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Performance on the movement assessment battery for children: a systematic review about gender differences

Desempeño en la batería de evaluación del movimiento para niños: una revisión sistemática sobre las diferencias de género

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Abstract

A gender difference has been found in motor competence using several instruments. The Movement Assessment Battery for Children (MABC) seems to be one of the most developed instruments for children's motor coordination assessment, allowing the identification of developmental coordination disorders. Our study aimed to systematically review the differences in the motor performance between genders in studies using only the MABC. Five databases (Scopus, EBSCO+Sport Discus, Web of Knowledge, B-ON and Pubmed) were systematically investigated and studies were included if the MABC tests was a central objective and gender was a considered factor. Five authors independently assessed the eligibility of the studies. A systematic review of electronic databases and reference lists has identified nineteen peer-reviewed studies that meet the inclusion criteria. Results revealed that gender differences in performance were consistent across studies, since boys had more success and ease in activities involving gross motor skills, and girls did better activities involving fine motor skills. Differences in balance were not conclusive as the results on this parameter were mixed. This systematic review highlights the magnitude of gender differences on motor competence as evaluated by the MABC.

Key words: systematic review; gender differences; movement assessment battery for children.

Resumen

Se ha encontrado una diferencia de género en la competencia motora utilizando varios instrumentos. La Batería de Evaluación del Movimiento ABC (MABC) parece ser uno de los instrumentos más desarrollados para la evaluación de la coordinación motora de los niños, lo que permite la identificación de problemas evolutivos da coordinación motriz. Nuestro estudio tuvo como objetivo revisar sistemáticamente las diferencias en el rendimiento motor entre los géneros en los estudios que utilizan solo el MABC. Se investigaron sistemáticamente cinco bases de datos (Scopus, EBSCO+Sport Discus, Web of Knowledge, B-ON and Pubmed) y se incluyeron los estudios si las pruebas MABC eran un objetivo central y el género era un factor considerado. Cinco autores evaluaron de forma independiente la elegibilidad de los estudios. Una revisión sistemática de bases de datos electrónicas y listas de referencias identificó diecinueve estudios revisados por pares que cumplen con los criterios de inclusión. Los resultados revelaron que las diferencias de género en el rendimiento fueron consistentes entre los estudios, ya que los niños tuvieron más éxito y facilidad en las actividades que involucran habilidades motoras gruesas, y las niñas realizaron mejores actividades que involucraban las habilidades motoras finas. Las diferencias en el equilibrio no fueron concluyentes ya que los resultados en este parámetro fueron mixtos. Esta revisión sistemática resalta la magnitud de las diferencias de género en la competencia motriz evaluada por el MABC.

Palabras clave: revisión sistemática; diferencias de género; batería de evaluación de movimiento para niños.

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Introduction

Gender differences in motor performance have been pointed out in the literature. A typical picture is one in which boys performed better than girls in gross motor skills (Freitas, Vasconcelos, & Botelho, 2014; Jelovčan & Zurc, 2016; Ruiz, Graupera, Gutiérrez, & Miyahara, 2003; Valtr, Psotta, & Abdollahipour, 2016) and girls performed better than boys in fine motor skills (Kita, Suzuki, Hirata, Sakihara, Inagaki, & Nakai, 2016; Kokštejn, Musálek, & Tufano, 2017; Mathisen, 2016). However, these outcomes are not consensual, with some studies revealing no such differences (Giagazoglou, Kabitsis, Kokaridas, Zaragas, Katartzi, & Kabitsis, 2011; Hermundur & Rostoft, 2003) or even contradictory results (Kjelsås, Stensdotter, & Sigmundsson, 2013).

