale) respectively. No interaction effects were found between sex, age and weight status on AMC or PMC. However, there was a statistically significant two-way interaction effect for enjoyment between age and weight status ($F(4,1454) = 2.464, p = .043$). Relative enjoyment scores for normal weight and overweight groups between high and low enjoyment were distributed 99% to 1%. However, in the obese group there was a distribution of 92% to 8% between high and low enjoyment. Conclusions: The results of this study suggest that there are no significant differences in AMC and PMC between children of different sex, ages (4, 5 and 6 years), and weight status in this age group. However, children with obesity more often experience less enjoyment during physical activity than children with another weight status. Targeted intervention for increasing enjoyment during physical activity in combination with reducing obesity seems advisable even at young age.

Keywords: children, motor competence, cross-sectional, body mass index, biological determinants, socio demographic determinants

Introduction

Early childhood is a period of rapid growth and therefore important for the development of different competences, such as motor competence (MC). MC is a global term used to reflect various other terminologies that have been applied previously (i.e., motor proficiency, motor performance, fundamental movement/motor skills, motor ability and motor coordination) to describe goal-orientated human movement (Lorås, 2020; Robinson et al., 2015). MC can be defined as a person's ability to execute different motor acts, including coordination of fine and gross motor skills that are necessary to manage everyday tasks (Barnett et al., 2016; D'Hondt, Deforche, De Bourdeaudhuij, & Lenoir, 2009; Estevan & Barnett, 2018; Henderson, 1992). MC enables children and adolescents to successfully participate in various types of physical activity (PA) (Barnett, Morgan, van Beurden, & Beard, 2008; Clark, J. E. & Metcalfe, 2002; Hesketh et al., 2017; Holfelder & Schott, 2014). Stodden et al. (2008) suggested in their developmental model that developing MC is foundational for engagement in PA. A few years later Robinson et al., (2015), in a revision of the model of Stodden et al., (2008), hypothesized that lacking MC leads to a negative spiral of withdrawal in PA as children lack the competence and confidence to move and will not enjoy participation in activities which they believe they will not be successful.

There is evidence that MC is related to several underlying mechanisms as perceived motor competence (PMC) (Khodaverdi, Bahram, Stodden, & Kazemnejad, 2016), weight status (Robinson et al., 2015), and enjoyment (Bardid et al., 2017; Loprinzi, Davis, & Fu, 2015). PMC is an important factor that mediates the role between actual motor competence (AMC) and PA (Babic et al., 2014; Barnett, Morgan, Van Beurden, Ball, & Lubans, 2011; Hulteen, True, & Pfeiffer, 2020; Robinson et al., 2015). PMC refers to an individual's perception of their actual movement capabilities and can be described as the belief in one's own ability to effectively use and apply a variety of general, refined, and specific movement patterns (Robinson et al., 2015; Robinson, Veldman, Palmer, & Okely, 2017). Without being specified by numbers, an optimal level of PMC in combination with AMC seem to be important for engaging children and adolescents in physical activity and sports (Clark, C. C., Moran, Drury, Venetsanou, & Fernandes, 2018; Estevan & Barnett, 2018; He, Ng, Cairney, Bedard, & Ha, 2021). Various studies have shown that besides PMC, enjoyment is also positively related to PA in children and youth (Cairney et al., 2012; Carroll & Loumidis, 2001; Moore et al., 2009; Owen et al., 2019; Tremblay, Kho, Tricco, & Duggan, 2010). Enjoyment is defined as a "positive affective response to the sport experience that reflects generalized feelings such as pleasure, liking, and fun" (Boyd & Yin, 1996; McCarthy, Jones, & Clark-Carter, 2008; Scanlan, Carpenter, Lobel, & Simons, 1993). Loprinzi and colleagues (2015) proposed a conceptual model in which enjoyment of PA is a potentially indirect pathway to mediate the relationship between AMC and PA at early childhood. Enjoyment is often discussed regarding intrinsic motivation but generally, enjoyment is a broader and more inclusive construct derived from internal and external origins.

