Nutritional Status of Autistic Children and Relationship with Nutritional Awareness of Their Mothers

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Abstract

Background: Autism Spectrum Disorder is prevalent worldwide. Autistic children are vulnerable, their preference in food intake, well established, that may lead to abnormal nutrition status, this study designed to describe nutritional awareness of mothers of autistic children.

Methods: This is a descriptive cross-sectional study aimed to determine the nutritional status of autistic children and their mother's awareness in Khartoum state. 67 child aged between 3-18 years were chosen from 12 Centers for children with special needs.

Data was collected by questionnaire, which included general information, anthropometric measurements, dietary, and food consumption of children, through case-findings or purposive sampling techniques.

Results: The prevalence of autism is higher in males than females, males (77.6%), females (22.4%). Socio-economic status findings showed (65.7%) were from middle class income. Autistic children fathers (74.6%) employed and employed mothers were (28.3%). Nutritional status showed Preschool Females (100%) underweight; while school age males were (44.4%). 94.9% of them consume wheat and other cereal products. Frequent attacks of upper respiratory tract infection occurs in (97%), malaria and worms infestation occurred in (49.3%) and (46.3%) had teeth decay.

Conclusion and Recommendations: Nutrition awareness is essential for mothers of autistic children. It's recommended that a dietitian should be a member in each center to educate mothers about consumption of recommended food especially in the early childhood for a better outcome through adulthood.

Keywords: autism spectrum disorder, dietary alternatives, food choices, gluten-free-diet, nutritional awareness

1. Introduction

Autism and Autism spectrum disorder (ASD), are general terms for a neurodevelopment condition that, is most often a life-long disorder that result in varying degrees of difficult social interactions, verbal and nonverbal communication and repetitive behaviors, leading to a wide range of problematic behaviors, (Butcher et al.,2013 ; (Abubakar, Ssewanyana, & Newton, 2016) ; (Olmsted & Blaxill, 2016).

Well balanced nutrition plays a great role in the mental and physical development in human being, especially in early stages of life, derangement of which may affect the later adulthood.

ASD is one of the most disabling disorders in childhood that leads to a wide range of problematic behaviors (Casella et al., 2017; Butcher et al., 2010).

ASD in infancy and childhood first described in 1943 and it is considered one of the most disabling feature for neurological, emotional, and intellectual development (Olmsted & Blaxill, 2016). In a recent report CDC estimated that 1 in 68 children has been identified with autism spectrum disorder .This estimate is roughly 30%higher than a previous estimate in 2012 (Mahan & Raymond, 2017).

Genetics may play a role as a causation factor, neuropathology studies identifies single nucleotide polymorphism which suggest a need for adding minerals and antioxidants for children with ASD (Mahan & Scott-Stump, 2008). A neuro-chemical cause of autism in earlier studies discovered a unique urinary peptide in adults with autism that comes from an exogenous source, the gluten and casein were the suspected sources (Marshal et al., 2016; Barasi,

2003; Pennesi & Klein, 2012).

Autism may also occur with maternal rubella, tuberous sclerosis, and maternal disorder (Cermak et al., 2010).

Children with autism suffer from impairment in three behavioral categories; social interaction, verbal and non-verbal communication, and restricted or repetitive behaviors .These impairments affect the intake and eating behaviors by acceptance of only one specific food, refusal of new or unfamiliar foods. Children with autism are described as picky or selective eaters (Katz, 2008) leading to a limited food choices or inadequate nutrients intake (Daley et al., 2013; Gandy et al., 2010; Parke & Guavaian, 2009; Meguid & Anwar, 2015; Meguid et al., 2017).

Their restricted diets make them at a risk for marginal or inadequate nutrients intake. (Garrow et al., 1993; Peckenpaugh, 2009; Meguid et al., 2015; Mahan & Rymond, 2017).

Individuals with autism have difficulty with communication, social behavior and perception of their environment; have unusual response to touch, pain, and temperature which represent a major health and educational problems, affecting many areas of daily living activities.

1.1 Statement of Research Problem

Autistic children behavior in food intake put them at risk for the development of malnutrition.

Awareness of nutritional requirement is very crucial for mothers of autistic children.

In Khartoum State there are few centers for autism, including the group of children of special needs. These centers are under the supervision and control of non-governmental organization or individuals as investment institutions.

Therefore no specific estimate of prevalence of autistic children is present in ministry of health or World Health Organization, Sudan office.

1.2 Objectives of the Study

1.2.1 General Objective

To study the nutritional status of children with autism and its relation with their mother's awareness.

1.2.2 Specific Objectives

-To determine the nutrition status of children with autism.

-To evaluate food intake of autistic children using 24-hour recall method

-To study the adherence to dietary alternatives by autistic children mothers.

