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Can balance trampoline training promote motor coordination and balance performance in children with developmental coordination disorder?



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ABSTRACT

The present study aimed to examine movement difficulties among typically developing 8- to 9-year-old elementary students in Greece and to investigate the possible effects of a balance training program to those children assessed with Developmental Coordination Disorder (DCD). The Body Coordination Test for Children (BCTC; Körperkoordinationstest für Kinder, KTK, Kiphard & Schilling, 1974) was chosen for the purposes of this study and 20 children out of the total number of 200, exhibited motor difficulties indicating a probable DCD disorder. The 20 students diagnosed with DCD were equally separated into two groups where each individual of the experimental group was paired with an individual of the control group. The intervention group attended a 12-week balance training program while students of the second – control group followed the regular school schedule. All participants were tested prior to the start and after the end of the 12-week period by performing static balance control tasks while standing on an EPS pressure platform and structured observation of trampoline exercises while videotaping. The results indicated that after a 12-week balance training circuit including a trampoline station program, the intervention group improved both factors that were examined. In conclusion, balance training with the use of attractive equipment such as trampoline can be an effective intervention for improving functional outcomes and can be recommended as an alternative mode of physical activity.

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1. Introduction

A minimal level of competence in motor skills, ranging from fine coordination to gross motor coordination and balance skills, is necessary to participate in daily physical activities typical of young children. However, while some children execute a whole range of motor tasks easily, others experience considerable difficulties coordinating and controlling their body movements. The latter children are often diagnosed with Developmental Coordination Disorder (DCD) which has been described as one of the six most commonly occurring developmental disorders (Kwan, Cairney, Hay, & Faught, 2013). There is

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a debate in the literature regarding the prevalence of DCD, with estimates ranging from 1.8% (Lingam, Hunt, Golding, Jongmans, & Emond, 2009) to 5–6% of school-aged children (Missiuna et al., 2008).

According to the diagnostic criteria of DCD, the current diagnosis is applied to children who present marked impairment in the development of motor coordination that has negative impact on the child's academic achievement or the performance of everyday life tasks and is not due to any known medical condition (APA, 2013). Children with DCD require much more effort and take much longer than their peers to learn specific complex age-appropriate motor skills (Sylvestre, Nadeau, Charron, Larose, & Lepage, 2013). Without proper intervention, the problems that arise from DCD may persist into adolescence and adulthood (Losse et al., 1991; Fitzpatrick & Warkinson, 2003). A typical characteristic of children with DCD is poor postural control (Geuze, 2003). It has been reported that 73–87% of children with DCD actually display balance control problems (Macnab, Miller, & Polatajko, 2001). Postural control has been defined as the control of the body's position in space for the purpose of balance and orientation (Shumway-Cook & Woollacott, 2001). Children without static balance control lack the stabilizing framework that is necessary to develop normal functional activities. Since the development of the balance control is the base for development of all other skills, the ability to maintain postural stability in children with DCD is an important area that needs to be addressed. Any impairment in postural control may limit the children's activity participation (Fong, Lee, & Pang, 2011; Smyth & Anderson, 2001) increase their risk of falling and delay motor skills development (Grove & Lazarus, 2007).

Without proper intervention, the balance and motor deficits that arise from DCD may persist into adolescence and even adulthood (Fitzpatrick & Warkinson, 2003). Early intervention to enhance motor and balance performance is thus very important. Although many different intervention strategies have been used and studied, it remains unclear which best improve motor performance or activities in children with DCD and lighten the associated problems (Smits-Engelsman et al., 2013; Peens, Pienaar, & Nienaber, 2008).

To our knowledge there is no study that examined the effects of balance training with the use of trampoline in healthy children with DCD on variables of static balance and motor coordination. However, it has been suggested in recent studies that trampoline exercises consist of a multicomponent approach which are likely to affect many physical factors such as balance, flexibility, strength, body stability, muscle coordinative responses, joint movement amplitudes and spatial integration (Aragao, Karamanidis, Vaz, & Arampatzis, 2011; Giagazoglou et al., 2013).

Children with DCD have been reported to avoid physical activity due to poor self-efficacy (Cairney, Hay, Faught, et al., 2005; Engel-Yeger & Hanna Kasis, 2010). The most difficult part for children with DCD is to find an appropriate exercise program to keep their interest in taking part and continue participation for a long time. In this regard, it was hypothesized from the authors that balance training circuit including a station with a trampoline as an equipment promoting fun and enjoyment, would keep children's interest throughout the whole duration of the activity program. Therefore, the purpose of the present study was to assess the effect of a 12-week balance training intervention program with the use of a trampoline on motor coordination and balance ability of school aged children with DCD.

2. Methods

2.1. Participants

The children who participated in this study were sampled from various elementary schools in Thessaloniki, a big town of Northern Greece. There were 200 children (104 boys and 96 girls) 8–9 years old (mean age 8.43 ± 1.85 months). All children were tested using the tasks from the quantitative test of neuromuscular coordination of the whole body (*Body Coordination Test for Children BCTC*; Körperkoordinationstest für Kinder, KTK) (Kiphard & Schilling, 1974, 2007). It was found that 20 children (13 boys and 7 girls) out of the total number of 200 children participating in this study exhibited motor difficulties indicating a probable Developmental Coordination Disorder.

All children had normal-range IQs and no evidence of physical or neurological disorder. Children with a history of prenatal problems, neurological diseases, sensory disturbances, premature children and children with epilepsy or other chronic diseases were excluded from the study. Additionally, information such as motor skill delays and poor coordination interfere with the performance of self-care activities and academic achievement beyond what would be anticipated, given their age and intellectual ability was derived from children's school records and parent's reports according to APA (2000) recommendations.

The 20 students diagnosed with DCD were equally separated into two groups where each individual of the experimental group was paired with an individual of the control group in terms of gender, age and school placement to ensure that both groups started from the same reference point prior to intervention. The first – experiment-group (mean age = 8.80 ± 1.7 years, height = 1.39 ± 0.13 cm, body weight = 38.77 ± 12.88 kg) followed a 12-week balance training program while students of the second – control-group (mean age = 8.43 ± 1.85 years, height = 1.36 ± 0.12 , body weight = 35.98 ± 11.61 kg) followed the regular school schedule. Independent *t*-tests indicated non-significant group differences in anthropometric parameters. The 20 participants were tested prior to the start and after the end of the 12-week period by performing static balance control tasks and structured observation of trampoline exercises while videotaping.

All parents or legal guardians provided written informed consent prior to participation approved by an Institutional Review Board for use of Human subjects, allowing children's involvement in the program and access to relevant information.

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