One possible explanation for such discrepancies is the variety of motor tests used for the identification of such differences in motor performance. The most frequently used standardised tests are the Movement Assessment Battery for Children (Henderson & Sugden, 1992), the Bruininks Oseretsky Test-2 (Bruininks & Bruininks, 2005), the Southern California Sensory Integration tests of Ayres (1989), the McCarron Assessment of Neuromuscular Development (MAND, McCarron, 1997), the Test of Gross-Motor Development (TGMD, Ulrich, 1985), the Test of Motor Impairment (TOMI) (Fletcher-Flinn, Elmes, & Strugnell, 1997), Southern California Sensory Integration tests of Ayres (1989), the Körperkoordinations Test für Kinder (KTK, Kiphard & Schilling, 1974), among others.

The Movement Assessment Battery for Children-Second Edition (MABC-2) (Henderson & Sugden, 2007) is one of the most widely used tools for evaluating motor coordination, specifically, developmental coordination disorder (DCD) in children (Rodrigues, Barros, Lopes, Ribeiro, Moreira, & Vasconcelos, 2017). The MABC-2 is constituted by items organized into three motor skills categories: manual dexterity (MD), aiming and catching (AC) and balance (BAL) that increase in difficulty across three age bands (3:0–6:11 years, 7:0–10:11 years, and 11:0–16:11 years).

MABC validity tests were reported extensively in its manual but limited preliminary validity evidence about the MABC-2 itself is reported (Barnett & Henderson,1998; Henderson & Sugden, 2007). Since the two versions are quite different evidence of MABC validity can't be generalized to the MABC-2, as pointed by Brown and Lalor (2009). However, MABC-2 evidence for factorial validity has been found for age version AB1 (Psotta & Brom, 2016), for the age version AB2 (Wagner, Kastner, Petermann, & Bös, 2011), for the AB3 (Vasconcelos, Rodrigues, & Vasconcelos, in press) and for the AB2 and AB3 (Psotta & Abdollahipour, 2017). Results showed that all AB of the MABC-2 test are able to discriminate between the three specific motor abilities. Good internal consistency (Cronbach $\alpha \geq 0.86$) and test-retest reliability (intraclass correlation coefficient ≥ 0.96) have also been found in several studies (Ellinoudis et al., 2011; Hua, Gu, Meng, & Wu, 2013; Valentini, Ramalho, & Oliveira, 2014). Hendersen, Sugden and Barnett (2007), reported an inter-rater reliability of 0.79.

As it concerns motor performance and according to the MABC manual, gender differences were not consistent across ages (Henderson & Sugden, 1992). As observed by Engel-Yeger, Rosenblum, and Josman (2010), the MABC manual expresses significant differences between genders as motor performance is concerned, boys outperforming girls in most age bands in the 4–12 age range, while girls at 9 years old presenting a significant difference in relation to boys. In order to consistently measure gender differences through age with the same instrument, our study aims to systematic review the differences in the motor performance between boys and girls in studies using only the MABC.

Methods

The criterion defined in the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Statement (Moher, Liberati, Tetzlaff, Altman, & Group, 2009) were used to guide our methodology.

Eligibility Criteria

For the accomplishment of this study, five authors (PR, RB, MR, SL and AS) independently assessed the eligibility of the studies according to the following inclusion criteria: i) articles that used MABC to evaluate performance as a central goal and where gender was a considered factor; ii) studies where the participants had no health problems or other disorders than DCD (e.g., intellectual disability, cerebral palsy, stroke, traumatic brain injury, attention deficit hyperactivity disorder); iii) any type of study design was considered (e.g., cross-sectional, longitudinal or experimental/ quasi-experimental); v) only studies written in English were included. Unpublished work, conference proceedings, abstracts and review papers were excluded.

Information sources and search Strategy

The quality of the article was ensured by the search on five electronic databases: Scopus, EBSCO+Sport Discus, Web of Knowledge, B-ON and Pubmed. The combination of the following keywords: 'MABC', 'movement assessment battery for children', 'sex' and 'gender' were used. The article was included when the study's title and abstract included at least movement assessment battery for children or MABC. The literature search was confined to studies from January 1st, 2000 to July 31st, 2017, since this time frame allows capturing all articles that have been used more recently. Only empirical articles were included.