Young children, 4- to 6- years, are in a crucial phase of developing AMC levels since many of the fundamental motor skills (FMS) such as running, jumping, throwing and catching are developed during this phase of life (Figuroa & An, 2017). Although research on AMC, PMC and enjoyment in young children is a growing field of interest, several questions remain to be answered. For example, clarification is needed on the development of AMC, PMC and enjoyment during early childhood and how they are related to each other. Also, potential confounding variables (e.g., socio-economic background, race- and cultural differences) as well as methodological difficulties when measuring young children (e.g., type of assessments used, concentration of children when being tested) might be of influence on the findings and need to be explored. As mentioned, proficiency in FMS is a prerequisite for engagement in PA which is partly influenced by underlying determinants, including PMC (Babic et al., 2014) and enjoyment (Carroll & Loumidis, 2001). However, the status of AMC, PMC and enjoyment, specifically at 4, 5 and 6 years old, is understudied and information on the differences in these outcome measures between boys and girls and children with different weight status is inconclusive (Figuroa & An, 2017; De Meester et al., 2020; Lopes, L. et al., 2021).

With respect to sex, a tendency is found with boys demonstrating more proficient object control skills (as part of motor competence) (Bardid et al., 2017; Bolger et al., 2021) and girls demonstrating better locomotor skills at young age (3-8 years old) (Cliff, Okely, Smith, & McKeen, 2009; Figuroa & An, 2017; Iivonen & Sääkslahti, 2014; Junaid & Fellowes, 2006). It has been suggested that object control skills relate most strongly to boys' habitual PA since boys participate in popular activities at primary school age such as soccer, Australian football, and basketball (Okely & Wright, 1997). However, sex differences could also be attributed to environmental, contextual and socio-cultural factors (Malina, Cumming, & e Silva, Manuel J Coelho, 2016; Robinson, 2011). In a study conducted among Belgian and US children (4-5 years old), Belgian children performed significantly higher on MC compared to US peers (Brian et al., 2018). With respect to PMC, higher PMC levels were found in boys compared to girls (Babic et al., 2014; Robinson et al., 2011). These findings are in contrast with a review done by De Meester et al., (2020) which showed no sex differences for AMC and PMC. The sequence of MC development and skill acquisition during early childhood is rather stable, from rudimentary movement patterns (i.e., reaching and grasping) to FMS development (Ozmun & Gallahue, 2016). However, the rate and extent of development are largely individually determined since a mature form of MC is likely to be achieved with appropriate practice, encouragement, feedback and instruction. Regarding MC development, differences are noticed. A large cross-sectional study conducted among 3–6-year-old US children showed that approximately 77% of the measured children were at risk for developmental delay in MC (Brian et al., 2019). However, a longitudinal study by Schmutz and colleagues (2020) showed highly stable MC levels throughout early childhood (2-6 years old).

Furthermore, in the last decade there has been an increasing interest in the relationship between AMC, PMC and enjoyment with weight status at (early) childhood (D'Hondt et al., 2014). Multiple cross-sectional studies showed an inverse relationship between AMC and Body Mass Index (BMI) indicating that lower AMC is accompanied with overweight and obesity (De Meester et al., 2016; Lubans, Morgan, Cliff, Barnett, & Okely, 2010; Morano, Colella, & Caroli, 2011; Nervik, Martin, Rundquist, & Cleland, 2011). In their review Trecroci, Invernizzi, Monacis, & Colella (2021) also showed a negative relationship between AMC with weight status among children from 6-10 years old. These effects are especially visible when a task requires manipulation of total body mass (D'Hondt, Deforche, De Bourdeaudhuij, & Lenoir, 2009). Without adequate motor skill improvements, BMI related differences in AMC become more pronounced as children grow older (D'Hondt et al., 2011).

