



RESEARCH ARTICLE

NUTRITIONAL STATUS OF AUTISTIC AND TYPICALLY DEVELOPING CHILDREN IN MUMBAI

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ABSTRACT

Autism Spectrum Disorder (ASD) is a broad term which is characterized by difficulty in social interaction and restricted or repetitive behaviors. This study aimed to assess the nutritional status of autistic children in Mumbai. The sample size was 100 children between 5-15 years of age. Fifty were autistic and 50 were age and gender matched typically developing children. In each group, there were 37 girls and 13 boys. Anthropometric measurements (Height, weight, BMI, hip circumference, waist circumference and MUAC) of the participants were recorded. The mean weight of autistic children was found to be slightly higher than the control group (29.66±13.51 cm vs. 28.97±11.55 cm). The mean BMI of children in the autistic and control group were 16.54±3.61 kg/m² and 16.21± 3.21 kg/m² respectively. The mean waist circumference, hip circumference and MUAC of autistic children was significantly higher as compared to the control group. Greater percentage of autistic children were found to be overweight and obese as compared to typically developing children (38% vs. 18%). The findings suggest that autistic children may be more prone to overweight and obesity as compared to the typically developing children. Also, it was seen that percentage of overweight and obesity in children of both the groups was high in higher family income groups. Regular nutritional assessment and weight monitoring of autistic children is therefore necessary to maintain good nutritional status.

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INTRODUCTION

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder which is characterized by difficulty in social interaction and restricted and repetitive behaviors (Ouseley and Cermak, 2014). According to the 5th edition of Diagnostic and Statistical Manual (DSM), there are three types of ASD: Classical autism, Asperger's syndrome and Pervasive Developmental Disorder- not otherwise specified (PDD-NOS) (American Psychiatric Association, 2013). Worldwide, there has been a rise in the prevalence of ASD and the prevalence is estimated to be 1 in 160 children (WHO, 2017). Despite the rise in the prevalence of ASD, its exact cause has not yet been identified. Both genetic factors and environmental factors are believed to have an important role in the development of ASD. Genetic causes include chromosomal abnormalities, gene disorders and heritability.

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The various environmental factors contributing to ASD are divided into pre-natal, peri-natal and post-natal factors (Chaste and Laboyer, 2012). Advanced parental age, preeclampsia, infections, maternal health, exposure to pesticides are the various pre- natal factors. Factors during pregnancy which could increase the risk of autism are caesarian delivery, preterm birth, congenital malformations, hypoxia, etc. Post-natal factors like jaundice, anemia, hemorrhages, aspiration, viral infections are also correlated with high risk of autism (Karimi *et al.*, 2017). Studies on nutritional status of children with ASD have reported varied findings. Individuals with ASD are more likely to suffer from malnutrition. Prevalence of underweight in children with ASD has been reported in few studies (Al-Farsi *et al.*, 2011; Bicer and Alsaffar 2013; Mari-Bauset *et al.*, 2015). However, several studies have reported that autistic children are overweight or obese (Xiong *et al.*, 2009; Memari *et al.*, 2012; Zuckerman *et al.*, 2014). Comparative studies have also reported a higher prevalence of overweight or obesity in children with ASD as compared to typically developing children (Curtin *et al.*, 2010; Evans *et al.*, 2012; Ranjan and Nasser, 2015; Voulgarkis *et al.*, 2017).

Several factors may be responsible for the prevalence of obesity in children with ASD. Lack of regular physical activity (Pan and Frey, 2006; Macdonald *et al.*, 2011), side effects of medications (Marcus *et al.*, 2009), cultural and environmental factors (Mari-Bauset *et al.*, 2016). Children with ASD are also reported to have an unusual dietary pattern (Curtin *et al.*, 2014). Some studies report that children with ASD have limited intake of food (Bandini *et al.*, 2010) or excessive consumption of energy dense foods (Shreck *et al.*, 2004), sugar sweetened beverages. One or a combination of these factors could predispose children with ASD to weight gain. Whereas, food selectivity, restricted eating habits and nutritional deficiencies may result in underweight in children with ASD (Emond *et al.*, 2010; Bicer and Alsaffar 2013). The purpose of the present study was to assess the nutritional status of children with ASD in Mumbai. The study aimed to assess anthropometric measurements (weight, height, mid upper arm circumference, waist and hip circumference) of autistic children and compare the nutritional status of autistic children with age and gender matched typically developing children.