Firstly, the articles were excluded or included by screening their titles for relevance. When appropriateness of the article could not be determined by the abstract, the full text was examined. Additionally, references of all selected articles were checked for further suitable inclusion (snowballing search) (Fig.1).

After the initial search, different stages were followed to select the studies for analysis, namely: i) Removing all duplicates; ii) Screening and removing articles based on the title and abstract. When doubts emerged or when there was insufficient information the full text was retrieved for further analysis in order to make a proper judgment; iii) Screening and removing articles based on full text selected in the previous step; iv) Screening and removing articles based on full text incorporated from the snowballing search.

All decisions, in all stages, were made independently by three of the authors (MR, PR and AS). The results were conferred after each stage and the following stage would only initiate when the full consensus was reached. Thereby there was a total agreement in all final articles.

Data collection process

In this step, all the information concerning references (author, year), study design, sample (type, total number and age), DCD sample (total number/percentage with separated boys and girls), DSM diagnostic criteria (A criteria, other diagnostic criteria and exclusion criteria) and results (Male, Female and total score), was organized by three the authors (MR, PR and AS) in Table 1. No instrument was used to determined studies' quality assessment.

Results

The search yielded five hundred and eighty-eight potentially relevant publications (Fig. 1).

After reviewing the titles and abstracts and removing duplicates; five hundred and forty-two articles were identified that met our relevancy criteria. To avoid repetition, we grouped those studies that were published by the same authors in multiple papers, which narrowed the results down to a total of nineteen studies that proceeded to the evidence synthesis stage.

