

Effect of Regular Swimming Training and Healthy Dietary Pattern on Endocrine-Related Indicators in Autism Spectrum Disorder - A New Insight

Moiniafshari K^{1*}, Kalantari F¹ and Nezhad HB²

¹Department of Physical Education and Sport Sciences, Islamic Azad University, East Tehran Branch, Tehran, Iran

²Department of Physical Education and Sport Sciences, University of Tehran, Tehran, Iran

*Correspondence: Kimia Moiniafshari, Department of Physical Education and Sport Sciences, Islamic Azad University, East Tehran Branch, Tehran, Iran

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Abstract

Background: Autism spectrum disorder (ASD), is a neuro-developmental disorder that is mainly characterized by social interaction impairments. Health-related challenges including weight abnormalities and hormonal impairment seem to have a higher prevalence in ASD individuals. The purpose of this study was to assess the effect of aquatic training and diet modification according to recommended guidelines on endocrine-related indicators including growth parameters and IGF-1 in teenage and young individuals with ASD.

Methods: 5 individuals diagnosed with ASD (age = 14.86 ± 1.22) participated in regular aquatic sessions for 12 weeks, 2 sessions per week which lasted 60 min in each session. Body weight, stature, body mass index (BMI), and IGF-1 were measured before and after the study. Caregivers and healthcare centers to which the participants were referred for their therapeutic purposes, were given booklets and brochures regarding nutritional recommendations published by health authorities.

Results: All of the participants were overweight (BMI = 27.98 ± 1.44). There was a significant improvement in body weight, BMI, and IGF-1 levels after the study ($p \leq 0.05$). Although, there was no significant improvement in dietary pattern ($p = 0.3$) despite reported improvements recorded by families regarding food variety and consumed food groups.

Conclusion: Aquatic training and diet modification can improve growth and health-related indicators in individuals with ASD.

Keywords: autism spectrum disorder, aquatic training, diet, growth, metabolism

Abbreviations: ASD: autism spectrum disorder; BMI: body mass index; TD: typically developed

Introduction

Autism spectrum disorder (ASD), is a neuro-developmental disorder characterized by social communication impairment and may lead to poor quality of life due to several reasons including inactivity and a sedentary lifestyle due to social challenges [1]. Low physical activity levels in individuals with ASD, may affect health status and cause several health complications including metabolic syndrome, diabetes type 2, insulin resistance, hormonal impairment, and cardiovascular diseases [2]. It has been suggested that increasing physical activity level in individuals with ASD, may improve their health status and can be considered a practical strategy for ASD management. Despite the beneficial effects of physical activity for ASD, attending physical activity programs seems to be more difficult and challenging in individuals with ASD in comparison to typically developed (TD) individuals [3]. There are several types of physical activity that have been suggested as effective strategies for ASD, but, as recruiting physical activity programs seems to be more difficult in individuals with ASD, prescribing physical activity for ASD, may require more consideration from health professionals. In this way, health professionals may encourage ASD individuals to do physical activities, by considering their preferences [4]. Among suggested physical activity types, aquatic exercise seems to be effective for ASD individuals [5]. It has been suggested that swimming may improve ASD-related challenges in several aspects, including motor skills, behavioral symptoms, and social skills which can be game-based or technical training [6].

Nutritional problems including food selectivity, restricted dietary patterns, and nutritional deficiencies are considered other health-related challenges for individuals with ASD, which may affect the metabolic status, body composition (underweight, overweight, or obesity), and overall health [7]. Nutritional inadequacy and deficiencies may increase health-related challenges in ASD. Among these, vitamin B6, vitamin B12, folate, and vitamin D deficiencies have been indicated in previous studies [8]. Due to the vital role of appropriate nutrition and dietary pattern in ASD and its role on immune system function and metabolic status, planning and recruiting effective strategies seems to have beneficial effects on ASD management [9].

The purpose of this study was to evaluate the effect of regular aquatic training and diet modification in individuals diagnosed with ASD.

Methods

Initial assessments

5 boys diagnosed with ASD (age = 14.86 ± 1.22) who attended a swimming course under a specialist and educated trainer's supervision were assessed for medical, metabolic, and growth status. CDC growth charts were used to assess weight for age, stature for age, and body mass index (BMI) as body composition indicators. IGF-1 was assessed *via* anterior cubital vein blood samples. Teenage and young individuals with ASD participated in aquatic training sessions for 12 weeks, 2 sessions per week, and each session for 60 min.

As caregivers and health-center staff are the main food providers, they were asked to improve dietary patterns in both family and individual scales. Nutritional recommendations according to health principles were handed to them and they were asked to record the dietary changes and/or any improvements in family and ASD individuals' dietary patterns. Body composition and endocrine and health-related indicators including body weight, stature, BMI, and IGF-1 were assessed before and after the study. A simple questionnaire was designed to assess the changes in diet patterns in both family and ASD participants and caregivers were asked to report the amount and serving numbers of each food group both before and after the study.