MATERIALS AND METHODS

Study Design: This was a cross sectional study and purposive sampling technique was used for the selection of subjects. The study was approved by Inter System Biomedica Ethics Committee (ISBEC) letter number ISBEC/NR-31/KM-JVJ/2017 dated 13th October 2017.

Participants: Fifty children with identified autism in the age group 5-15 years were taken from various special schools for disabled children in Mumbai. The schools were Samarpan School of Autism (Jogeshwari), Aashiana Institute of Autism (Andheri), Adapt (Bandra), Priyanj Special School (Goregaon), Punarvas Special School (Goregaon), Aanandi Special School (Vile Parle), Aarushi Special School (Santacruz), Dakshinya Academy (Goregaon). Permission from the Principal or head of respective institution was taken personally. Fifty age and gender matched typically developing children were taken from other schools. Participants with severe visual, auditory or motor problems were excluded. Parents of the participants were briefly explained about the study and an informed consent was taken from them. A signed assent was also taken from the typically developing children who were above 7 years.

Procedures and Analysis: Parents of the participants were asked to fill a self-constructed questionnaire consisting of socio-demographic information and other details about the participant. Anthropometric measurements of the participants were taken at the time of the interview. Participants were asked to remove their bags, shoes or any heavy clothing. Weight was measured on a standard weighing machine to the nearest 0.1 kg. Height, mid upper arm circumference, waist and hip circumference were measured to the nearest 0.1 cm using a measuring tape (Fidanza, 1991). BMI was calculated, and percentiles were obtained using the Revised IAP Growth charts for Body Mass Index for 5-18-year-old Indian children (Khadilkar and Khadilkar, 2015). BMI percentiles of \leq 3rd percentile was considered as underweight, adult equivalents 23rd and \geq 27th percentile as overweight and obese respectively. The data was analyzed using the statistical package for the social sciences (SPSS) version 22.0. The statistical tests included mean, standard deviation, Chi square and ANOVA for intergroup and intra group differences, etc.

RESULTS

Out of the total 100 participants, 50 were autistic and 50 were age and gender matched typically developing children. There were 37 boys and 13 girls in each group. The male female ratio was found to be 2.8:1. Both the groups consisted of 36 children in the 5-10-year age group 14 children in the 11-15-year age group. The monthly family income of all typically developing children was significantly higher as compared to the autistic children ($\chi^2 = 11.91$, $p = 0.008$). Forty four percent of typically developing children and 34% of autistic children belonged to higher income group. Forty eight percent of the typically developing children and 30% of autistic children were in the monthly family income range of Rs. 30,000 to 50,000. While only 8% typically developing children had family income of Rs. 10,00 to 30,000, thirty two percent autistic children were in the same income group. None of the typically developing children were in the lowest income group, however four percent of autistic children were in the same income range. When the anthropometric measurements of the children in both the groups were compared, it was seen that the mean waist circumference, hip circumference and MUAC of the autistic children was significantly higher as compared to the typically developing children ($p < 0.05$). Mean weight of the autistic children was also higher than the typically developing children, but it was not significant. The mean height of the typically developing children was higher than the autistic children. There was no significant difference in BMI of the two groups (Table 1).