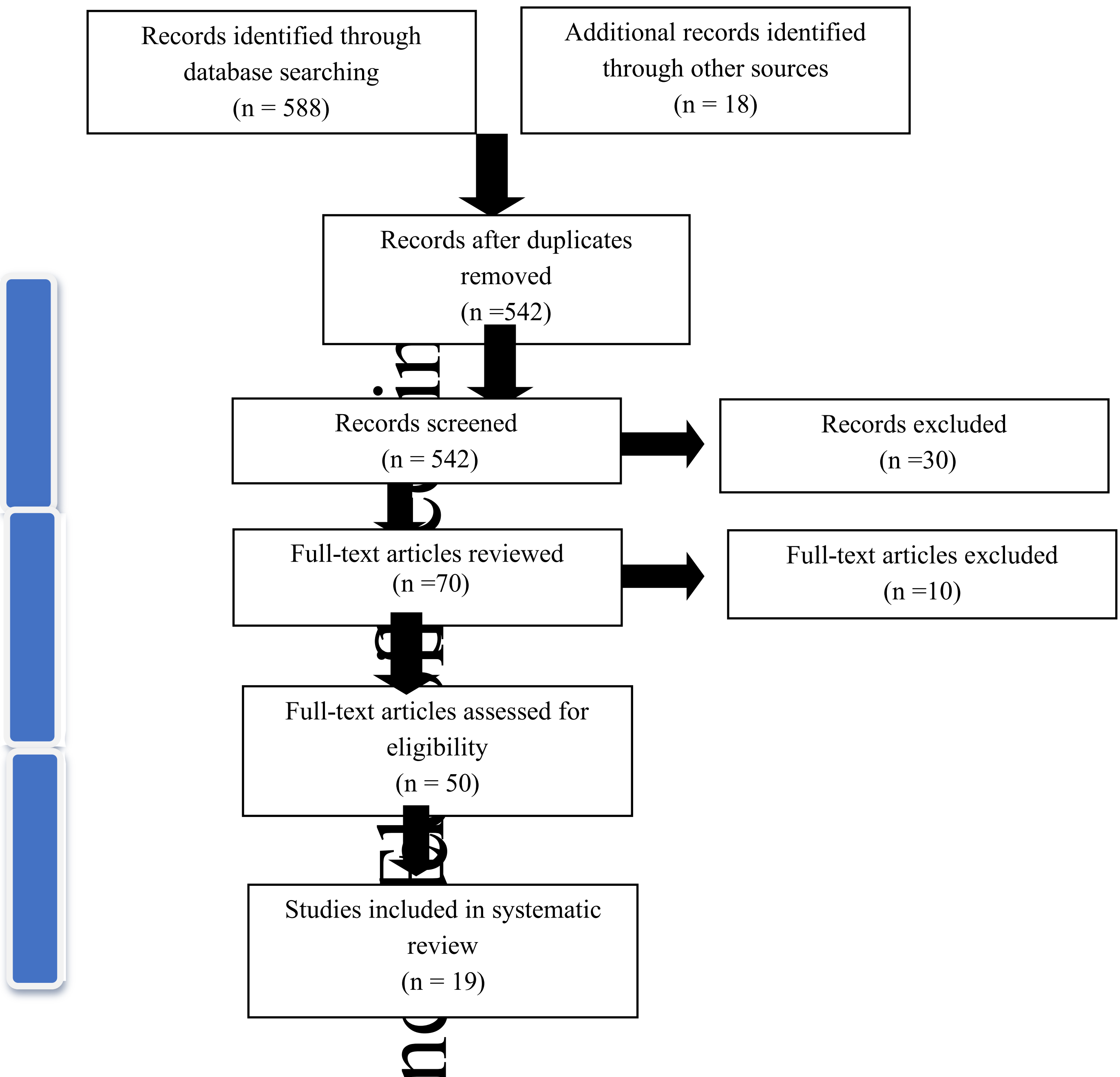

Figure 1. Flow of article selection.

Considering the temporal frame used for the selection of studies, it was noted that approximately 57% of the publications focused on the last four years. Study samples were drawn from various locations all over the world (i.e. Australia, Belgium, Brazil, China, Columbia, Denmark, Czech Republic, Greece, Israel, Netherlands, Norway, Slovenia, Spain, Taiwan, Hong Kong, Republic of South Africa, UK).

All nineteen studies included in this systematic review were cross-sectional and used a school sample. Sample sizes varied greatly, from n=53 (Venter, Pienaar, & Coetzee, 2015) to n=627 (Olesen, Kristensen, Ried-Larsen, Grontved, & Froberg, 2014); sixteen studies had a sample size between 50 and 450. Moreover, we found samples with considerable dimension on several studies (three studies with samples between 460 and 1000 participants.

The age of participants ranged from 3 to 16 years, with the majority of participants between 4-10years.

The MABC was used in all studies to identify children with DCD or probable DCD (pDCD). There were other studies that used complementary tools. Some studies also used the Developmental Coordination Disorder Questionnaire (DCDQ, derived from the MABC) (Engel-Yeger et al., 2010; Freitas et al., 2014), the Test of gross motor developmental (TGMD2) (Valentini et al., 2015), the Body Coordination Test for Children (KTK) (Olesen et al., 2014).

Cut-off points used to identify children as having DCD or pDCD (i.e. applying DSM-IV or DSM-IV-R criterion A) ranged from the 5th to the 15th percentile.

According to our analysis, conflicting results were found about gender differences as the total score is concerned. Some studies found higher scores in girls (Hermundur & Rostoft, 2003; Kita et al., 2016; Kokštejn et al., 2017; Mathisen, 2016), and others found no differences between boys and girls (Engel-Yeger et al., 2010; Freitas et al., 2014; Giagazoglou et al., 2011; Junaid & Fellowes, 2006; Kjelsås et al., 2013; Kourtessis et al., 2008; Valentini et al., 2015; Venter et al., 2015). It should be noticed that seven studies did not mention results about total score (Jelovčan & Zurc, 2016; Livesey, Coleman, & Piek, 2006; Olesen et al., 2014; Psotta & Hendl, 2012; Psotta, Hendl, Frömel, & Lehnert, 2012; Ruiz et al., 2003; Valtr et al., 2016).