In summary, previous studies have shown insight in the underlying determinants of developing MC. However, most research has been conducted among older children, starting at middle childhood age (from 6

years). The differences in AMC, PMC and enjoyment between children of different age, sex and weight status are not yet unequivocal in the literature due to confounding factors and methodological issues. This study includes a large sample size of young children in which different determinants of MC development have been measured at the same time. Therefore, the purpose of this study is to examine the differences in AMC, PMC and enjoyment for boys and girls aged 4, 5 and 6 years with different weight status. Insight in these differences is crucial and can help developing effective practices and policies on FMS promotion essential for a lifelong PA.

Material and methods

Participants

This cross-sectional study collected data from 1708 young children (860 boys; 50.4%) with a mean age of 5.34 years (SD \pm 0.73) old from 36 primary schools in southern, western and northern urban and suburban parts of the Netherlands. The directors of the schools were informed about the nature, aims and procedures of the study. Before assessment, written informed consent was obtained from the parents or guardians of the children. The study was approved by the Ethics Committee of the Faculty of Behavioural and Movement Sciences, VU Universiteit Amsterdam, the Netherlands (ref. number VCWE-2019-139R1). All measurements took place between February and September 2020. To be included in the analyses, a child had to complete all measurements. Table 1 shows an overview of the background characteristics and test results of the included children.

Procedure

Trained research assistants assessed AMC, PMC and enjoyment in physical activity of the children during a regular 50-minute physical education (PE) lesson at school. All research assistants participated in a two-hour training session to conduct the tests according to the protocol. Body height and weight of the children were measured individually to the nearest 0.1 cm using a stadiometer (SECA 217, Hamburg, Germany) and to the closest 0.1 kg using a digital scale (SECA 878dr, Hamburg, Germany) at the start of the PE lesson. At time of testing the children wore regular sportswear without socks and shoes. The age of the children was determined at the day of data collection by subtracting the date of measurement from the date of birth.

Actual motor competence

AMC was measured with the Athletic Skills Track (AST). The AST is an age specific track that consists of a series of 5–7 detached activities based on coordinative abilities (i.e., coupling, spatial orientation, and balance ability) (Hoeboer, Krijger-Hombergen, Savelsbergh, & De Vries, 2018). In this study, AST-1 (age group 4, 5 and 6 years old) was used consisting of the following five activities: (1) Walking, (2) Traveling jumps, (3) Alligator crawl, (4) Slaloming, and (5) Clambering. Prior to the measurement, the research assistant demonstrated the participating children how to complete the track. Each child performed, on bare feet, three practice trials and one test trial. During the practice trials feedback was given when necessary. The time to complete the track was registered to the nearest 0.1 second by the research assistant using a stopwatch. The test-retest reliability of the AST-1 was high (ICC = 0.881 (95%), CI: 0.780–0.934) in a study among 4–12-year-old children (Hoeboer et al., 2018). The internal consistency of the AST-1 was above the acceptable level of Cronbach's $\alpha > 0.70$ ($\alpha = 0.764$) (Hoeboer et al., 2018) and the validity of the AST-1 was high when compared to the Körperkoordinations Test für Kinder (KTK) ($r = -0.747$, $P = 0.01$) (Hoeboer et al., 2018).

Perceived motor competence

To measure PMC, the 12-indicator Pictorial Scale of Perceived Movement Skill Competence for Young Children (PMSC) was used (Barnett, Ridgers, Zask, & Salmon, 2015). The children were individually assessed on six locomotor (LOC) skills (i.e., running, galloping, hopping, leaping, horizontal jumps, and height jumps) and six object control (OC) skills (i.e., striking a stationary ball, stationary dribbling, kicking, catching, overhand throw, and underhand roll) using a pictorial instrument (Barnett et al., 2015; Lopes, V. P. et al., 2016; Valentini et al., 2018). Children were required to choose which picture was most like them (i.e., “this child is pretty good at throwing, this child is not that good at throwing, which child is most like you?”) and within the chosen picture were asked to further indicate their perceived competence on a scale from 1 till 4. Options for the ‘good performance’ picture included: ‘really good at. . .’ (rated as four points) or ‘pretty good at. . .’ (three points); and for the ‘poor performance’ picture, included: ‘sort of good at. . .’ (two points) or ‘not that good at. . .’ (one point). Test-retest reliability scores of the PMSC for 4- to 7-year-old children were excellent (ICCs for all 12 skills: 0.83, the six LOC-items: 0.82 and the six OC-items: 0.78). The internal consistency of the PMSC was above the acceptable level of Cronbach's $\alpha > 0.60$ for LOC as well as OC skills and high correlation coefficients were reported between the pictorial scores and the Test of Gross Motor Development-2 (TGMD-2) ($r = 0.82-0.90$) (Barnett et al., 2015; Valentini et al., 2018).

