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Developmental Coordination Disorder, gender, and body weight: Examining the impact of participation in active play

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ABSTRACT

Background: To examine whether differences in participation in active play (PAP) can account for gender differences in the relationship between Developmental Coordination Disorder (DCD) and body weight/fat (BMI and percentage fat) in youth.
Methods: A cross-sectional investigation of students in grades four through eight ($n = 590$). Height, weight (BMI), and percentage body fat using bioelectrical impedance analysis (BIA; RJL Systems, MI) were collected. Motor proficiency and physical activity levels were also evaluated.
Results: We found gender specific patterns in the relationship between PAP, DCD, and BMI and body fat. Among boys with DCD, greater participation in active play is associated with higher BMI and percentage body fat. For girls with the disorder, the opposite relationship is observed.
Conclusions: Participation in active play moderates the association between DCD, gender and body weight. Three possible explanations for why PAP is associated with higher BMI and percentage body fat in boys with DCD are provided.

Developmental Co-ordination Disorder (DCD) is the diagnosis for motor skill impairment unrelated to other physical (e.g., Cerebral Palsy) and/or intellectual (e.g., Pervasive Developmental Disorder) disorders (APA, 1994). The prevalence of DCD is estimated to be between 5% and 8% (Kadesjo & Gillberg, 1999; WHO, 1992; Wright & Sugden, 1996). The specific manifestations of the disorder are varied and pervasive, affecting both gross and fine motor skills (APA, 1994). These problems make day-to-day activities such as tying shoelaces and handwriting, and participating in activities such as skipping or playing soccer extremely difficult (if not impossible). Often undiagnosed, untreated DCD can significantly interfere with academic performance and/or activities of daily living. Unfortunately these children are often viewed as unmotivated or lazy with little more than a "playground disability" (Hay & Missiuna, 1998). DCD is often not diagnosed or treated due to the belief that these problems are not serious enough to warrant intervention, or that children with coordination problems will out-grow the problem (Losse et al., 1991). However, it must be recognized that children and youth with DCD are at much greater risk for social and emotional problems and poorer physical health status, and that DCD persists into adolescence (Cantell, Smyth, & Ahonen, 1994).

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Children and adolescents with DCD are at a much greater risk for being overweight or obese in comparison to their typically developing peers (Cairney et al., 2010; Fong et al., 2011; Hands & Larkin, 2002; Jolliffe, 2004; Rivilis et al., 2011; Tremblay & Willms, 2000; Wagner et al., 2011). Recent research by Cairney et al. (2011) found children with DCD to be at much greater risk for overweight and obesity, when compared to typically developing children. Perhaps more problematic was the finding that differences in BMI and waist circumferences between children with and without DCD appears to widen as children get older. While there is compelling evidence that children with DCD are at greater risk for obesity, remarkably few studies have examined the mechanisms linking DCD to body weight/fat.

Children and adolescents with DCD often perceive themselves to be less competent with regard to their physical abilities than other children (Skinner & Peik, 2001); and as a result, tend to be less active than typically developing children (Cairney, Hay, Faught, & Hawes, 2005; Cairney, Hay, Faught, Mandigo, & Flouris, 2005). The well-know "activity-deficit" between children with DCD and those without is often identified as the main cause for increased risk of obesity in this population (Hands & Larkin, 2002). Inactivity itself is generally considered to be one of the principal causes of increased rates of obesity in children over the past couple of decades (Leitch, 2007; Tremblay et al., 2010). It is logical to assume that children with significant motor coordination problems will be less likely to engage in physical activity; and consequently, inactivity increasing the likelihood of obesity. Surprisingly however, there is no research that has actually tested whether differences in physical activity between children with and without DCD can account for differences in body fat between these groups.

In addition to testing whether differences in inactivity can account for differences in unhealthy body weight between children with and without DCD, a consideration of other possible factors that might influence the association between DCD, inactivity and obesity is also absent from the existing literature. Arguably, the most important of these is gender. Gender is known to influence participation in physical activity, especially in adolescence. Generally speaking, boys tend to be more physically active than girls (Boreham, Twisk, Savage, Cran, & Strain, 1997; Pate, Heath, Dowda, & Trost, 1996; Sallis, Prockaska, Taylor, Hill, & Geraci, 1999). Moreover, boys are more likely than girls to define advantaged social status in terms of athletic abilities (Chase & Dummer, 1992). For this reason, we may expect boys with DCD to be more likely to avoid activities that require even a modicum of motor coordination since public failure in these activities may have serious social consequences (e.g., humiliation) (Cairney, Hay, Faught, & Hawes, 2005). For girls, the social costs of failing at sports and PA may be much less, and in the absence of social pressure, girls with DCD may be more inclined to participate in physical activities even when their deficits hinder performance. Alternatively, gender-specific social pressure may have the opposite effect. For boys with DCD, the pressure to be active may lead to participation, even though the consequences of failure is a significant risk. Boys with DCD may choose activities commensurate with their motoric capabilities, or find a level of participation (even if only minimal) within the scope of their athletic abilities. For girls with DCD, the absence of pressure to be physically active may make it easier for them to withdraw from active play altogether. While intriguing, we know of no research that has examined the associations between body weight, participation in active play (PAP), either organized (e.g., team sports) or free play, and gender among children and adolescents with DCD.

1. Methods

1.1. Participants

This study involved a cross-sectional investigation of all students in grades four through eight from five elementary schools ($n = 929$). Youth with known impediments to physical activity such as learning disorders ($n = 8$) and pre-existing physical limitations ($n = 18$) were excluded. A total of 590 children and adolescents ($n = 322$ males, $n = 268$ females) provided informed consent and participated (63.51% response rate). After list-wise deletion of cases with missing values, the sample was reduced to 578. This final sample represented 12.4% of all 9-to-13 year old children and youth living in the city of St. Catharines, Ontario, Canada (Statistics Canada, 2001). The average age of our sample was 11.46 ± 1.45 years. Brock University and the local school board reviewed and approved the research protocol.

We elected to describe cases as probable DCD (hereafter *p*DCD) because our method of case-identification was a field test administered by trained researchers, not a diagnostic protocol administered by a pediatrician. Moreover, our method follows the majority but not all of the criteria stipulated in the DSM-IV (APA, 1994). In this study, the short-form Bruininks–Oseretsky test of Motor Proficiency (BOTMP-SF) was used for criterion A, and all children and adolescents with known learning disabilities or physical health problems were excluded from the analyses (criterion C and D). Criterion B (limitations in activities of daily living) was the only aspect of diagnosis not measured. However, as Visser (2003) notes, most studies do not take into account the exclusion criteria in the DSM-IV.

1.2. Assessments

1.2.1. Developmental Coordination Disorder (DCD)

The Bruininks–Oseretsky test of Motor Proficiency is a commonly used standardized test in the diagnosis of DCD in North America (Crawford, Wilson, & Dewey, 2001). The short form (BOTMP-SF) includes selected items to examine the full scope of motor proficiency (static and dynamic balance, reaction time, bilateral coordination, etc.). The short form has been validated against the full scale with inter-correlations between .90 and .91 for children between the ages of 8 and 14 (Bruininks, 1978). The BOTMP-SF was administered individually to each consenting child in each school's gymnasium. A BOTMP-SF standard