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ORIGINAL PAPER

The Effects of Aquatic Versus Kata Techniques Training on Static and Dynamic Balance in Children with Autism Spectrum Disorder

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Abstract
The present study aimed to compare the effect of a land-based and a swimming-based exercise program on balance abilities in children with autism. Thirty children were voluntarily selected and randomly assigned to karate exercise, aquatic training and control groups. Participants practiced for 10 weeks, 2 sessions of 60 min per week. Before and after the 10-week intervention, static and dynamic balance tests were administered. The results showed that both interventions had a significant effect on balance abilities ($p < 0.001$); interestingly, we found the greater improvement in balance performance in kata techniques group. Due to the importance of balance performance on daily functions, communication and interaction skills, karate and swimming exercises can be the valuable interventions added to autism's daily programs. Iranian Registry of Clinical Trials number: IRCT20180626040242N1

Keywords Static balance · Dynamic balance · Autistic children · Kata techniques · Swimming

Introduction

Autism spectrum disorders (ASD), diagnosed by significant impairment in behavior and communication, are multifactorial and neurodevelopmental disorders that appear in early childhood and last until late in life (American Psychiatric Association, 2013). In 2019, it was estimated that the overall prevalence of ASD was 10 per 10,000 among Iranian children (Mohammadi et al. 2019).

In addition to communication and behavioral concerns, studies have addressed that children with ASD have a higher motor and postural abnormalities, and poorer coordination and balance than typically developing children (Bhat et al. 2011; Memari et al. 2013; Sam et al. 2017; Stins et al. 2015; Travers et al. 2013). Balance control is derived from the integration of three major sensory inputs: visual, vestibular, and somatosensory systems (Cordo and Nashner 1982). Children with motor disabilities and disturbed balance are likely susceptible to more falling during a daily performance and may experience increased impairment in the development of communication and interaction skills (Stins et al. 2015).

Because of the consequences of impairments and associated problems on the daily functions and quality of life of ASD children and their parents, researchers in various fields of behavioral, psychological, and medical sciences tried to find effective interventions to reduce its complications. In recent years, physical activity and exercise interventions are known to be beneficial for decreasing repetitive behaviors (Liu et al. 2016), increasing physical fitness (Azimigarosi et al. 2020; Fragala-Pinkham et al. 2011; Yilmaz et al. 2004), improving communication and social interaction (Azimigarosi et al. 2020; Guest et al. 2017; Movahedi et al. 2013; Pan 2010; Zhao and Chen 2018), balance and motor abilities (Cheldavi et al. 2014; Ketcheson et al. 2017; Lourenço et al. 2015; Salar et al. 2014) in children with ASD.

Swimming-based exercise intervention is a potentially safe and recreational activity for children with disabilities,

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