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Self-perceptions in children with probable developmental coordination disorder with and without overweight



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ABSTRACT

Background: Children with probable developmental coordination disorder (pDCD) experience motor problems that negatively influence their self-perceptions and increase the risk to develop overweight due to physical inactivity. Whether overweight in children with pDCD has an additional impact on their self-perceptions is unclear. Insight in this impact would provide vital information for diagnostics and interventions to enhance physical activity in children with pDCD and overweight.

Aims: Investigate differences in self-perceptions between children with pDCD and overweight (pDCD-O), children with pDCD without overweight (pDCD-NO), and typically developing children (TD).

Methods and procedures: A total of 366 children (188 boys/178 girls), aged between 7 and 13 years, participated in this study. Thirteen children were categorized as pDCD-O, 51 children as pDCD-NO, and 302 children as TD. Self-perceptions were assessed with the Self-Perception Profile for Children.

Outcomes and results: Children with pDCD-O perceived themselves lower in social acceptance than children with pDCD-NO and TD children. Children with pDCD-NO perceived themselves lower in athletic competence than TD children, but not than children with pDCD-O. No differences were found for perceived physical appearance and global self-esteem.

Conclusions and implications: Overweight has an additional negative impact on perceived social acceptance in children with pDCD.

What this paper adds?

This is the first study to investigate the additional impact of overweight on self-perceptions in children with probable developmental coordination disorder (pDCD). Furthermore, we provide recent insight in self-perceptions in children with pDCD as most studies that investigated multiple self-perceptions in children with DCD are more than 10 years old. We investigated self-perceptions in a group of 366 children, aged between 7 and 13 years old. Based on motor performance and BMI scores, we created three groups for analyses: (a) children with pDCD and overweight (pDCD-O) ($n = 13$), (b) children with pDCD without overweight (pDCD-NO) ($n = 51$), and (c) typically developing children (TD) ($n = 302$). Children with pDCD-O perceived themselves lower in social acceptance than children with pDCD-NO and TD children. Children with pDCD-NO perceived themselves lower in athletic competence than TD children.

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children, while differences between children with pDCD-O and TD children were not significant. No differences were found for perceived physical appearance and global self-esteem. Our results stress the importance for therapists to investigate perceived social acceptance in children with pDCD-O. Current motor interventions focus primarily on improving children's motor performance to participate in daily life. Motor interventions for children with pDCD-O who experience low (perceived) social acceptance should also focus on the social context in which children experience motor problems (e.g., basketball, football).

1. Introduction

Children with developmental coordination disorder (DCD) have trouble mastering and performing motor activities. This impairment significantly interferes with activities in daily life and/or academic achievement and is not due to a general medical condition (American Psychiatric Association, 2013). The prevalence of DCD is estimated at around 5–6 % in school-aged children, where boys are overrepresented compared with girls (Blank, Smits-Engelsman, Polatajko, & Wilson, 2012). Empirical evidence showed that children with DCD have lower levels of self-perceptions than typically developing (TD) children (e.g., Noordstar, van der Net, Voerman, Helders, & Jongmans, 2017; Poulsen, Ziviani, Johnson, & Cuskelly, 2008). Whether overweight in children with DCD has an additional impact on their self-perceptions is unclear. The current study therefore focuses on the self-perceptions of children with DCD who may or may not be overweight. Insight into the impact of overweight on the self-perceptions of children with DCD would provide valuable information for diagnostics and interventions.