Our results indicate that in approximately 75% of the studies boys performed better than girls in gross motor skills (skipping rope) (Jelovčan & Zurc, 2016), and in ball skills (Engel-Yeger et al., 2010; Freitas et al., 2014; Giagazoglou et al., 2011; Junaid & Fellowes, 2006; Kjelsås et al., 2013; Kourtessis et al., 2008; Olesen et al., 2014; Psotta & Hendl, 2012; Ruiz et al., 2003; Valtr et al., 2016).

On the other hand, in approximately 65% of the studies girls performed better than boys in fine motor skills (Freitas et al., 2014; Hermundur & Rostoft, 2003; Junaid & Fellowes, 2006; Kita et al., 2016; Kokštejn et al., 2017; Livesey et al., 2006; Mathisen, 2016; Psotta & Hendl, 2012; Psotta et al., 2012; Ruiz et al., 2003; Valtr et al., 2016; Venter et al., 2015) and nearly 50% of the studies reported better performance on balance (Engel-Yeger et al., 2010; Hermundur & Rostoft, 2003; Kita et al., 2016; Kokštejn et al., 2017; Kourtessis et al., 2008; Livesey et al., 2006; Olesen et al., 2014; Psotta & Hendl, 2012; Ruiz et al., 2003; Valtr et al., 2016; Venter et al., 2015). Only one study found that boys performed better than girls in balance (Kjelsås et al., 2013).

Some studies did not mention gender differences relatively to sub-components of the MABC although information of the total score was reported (Valentini et al., 2015).

As the total score is concerned 42% of the articles in this review reported no differences (Engel-Yeger et al., 2010; Freitas et al., 2014; Giagazoglou et al., 2011; Junaid & Fellowes, 2006; Kjelsås et al., 2013; Kourtessis et al., 2008; Valentini et al., 2015; Venter et al., 2015), a higher value was found in girls compared with boys in about 21% of the studies (Hermundur & Rostoft, 2003; Kita et al., 2016; Kokštejn et al., 2017; Mathisen, 2016) and 37% did not report information (Jelovčan & Zurc, 2016; Livesey et al., 2006; Olesen et al., 2014; Psotta & Hendl, 2012; Psotta et al., 2012; Ruiz et al., 2003; Valtr et al., 2016).

The study characteristics of included articles are outlined in Table 1.

Discussion

As previously mentioned, our study aimed to systematically review the available literature evidence of differences in motor performance between genders evaluated by the MABC. Concerns about this issue have increased in recent years, the results of this study showed that most of the manuscripts were published in the last four years (2014-2017), revealing a progressive interest of the scientific community in issues related to performance and gender.

The cross-sectional study design and school sample were the most frequently used, but on the other hand, longitudinal studies that allow a greater amount of information to be collected are significantly less observed. This type of study can be used to perceive the differences in performance between genders over time and also to see if it may be different according to the age group. We agree with Rivilis et al. (2011) when they pointed out a lack of large-scale epidemiologic longitudinal studies that quantify risk over time and changes in health outcomes. In fact, there are few studies that use longitudinal follow-up designs. The same scenario arises in relation to studies based on different cohorts (Geuze, Jongmans, Schoemaker, & Smits-Engelsman, 2001).

The use of the MABC unites the studies under analysis, although some authors use other complementary tools as already mentioned. MABC is the largest test cited in the literature for the identification of children exhibiting DCD. Some studies use between the 0^{th} and the 5^{th} percentile to prove DCD (Giagazoglou et al., 2011), others use a higher cut-off, between the 5^{th} and 15^{th}percentile for children who are at risk of DCD (Engel-Yeger et al., 2010).