Enjoyment

All children completed a six-item ‘smileyometer’ individually to assess the enjoyment of being physically active on a 5-point Likert Scale from one ‘not nice at all’ till five ‘very nice’. Children were asked to point out one smiley which matched best to the specific question (i.e., “what do you think of the PE class at school?”). The questions, accompanied by corresponding images, were based on five ‘active’ constructs (i.e., participating during the PE lessons, swimming, playing outdoors at the school yard, playing outdoor elsewhere, and participating in sports at the sports club) and one sedentary or ‘passive’ construct (i.e., conducting a

sedentary activity such as watching television/tablet). The smileyometer has been widely adopted and applied in research studies with children (Hoeboer, De Vries, Mast, & Savelsbergh, 2017; Read, MacFarlane, & Casey, 2002; Sim & Horton, 2012). It is easy to complete and requires no writing of young children. The reliability and age effect of the smileyometer have been positively evaluated in young children by Read (2008).

Data analysis

Based on the time to complete the AST, motor quotient (MQ) scores were generated with the formula; $MQ = (50\text{th percentile } AST-1 / \text{time } AST-1) \times 100$. For PMC, the average score of the 12 PMSC-items was calculated and taken as outcome measure. A higher score reflects higher PMC (range 1 – 4) (Barnett et al., 2015). Enjoyment outcomes were determined by calculating the average scores of the five ‘active’ items and one ‘sedentary’ score (scale 1-5). In addition, the enjoyment data was dichotomized into two categories (low enjoyment ≤ 3 and high enjoyment > 3). From the anthropometric measures (body mass and body height) body mass index (BMI) was derived by dividing the child’s weight in kilograms by their height in meters squared. Next, BMI was labelled in three meaningful categories, i.e., normal weight, overweight and obesity based on age- and sex-related cut offs (Cole, Bellizzi, Flegal, & Dietz, 2000).

After removing outliers ($>$ three standard deviations below or above the mean) descriptive statistics (means and standard errors) were generated to characterize AMC, PMC and enjoyment by sex, age and weight status. The data were analyzed using a three-way ANOVA ($2 \times 3 \times 3$) (Sex [boys, girls] \times Age [4 years, 5 years, 6 years] \times weight status [normal weight, overweight and obesity]) to compare means group differences. Results with p-values <0.05 were considered statistically significant. A Shapiro-Wilks test was used to check up on normality of distributions before analysis. The assumption of normality was violated for some groups in the PMC and enjoyment analysis. When the assumption of normality was violated, no further statistical analyses have been performed. Homogeneity of variance was checked using Levene’s test. When the assumption of homogeneity of variances was violated, the significance threshold was set to $p < 0.01$ (Pallant, 2020). Significant multivariate main and interaction effects were analyzed by means of univariate F-tests and estimation of means and standard errors of the outcome variable by levels of the interacting variables. Bonferroni correction was applied to multivariate tests. In addition, the relative distributions within the categorized enjoyment data for the different weight statuses were examined. Data analysis was performed with the Statistical Package for the Social Sciences (SPSS version 27.0, 64-bits edition, SPSS Inc, Chicago, Illinois).

Results

Table 1 shows an overview of the Actual Motor Competence (AMC), Perceived Motor Competence (PMC) and Enjoyment scores (ENJ) for groups of children with different sex, age and weight status.