Most studies that investigated differences in self-perceptions between children with DCD and typically developing children focused on perceived athletic competence, which is defined as how children perceive their sport ability and athletic performance (Harter, 1982; Ridgers, Fazey, & Fairclough, 2007). There is overwhelming evidence that children with DCD have lower levels of perceived athletic competence than typically developing children (e.g., Cocks, Barton, & Donnelly, 2009; Noordstar et al., 2014; Poulsen, Ziviani, & Cuskelly, 2006, 2008), whereby differences become larger as children grow older (Piek, Baynam, & Barrett, 2006). Children with DCD also perceive themselves lower in physical appearance than typically developing children (Poulsen et al., 2006; Watson & Knott, 2006). These differences are somewhat expected as both self-perceptions pertain to the physical domain. However, children with DCD have also lower levels of self-esteem than typically developing children (e.g., Noordstar et al., 2017; Poulsen et al., 2006; Skinner & Piek, 2001). Self-esteem is defined as a person's overall perception of oneself and considered to be an important index of well-being and mental health (see for review: Harter, 2012). Self-esteem is influenced by a number of more specific (lower-order) self-perceptions (e.g., perceived athletic competence, perceived physical appearance) (e.g., Fox & Corbin, 1989; Paradise & Kernis, 2002; Sonstroem, Harlow, & Josephs, 1994).

Self-perceptions of social acceptance have been less investigated in children with DCD, and results are somewhat contradictory (e.g., Piek et al., 2006; Poulsen et al., 2006). Most studies found that children with DCD had lower levels of perceived social acceptance than typically developing children (Cocks et al., 2009; Poulsen et al., 2006; Roze, Larkin, & Berger, 1997; Schoemaker & Kalverboer, 1994). The ability to perform in sports is highly valued by children in Western society (Chase & Dummer, 1992; Vannatta, Gartstein, Zeller, & Noll, 2009). Because of their motor problems, children with DCD participate less in sports than typically developing children (e.g., Baerg et al., 2011; Noordstar et al., 2014). This negatively affects their peer relations and, in turn, their perceived social acceptance (Cairney, Rigoli, & Piek, 2013; Livesey, Lum Mow, Toshack, & Zheng, 2011). Two studies found no differences in perceived social acceptance between children with DCD and typically developing children, but gave no clear explanations for this contradictory result (Piek et al., 2006; Skinner & Piek, 2001).

As mentioned before, children with DCD are at greater risk to develop overweight (Cermak et al., 2015; Hendrix, Prins, & Dekkers, 2014). This risk is higher for boys and seems to increase with age (Hendrix et al., 2014). Perceived athletic competence and perceived physical appearance were lower in children with overweight than in children of a normal weight (Danielsen et al., 2012). Again, differences are somewhat expected as both self-perceptions pertain to the physical domain. However, studies reported that children with overweight had lower levels of self-esteem and perceived social acceptance than children of a normal weight (e.g., Danielsen et al., 2012; Franklin, Denyer, Steinbeck, Caterson, & Hill, 2006). These results indicate that the impact of overweight stretches beyond the physical domain. To our knowledge, no study investigated the additional impact of overweight on self-perceptions in children with DCD.

While not the primary aim of this study, we also investigate differences in self-perceptions between boys and girls because of the large known differences (see for review: Gentile et al., 2009; Kling, Hyde, Showers, & Buswell, 1999). Differences in global self-esteem between boys and girls are not present during elementary school (Noordstar, van der Net, Jak, Helders, & Jongmans, 2016; Wigfield et al., 1997), but start to appear during middle school in favor of boys (e.g., Morin, Marsh, Maïano, Nagengast, & Janosz, 2013). The primary reason for these differences is the low self-perception of physical appearance in girls during this period, which affects their global self-esteem (Kling et al., 1999). Boys perceive their athletic competence higher than girls in every grade of elementary and middle school (e.g., Gentile et al., 2009; Noordstar et al., 2016), while perceptions of social acceptance are the same (Gentile et al., 2009).

In the present study, we investigate differences in self-perceptions of athletic competence, physical appearance, global self-esteem, and social acceptance between children with DCD and overweight (DCD-O), children with DCD without overweight (DCD-NO), and TD children. We also investigate differences in self-perceptions between boys and girls.

