



## Motor ability and weight status are determinants of out-of-school activity participation for children with developmental coordination disorder

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### ARTICLE INFO

#### Article history:

Received 19 June 2011

Accepted 19 June 2011

#### Keywords:

Developmental coordination disorder

Participation

Motor ability

Overweight

Rehabilitation

### ABSTRACT

According to the International Classification of Functioning, Disability and Health model endorsed by the World Health Organization, participation in everyday activities is integral to normal child development. However, little is known about the influence of motor ability and weight status on physical activity participation in children with developmental coordination disorder (DCD). This study aimed to (1) compare motor performance, weight status and pattern of out-of-school activity participation between children with DCD and those without; and (2) identify whether motor ability and weight status were determinants of participation patterns among children with DCD. We enrolled 81 children with DCD (boys,  $n = 63$ ; girls,  $n = 18$ ; mean age,  $8.07 \pm 1.5$  years) and 67 typically developing children (boys,  $n = 48$ ; girls,  $n = 19$ ; mean age,  $8.25 \pm 1.6$  years). Participation patterns (diversity, intensity, companionship, location, and enjoyment) were evaluated with the Children Assessment of Participation and Enjoyment. Motor ability was evaluated with the Movement Assessment Battery for Children, second edition (MABC-2). Other factors that may influence participation such as age, gender, and body weight were also recorded. Analysis of variance was used to compare outcome variables of the two groups, and significant determinants of activity participation were identified by multiple regression analysis. Children with DCD participated in fewer activities (i.e., limited participation diversity) and participated less frequently (i.e., limited participation intensity) than their typically developing peers; however, companionship, location of participation, and enjoyment level did not differ between the two groups. Children in the DCD group demonstrated significantly worse motor ability as assessed by the MABC-2. Further, a greater proportion of children in the DCD group were in the overweight/obese category compared with their typically developing peers. After accounting for the effects of age and gender, motor ability and weight category explained 7.6% and 5.0% of the variance in participation diversity, respectively, for children with DCD. Children with DCD showed less diverse and less intense out-of-school activity participation than typically developing children. Motor impairment and weight status were independently associated with the lower participation diversity. Interventions aiming at improving participation for children with DCD should target weight control and training in motor proficiency. Further study is needed to identify other factors that may hinder participation in this group of children.

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## 1. Introduction

Based on the International Classification of Functioning, Disability and Health (ICF) model, participation in everyday activities and a variety of life situations is integral to normal child development and positively influences health, quality of life, and future life outcomes (Mandich, Polatajko, & Rodger, 2003; WHO, 2001). However, children with developmental coordination disorder (DCD) have motor difficulties that often restrict their ability to participate in typical activities of daily living (Jarus, Lourie-Gelberg, Engel-Yeger, & Bart, 2011).

DCD is a well-known motor-based problem that affects approximately 6% of children of primary school age (APA, 2000). Common symptoms include marked delays in achieving motor milestones, clumsiness, and poor balance, coordination, and handwriting (APA, 2000; Cermak & Larkin, 2002). These motor impairments also significantly interfere with the child's academic achievements and activities of daily living. DCD is diagnosed when these impairments cannot be explained by any medical or intellectual conditions (APA, 2000). Although enrolled in regular classrooms, children with DCD often experience difficulty participating in typical childhood activities and thus are more sedentary (Mandich et al., 2003).

A number of studies have examined participation patterns of children with DCD, but important domains such as skill-based and recreational activities have not been assessed (Cairney et al., 2005b; Cermak & Larkin, 2002; Chen & Cohn, 2003; Green et al., 2011; Mandich et al., 2003; Poulsen, Ziviani, & Cuskelly, 2006; Poulsen, Ziviani, & Cuskelly, 2007). Moreover, only one recent study by Jarus et al. (2011) used standardized measures to assess participation in a wide range of out-of-school activities among school-age children with and without DCD. In their study, children with DCD showed limited participation diversity, in which they engaged less frequently and chose activities that were quieter and more socially isolating compared with children without DCD (Jarus et al., 2011). However, this study included only children aged 5–7 years old. Studies with larger sample sizes and a wider age range are needed to more accurately detect differences in participation patterns between primary school-aged children with and without DCD.

According to the ICF model, many factors influence the participation level of an individual. These include personal factors (e.g., age, gender), environmental factors (e.g., family support), and physiologic impairments (e.g., motor deficits). To develop effective interventions for children with DCD, a better understanding of their participation patterns and the determinants of participation are needed. Previous studies have attempted to identify the clinical correlates of participation in children with DCD. Jarus et al. (2011) identified a positive relationship between motor ability and participation patterns in children with DCD; however, multivariate analysis could not be performed because of the relatively small sample size ( $n = 25$ ). Therefore, the effects of potentially confounding variables (e.g., gender) were not taken into account. Previous research demonstrated that boys and girls tend to participate in different types of activities (Bult, Verschuren, Jongmans, Lindeman, & Ketelaar, 2001); therefore, it is important to use a larger sample size and take covariates into account when evaluating the relationship between motor ability and participation patterns in children with DCD.

Another important correlate of activity participation may be related to weight status. Because of deficits in physical functioning (Cairney et al., 2005b; Poulsen, Ziviani, & Cuskelly, 2008) and psychosocial functioning (i.e., low self-esteem, perceived competency) (Cermak & Larkin, 2002), children with DCD may be less inclined to participate in physical activities (Cairney et al., 2005b; Cermak & Larkin, 2002; Poulsen et al., 2008). This lower activity level may predispose children with DCD to obesity and cardiovascular disease. Indeed, children with DCD were found to have increased body fat and poor cardiorespiratory fitness (Cairney, Hay, Faught, & Hawes, 2005; Cairney et al., 2007; Cairney, Hay, Veldhuizen, & Faught, 2010; Cermak & Larkin, 2002; Faught, Hay, Cairney, & Flouris, 2005). A vicious circle of further physical deconditioning, increased body weight, and motor deficits may ensue. However, no study has yet examined the association between activity participation and weight status in children with DCD.

The objectives of this study were to (1) compare motor performance, weight status, and pattern of out-of-school activity participation between children with and without DCD; and (2) determine whether motor ability and weight status are associated with activity participation diversity among children with DCD.

## 2. Methods

### 2.1. Study design

This was a cross-sectional exploratory study.

### 2.2. Participants

Sample size calculations were based on a statistical power of 0.80 and alpha of 0.05 (two-tailed). According to Jarus et al. (2011), the Movement Assessment Battery for Children, second edition (MABC-2) percentile rank was 2.6 (standard deviation [SD] = 1.84) for the DCD group ( $n = 25$ ) and 49.96 (SD = 26.63) for the control group ( $n = 25$ ), which translates into a large effect size (2.51). For the Children's Assessment of Participation and Enjoyment (CAPE) total activity diversity and intensity scores, the effect sizes were medium to large (0.74–0.80). Therefore, assuming a medium to large effect size (0.74) and power of 0.80, the minimum sample size needed to detect a significant between-group difference in outcomes

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