2. Materials and Methods

2.1 Study Design

This is a descriptive cross-sectional institutional based study.

2.2 Study Area

The study was conducted in Khartoum State, 12 centers of autistic children, namely

Khartoum Malak Center, Khartoum Center, Sad Altayeb Center, Alsharef Center, Sudan International for Autism and Special Needs Training Center, Althea Center.

Khartoum North: Alnel-Alazrag Center, Sudan Organization for Autism, Dar Mariam, Saad Eltayeb Center.

Omdurman: Dar Albalsam, Mental Development Center for Special Needs.

2.3 Study population

Autistic children (aged 3 and less than 18 years old) who attend autistic centers during the study period from September 2013 to march 2014.

2.4 Sample Size

Sample size of this study was calculated according to (Ryan, 2013) by using the following formula:

n= NZ *p (1-p)\ Nd² +z² *p (1-p)

Where

n=sample size

N= population size

Z= z-score=1.96 (95% confidence interval)

P= prevalence of scores (50%)

d=difference or marginal error=5%=0.05

n=67

2.5 Data Collection

The data have been collected from different sources, primary data depends on questionnaire designed for the study, and secondary data by using references and textbooks, scientific journals.

The sampling technique is purposive or case-finding sampling due to the informality of the specialized above centers.

2.5.1 Design of the Questionnaire

The questionnaire mainly designed to collect data about demographic characteristics and socio-economic information about the autistic children and their families; medical information and maternal disorders; anthropometric measurements and dietary assessment of the studied autistic children. (Sharma, 2009).

2.5.2 Nutrition Status of the Children with Autism

2.5.2.1 Anthropometric Measurements

Anthropometric data was assessed by body mass index for age according to WHO (2007) classification, which is a number calculated from a child's weight and height according to their age ; and is efficient tool for screening for obesity, over-weight, healthy weight, or underweight (Rolfes et al., 2009).

2.5.2.2 The 24-Hour Dietary Recall Method

Is done through a guided interview which an individual recounts all food and beverages consumed in the past 24-hrs or during the previous day (Mahan &Scott-Stump, 2008).

2.5.3 Inclusion Criteria

-All autistic children whose family agreed to participate.

-All autistic children ages 3-18 years old

2.5.4 Exclusion Criteria

-Children whose family refused to participate

2.6 Data Analysis

The collected data was analyzed using statistical packages for social sciences (SPSS version 20), with the ordinary statistical tabulation, and the tests of significance t-test and X^2 at level of significance less than or equal 0.05.

2.7 Ethical Considerations

Data of this study will be confidential and only for the purpose of this academic study and every mother had the right to withdraw at any time after they agreed to participate in the study.

3. Results

3.1 Gender and Age of Autistic Children in Khartoum State

General characteristics of autistic children as shown in Table.1 illustrated that (77.6%) of them were males, and (22.4%) were females. (86.5%) were at school age, and only (13.5%) were at preschool age.

Table 1. Gender and Age of Autistic Children in Khartoum State

Gender	No.	(%)
Male	52	77.6
Female	15	22.4
Total	**67**	**100.0**
Age		
Preschool age	9	13.5
School age	58	86.5
Total	**67**	**100.0**

3.2 Socioeconomic Characteristics of Autistic Children Attending Khartoum State Centers

Regarding education level of parents, the highest percentage were university level (59.7%), (80.6%), for mothers and fathers respectively .While (38.8%) of mothers had high school education, and (17.9%) of fathers had high school education.

Table 2 showed that (65.7%) of mothers were housewives, while (74.6%) of fathers and, (28.3%) of mothers were employed. The income level showed (65.7%), of parents had medium income and (16.4%) had high level of income, while low income level represented by (17.9%) of these families.

Table 2. Socioeconomic Characteristics of Autistic Children Attending Khartoum State Centers

Education	Mothers			Fathers	
	No.	(%)		No.	(%)
Illiterate	-	-		-	-
Primary	1	1.5		1	1.5
High school	26	38.8		12	17.9
University	40	59.7		54	80.6
Total	**67**	**100.0**		**67**	
Occupation					
Unemployed	44	65.7		2	3.0
Employed	19	28.3		50	74.6
Self-employed	04	6.0		15	22.4
Total	**67**	**100.0**		**67**	**100.0**
Family Income	No.			(%)	
Low	12			17.9	
Middle	44			65.7	
Highs	11			16.4	
Total	**67**			**100.0**	

3.3 Recurrent Diseases among Autistic Children in Khartoum State Centers

Table .3 showed that, autistic children suffered from different diseases. Frequent colds (97%), anemia (4.5%), malaria (25.4%).Worms infection was (23.9%).kidney dysfunction was (3%). Teeth Decay represents (46.3%) among autistic children.