Based on the current literature, we hypothesize that children with DCD-NO perceive themselves lower for athletic competence, physical appearance, global self-esteem, and social acceptance than TD children (e.g., Danielsen et al., 2012; Noordstar et al., 2017; Poulsen et al., 2006). Although we are unable to make a clear hypotheses, we expect being overweight causes an extra negative impact on children's self-perceptions. We therefore expect children with DCD-O to perceive themselves lower than children with

DCD-NO and TD children. With regard to sex, we expect boys to perceive themselves higher for athletic competence, physical appearance, and global self-esteem than girls. We expect perceived social acceptance to be the same in boys and girls.

2. Methods

2.1. Study design

This study was part of the “Be Active, Be Happy” study, in which we investigated associations between motor performance, self-perceptions, and Body Mass Index (BMI) in children in grade 2 through grade 6. Data were collected between January 2017 and June 2018. The Ethical Committee of the Faculty for Social Sciences of Utrecht University approved this study. All families gave written informed consent for their child’s participation. All children gave verbal assent as well.

2.2. Participants

A total of 400 children participated in this study. Children were excluded when data for motor performance ($n = 28$), BMI ($n = 2$), or for all self-perceptions domains ($n = 4$) was missing. A total of 366 children (188 boys / 178 girls) were therefore included in the analysis. Age ranged between 7 and 13 years old, and 50 children were categorized as being overweight. Children were in grade 2 ($n = 110$), grade 3 ($n = 81$), grade 4 ($n = 57$), grade 5 ($n = 60$), or grade 6 ($n = 58$) from regular schools.

If one or more of the criteria for diagnosing children with DCD are not evaluated, which was the case in the present study, children are categorized as having probable developmental coordination disorder (pDCD) (Smits-Engelsman, Schoemaker, Delabastita, Hoskens, & Geuze, 2015). Children were categorized as having pDCD ($n = 64$) when they met three of the four criteria for DCD: They experienced motor problems substantially below expected levels given the child’s chronological age and appropriate opportunity for skill acquisition (criterion A). Also, the experienced motor problems had an onset in the early developmental period (criterion C) and were not better explained by another disability (criterion D) (American Psychiatric Association, 2013). More specifically, children scored $\leq 16^{\text{th}}$ percentile on the Movement Assessment Battery for Children-Second Edition (MABC-2) (criterion A), were between 7 and 13 years old (criterion C), and had no known neurological disorder causing motor problems (e.g., Cerebral Palsy, Spina Bifida) (criterion D).

Based on motor performance and BMI scores, we created three groups for analyses: (a) children with pDCD and overweight (pDCD-O) ($n = 13$), (b) children with pDCD without overweight (pDCD-NO) ($n = 51$), and (c) typically developing children (TD) ($n = 302$).

2.3. Measurements

2.3.1. Movement assessment battery for children – second edition (MABC-2)

Motor performance was assessed using the Dutch edition of the MABC-2 (Henderson, Sugden, & Barnett, 2007). This test is divided into three different age bands (3–6, 7–10, and 11–16 years), each consisting of eight items to measure children’s motor performance. The eight items are divided into three subsets: (a) manual dexterity (three items), (b) aiming and catching (two items), and (c) balance (three items). Raw scores are converted into standard scores (1–19) and percentile scores (0–100) so results can be compared with peers of the same age. Scores above the 16th percentile are regarded as normal motor performance. Scores between the 6th and 16th percentile are considered “at risk” for motor problems and scores $\leq 6^{\text{th}}$ percentile indicate significant motor problems. We used standard scores (1–19) for analyses. The MABC-2 has reasonable to good clinical utility in identifying children with motor performance differences (Brown & Lalor, 2009). Test-retest reliability (ICC = .97) and internal consistency ($\alpha = .90$) for the total score are excellent (Wuang, Su, & Su, 2012).