Table 1: Actual Motor Competence (AMC), Perceived Motor Competence (PMC) and Enjoyment (ENJ) by sex, age and weight status.

	Age (in years)	Weight status	AMC	SE	n	PMC	SE	n	ENJ	SE	n
Boys	4 years old	<i>normal weight</i>	102	1.37	237	3.25	0.03	226	4.36	0.04	215
		<i>overweight</i>	90	5.64	14	3.19	0.14	13	4.39	0.16	14
		<i>obesity</i>	103	12.19	3	3.31	0.29	3	4.58	0.34	3
	5 years old	<i>normal weight</i>	102	1.16	333	3.36	0.03	324	4.39	0.03	307
		<i>overweight</i>	106	4.85	19	3.42	0.12	18	4.46	0.14	17
		<i>obesity</i>	100	7.04	9	3.29	0.18	8	3.66	0.21	8
	6 years old	<i>normal weight</i>	102	1.79	140	3.38	0.04	135	4.40	0.05	137
		<i>overweight</i>	101	4.85	19	3.34	0.12	18	4.46	0.14	18
		<i>obesity</i>	98	8.62	6	3.15	0.22	5	4.53	0.24	6
	total	<i>normal weight</i>	102	21.23	710	3.33	0.49	685	4.38	0.61	659
		<i>overweight</i>	100	19.29	52	3.33	0.61	49	4.44	0.51	49
		<i>obesity</i>	100	13.67	18	3.25	0.48	16	4.13	0.86	17
Girls	4 years old	<i>normal weight</i>	101	1.42	222	3.28	0.03	233	4.39	0.04	220
		<i>overweight</i>	104	4.50	22	3.31	0.11	21	4.62	0.13	20
		<i>obesity</i>	105	7.04	9	3.11	0.17	9	4.48	0.20	9
	5 years old	<i>normal weight</i>	102	1.15	335	3.30	0.03	318	4.45	0.03	320
		<i>overweight</i>	98	3.99	28	3.20	0.10	27	4.43	0.11	28
		<i>obesity</i>	99	4.85	19	3.30	0.12	17	4.33	0.14	18
	6 years old	<i>normal weight</i>	101	2.00	112	3.28	0.05	113	4.52	0.06	109
		<i>overweight</i>	102	4.72	20	3.61	0.12	18	4.59	0.14	17
		<i>obesity</i>	90	7.98	7	3.37	0.19	7	4.63	0.24	6
	total	<i>normal weight</i>	101	20.93	669	3.29	0.49	664	4.44	0.57	649
		<i>overweight</i>	101	22.47	70	3.34	0.56	66	4.53	0.57	65
		<i>obesity</i>	99	24.04	35	3.26	0.52	33	4.42	0.75	33
Overall	<i>normal weight</i>	102	21.08	1379	3.31	0.49	1349	4.41	0.59	1308	
	<i>overweight</i>	101	21.10	122	3.34	0.58	115	4.49	0.55	114	
	<i>obesity</i>	99	20.96	53	3.26	0.50	49	4.32	0.80	50	

Regarding AMC, no significant interaction effects were found between sex, age and weight status on AMC. Likewise, no interaction effects were found between sex, age and weight status on PMC. However, there was a statistically significant two-way interaction effect between age and weight status for enjoyment, ($F(4, 1454) = 2,464, p = .043$). While, post-hoc analyzes were not performed because the assumptions for normality was violated for some groups of sex and weight status, the dichotomized enjoyment data were further explored. The absolute and relative distributions of the dichotomized enjoyment data were examined for the normal weight, overweight and obese weight group (Table 2).

Table 2: Absolute (n) and relative (%) values for the categorized enjoyment data (low enjoyment ≤ 3 and high enjoyment > 3) divided over the weight groups normal weight, overweight and obese for children between 4 and 6 years old.