Cutoff scores are important to consider the impact on determining which children will receive intervention services. As emphasized by Holsti, Grunau, and Whitfield (2002), the benefit of the use of a more stringent criterion prevents any ‘‘over labeling’’ and thus ensures that only those children with the poorest performance are given assistance. After different cut-off points, that were used to assign children to the DCD group, the percentile rate that is used to identify these children should be taken into account.

Relatively to the motor competence differences between genders our findings are consistent with the literature using other motor tests. The obvious potential sources of explanation are biology, environment and, their interaction, all mentioned in the articles cited in this study. For example, sociocultural views on appropriate activities for genders reflected in the gender differences found in ball skills and in manual dexterity is shared by some authors (Kjelsås et al., 2013; Livesey et al., 2006). This sociocultural view on appropriate activities for genders, reflected by different kind of games that the two sexes play, offer different opportunities for the developmental of motor competence and can contribute to these gender differences. The greater involvement in ball games is more typical of boys than girls and therefore girls may show poorer performance (Giagazoglou et al., 2011; Kourtessis et al., 2008; Ruiz et al., 2003). As Jelovčan and Zurc (2016) pointed out many stereotypical attitudes to girls make it impossible for them to be as physically adept as boys in certain activities such as ball games. However, since boys with 3 years were better than girls in ball skills, it might be suggested that a biological component may also be involved (Kokštejn et al., 2017; Livesey et al., 2006).

The superior performance of girls over boys in fine tasks of motor coordination may also be explained by the stronger social support and inner motivation in favor of the girls regarding participation in more fine manipulation activities (Kourtessis et al., 2008). Better hand-eye coordination is also pointed as an advantage of manual dexterity superiority of girls (Valtr et al., 2016). Additionally, the same author outlined that more time participation on activities of daily life, such as, housework, meal preparation, personal care, cleaning, cutting, enameling and applying makeup by girls may contribute to this outcome.

Regarding balance, mixed results were found. Almost 50% of the articles reported differences between genders with girls outperforming boys and the other 50% did not find these differences. Engel-Yeger et al. (2010) emphasized that the superiority of girls may be due to the fact that girls may have an advantage in terms of developing postural control. Also, supporting socialization explanation and as pointed by Valtr et al. (2016, citing Faraldo-García, Santos-Pérez, Crujeiras-Casais, Labella-Caballero, & Soto-Varela, 2012), girls wear shoes with high heels or shoes that reduce the surface of the base support, which facilitates the development of balance. On the other hand, several authors (e.g. Kourtessis et al., 2008) pointed out the age band as a possible explanation for the lack of differences between genders. The development of balance ability tends to be fully developed between the 8th and 9th year (Kourtessis et al., 2008) being in accordance with the initial standardization process of MABC which also revealed no significant differences with regard to gender in motor performance (Giagazoglou et al., 2011).

Very few articles (Hermundur & Rostoft, 2003; Kita et al., 2016; Kokštejn et al., 2017; Mathisen, 2016) reported gender differences concerning the total score with girls showing an advantage. We might speculate that these results may be in part explained by the higher scores of girls in the sub-components balance and manual dexterity.

As outlined by Kokštejn et al. (2017), the research process aims to reveal patterns that are repeatedly observed within a population in order to provide conclusive statements about a topic. It is our conviction that the aforementioned body of literature allow for conclusive statements as it concerns to ball skills and manual dexterity, using the MABC as an instrument to measure it. However, we noticed that concerning balance no consensual results were achieved.

Some discrepancies within the data can most likely be explained by a number of possibilities: 1) studies not including children from the entire age bands period (3±16 years old); 2) studies often combining children of both sex together; 3) studies using different versions of MABC test. Therefore, an under or overestimation of gender differences may be possible.