2.3.2. Self-perception profile for children (SPPC)

The Dutch version of the Self-Perceptions Profile for Children (SPPC) consists of 36 questions divided over six subscales (Veerman, Straathof, Treffers, Van den Bergh, & Ten Brink, 1997). Because we were interested in self-perceptions that were directly related to physical activity, we only used the subscales: (a) perceived athletic competence, (b) perceived physical appearance, (c) global self-esteem, and (d) perceived social acceptance. Each question consists of two contradictory quotes. Children have to choose which quote describes them best. For example: ‘some kids are really good at sports’ or ‘other kids are not so good at sports’. After choosing one of the quotes, the child has to indicate whether this was either ‘a little bit true for me’ or ‘totally true for me’. The total score per subscale ranges between 6 and 24 points. Higher scores indicate a more positive self-perception (Veerman et al., 1997). Scores are converted to percentile scores (0–100), whereby children scoring $\leq 15^{\text{th}}$ percentile are considered as having low self-perceptions and children scoring $> 15^{\text{th}}$ percentile are considered as having normal to high self-perceptions. The scales were developed for children between 8 and 12 years and have good validity and reliability (Muris, Meesters, & Fijen, 2003). In the present study, Cronbach’s alpha was low for athletic competence ($\alpha = .593$), but acceptable for physical appearance ($\alpha = .791$), global self-esteem ($\alpha = .748$), and social acceptance ($\alpha = .732$).

2.3.3. Body Mass Index (BMI)

Weight was measured with an electronic weight scale and was rounded to the nearest 0.1 kg. Height was measured with a centimetre and was rounded to the nearest centimetre. BMI was then calculated by dividing weight in kilograms over height in meter

squared. Next, we categorized children as: (a) normal weight, and (b) overweight based on the Dutch Norms for Overweight in Children (Talma, 2010). BMI is a reliable measure with reasonable clinical validity in children and adolescents (Dietz & Robinson, 1998).

2.4. Procedure

Twenty-one elementary schools spread throughout the Netherlands participated in the “Be Active, Be Happy” study. After receiving approval from the principals of the elementary schools, the parents of children in grade 2 through grade 6 received an information letter and informed consent forms. Administration of the MABC-2 and BMI took place individually in a quiet room at school and was performed by trained research assistants. The SPPC was assessed in small groups (1–3 children) with a research assistant present to answer any questions.

2.5. Statistical analysis

First, we investigated descriptive statistics for motor performance (standard total scores), self-perceptions, and BMI. Second, we used Spearman correlations to investigate associations between self-perceptions and motor performance for children with pDCD and TD children separately. Correlation coefficients between 0.0 and 0.3 were considered weak, correlation coefficients between 0.3 and 0.5 as moderate, and correlation coefficients greater than 0.5 as strong (Cohen, 1988).

Third, we checked whether the data met the assumptions for a normal distribution. Because the data were left-skewed and residuals were not normally distributed, we applied a square root transformation on the raw data of all self-perceptions. After the transformation, residuals met the assumptions for a normal distribution. We then applied a *group* (pDCD-O, pDCD-NO, and TD) by *sex* (boys versus girls) ANOVA to investigate significant main and interaction effects. Because of the unequal sample sizes and unequal variances between the three groups, we also applied a Welch’s ANOVA, which is robust for unequal sample sizes and unequal variances, to investigate the main effect of *group*. Games Howell post hoc tests were applied to test for significant differences between groups. Data were analyzed using SPSS 24.0 and the statistical significance threshold was set at $\alpha = .05$. To reduce the chance of a type I error, we applied a Bonferroni correction for multiple post hoc testing ($\alpha = .017$).