Table 3. Recurrent Diseases among Autistic Children in Khartoum State Centers

Frequency of diseases	Rare		Frequent		Total	
	No.	(%)	No.	(%)	No	(%)
Cold	2	30	65	97	96	**100.0**
Anemia	64	95.5	3	45	67	**100.0**
Malaria	50	74.6	17	25.4	67	**100.0**
Worms	51	76.1	16	23.9	67	**100.0**
Kidney Disease	65	97.0	2	3	67	**100.0**
Teeth Decay	36	53.7	31	46.3	67	**100.0**

3.4 Nutritional Status of Autistic Children Attending Khartoum State Centers

Table 4.showed the nutritional status among preschool age (3-5), indicated that all of females were underweight (100%), and just (14.29%) of the males were underweight. 57.14% of pre-school males had normal weight.

Nutrition status of school age (6-13), showed that about (46.15%) of females had normal weight, and only (7.69%) were overweight. While (44.44%) of males were underweight; the males normal, and obese were (35.56%), (6.67%), respectively.

Table 4. Nutritional Status of Autistic Children Attending Khartoum State Centers

BMI	Females Age 3 – 5			Males Age 3 -5	
	No.	(%)		No.	(%)
Normal	-	-		4.0	57.14
Obese	-	-		-	-
Overweight	-	-		2.0	28.57
Underweight	2.0	100.0		1.0	14.29
TOTAL	**2.0**	**100.0**		**7.0**	**100.0**
	Age 6-13			**Age 6-13**	
Normal	6.0	46.15		16	35.56
Obese	2.0	15.38		3.0	6.67
Overweight	1.0	7.69		6.0	13.33
Underweight	4.0	30.77		20	44.44
TOTAL	**13**	**100.0**		**45**	**100.0**

3.5 Macronutrients and Energy Intake

Macronutrients as Energy provider shown in table 5.The mean caloric intake was(704.8±139.2), and (1191.9±544.7) kilocalories for energy preschool and school- aged females, respectively .Compared with(1055.8 ±485.6), (1288.4±753.5) kilocalories for males at the same categories..

Energy adequacy as shown in table (5) showed insufficient energy consumption (47%) was showed by the autistic females, while energy adequacy level of (73.3%) for preschool aged males, in the same categories. For the energy adequacy of school-aged children were (62.5%), and (62%) for females and males respectively.

Table 5. Energy &M acronutrient Intake of Autistic children Vs. Adequacy

Age group be gender	CHO(g)	FAT(g)	PROTEIN	Kcal	REQUIRMENTS	ADEQUACY (%)
Females aged 3-6 (pre-school age)	140.729±46.363	11.5±8.667	18.419±8.237	704.798±139.206	1847	47.4
Females aged 7-13 (school–age)	167.267±54.728	32.807±13.734	39.047±13.771	1191.961±544.742	1907	62.5
Males aged 3-6 (pre-school age)	141.649± 45.787	29.678± 11.83	32.732± 13.159	1055.791± 485.537	1441	73.3
Males aged 7-13 (school –age)	160.741± 57.642	30.448± 16.217	43.828± 17.326	1288.392± 753.472	2079	62

3.6 Type of Consumed Cereals

Results of table (6) showed that most of children consumed wheat (94%), (100%) consumed corn, rice, and those who consumed millet were (95%).

Table 6. Type of Consumed Cereals of Autistic Children Attending Khartoum State Centers

Type of Cereals	Yes		No		Total	
	No.	(%)	No.	(%)	No.	(%)
Wheat	63	94.0	4	6.0	67	100.0
Corn	67	100.0	-	-	67	100.0
Rice	67	100.0	-	-	67	100.0
Millet	64	95.5	3	4.5	67	100.0

The consumption of wheat bread intake Table (7) Showed that (945.1%) of university educated mothers offered wheat to their children.

Table 7. Cross Tabulation of wheat Bread Consumption by Autistic Children& Mothers Education

Response	Primary school		High school		University		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Yes	1	100.0	23	92	39	95.1	63	94
No	-	-	2	8	2	4.9	4	6
Total	1	100.0	25	100.0	41	100.0	67	100.0

4. Discussion

Results showed that majority of the autistic children were male, while few of them were female,that agreed with (Duvekot et al., 2016; Parke & Guavain, 2009; Christensen et al., 2016), and Thompson (1998) who stated that these disorders are more common in boys than girls, the ratio is four to one. Most of them were of school age. Wardlaw &Hample (2007) stated that autism appears during the first three years of life. In contrast Yehuda, et al., (1999); Gibney et al., (2005); and (Zablotsky et al., 2017) stated that knowledge about this disorder is still limited and most parents and teacher do not understand its diagnosis and symptoms.