Enjoyment category	Weight status		
	Normal weight n (%)	Overweight n (%)	Obese n (%)
Low enjoyment ≤ 3	19 (1.45%)	1 (0.9%)	4 (8%)
High enjoyment > 3	1289 (98.55%)	113 (99.1%)	46 (92%)
Total=	1308	114	50

For the normal weight and overweight groups, the distribution between high and low enjoyment scores is 99% to 1%. However, in the obese group there is a notable different distribution of 92% to 8%. However, it should be noted that the absolute numbers in the low enjoyment group are low.

Discussion

In this study, we examined differences in AMC, PMC and enjoyment between boys and girls aged 4, 5 or 6 years old with different weight status. For AMC and PMC, no significant differences were found between children of different age, sex and weight. However, an interaction effect of weight status was found for enjoyment. When looking at the relative distribution between high and low enjoyment categories, this distribution is different for the obese children (92% versus 8%) compared to the children with normal weight or overweight (99% versus 1%). This means, relatively more 4-, 5- and 6-years-old children with obesity experience less enjoyment during physical activity than children with other weight status.

Actual motor competence

In this study sex, age and weight status did not have a significant effect on AMC. This is not in line with the study of (Navarro-Patón, Mecías-Calvo, Rodríguez Fernández, & Arufe-Giráldez, 2021) which found that 5-years-old girls score significantly better than boys on several items of the Movement Assessment Battery for Children-2 (MABC-2). The study of Kokšejn, Musálek, & Tufano (2017) showed similar results: 3- and 4-year-old girls had higher total-, fine motor skill, and balance scores compared to boys. However, there were no sex differences for total test or balance scores in 5- and 6-year-olds, while 6-year-old boys outperformed girls in aiming and catching. With respect to weight status, Laukkanen, Pesola, Finni, & Sääkslahti, (2017) did not find a significant association between BMI at early childhood and AMC at middle childhood although a trend was noticed in girls from the age of 4 onwards. An explanation for the different study results is that there is a wide range of individual differences in the development of motor competence between different ages and sex (Kambas et al., 2012) and that these differences do not remain stable throughout the preschool period (Kokšejn, Musálek, & Tufano, 2017). The chosen assessment tool might play an important role in determining the differences. In the present study AMC is assessed with the Athletic Skills Track. This track measured how fast children can perform a diverse range of locomotor movements but does not distinguish separate motor skills as balance or catching. There are many assessment tools to evaluate MC in children and adolescents. The use of several MC assessment tools by different studies and countries precludes direct comparisons across the globe. Indeed, there is no universal agreement about what might constitute a “gold standard” assessment of MC. Alternatively, the construction of an international standardized field-based assessments of MC would ensure comparability between populations and over time (Lopes et al., 2021).

Perceived motor competence

No significant distinction was found in perceived motor competence for children of different sex, age and weight. A study done by Spessato, Gabbard, Robinson, & Valentini (2013) among 4–7-year-old children found that obese children experience less perceived motor competence compared with normal weight children. Noordstar, van der Net, Jak, Helders, & Jongmans (2016) stated that PMC is diminishing as children grow older with boys generally representing higher PMC scores compared with girls. As children’s cognitive capacities continue to develop over time (6-8 years) they become more accurate in assessing their own motor competence via comparison against peers and their level of success (De Meester et al., 2016; Harter, 1999; Pesce et al., 2016). This results in a stronger correlation between actual- and perceived MC. Similar findings were reported by Liang, Ridgers, & Barnett (2015) stating that less accurate perceptions of their own skills lead to an overestimation of their abilities at young age (age 5-8 years). A clarification for the discrepancy between actual- and perceived MC scores at young age can be found that young children tend to confuse the wish to be competent with the reality, resulting in high scores due to misunderstanding the content (Estevan & Barnett, 2018). According to Stodden et al., (2008) the relationship between AMC and PMC will just emerge in young children.