3. Results

3.1. Child characteristics

Children with pDCD-O (five girls / eight boys) were 9.0 (1.4) years old, children with pDCD-NO (21 girls / 30 boys) were 9.4 (1.3) years old, and TD children (152 girls / 150 boys) were 9.1 (1.6) years old. We found no significant differences for sex, $\chi^2(2, 364) = 2.02, p = .364$, or grade, $\chi^2(8, 358) = 8.60, p = .377$, between the three groups. We found a main effect of group on motor performance, $H(2, 364) = 158.67, p = .000$, and BMI, $H(2, 364) = 29.13, p = .000$. Post-hoc analyses revealed that motor performance was lower in children with pDCD-O, $p = .000$, and pDCD-NO, $p = .000$, than in TD children. We found no significant differences between children with pDCD-O and pDCD-NO, $p = .773$. With regard to BMI, post-hoc analyses revealed that BMI scores were higher in children with pDCD-O than in children with pDCD-NO, $p = .000$, and TD children, $p = .000$. We found no significant differences between children with pDCD-NO and TD children, $p = .430$. See Table 1 for characteristics of the children.

The means and standard deviations of perceived athletic competence, perceived physical appearance, global self-esteem, perceived social acceptance, and motor performance (i.e., MABC-2 standard total scores) are reported in Table 3.

3.2. Main effects on self-perceptions

We found a significant main effect of *group* on perceived athletic competence, $F(2, 363) = 5.90, p = .007$. Post-hoc analyses revealed that children with pDCD-NO, $p = .017$, perceived themselves lower in athletic competence than TD children. We found no significant differences between children with pDCD-O and pDCD-NO, $p = .788$, and between children with pDCD-O and TD children,

Table 1
Characteristics of the Children.

	Children with pDCD-O (n = 13)	Children with pDCD-NO (n = 51)	Typically developing children (n = 302)	Sig.
Girls / boys	5 / 8	21 / 30	152 / 150	.364
Age (SD)	9.0 (1.4)	9.4 (1.3)	9.1 (1.6)	.446
Grade (2 / 3 / 4 / 5 / 6)	5 / 5 / 1 / 0 / 2	11 / 14 / 11 / 7 / 8	94 / 62 / 45 / 53 / 48	.377
Motor performance total score (SD)	6.0 (1.0)	5.9 (1.4)	11.4 (2.3)	.000*
BMI (SD)	21.9 (3.7)	16.3 (1.8)	16.8 (2.2)	.000*
Obese / overweight / normal (n)	4 / 9 / 0	0 / 0 / 51	5 / 32 / 265	.000*

Note: pDCD-O = children with pDCD and overweight; pDCD-NO = children with pDCD without overweight; motor performance = standard scores MABC-2; BMI = Body Mass Index.

* $p < .05$.

Table 2
Main Effects for Group and Gender.

	Boys (n = 188)	Girls (n = 178)	p	pDCD-O (n = 13)	pDCD-NO (n = 51)	TD (n = 302)	p
Global Self-Esteem	20.93 (2.93)	20.34 (3.60)	.015*	19.46 (5.13)	20.14 (3.28)	20.77 (3.18)	.132
Physical Appearance	20.97 (3.16)	20.14 (3.91)	.134	19.23 (4.25)	20.02 (3.40)	20.72 (3.55)	.169
Athletic Competence	19.30 (3.00)	18.28 (3.23)	.011*	17.31 (2.75)	17.86 (2.88)	19.03 (3.17)	.007**
Social Acceptance	19.58 (3.53)	18.62 (3.97)	.044*	16.62 (2.72)	19.29 (3.76)	19.19 (3.79)	.003**

Note: pDCD-O = children with probable DCD and overweight; pDCD-NO = children with probable DCD without overweight; TD = typically developing children. P-values for group are the results of the Welsh ANOVA.

* p < .05.

** p < .01.

p = .091. We found a significant main effect of group on perceived social acceptance, $F(2, 363) = 6.97, p = .003$. Post-hoc analyses revealed that children with pDCD-O perceived themselves lower in social acceptance than children with pDCD-NO, $p = .008$, and TD children, $p = .006$. We found no significant differences between children with pDCD-NO and TD children, $p = .983$.

We found no significant main effect of group on perceived physical appearance, $F(2, 363) = 1.89, p = .169$, or global self-esteem, $F(2, 364) = 1.21, p = .312$.