One limitation of this study was that our review includes only published and peer-reviewed articles. Since gray literature, papers in publication, and non-English sources were excluded, the gender issues in motor competence reported here may not be general. The studies quality that was integrated into our analysis was not assessed by tools like Oxford Centre for Evidence-Based Medicine or PEDro scale. Therefore, we recommend that in future studies.

Conclusion

This systematic review highlights the magnitude of gender differences on motor competence as evaluated by the MABC. A greater tendency for boys to be more successful in gross motor skills and girls in fine motor skills was found. However, differences in balance were not conclusive as the results on this parameter are mixed. Expanding the age range of participants in research studies as well as conducting longitudinal studies would add needed information on the impact of gender differences on motor performance. Moreover, future publications would benefit from evidence regarding the shape of the gender distribution at the critical, lower edge of motor performance. The gender differences in motor skills mentioned above could be taken into account by professionals, in order to promote the pedagogical practice, by working more incisively the less developed motor competences.

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ANEXO 1. Description of studies and outcomes

Study	Study design	Sample			DCD sample (N/%)			DSM diagnostic criteria			Results		
		Type	Total N	Age	N	M	F	A criteria (assessment tool + cutoffs)	Other diagnostic criteria	Exclusion criteria	M	F	Total score
(Engel-Yeger et al., 2010)	Cross-sectional	School sample	249	4-12				Demographic questionnaire MABC 15th=risk DCD/ <5th= definite motor difficulties		Low IQ level, neurological, developmental or learning disabilities.	Ball skill (p≤0,005)	Balance (p≤0,001)	No significant differences
(Freitas et al., 2014)	Cross-sectional	School sample	273	4-12	84 (60%)	45 (31.5%)	37 (28.5%)	Dutch Handedness questionnaire MABC 0th-5th=worst performance		Learning disabilities; attention deficit disorder, prenatal problems, neurological or sensory disturbances, premature children, chronic illnesses	Age Band 2 and 3: Ball skill (p<0,001)	Age Band 1: Manual dexterity (p=0,009)	No significant differences
(Giagazoglou et al., 2011)	Cross-sectional	School sample	412	4-6	48 (11.7%)			MABC <5thpercentile		Normal-range IQs, No evidence of physical or neurological disorder, prenatal problems, neurological diseases, sensory disturbances, premature children and children with epilepsy or other chronic diseases	Ball skill (p=0.042)	*	No significant differences
(Hermundur & Rostoft, 2003)	Cross-sectional	School sample	91	4-5	1	1(1%)		MABC child has a normal motor performance				Manual dexterity (p<0.0001) Balance	Significant differences favoring Girls

								or belongs to the 5^{th} percentile child at the 15^{th} percentile and a score greater than 17.0 at the 5^{th}			(p =0.01)	(p=0.001)
(Jelovčan & Zurc, 2016)	Cross-sectional	School sample	100	4-5	4(4%)	*1(25%)*	*3(75%)*	MABC $\leq 5^{th}$ (sign of undoubted motor difficulties) 5^{th}-15^{th} (borderline level of difficulties) $\geq 15^{th}$ (no difficulties)		gross motor skills (Skipping the rope) ($p = 0.002$)	*	No reference
(Junaid & Fellowes, 2006)	Cross-sectional	School sample	103	7-8	NR			MABC	Children who were already identified by the school district as having severe physical, mental or language handicaps were excluded	Ball skill ($p < 0.02$)	Manual dexterity ($p < 0.005$)	No significant differences
(Kita et al., 2016)	Cross-sectional	School sample	132	7-10	NR			MABC'2	no severe neurological or psychiatric disorders, nor any physical problems, normal or corrected-to-normal vision and did not have any visual problems	*	Manual dexterity (p=0,041) Balance (p=0,000)	Significant differences Favoring Girls ($p = .017$).
(Kjelsås et al., 2013)	Cross-sectional	School sample	67	11	NR			MABC	No reported history of learning difficulties or any behavioral, neurological or	Ball skill ($p<0.05$) Balance (Jumping)	*	No significant differences