Enjoyment

The experience of enjoyment during physical activity seems a critical factor for children's motivation to participate in exercise settings (Burns, Fu, & Podlog, 2017; Cairney et al., 2012; Carroll & Loumidis, 2001; Dismore & Bailey, 2011; Haas, Yang, & Dunton, 2021; Loprinzi et al., 2015; Sallis, Prochaska, Taylor, Hill, & Geraci, 1999). Since enjoyment is increased by success experience in being able to demonstrate motor competence, being overweight can have a negative influence because it prevents physical activity, resulting in lack of success. (Morano, Colella, & Caroli, 2011). The relationship between enjoyment and BMI however is rarely being studied in young children. Although in our study a statistically significant difference was not found, the results did show a relative discrepancy between enjoyment and weight status. Similar research conducted among older children led to divergent results. A longitudinal study done by Prochaska and colleagues (2003) with an average study population of 9.5 years, did not find differences between PE enjoyment and weight status. However, Barr-Anderson et al., (2008) did find a relationship among 12-year-old children with higher BMI levels associated with lower levels of PE class enjoyment. Worth mentioning is that in this study overweighted girls expressed the lowest enjoyment levels.

Practical implications

Based on the present study, for AMC development, sex, age and weight status do not have to be taken into account at a young age. Also, the fact that no significant differences were found in PMC for the children participating in this study ensures the sport professional to implement a wide range of activities to stimulate PA. However, it is plausible that there is a difference in enjoyment among children who are obese. Although it is not the case for all children with obesity, an important signal is being sent. Moving a heavier body mass against gravity during physical activity may decrease the motivation of obese children to be involved in physical activity programs, which in turn negatively affect their motor competence. And this negative spiral at young age will likely affect sport participation later in life. So, PE teachers at primary schools and other professionals involved in sports should be aware of this and therefore it's important to promote motor competence and physical activity programs for young children. Within these programs, especially children who are obese should be stimulated to choose physical activities that they like to do in a safe pedagogical climate.

Limitations and further research

As earlier mentioned, younger children have a less accurate perception of their actual skills, tending to overestimate their ability (De Meester et al., 2016; Flavell, 1999; Liong et al., 2015; Pesce et al., 2016). In our study this has led to an unequal distribution of the PMC scores with children scoring maximum scores. Similar skewed distributions were also found for enjoyment scores. Both assessment tools measuring PMC and enjoyment work with item scales where the children had to make their own choices, so perception is necessary. A complicating factor is that within the literature the construct of enjoyment during physical activity is being described and interpreted subjectively (Dudley, Okely, Pearson, & Cotton, 2011). This limit understanding of the construct and makes it hard to measure it in a valid manner. In addition, the different assessment methods measured different aspects of motor competence and physical activity. Therefore, the results obtained by assessment tools, which all have been validated for the target population (Barnett et al., 2015; Hoeboer et al., 2018; Read, 2008), should be interpreted with caution. Many age x weight groups were not normally distributed, making further statistical analysis impossible. Also, since the number of subjects in the obesity group is small, finding specific results is limited. Further research should focus more on children with overweight / obesity to gain better insight in the results found.

As cognitive capacities continue to develop over time it is interesting to find out what the outcomes of a longitudinal study design will be. Longitudinal data can provide a more accurate insight if, and when, differences in AMC, PMC and enjoyment for boys and girls with different weight status will emerge during primary school, and consequently, when specific interventions targeting motor competence can best be applied.

Although the results found in this study were not statistically significant, the data provided in this large-scale population with more than 1700 children involved, did contribute to get a better insight in the sociodemographic and biological determinants of young children's MC.

Conclusions

The results of this study suggest that there are no significant differences in actual and perceived motor competence between boys and girls within the age group 4-to-6-years old and with different weight status. For enjoyment there is a difference for children who experience a lot of enjoyment and less enjoyment. Relatively more 4-, 5- and 6-years-old children with obesity experience less enjoyment during physical activity than children with another weight status. The findings provide important information to professionals when developing effective practices and policies on FMS promotion.

Funding details

This work was supported by a Grant from the National Agency of Applied Research (Regieorgaan SIA), part of The Dutch National Science Organization (NWO) under Grant registration number: RAAK.PRO 03.123.

Disclosure statement

No potential conflicts of interest were reported by the authors.

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