Children were distributed in two age groups of 5-10 years and 11-15 years. In the younger age group, it was seen that weight ($p = 0.03$) and MUAC ($p = 0.01$) of the typically developing children was significantly higher as compared to autistic children. However, in this age group, autistic children had significantly higher waist circumference ($p = 0.02$) compared to typically developing children. In the 11-15-year age group, no significant difference was seen in the anthropometric measurements of two groups of children. Autistic and typically developing children were distributed in the BMI category given by Khadilkar and Khadilkar (2015). Table 2 shows the percentage of underweight, normal weight, overweight and obese children in the two groups. Among autistic children, 14% were obese, 24% were overweight, 54% were normal and 8% of them were underweight. In typically developing children, 10% were obese, 8% were overweight, 78% were normal and 4% were underweight. Thus, a higher percentage of autistic children were overweight and obese as compared to typically developing children (38% vs. 18%). Although more autistic children were overweight and obese than typically developing children, no difference was observed in the two groups when distributed in BMI categories ($\chi^2 = 7.182$, $p = 0.066$). Autistic and typically developing children were compared in the two genders for underweight, normal weight, overweight and obesity. It was observed that a higher percentage of autistic boys (18.9 %) were obese as compared to the typically developing boys (8.1%). Similarly, more autistic boys were overweight as compared to typically developing boys (27.1% vs. 8.1%). Over 10% of autistic boys were underweight, whereas, only half i.e., 5% of typically developing boys were underweight. Among the girls, 15.3 % of the typically developing girls were obese, however, none of the autistic girls were obese. Also, 18.1% autistic girls were overweight as compared to 7.7% typically developing girls.

Table 1. Anthropometric Measurements of Subjects in Both the Groups

Parameter	Autistic (n=50)	Control(n=50)	F, p
Height (cm)	130.33± 17.44	131.55± 17.21	0.077, 0.07
Weight (kg)	29.66± 13.51	28.97± 11.55	3.447, 0.06
BMI (kg/m ²)	16.54± 3.61	16.21± 3.21	1.905, 0.17
Waist circumference (cm)	63.79± 11.59	61.35± 9.1	5.475, 0.02
Hip Circumference (cm)	69.96± 12.91	69.75± 10.60	4.389, 0.03
Mid upper arm circumference (cm)	20.54± 4.16	20.06± 2.95	10.306, 0.002

Table 2. Distribution of Autistic and Typically Developing Children in BMI Category

Group	Underweight	Normal	Overweight	Obese	Overweight and Obese
Autistic (n=50)	8% (4)	54% (27)	24% (12)	14% (7)	38% (19)
Typically developing children (n=50)	4% (2)	78% (39)	8% (4)	10% (5)	18% (9)

Figures in parenthesis indicate numbers

Approximately similar number of typically developing girls and autistic girls had normal weight (84.6 % vs. 77%). None of the girls were underweight in both autistic and typically developing children. The weight status of the children was compared with family income. The weight status of the children was classified using the weight percentiles given by Khadilkar and Khadilkar (2015). Children were classified as underweight, normal weight, overweight and obese in the income categories. The income categories as obtained from the students were Rs. < 10,000, 10,000-30,000, 30,000-50,000 and >50,000. Out of the 50 autistic children, six were underweight and they belonged to lower and middle-income group. Only one typically developing child in the same income group was underweight. Eight autistic children who were overweight and obese belonged to middle and higher income groups. Similarly, seven typically developing children were overweight and obese in the same income groups. A higher number of normal weight autistic children belonged to the 10,000-30,000-income group. Whereas, maximum percent of normal weight typically developing children were in the 30,000- 50,000 income group. It was seen that as the family income increased, the percentage of overweight and obesity in children of both the groups was high.