									orthopedic problem	(p<0.05)		
(Kokštejn et al., 2017)	Cross-sectional	School sample	325	3-6	NR			MABC'2	Children who had been diagnosed with mental or other clinically diagnosed impairments (such as ADHD, DCD, developmental dysphasia, etc.) and children from special needs classes were not included in the study.	aiming and catching (6-year-old) (p < .001)	Manual dexterity (3- and 4-year-old) (p < .01) balance scores (3- and 4-year-old) (p < .05)	Significant differences Favoring Girls (3- and 4-year-old) (p < .01)
(Kourtessis et al., 2008)	Cross-sectional	School sample	354	4-6	6 (1,6%)	5 (83,33 %)	1 (16,66 %)	MABC 6th-15th= moderate dificulties/ 5th-15th= severe motor problem		Ball skill (p<0,001)	Manual dexterity (p<0,01)	No significant differences
(Livesey et al., 2006)	Cross-sectional	School sample	128	3-5				MABC 5th and 15th percentiles (the cut-offs normally used to identify those with or at risk of DCD).		Ball skills (p<0.001)	Manual dexterity (p<0.001) Balance (p <0.01)	No reference
(Mathisen, 2016)	Cross-sectional	School sample	94	6				MABC scoring at or below the 5th percentile is regarded as children with motor problems, and children scoring at or below 15th percentile is `borderline` performance group			Manual dexterity (p=0,001)	Significant differences Favoring Girls (p=0,032)

(Olesen et al., 2014)	Cross-sectional	School sample	627	5-6				MABC'2 Körperkoordination Test für Kinder (KTK)		Aim and catch ($p<0.001$)	Balance ($p<0.001$)	No reference
(Psotta & Hendl, 2012)	Cross-sectional	School sample	589	11-15	8	6(1.9%)	2(0.7%)	MABC-2	Children with physical and other neurological Disabilities were not tested.	Aim and catch *	Manual dexterity * Balance *	No reference
(Psotta et al., 2012)	Cross-sectional	School sample	487	7-10	3(0,6 %)			MABC'2		*	Manual dexterity *	No reference
(Ruiz et al., 2003)	Cross-sectional	School sample	385	7-9				MABC	Criteria described in the manual MABC	Band age 2: Ball skill (One-catch bounce and catch) (p=.004) throwing a beanbag into a box (p=.000) Band age 3: Ball skill (One-catch bounce and catch) (p=.009) throwing a beanbag into a box(p=.001)	Band 3: Manual dexterity (flower trail (p=.012) Band 2: Balance (Heel-to-toe walking (p=.000)	No reference
(Valentini et al., 2015)	Cross-sectional	School sample	424	4-10	58			MABC DCD $\leq 5^{th}$ At risk $>5^{th}$ to $\leq 15^{th}$ TD $>16^{th}$ Test of gross motor developmental (TGMD)		*	*	No significant difference

(Valtr et al., 2016)	Cross-sectional	School sample	121	15-16				MABC´2		Participants who were physically and psychologically healthy and without general medical conditions or other neurological dysfunctions were included in the study.	Aim and Catch Preferred hand ($p < .030$) Other hand ($p < .001$)	Manual dexterity preferred hand ($p < .001$) Graphomotor ($p = .001$) Balance ($p =0.011$)	No reference
(Venter et al., 2015)	Cross-Sectional	School Sample	53	3-4	6	1	5	MABC'2 $\geq 15^{th}$= No DCD / 5^{th}-15^{th}=risk DCD / $\leq 5^{th}$= severe DCD	CD		Aim and catch ($p=0.016$)	*	No significant difference

MABC, Movement Assessment Battery for Children; DCD, developmental coordination disorder; TD, typical development; ADHD, Attention deficit hyperactivity disorder; NR, not reported; %ile, percentile; *p value is not reported