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Role of physical activity and perceived adequacy on peak aerobic power in children with developmental coordination disorder

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ABSTRACT

The purpose of this study was to determine the mediating role of physical activity and perceived adequacy towards physical activity on peak aerobic power (VO_{2peak}) in children with developmental coordination disorder. This case-control study involved 61 male and female subjects age 12–13 years with motor impairments and 61 healthy controls matched for age, gender and school location. Subjects were assessed for motor proficiency and classified as probable developmental coordination disorder (p-DCD) or healthy control using the Movement Assessment Battery for Children, 2nd Edition. VO_{2peak} was assessed by a progressive exercise test on a cycle ergometer. Perceived adequacy towards physical activity was estimated using the Children's Self-perception of Adequacy and Predisposition for Physical Activity scale. Physical activity was monitored for seven days using accelerometry. Children with p-DCD had significantly lower VO_{2peak} adjusted for lean mass (48.8 ± 7.2 ml/kg LM/min; $p \leq 0.05$) compared to controls (53.1 ± 8.2 ml/kg LM/min). Regression analysis demonstrated that perceived adequacy and physical activity were significant mediators in the relationship between p-DCD and VO_{2peak} (R -squared = 24.3%). In conclusion, using a stringent laboratory assessment, the current study verifies earlier non laboratory findings, adding low aerobic power, the most important component of cardiorespiratory fitness, to the list of health consequences associated with developmental coordination disorder.

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1. Introduction

Motor learning refers to the relatively permanent gains in motor skill capability associated with practice or experience that occurs over the life span (Schmidt & Lee, 1991). There is a condition whereby a child's learning and performance on everyday motoric tasks at home, school, and play environments is challenged (Cermak, Gubbay, & Larkin, 2002). Developmental coordination disorder (DCD) is characterized by poor movement skills found in children that are not primarily due to general intellectual, primary sensory, or motor neurological impairment (DSM-IV, 1994). These challenges make daily activities and participation in physical activities extremely difficult (Cairney, Hay, Faught, Corna, & Flouris, 2006). Moreover, these children may suffer ridicule in the playground, an environment where their motor impairments are frequently most visible (Cairney, Hay, Faught, & Hawes, 2005). It is not surprising that children with DCD have reported that their clumsiness contributes to negative feelings about themselves, reduced motivation to participate in physical activities, and low perceived competence in the physical domain (Losse et al., 1991).

Research conducted in the past decade has provided evidence that children with DCD demonstrate a risk factor profile that mirrors that of adults with cardiovascular disease, including decreased cardiorespiratory fitness (CRF) and increased body fat mainly due to decreased levels of physical activity (Barnett, van Beurden, Morgan, Brooks, & Beard, 2008; Cairney, Hay, Faught, Flouris, & Klentrou, 2007; Faught, Hay, Cairney, & Flouris, 2005; Schott, Aloff, Hultsch, & Meermann, 2007; Tsiotra, Nevill, Lane, & Koutedakis, 2009). Although the findings are consistent, these studies used only field-based methods for the prediction of peak aerobic power in order to assess CRF (e.g., Léger 20-m shuttle run). Such field tests have been described as vulnerable to both motivational and environmental effects, especially for children with DCD (Armstrong & Welsman, 2001; Cairney, Hay, Wade, Faught, & Flouris, 2006). Given the reported diminished perceptions of athletic competence, the low levels of peer acceptance (Cairney, Hay, Faught, Mandigo, & Flouris, 2005; Cantell, Smyth, & Ahonen, 1994), and the fact that children with DCD report greater anxiety than typically developed peers when faced with movement challenges (Rose, Larkin, & Berger, 1991; Skinner & Piek, 2001), it is not surprising that children with DCD perform poorly on field tests. Moreover, these studies failed to provide evidence that a true maximum effort was obtained from the participants (Cairney, Hay, Faught, 2007; Faught et al., 2005; Hands & Larkin, 2006; Schott et al., 2007; Tsiotra et al., 2009).

There is minimal evidence underlying reasons for this low level of cardiorespiratory fitness in these children. Perceived adequacy toward physical activity is likely an important factor affecting performance in aerobic testing, particularly in field tests conducted in groups (Cairney, Hay, Faught, Léger, & Mathers, 2008; Hands & Larkin, 2002). The Léger multistage 20-m shuttle run is one such field assessment and has been adopted in much of the research on cardiorespiratory fitness in children with DCD (Cairney, Hay, Faught, et al., 2007; Faught et al., 2005; Hands, 2008; Tsiotra et al., 2009). Cairney, Hay, Faught and colleagues (2006) were the first to examine the role of psychological factors in the relationship between motor coordination and cardiorespiratory fitness in children with DCD in an epidemiologic field-based research. Their findings suggested that a significant amount (34%) of the variance in cardiorespiratory fitness as assessed by the Léger 20-m shuttle run could be explained by perceived adequacy toward physical activity in children with DCD. However, in order to gain a better understanding as to the true influence of perceived adequacy on cardiorespiratory fitness in children with DCD, a direct measure of peak aerobic power ($\text{VO}_{2\text{peak}}$) under maximum fatigue in a laboratory setting is essential.

Finally, lower levels of physical activity among children with DCD can put their long-term health and well-being at greater risk (Cairney et al., 2005; Cairney, Hay, Faught, et al., 2007; Cantell, Crawford, & Tish Doyle-Baker, 2008; Faught et al., 2005). More specifically, they have less opportunity to develop their cardiorespiratory fitness (Hands & Larkin, 2002). Considering the sedentary lifestyle reported in children with DCD, we also considered the influence of physical activity on cardiorespiratory fitness in this cohort. Therefore, the primary objective of this study was to examine the mediating role of perceived adequacy and physical activity on cardiorespiratory fitness, in children with developmental coordination disorder using direct measurement of peak aerobic power.

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