DISCUSSION

Nutritional status has been defined as an individual's health condition influenced by the intake and utilization of nutrients (Todhunter, 1970). CDC lists underweight, overweight, obesity and short stature as indicators for nutritional status (CDC, 2000). Not many studies on nutritional status of autistic children have been reported in India. In 2015, Prabhakar *et al.*, assessed the nutritional status and eating habits of 62 autistic children in Andhra Pradesh. They reported that 35.8% children were overweight and 9.8% were obese. Shaly and Sreesana (2013) had reported in their study of 100 autistic children in Kerala that 10% of the children were severely underweight, 13% were moderately underweight and the rest 77% autistic children belonged to the normal weight category according to BMI for age. The present study examined the nutritional status of fifty autistic children in Mumbai. Our study has a lower percentage of overweight autistic children (24%) compared to Prabhakar *et al.*, (2015) (35.8%). However, we found a higher percentage of autistic children to be obese (14%) whereas they reported only 8% to be obese. Our results showed no significant difference between the means of BMI in autistic and typically developing children. Whereas, both Shmaya *et al.*, (2015) and Kummer *et al.*, (2016) had reported that autistic children had significantly higher BMI as compared to the typically developing children.

The exact cause for overweight and obesity in autistic children is not known. Several studies report various factors which maybe associated with obesity in children with ASD. Ho *et al.*, (1997) in Canada found that 42.6% of the children were obese and half of them had very low physical activity. In the same study they also reported a positive correlation between severity of autism and obesity. Memari *et al.*, (2015) too had reported that children with ASD in the age group 6-15 years had very low physical activity. Reinehr *et al.*, (2010) suggests that factors like lack of exercise or physical activity, unusual eating habits, inadequate social interaction or participation and lack of awareness and attention of the parents towards the weight status of their child may be factors which may dispose children with disability to overweight or obesity. Corvey *et al.*, (2016) and Liu *et al.*, (2016) had reported no significant association between ASD and obesity. Mari-Bauset *et al.*, (2016) suggested that these differences in the nutritional status of children with ASD could be attributed to differences in the cultural pattern and environmental factors. In the present study, it was seen that autistic and typically developing children who were overweight and obese belonged to higher income groups. Children of higher family income may have greater access to processed foods and to a larger variety of foods. Frequent consumption of processed foods which may be high in trans-fat, saturated fat or sugars and have little nutritive value may result in obesity in children. The family's eating habits are an important factor which may influence the dietary pattern of autistic children. Lack of nutritional knowledge in parents/ caregivers of autistic children may result in unhealthy food choices which could be a contributing factor for obesity in autistic children. Autistic children may also not have regular physical activity due to their delayed or impaired motor development. Difficulty in social interaction and engaging with peers of the same age group may further limit their participation in outdoor games, sports and other recreational activities. Such a sedentary lifestyle may therefore put them at a risk of overweight or obesity. Autistic children are often prescribed psychotropic medications which are found to have side effects such as weight gain or increase in appetite. Children with ASD may exhibit some degree of oral motor dysfunction, sensory processing difficulty and cognitive inflexibility. Therefore, they may be repetitively demanding same kind of foods and may be unwilling to try out new or different foods. Parents of autistic children may find it difficult to feed them due to these issues. Due to a restricted diet, autistic children may also have various nutritional deficiencies. The main concern of parents of children with disabilities is usually to manage the symptoms associated with the disability. Thus, they may not give adequate attention to the child's weight.

Parents may also fail to resist the child's demands for foods like chocolates, chips, beverages, etc. Maintaining good nutritional status of these children is not easy. Thus, there is a need for creating awareness among parents of autistic children about the various risk factors for obesity. It is also necessary to educate them about various approaches to maintain good nutritional status of their child. Overweight and obese autistic children should be motivated to take part in regular physical activities. Foods high in sugar, fat and energy must be restricted and fruits, vegetables and whole grains should be incorporated in the diet.

Conclusion

Our results indicate a higher incidence of overweight and obesity in autistic children as compared to the typically developing children in the 5-15-year age group. This is alarming. Apart from the core features of ASD, autistic children may also face other problems such as cognitive abnormalities, intellectual disabilities, obsessions, anxiety, sleep disturbances, etc. An unhealthy weight may add to other co-morbidities. Thus, special attention should be given to improve the nutritional status of autistic children. Nutritional education and awareness among parents of autistic children is necessary. Interventions for these children should be planned based on the severity of autism, physical activity level, their eating pattern and the feeding difficulties faced by them.

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