The education level of parents showed that most of them were universities level, and the rest of them attained

primary school. This means that most of parents are well educated and this can make nutrition counseling with these parents easier beside the other internal and external factors (Lung, Chiang, Lin, & Shu, 2016) and (Katz, 2008) who stated that education of parents may enhance the mutual nutrition session and counseling. Also (Hajiabolhasani-Nargani, Najafi, & Mehrabi, 2016) reported that education can be conducted through Mobile parenting skills.

The findings showed that most of the mothers were housewives, and few were employed. Majority of fathers were employed. Barasi (2003) stated that the traditional pattern of family gathered at the same time of meal has changed due to shifts in family structure and worker woman that lead to more than one-third of the income spent away from home. Also Mahan &Scott-Stump (2008) stated that because almost three fourths of women with school-age children are employed outside the home, children eat one or more meals at child-care homes, day-care centers, or schools.

Most of parents in this study have middle income, while minority of them has high income. Sharma (2009) revealed that in a study directed towards areas of low income regions of India; an alarming incidence of malnutrition which included every type of deficiency seen in developing countries (Macedoni-Luksic et al., 2015) & (Meguid et al., 2017). However, cases of sever deficiency states like kwashiorkor, rickets and goiter were few, but still occurred. The incidence of failure to gain weight at a satisfactory rate was high among pre-school children. Anemia was widely seen in this age group and dental caries was found to be practically universal,Cermak, et al. (2010) ;Garrow, et al. (1993) stated that marginal zinc deficiency has been reported in pre-school and school-age children from both middle-and low income families.

Autistic children in this study suffered from different diseases. Many of them suffered Frequent colds few of them had malaria. Anemia, Worms infection, kidney dysfunction, Teeth Decay represents a profound health problem since half of autistic children recorded frequent morbidity. Oral diseases are a global health problem in both industrialized and increasing in developing countries, especially amongst poorer communities. Similar results were reported by (Ekhlaspour et al., 2016); Rolfes, et al., 2009; (Tanoue, Takamasu, & Matsui, 2016) who found that Autistic children are more likely to have behavior problems relating to food and requiring special diets, (Al-Ayadhi, Halepoto, Al-Dress, Mitwali, & Zainah, 2015; Mihic, Rainkie, Wilby, & Pawluk, 2016; Zibaee et al., 2015).

Nutritional status among preschool age showed that all of females were under weight, while half of pre-school males have normal weight, and just few of them were underweight. Many factors are contributed with satisfied nutrition status of these categories besides food or dietary patterns (Gibney et al., 2005; Malhi, Venkatesh, Bharti, & Singhi, 2017; Mari-Bauset, Llopis-Gonzalez, Zazpe, Mari-Sanchis, & Morales Suarez-Varela, 2016; Pan, Davis, Nichols, Hwang, & Hsieh, 2016).

Body mass index for age showed that for school age children normal weight were represented by about half, and one-third of female and males, respectively. While underweight were contributed by one-third of school age females, and only few proportion of males.

As children are growing and developing bones, teeth, muscles and blood, they need more nutritious food in proportion to their weight than do adult (Mahan & Raymond, 2017) & (Meguid et al., 2017). They become at risk for malnutrition when they have poor appetite for long duration. (Ekhlaspour et al., 2016; Malhi et al., 2017).

The percentage adequacy of energy intake for pre-school age females was below the intake of males at the same age, but there was no statistically significant difference. On the other hand, both school females and males have the same percentage of energy adequacy

The energy adequacy showed that most of energy requirements were fulfilled by the younger autistic children, which agreed with (Thompson, 1998; Evans et al., 2012).

Regarding wheat consumption of autistic children results showed that (94%) of them consumed bread wheat. This indicated that most of mothers did not follow the Gluten-free diet, which not only have to adjust to the limits of foods allowed, but also have to deal with issues of independence and peer acceptance as they grow older (Lionetti et al., 2015).

Modification of diet needs available information and well known techniques of application (Joshi, 2008; Handen et al., 2015; Malhi et al., 2017).

Results showed that there was no significant difference between mother's education levels and autistic children consumption of wheat bread (Katz, 2008).

5. Conclusion and Recommendations

In this study the males contribute to higher percentage than autistic females, mothers of autistic children were at different educational levels but most of fathers and mothers are well educated and had medium income while. Most of children eat cereals and bread mainly wheat which causes allergic symptoms and the all mothers were not aware about wheat alternatives.

The nutrition status of preschool females showed that all of them were under -weight, while half of the school age females showed normal weight.

For improvement of the nutritional status and wellbeing of autistic children trained dietitians should be members of any health care team in autistic center.

As most of autistic children parents were educated a modern tool of nutrition counseling should be used such as cell phones messages.

Competing Interests Statement

The authors declare that there is no conflict of interests regarding the publication of this paper.

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