Results

The purpose of this study was to evaluate the effect of swimming training along with diet improvement on metabolic-related indicators and IGF-1 levels in teenage and young individuals diagnosed with ASD. After assessments, there was no significant difference between individuals for all the evaluated indicators ($p = 0.789$). By using BMI provided by CDC, it was indicated that all 5 participants were overweight ($BMI = 27.98 \pm 1.44$).

There was a significant improvement in body weight after the intervention ($p = 0.02$). BMI improved significantly after the intervention ($p = 0.001$). IGF-1 was considered another indicator of health, growth, and metabolic status in this study. The results of this study have indicated a significant improvement in IGF-1 levels ($p = 0.003$).

Dietary improvements and any changes were assessed using a simplified questionnaire. There was no significant improvement in the number of servings for each food group consumed during the 12 weeks of study ($p = 0.3$), despite improvements in dietary pattern and food group consumption reported after the intervention, as caregivers reported more variety of each food groups that were consumed within the 12 weeks of intervention.

| Variable | Pre-test | Post-test | p |
|--------------------------------|------------------|------------------|--------|
| Weight (kg) | 76.34 ± 1.45 | 74.68 ± 1.02 | 0.02 |
| Height (cm) | 98 ± 2.3 | 99 ± 1.02 | > 0.05 |
| BMI (kg/m^2) | 27.98 ± 1.44 | 25.65 ± 0.89 | 0.001 |
| IGF-1 (ng/ml) | 102 ± 5.56 | 154 ± 7.89 | 0.003 |

Table 1: Comparison of endocrine-related indicators and IGF-1 before and after the study.

Discussion

The purpose of this study was to indicate the effect of regular aquatic training along with diet modification in teenage and young individuals diagnosed with ASD on growth and metabolic-related indicators during the summer of 2022. For this reason, we conducted regular aquatic training for 12 weeks and nutritional recommendations for the healthy dietary pattern were handed to caregivers and provided for health care centers, where the participants were referred for their medical and therapeutic purposes. Nutritional recommendations including dietary guidelines according to health principles were provided as booklets and brochures for caregivers and related centers. The results of this study have suggested significant improvement in assessed indicators including body weight, BMI, and IGF-1.

Aquatic training has been suggested as an effective strategy for improving physical activity status in ASD individuals which seems to improve behavioral and motor skills. Previous studies have suggested that even taking a shower or bath time may have a beneficial effect on the result [10]. Previous studies have focused on the effect of aquatic training on behavioral and other symptoms of ASD and have suggested improving social and physical competence [11]. Moreover, the effect of aquatic training can bring beneficial occupational therapeutic effects which can be considered as a therapeutic strategy [12]. Previous studies have shown that the prevalence of weight for age impairments including low weight for height, overweight, and/or obesity is common among individuals with ASD. It seems that overweight and/or obese have a higher prevalence in individuals with ASD in comparison to TD individuals which is associated with insulin resistance, diabetes, cardiovascular diseases, and some cancers which can be modified by lifestyle components modulations [13]. Recent studies have suggested a higher prevalence of unhealthy weight in individuals with ASD which is considered a health-related challenge due to the effect of being overweight and/or obese on health status and chronic disease prevalence [14]. The results from this investigation have approved the higher weight for age in ASD participants, as all of the participants were overweight which may increase the necessity for physical activity and nutritional interventions. The results from this study have indicated an improvement in IGF-1 levels after 12 weeks of aquatic training and diet modification. Despite this improvement, the results of this study are not consistent with some previous studies which indicated that IGF-1 level is higher in ASD individuals in comparison to TD individuals [15].

Aquatic training and nutritional care seem to be two important components in ASD symptom management.

Nutrition problems are common among individuals with ASD. Food selectivity, restricted dietary intake, nutritional deficiencies, and mealtime behavioral problems are common among ASD individuals which may decrease dietary quality [16]. The results from this study have indicated the improvement in body composition components and IGF-1 followed by aquatic and dietary modification in teenage and young participants with ASD which may improve metabolic status. These results are in parallel with previous studies which suggested unbalanced body composition, inadequate dietary intake, and higher food selectivity in ASD [17].

Nutrition care was provided by handing required and necessary recommendations for health daily dietary pattern to caregivers and related centers. Previous studies have also focused on the role of caregivers in ASD individuals' health improvement, as caregivers are important members of health assessments and intervention recruitment. Caregivers can follow their children's body weight, body composition changes, and dietary patterns and report to healthcare professionals [18]. In this study, caregivers participated as assistants to improve family and ASD individuals' dietary patterns according to recommended guidelines and report the changes after 12 weeks. They were also asked to refer to a health professional in case of nutritional assessments to take a suitable step including supplementation which can be effective, especially when combined with aquatic training [19].

Conclusion

Aquatic training and diet modification may improve growth and health-related indicators in teenage and young individuals with ASD. Aquatic training sessions have been prescribed as a therapeutic intervention with the purpose of physical activity improvement, weight management, growth, and metabolic improvement which may be a leading cause for better health status in ASD individuals. Nutritional improvement by providing nutritional recommendations released by health authorities to caregivers and health centers seems to be an effective step for dietary improvement and modifications in ASD. Further research is suggested to indicate the role of combined aquatic training and diet modification (both for family and ASD individuals) on health-related indicators in ASD.

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