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Metabolic syndrome in children with and without developmental coordination disorder

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ABSTRACT

Children with developmental coordination disorder (DCD) have higher rates of obesity compared to children with typical motor development, and, as a result may be at increased risk for developing metabolic syndrome (MetS). The purpose of this study was to determine the presence of MetS and its components among children with and without DCD. This nested case–control study classified 63 children scoring below the 16th percentile on the Movement Assessment Battery for Children (M-ABC-2) as probable DCD (pDCD), and 63 controls, all of whom scored above the 16th percentile. Metabolic syndrome was defined using the International Diabetes Federation (IDF) criteria. Eleven children met the criteria for MetS; 8 (72.3%) with pDCD and 3 (27.3%) controls ($p = 0.115$). Abdominal obesity was found in 39 (30.9%) of children, 29 (46.0%) with pDCD and 10 (15.9%) controls ($p < 0.01$). Serum triglycerides were higher in pDCD compared to controls, 91.9 mg/dl (63.1) vs. 67.7 mg/dl (33.3) in the control group, $p = 0.001$. Blood pressure was also significantly higher in the pDCD group, mean systolic BP (110 vs. 105 mmHg, $p = 0.01$) and mean diastolic BP (69 vs. 65 mmHg, $p = 0.01$). There were no statistically significant differences between the groups for other components of MetS. The higher prevalence of abdominal obesity and elevated triglycerides and blood pressure in children with pDCD may put them at risk of meeting all criteria of MetS earlier then their peers.

1. Introduction

Over the past two decades the prevalence of overweight and obesity in children has steadily risen around the world (Shields, 2006; Tremblay & Willms, 2000). Factors contributing to this epidemic include poor diet, less physical activity, and more time spent participating in sedentary behaviors (Krebs & Jacobson, 2003). Certain sub-populations of children with developmental disabilities are more vulnerable to developing obesity and its related consequences. For example, it has been shown that children with developmental coordination disorder (DCD) have higher rates of obesity compared to children with typical motor development (Cairney, Hay, Faught, & Hawes, 2005; Cairney, Hay, Veldhuizen, Missiuna, et al., 2010).

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DCD is characterized by difficulties with motor coordination that significantly impact activities of daily living and school achievement, and is not due to other existing medical or neurological conditions (American Psychiatric Association, 2000). DCD affects 5–6% of school-aged children in Canada (Gibbs, Appleton, & Appleton, 2007), and the prevalence of overweight and obesity in children with this condition has been estimated to be 50% or higher (Cairney, Hay, Veldhuizen, Missiuna, et al., 2010; Schott, Alof, Hultsch, & Meermann, 2007). Therefore, using census data, it can be estimated that there are as many as 400 000 children in Canada between 4 and 11 years old with DCD who are overweight or obese. The co-occurrence of DCD and obesity is, therefore, of significant clinical and public health concern.

It has been postulated that the higher rate of adiposity seen among children with DCD is due in part to lower levels of physical activity and poorer fitness levels (Bouffard, Watkinson, Thompson, Causgrove Dunn, & Romanow, 1996; Cairney, Hay, Faught, Wade, et al., 2005; Faught, Hay, Cairney, & Flouris, 2005; Poulsen, Zivani, Cuskelly, & Smith, 2007). The higher rate of obesity observed in children with DCD increases the likelihood that they are at greater risk for the consequences of increased adiposity, including metabolic syndrome (MetS). This hypothesis needs examination as it would significantly increase the risk for early development of cardiovascular disease.

The clustering of cardiometabolic risk factors consisting of abdominal obesity, hypertension, insulin resistance, and dyslipidemia is called the metabolic syndrome (MetS; Zimmet et al., 2007). Adults with MetS have increased risk of developing type 2 diabetes mellitus and coronary heart disease (Mente et al., 2010; Zimmet et al., 2007). Obesity-related complications developed during childhood have been demonstrated to persist into adulthood, resulting in a higher incidence of type 2 diabetes mellitus and cardiovascular morbidity and mortality (Freedman, Khan, Dietz, Srinivasan, & Berenson, 2001; Zimmet et al., 2007). It has been established that adults with poor motor coordination issues similar to children with DCD have demonstrated components of MetS, including lower levels of serum high-density lipoprotein (HDL) and higher triglyceride levels (Cantell, Crawford, & Doyle-Baker, 2008). A comprehensive assessment of obesity-related complications, specifically components of MetS, has not been carried out in children with DCD. The purpose of this study was to examine the presence of MetS and it's components in children with and without DCD.

2. Methods

2.1. Design and sample

The sample was drawn from a population-based study of motor coordination and physical health in children, called the Physical Health Activity Study Team (PHAST) (Cairney, Hay, Veldhuizen, Missiuna, et al., 2010). Details of the lab procedure and case–control verification procedures have been described in detail in a previous publication (Cairney, Hay, Veldhuizen, & Faught, 2010). In brief, a total of 126 children were recruited from the PHAST field study, and re-assessed in the lab to determine DCD status; 63 of who scored below the 15th percentile on the Movement Assessment Battery for Children, 2nd edition (M-ABC-2), and 63 who scored above that threshold. The Brock University research ethics board approved the protocol for this study. Each participant and one parent or guardian was informed of the study purpose and consent forms were signed during their visit to the lab.

2.2. Collection and analysis of blood samples

Blood samples were collected from participants in their home 8–10 days after their visit in the lab at Brock University. Participants were asked to refrain from eating or drinking after their dinner the previous day and blood collection was conducted in the morning before breakfast. Upon arrival in the home, the technician explained the sampling process to the participant and whole blood was collected from a finger pinprick. Lipid profiles were obtained using the Cholestech LDX, a small portable analyzer capable of obtaining results in 5 min from one drop of whole blood. Each blood sample was tested for total cholesterol (TC), HDL, low-density-lipoprotein (LDL), triglycerides (TG) and glucose. The same technician collected and reported all samples.

2.3. Defining criteria

2.3.1. DCD

Standardized tests were administered by a trained occupational therapist blinded to the child's recruitment status from the field portion of the PHAST study. Both gross and fine motor coordination were assessed using the Movement Assessment Battery for Children (M-ABC-2; Henderson & Sugden, 2007). The M-ABC2 has been updated with new norms, and the ability to assess an extended age range with more task-age overlap (Henderson, Sugden, & Barnett, 2007). Peer-reviewed literature regarding validity of the M-ABC2 is limited, but is considered to have reasonably high utility in evaluating children and adolescents in clinical, educational and research-based environments (Brown & Lalor, 2009). Children scoring at or below the 5th percentile have significant motor coordination difficulties and may require intervention; children scoring at or below the 15th percentile are thought to have significant motor coordination difficulties, and should be followed and re-assessed periodically to determine if intervention is required (Henderson & Sugden, 2007). Since we did not assess limitations in activities of daily living (ADLs), school achievement, or have a physician perform a medical exam, we use the term probable DCD (pDCD) to identify children scoring at or below the 15th percentile on the M-ABC.