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Are gross motor skills and sports participation related in children with intellectual disabilities?

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ABSTRACT

This study compared the specific gross motor skills of 156 children with intellectual disabilities (ID) ($50 \leq IQ \geq 79$) with that of 255 typically developing children, aged 7–12 years. Additionally, the relationship between the specific gross motor skills and organized sports participation was examined in both groups. The Test of Gross Motor Development-2 and a self-report measure were used to assess children's gross motor skills and sports participation, respectively. The children with ID scored significantly lower on almost all specific motor skill items than the typically developing children. Children with mild ID scored lower on the locomotor skills than children with borderline ID. Furthermore, we found in all groups that children with higher object-control scores participated more in organized sports than children with lower object-control scores. Our results support the importance of attention for well-developed gross motor skills in children with borderline and mild ID, especially to object-control skills, which might contribute positively to their sports participation.

1. Introduction

In the Netherlands, about 44,000 children attend primary special-needs schools (Central Bureau of Statistics, 2010), which include children with borderline (IQ = 71–79) and mild (IQ = 50–70) intellectual disabilities. Intellectual disabilities (ID) are characterized by limitations in cognitive functioning and includes severe deficits or limitations in an individual's skills in several domains: cognitive, language, motor, psychosocial, and specific activities of daily living (American Association on Intellectual and Developmental Disabilities, 2010; Pratt & Greydanus, 2007; Salvador & Bertelli, 2008; Schalock, Luckasson, & Shogren, 2007).

Although most attention has been given to the cognitive functioning of children with ID, it has been shown that motor problems are not uncommon in this population (Frey & Chow, 2006; Hartman, Houwen, Scherder, & Visscher, 2010; Simons et al., 2008; Vuijk, Hartman, Scherder, & Visscher, 2010; Zhang, 2001). Well-developed gross motor skills are important, because these skills are thought to facilitate children's cognitive development (Piek, Dawson, Smith, & Gasson, 2008; Son & Meisels, 2006), contribute positively to activities of daily living (Watkinson et al., 2001) and are commonly considered as the building blocks for the development of more complex motor and sport-specific skills (Stodden et al., 2008; Wall, 2004). Although a number of studies have examined the gross motor skill (i.e. locomotor skills and object-control skills) of children with borderline and mild ID (Frey & Chow, 2006; Hartman et al., 2010; Simons et al., 2008; Zhang, 2001), none of these studies focused on specific skills like running, jumping, catching, and throwing. The question remains, therefore, whether all

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gross motor skills are impaired in children with ID or only the relatively more complex skills. More specific information about the gross motor performance of children with ID may provide useful knowledge for physical education teachers and could be utilized in the development of motor interventions for this population.

That some motor tasks may lead to more problems for children with ID may be related to the extend to which cognitive information is necessary for successful execution of the task. Complex motor tasks are expected to be more strongly related to children's cognitive functioning than simple motor tasks (Planinsĕc, 2002; Planinsĕc & Pišot, 2006). Complex motor skills can be described as open skills, which are more dependent on factors in the environment for example extern objects and other players, than simple motor skills (Wall, 2004). With regard to gross motor skills, locomotor skills are generally supposed to be more automatized and less dependent on cognitive functioning, while the execution of object-control skills are supposed to require more involvement of cognitive processes (Latash & Turvey, 1996).

Gross motor skills are involved in many physical activities and are prerequisites for the performance of sport-specific skills (Barnett, van Beurden, Morgan, Brooks, & Beard, 2009; Graf et al., 2004; Okely, Booth, & Patterson, 2001; Wrotniak, Epstein, Dorn, Jones, & Kondilles, 2006). Previous studies have shown a positive relationship between gross motor skills and organized sports participation in typically developing children (Barnett et al., 2009; Okely et al., 2001; Ulrich, 1987), in deaf children (Hartman, Houwen, & Visscher, in press), and in children with visual impairments (Houwen, Visscher, Hartman, & Lemmink, 2007). Childhood motor proficiency may thus be an important factor in organized sports participation. To our knowledge, no studies have examined whether there is a relationship between specific gross motor skills and organized sports participation in children with ID. Gaining insight into the relationship between specific motor items and participation in organized sports in children with ID may provide clues about which gross motor skills (e.g. running, jumping, catching or throwing) are most important in the participation in organized sports in this vulnerable population. Therefore, the present study focused on this relationship in a large sample of children with borderline and mild ID.

Although studies generally found a relationship between gross motor skills and organized sports participation, this relationship is generally weak-to-moderate. Fisher et al. (2005), however, have suggested that the relationship between these parameters might be stronger for children who have the lowest motor skill scores. We, therefore, expect a stronger relationship between gross motor skills and organized sports participation in children with ID compared to their typically developing peers, with the strongest relationship in children with mild ID.

Within the present study, we thus sought to identify differences in the specific gross motor skills in a large sample of children with borderline and mild ID and typically developing children. From the literature, it has been established that children with borderline and mild ID had poor gross motor performance than typically developing children (Frey & Chow, 2006; Hartman et al., 2010; Simons et al., 2008; Zhang, 2001). Therefore, a lower performance on these skills can be expected, however, it would be interesting to know whether all specific gross motor skills are impaired. When children have limited cognitive functioning, like in children with borderline and mild ID, the complexity of the task would affect performance. As object-control skills are generally more complex than locomotor skills (Houwen et al., 2007), we hypothesized a difference in performance on these skills. Additionally, this study also aimed to examine the relationship between the specific gross motor skills and organized sports participation in both groups.

2. Materials and methods

2.1. Participants

The children with ID, aged between 7 and 12 years, were recruited from two primary special-needs schools located in the northern Netherlands. Children who were also diagnosed with Attention Deficit Hyperactivity Disorder ($n = 14$) or Autism Spectrum Disorders ($n = 14$) were excluded from the study sample. The definitive study sample consisted of 156 children (104 boys and 52 girls) with a mean age of 9.5 years (SD 1.5). Based on the information provided in their individual school files, the study sample included 88 children with borderline ID (56 boys and 32 girls; mean age 9.5, SD 1.6) and 68 children with mild ID (48 boys and 20 girls; mean age 9.6, SD 1.3). The mean IQ of the children with borderline ID was 75.3 (SD 2.6; range 71–79) and the mean IQ of the children with mild ID was 65.0 (SD 4.5; range 50–70).

We recruited 255 typically developing children (138 boys and 117 girls), aged between 7 and 12 years (mean age 9.7 years, SD 1.3) attending two mainstream schools in the same region as a reference group. The children's age was appropriate to their grade level, indicating that their ability on academic performance was in the normal range (i.e. the expected level in relation to their learning experiences).

The three groups (borderline ID, mild ID, and typically developing children) did not statistically differ from each other on age ($F(2,408) = 1.244$, $p = .289$), but the amount of boys and girls in the three groups differed significantly ($F(2,408) = 3.566$, $p = .029$): there were significantly more boys in the ID groups compared to the group of typically developing children.

The parent(s) provided informed consent for their children's participation and all procedures were in accordance with the ethical standards of the Faculty of Medical Sciences of the University Medical Centre Groningen, University of Groningen.

2.2. Test of Gross Motor Development-2 (TGMD-2)

The TGMD-2 (Ulrich, 2000) is a qualitative measure to assess 12 gross motor skills divided into locomotor skills (run, gallop, hop, leap, jump, and slide) and object-control skills (two-hand strike, stationary bounce, catch, kick, overhand throw,