Boys perceived themselves significantly higher in athletic competence, $F(1, 364) = 6.60, p = .011$, global self-esteem, $F(1, 365) = 5.97, p = .015$, and social acceptance, $F(1, 365) = 4.10, p = .044$, than girls. We found no significant differences between boys and girls for perceived physical appearance, $F(1, 364) = 2.26, p = .134$. See Table 2.

3.3. Interaction effects on self-perceptions

We found no significant group x sex interaction effects for perceived social acceptance, $F(2, 364) = 0.51, p = .601$, perceived athletic competence, $F(2, 363) = 1.10, p = .334$, perceived physical appearance, $F(2, 363) = 0.57, p = .567$, and global self-esteem, $F(2, 364) = 1.89, p = .153$. See Table 3.

3.4. Correlations between self-perceptions and motor performance

In children with pDCD, we found a moderate association between global self-esteem and athletic competence, $r_s = .44, p < .001$, and strong associations between other self-perceptions, $r_s = .50$ to $.66$, all $p < .001$. We found no significant associations between motor performance and any of the self-perceptions, -0.02 to $-.16$, all $p > .05$.

In TD children, we found a strong association between global self-esteem and perceived physical appearance, $r_s = .64, p < .001$, and moderate associations between other self-perceptions, 0.32 – 0.41 , all $p < .001$. Motor performance was associated with perceived physical appearance, $r_s = .17, p = .003$, but not with any of the other self-perceptions, $.03$ – $.10$, all $p > .05$. See Table 4 for correlation coefficients.

4. Discussion

The aim of the present study was to investigate differences in self-perceptions of athletic competence, physical appearance, global self-esteem, and social acceptance between children with pDCD and overweight (pDCD-O), children with pDCD without overweight (pDCD-NO), and typically developing (TD) children, and between boys and girls.

4.1. Self-perceptions in pDCD-O, pDCD-NO, and TD children

We found that children with pDCD-NO had significantly lower perceptions of athletic competence than TD children. This result is consistent with previous findings (e.g., Noordstar et al., 2017; Poulsen et al., 2006; Skinner & Piek, 2001). We found no differences in

Table 3
ANOVA Results for Self-Perceptions.

	Group		Sex		Group by Sex	
Indices	F(2, 363)	η^2	F(1, 364)	η^2	F(2, 363)	η^2
Global Self-Esteem	2.33	.013	5.97*	.016	1.89	.010
Physical Appearance	2.58	.014	2.26	.006	0.57	.003
Athletic Competence	6.69**	.036	6.60*	.018	1.10	.006
Social Acceptance	4.01*	.022	4.10*	.011	0.51	.003

Note. η^2 = Partial Eta-squared.

* p < .05.

** p < .01.

Table 4
Descriptive Statistics and Correlation Matrix.

	Mean (SD)	Global Self-Esteem	Physical Appearance	Athletic Competence	Social Acceptance
Global Self-Esteem	20.6 (3.3)		.64**	.41**	.40**
Physical Appearance	20.6 (3.6)	.66**		.37**	.32**
Athletic Competence	18.8 (3.2)	.44**	.51**		.38**
Social Acceptance	19.1 (3.8)	.52**	.51**	.50**	
Motor performance total score children with pDCD (<i>n</i> = 64)	6.0 (1.3)	-.05	-.02	-.16	-.16
Motor performance total score TD children (<i>n</i> = 301)	11.4 (2.3)	.06	.17**	.03	.10

Note: motor performance total score = standard total scores MABC-2; pDCD = probable developmental coordination disorder; TD = typically developing. Correlations between self-perceptions in TD children (*n* = 365) are displayed above the main diagonal, correlation between self-perceptions in children with pDCD (*n* = 64) are displayed below the main diagonal.

* $p < .05$.

