

## How Different Health-Related Interventions Improve Metabolic Impairments in Individuals with Autism Spectrum Disorder

Kimia Moiniafshari<sup>1\*</sup>, Farshad Kalantari<sup>2</sup> and Hafez Behzadi Nezhad<sup>3</sup>

<sup>1</sup>Department of Land, Environment, Agriculture and Forestry, University of Padova, Padova, Italy.

<sup>2</sup> department of physical education and sport sciences, East Tehran Branch, Islamic Azad University, Tehran, Iran.

<sup>3</sup> department of physical education and sport sciences, University of Tehran, Tehran, Iran.

### \*Corresponding author:

Kimia Moiniafshari, Food and Health group, Department of Land, Environment, Agriculture and Forestry, University of Padova, Padova, Italy.

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### Abstract

Autism Spectrum Disorder, is a neuro-developmental disorder diagnosed at the age of three. Individuals with ASD may have several health-related challenges including insulin resistance, dyslipidemia, over-weight and other metabolic impairments which may be due to poor nutrition, low quality dietary pattern, food selectivity and low level of physical activity. There are many nutritional and physical activity interventions introduced in autism society. The purpose of this study was to assess and discuss about some nutritional and physical activity interventions which are usually prescribed for individuals with ASD.

**Keywords:** autism spectrum disorder, nutrition, physical activity, metabolism.

### Introduction

Autism spectrum disorder (ASD) is a neuro-developmental disorder, diagnosed mostly at the age of three which is usually accompanied by social interaction disorder. Individuals with ASD, may also face with some other challenges especially health-related challenges including metabolic disorders. Health-related challenges may increase due to society and public challenges or a pandemic such as COVID-19 pandemic which has brought a lot of worldwide health challenges for publics and health services.

Recent studies have focused on appropriate interventions in order to improve metabolic status and general health in individuals with ASD. Poor social interactions, poor dietary pattern and dietary quality, low level of physical activity and behavioral problems may lead to poor health status. Among thousands of introduced health-related strategies, nutrition and physical activity interventions have gained a lot of attention. Nutrition and physical activity will become more important for ASD due to higher prevalence of inflammation, higher level of IL-6, IL-8, TNF- $\alpha$  and lower level of CAM cells [1].

### Methods

The purpose of this study was to assess the effect of different nutritional and physical activity interventions which have been

prescribed within recent years in order to find out an effective intervention to improve metabolic status in individuals with ASD. For this reason, recent studies which have considered different nutritional interventions including nutritional assessments, diet prescription and micronutrient supplementation, was assessed along with different physical activities including aerobic, strength, aquatic and home-based activities which have been suggested as effective interventions for individuals with ASD.

### Different Health-Related Interventions Suggested for ASD Different Nutritional Interventions and Related Challenges in ASD

It has been suggested that nutritional deficiencies have high prevalence among individuals with ASD which may be due to repetitive dietary intake, food selectivity and restrict dietary intake. Nutritional assessment may be an effective strategy for screening the dietary pattern and nutritional status which can be assessed using food records and Healthy Eating Index (HEI) and comparing the results with DRI [2]. Moreover, some other nutritional assessment tools including Food Frequency Questionnaire (FFQ) and food diary, can also reflect dietary status and intakes which may be related to metabolism, homocysteine, IL-6 and other metabolic indicators [3]. These screening strategies may also be effective for following growth pattern and body composition especially in individuals

with ASD during childhood and teenage stage [2]. There are a lot of nutritional interventions introduced for ASD, including several diets which seems to improve metabolic and health status in ASD due to food allergies and food intolerance alleviation and dietary pattern improvement [4]. These interventions aim to improve dietary pattern in ASD and have focused on moderate and health dietary pattern in order to improve lipid profile, BMI and metabolic status [5]. Nutritional status improvement is a crucial step in ASD and studies have indicated that dietary intake is related to insulin resistance, metabolic syndrome, systemic inflammation and obesity in ASD individuals which can be modified and improved by recruiting effective nutritional interventions [6].

It has been suggested that some metabolic impairments including insulin resistance and dyslipidemia, may be due to higher rate of systemic inflammation in ASD, which can be modified by nutritional interventions. As individuals with ASD often have limited dietary intake with usually higher amounts of processed foods which can be a leading cause for higher inflammatory response, supplementation may be considered as a beneficial intervention [7]. Vitamin D3 and omega-3 fatty acids, are two micronutrients which seem to reduce inflammatory responses in ASD when prescribed as supplements. This may lead to metabolic disturbance improvement [7].

#### **Different Types of Physical Activities and ASD**

Beside nutritional status improvement, improving physical activity status, seems to be another effective intervention for metabolic status improvement in ASD. This health-related challenge will become more important in ASD, as over-weight and lower level of Adiponectin, Ghrelin and Leptin hormones have higher prevalence in ASD [8]. There are many physical activity methods which are introduced as effective activities for ASD, but this should be mentioned that ASD has its specific requirements and some recruiting and prescribing some activities may not be applicable for ASD. It has been suggested that physical activities with moderate intensity can improve inflammatory responses and metabolic status, even independent from changes in adipose tissue, although there are several suggested improvements as a result of regular recruitments of activities with higher intensities [9, 10]. The results about the most effective physical activity are still unknown and several studies have suggested inconsistent results and have indicated that physical activities with higher intensities can enhance inflammation, but when more resting time included in physical activity program, this inflammation may reduce [11]. This outcome seems to improve metabolic status in ASD. This has led to more focus on the role of different types of physical activities in ASD individual's health improvement.

One of the physical activities which has high rate of prescription for ASD, is aerobic activities which can be recruited in different types and areas including outdoor and indoor. This type of activity can bring more beneficial effects especially when prescribed for longer durations and can improve body composition and ultimately metabolic status in ASD [12].

Water-based activities, can be considered as effective approach for metabolic status improvement in ASD, especially when combined with nutritional interventions including vitamin D3 supplementation [13]. Aquatic physical activity has gained a lot of attention during recent years and variety of interventions including its combination with vitamin supplementation have considered as beneficial intervention for improving metabolic and inflammation in ASD [14]. This improvement in inflammatory response, may lead to better metabolic status. It is suggested that the combination of water-based activities along with vitamin D3 supplementation, may improve lipid profile and some anthropometric measurements except waist-to-hip ration (WHR) and Body Mass Index (BMI) in ASD [13].

Moreover, coordination and strength trainings, are other interventional strategies for improving physical activity status and lipid profile improvements in ASD which can lead to better metabolic status [15].

Other physical activity interventions, may include indoor and home-based activities which introduced especially during the COVID-19 pandemic, when ASD individuals spent more times at home due to quarantine and lockdowns. This type of physical activity, has focused on strength and flexibility improvement due to poor physical fitness in most of the individuals with ASD in a calm and warm environment with therapist's supervision. These activities usually are prescribed to improve body composition, weight management and metabolic disorders prevention [16, 17].

#### **Conclusion**

There are several health-related challenges in ASD which can be modified by nutritional and physical activity interventions. There are many nutritional and physical activity interventions introduced for ASD individuals which have focused on metabolic and general health improvement. There is still a doubt on the most effective interventions and the question remained unanswered that which strategy, nutritional or physical activity is the most effective. Furthermore, there is still remained unclear that which nutritional strategies, including diet prescription or supplementation, or physical activities, including aerobic, strength, aquatic or home-based training, are more effective than others. It can be concluded that nutritional and physical activity interventions may bring more beneficial effects for ASD individuals when recruited in combination. Further studies are required in order to find out which strategy is more effective for metabolic status improvement in ASD.

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