



The relationship between motor skills, ADHD symptoms, and childhood body weight



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ARTICLE INFO

Article history:

Received 11 November 2015

Received in revised form 3 May 2016

Accepted 4 May 2016

Keywords:

Attention deficit hyperactivity disorder

Motor impairment

Overweight

Obesity

Children

ABSTRACT

Background: Research has suggested an important association between motor proficiency and overweight/obesity. Many children with motor difficulties experience ADHD symptoms which have also been linked with overweight/obesity. Previous research has not considered both ADHD and motor performance when investigating their relationship with overweight/obesity.

Aims: To investigate the relationships between motor performance, ADHD symptoms, and overweight/obesity in children.

Methods and procedures: A cross-sectional study was conducted involving 189 children aged six to 10 years. Symptoms of ADHD were identified using the SNAP-IV rating scale. Motor impairment (MI) was identified using the Movement Battery Assessment for Children-2. Body composition was estimated from the Body Mass Index (BMI) based on World Health Organization child growth standards.

Outcomes and results: Balance was the only motor skill associated with BMI even after controlling for gender and ADHD. Group comparisons revealed that the proportion of overweight ADHD children was significantly less than the proportion of overweight control children and overweight MI children; the proportion of underweight ADHD children was significantly greater than the proportion of underweight MI children.

Conclusions and implications: The results highlight the importance of taking into consideration both ADHD symptoms and motor difficulties in the assessment and intervention of physical health outcomes in children with ADHD and/or movement problems.

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What this paper adds?

Despite previous evidence linking ADHD with overweight/obesity, no significant correlations were found. Results demonstrated a significant link between balance and BMI, and suggested that children with ADHD aged from six years to 10 years may be at lower risk for being overweight compared to children with movement difficulties and controls.

1. Introduction

Research has highlighted important links between motor competence, physical activity outcomes, and fitness (Hands, Larkin, Parker, Straker, & Perry, 2009; Rivilis et al., 2011). It has been suggested that motor difficulties are related to reduced participation in physical activities in these children for fear of failure and/or peer criticism (Goulardins, Marques, Casella, Nascimento, & Oliveira, 2013; Graf et al., 2004; Mond, Stich, Hay, Kraemer, & Baune, 2007). This, in turn, limits the opportunity to practice and learn skills (Skinner & Piek, 2001). Researchers have also shown higher body mass index (BMI) scores, larger waist circumference and greater percentage body fat in individuals with poor motor coordination compared with controls (Cairney, Hay, Veldhuizen, & Faught, 2011; Cairney, Hay, Faught, & Hawes, 2005; Hendrix, Prins, & Dekkers, 2014; Zhu, Wu, & Cairney, 2011).

Although accumulating evidence suggests that motor problems are significantly related to overweight and obesity, to our knowledge, previous studies have not accounted for the role of attention deficit hyperactivity disorder (ADHD) symptomatology in this relationship and vice versa. This is important given the overlap between motor problems and ADHD is estimated at 50% (Fliers et al., 2008; Gillberg et al., 2004; Pitcher, Piek, & Hay, 2003; Polatajko & Cantin, 2005; Visser, 2003). Indeed, motor hyperactivity is a prominent feature of ADHD, manifested by agitation, restlessness and unnecessary body movements (Zametkin & Ernst, 1999). Various motor difficulties have been identified in individuals with ADHD, such as gross motor skill difficulties (e.g., ball skills) (Piek, Pitcher, & Hay, 1999), fine motor difficulties (e.g., manual dexterity and bimanual coordination tasks) (Piek et al., 1999; Rommelse et al., 2007), balance (Mao, Kuo, Yang, & Su, 2014), and gait and postural control problems (Buderath et al., 2009; Papadopoulos, McGinley, Bradshaw, & Rinehart, 2014). In addition, children with ADHD have demonstrated a delay in their overall motor development when compared to controls (Goulardins et al., 2013; Poeta & Rosa-Neto, 2007; Vidarte, Ezquerro, & Giraldez, 2009).

Research has also revealed a significant association between ADHD and obesity (Cortese et al., 2016). However, although the links between ADHD symptoms, motor impairment and overweight/obesity are frequently described at the literature, studies taking into consideration all three areas are limited. Fliers et al. (2013) found no association between motor coordination problems and overweight; but found that boys with ADHD aged 10–17 years old and girls aged 10–12 years of age were more likely to be overweight than children in the general population. However, the confounding influence of motor impairment in the ADHD group was not considered. A further limitation of this study was the use of questionnaire data rather than an objective assessment of motor functioning. Furthermore, the possible differential relationships between specific motor skills (e.g., fine motor versus gross motor) and weight were not examined. It is plausible that certain motor skills may be predictive of body weight while others are not. For example, given the important role of gross motor skills for many sporting activities (Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006), it is possible that these skills have a particularly important role when understanding overweight/obesity in children.

The current study investigated the relationship between motor performance (using a standardized motor test), ADHD symptoms, and overweight/obesity in children aged six to 10 years. It was hypothesized that motor performance would be negatively associated with BMI z-scores, after controlling for ADHD symptomatology, whereas ADHD symptomatology would be positively associated with BMI z-scores, after controlling for motor skills. It was further hypothesized that a greater proportion of children in the motor impairment and ADHD groups would be identified as overweight or obese compared with the control group, after controlling for ADHD and motor performance respectively.

2. Material and methods

2.1. Participants

The initial potential sample involved 2184 children from 20 public schools in Brazil (Maringá and São Paulo), in low socio-economic areas. A final sample of 189 participants met the criteria for the study, including parental consent to participate and complete data. Participants (73 females and 116 males) were aged from six years to 10 years (mean = 8.46 y; $SD = 1.01$ y) and were divided into four groups; an ADHD group of 51 children (15 girls and 36 boys) with symptoms of ADHD (i.e., both parent and teacher SNAP-IV ratings for inattention, hyperactivity and impulsivity, and/or combined above the cut-off scores as per <http://www.myadhd.com/snap-iv-6160-18sampl.html>); and motor performance at or above 16th percentile on MABC-2), an ADHD/MI group of 27 children (10 girls and 17 boys) with symptoms of ADHD and motor impairment (i.e., both parent and teacher SNAP-IV ratings for inattention, hyperactivity and impulsivity, and/or combined above the cut-off scores; and motor performance at or below 15th percentile on MABC-2), an MI group of 24 children (8 girls and 16 boys) with motor impairment (i.e., parent SNAP-IV ratings for inattention, hyperactivity and impulsivity, and/or combined below the cut-off scores; and motor performance at or below 15th percentile on MABC-2), and a control group of 87 typically

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