** $p < .01$.

perceived athletic competence between children with pDCD-O and pDCD-NO, which may be explained by the fact that both groups did not differ in actual motor performance. Apparently, the overweight condition itself has no additional negative influence on the perceived athletic competence of children with pDCD-O. We argue that the non-significant difference ($p = .091$) between children with pDCD-O and TD children is due to the small sample size of children with pDCD-O ($n = 13$).

Interestingly, we found that children with pDCD-O perceived themselves lower for social acceptance than children with pDCD-NO and TD children. Associations between motor performance and BMI (Barnett et al., 2016), and between DCD and overweight (Cairney & Veldhuizen, 2013), have already been reported in previous studies. The present study shows that children with pDCD-O are even more at risk for social isolation than children with pDCD-NO. This finding is also in accordance with previous findings that children with overweight show a lower perceived social acceptance (Danielsen et al., 2012). We speculate that children with pDCD-O are the last to be chosen, or do not participate at all, in sports and games in the schoolyard and the neighborhood. This may lead to feelings of not being accepted by the group with low self-perceived social acceptance as a result. It is therefore important for physical and occupational therapists to have insight into the possible low self-perceived social acceptance of children with pDCD-O, and to take this into account in their treatment. For example, by paying attention to the social context in which the problems of social acceptance occur.

Unexpectedly, we found no differences in perceived physical appearance and global self-esteem between children with pDCD-O, pDCD-NO, and TD children. Other studies, that used the same, or comparable, questionnaires to investigate self-perceptions, found that DCD children perceived themselves lower in perceived physical appearance and global self-esteem (Poulsen et al., 2006; Skinner & Piek, 2001). A possible explanation for this result is that children in our sample were fairly young, while differences in perceived physical appearance start to appear in middle school (Smolak, 2004). We now found that self-perceptions directly related to motor performance (i.e., perceived athletic competence) are already negatively affected in younger children with pDCD, but self-perceptions that indirectly pertain to the physical domain (i.e., perceived physical appearance) are not yet.

The finding that children with pDCD and TD children did not differ in global self-esteem is in accordance with findings from the study by Watson and Knott (2006), but not with two other studies (Poulsen et al., 2006; Skinner & Piek, 2001). We have no clear explanation for the differences in findings, although differences in global self-esteem were largest in older children (12–14 years old) (Skinner & Piek, 2001). Together, these studies, and our study, show that differences in global self-esteem between children with pDCD and TD children will arise over time, but there's no consensus as to the age at which these differences arise.

We found no differences in perceived physical appearance and global self-esteem between children with pDCD-O and pDCD-NO. Because the present study is the first to investigate differences in self-perceptions between children with pDCD-O and pDCD-NO, our exploratory hypothesis was that children with pDCD-O would perceive themselves lower than children with pDCD-NO. An explanation for our finding is that the sample of children with pDCD-O consisted mainly of children who were mildly overweight. We argue that perceived physical appearance and global self-esteem are not more affected in children with pDCD who are mildly overweight than in children with pDCD-NO. Shin and Shin (2008) also found no differences in perceived physical appearance and global self-esteem between children in grade 5 and grade 6 with overweight and children with a normal weight. In their study, they categorized children as: (a) normal weight, (b) overweight, and (c) obese. Children with obesity had lower levels of perceived physical appearance and global self-esteem than children with overweight and children of a normal weight, but self-perceptions between children with overweight and children of a normal weight were the same (Shin & Shin, 2008). The authors argued that being mildly overweight may be regarded as a desirable condition in Asian society, and does not impact perceived physical appearance and global self-esteem (Shin & Shin, 2008). In the present study, our sample of children with pDCD-O consisted of four children (30.8 %) that could be categorized as obese. The number of children with overweight in Western society has increased in the past decades (Wang & Lobstein, 2006). Overweight might be more accepted nowadays and, therefore, did not impact children's perceived physical appearance and global self-esteem significantly.

4.2. Self-perceptions in boys and girls

As expected, boys perceived their athletic competence and global self-esteem higher than girls. This result is in accordance with a number of other studies that investigated differences in self-perceptions between boys and girls (see for review: Gentile et al., 2009). However, boys also perceived their social acceptance higher than girls. A possible explanation for this unexpected result can be found in the questionnaire (i.e., SPPC) used to investigate perceived social acceptance. More specifically, in most items children were asked about the *number* of peer relations (e.g., “some children have a lot of friends”). Girls’ social interactions are typically characterized by close, intimate bonds with one or two other girls, while boys have a greater tendency to interact in larger groups (Lever, 1978; Maccoby, 1990). Questions about the number of peer relations would result in higher levels of perceived social acceptance in boys than girls.

Contrary to findings in previous studies (see for review: Gentile et al., 2009), no differences between boys and girls were found with regard to perceived physical appearance. As mentioned before, most children in our sample were in grade 2 ($n = 110$) and grade 3 ($n = 81$), while differences in perceived physical appearance become more apparent when children hit puberty. Moreover, differences in perceived physical appearance between boys and girls become larger as children grow older, with largest differences found in junior high in favor of boys (Gentile et al., 2009). We argue that we found no differences in perceived physical appearance between boys and girls because most of the children in our sample were in grade 2 and grade 3 and were not yet subject to the stereotypical beauty of the media, which is considered to be the main reason for the decrease in perceived physical appearance among girls (Gentile et al., 2009).

4.3. Weaknesses and strengths of the study

Several limitations of this study have to be recognized. First, children with pDCD-O were considered overweight based solely on their BMI scores. Although there is no golden standard for measuring overweight (see for review: Stanhope, Kay, Stevenson, & Gazmararian, 2016), and BMI scores are considered a reliable measure with reasonable clinical validity in children and adolescents (Dietz & Robinson, 1998), investigating children’s skin-fold thickness and/or waist circumference would have provided a more valid measure. Second, we did not correct for age of the children, which might have affected our results. Younger children tend to have overly optimistic self-perceptions, which decrease as they grow older (Harter, 2012). Others found self-perceptions to remain stable during elementary school (e.g., Noordstar et al., 2016) or found a small increase (e.g., Cole et al., 2001). However, we argue that age did not affect our results because grade children were in was equally divided between the three groups ($p = .377$). Third, we did not investigate home environment and/or socioeconomic status (SES) of children, which is associated with children’s self-perceptions and motor performance (Ferreira, Godinez, Gabbard, Vieira, & Caçola, 2018; Orth, 2018).

In terms of strengths, this is the first study that investigated the additional impact of overweight on self-perceptions in children with pDCD. Also, this study provides insight in multiple self-perceptions in children with pDCD. Previous studies that investigated multiple self-perceptions in children with DCD are more than 10 years old (e.g., Poulsen et al., 2006; Skinner & Piek, 2001).

5. Conclusion and practical implications

To conclude, this study adds knowledge to the empirical evidence about self-perceptions in children with pDCD. Our main result is that children with pDCD-O perceived themselves lower in social acceptance than children with pDCD-NO and TD children. We also found that children with pDCD-O and pDCD-NO perceived themselves lower in athletic competence than TD children, and girls had lower self-perceptions than boys. Future research should investigate if obesity in children with pDCD affects their self-perceptions more than overweight.

From a practical viewpoint, our results stress the importance for therapists to investigate self-perceptions of athletic competence and social acceptance in children with pDCD. Current motor interventions focus primarily on improving children’s motor performance to participate in daily life, with attention for perceived athletic competence gaining ground (e.g., Noordstar et al., 2017). However, overweight in children with pDCD also impacts their perceived social acceptance. Therapists should, therefore, pay attention to (perceived) social acceptance in children with pDCD and overweight in their diagnostics and interventions.

Author contribution

J. J. Noordstar designed the study, gathered the data, performed the data-analyses, and wrote the paper

M. J. M. Volman designed the study, performed the data-analyses, and edited the paper

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