Original paper

Feeding Problems and Nutritional Assessment in Children with Autism

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Abstract

Background: Autism is a brain developmental disorder characterized by impaired social interaction and communication, and by restricted and repetitive behavior. These signs all begin before a child is three years old. Feeding disorders common in children with autism and considered as a major concern for their parents. Selective or "picky eating" is a frequent problem in children with autism.

Objectives: To identify common feeding problems in children with autism and to assess the nutritional status of children with autism.

Method: A descriptive cross – sectional study conducted to determine feeding problems and to assess nutritional status in children with autism, in period between the 1st of February to the 31th of May 2014. A convenient sample of (70) child with autism has been collected from (3) specialized institutes for mental handicapped, slow learning, difficult speech and autism, (Al Rehma Institute of Autism and Babil Specialized Institute of Autism in Babylon city and Al Imam Al Husien Institute of Autism In Karbala city). Data obtained include questionnaire and Anthropometric measures: Weight, Hieght, calculating BMI, and plotted them on growth charts (BMI for age).

Results: The study included 70 patients that 56 (80%) were males and 14 (20%) were females with male to female sex ratio of 4:1, whose Mean age ± SD (5.95 ± 1.77) years old. Of those 4 (5.7%) were under weight, 28 (40%) were normal weight and 38 (54.3%) were overweight/obese. The percentage of autistic children who had select food type, select food texture, food refusal, food allergy were (47.1%), (52.9%), (40%), (11.4%) respectively. Children who exhibit pica were (25.7%).

Conclusion: More than half of children with autism were overweight/obese. Males affected more commonly than females. No significant association between type of feeding during first six months of life, age at weaning and signs of hungry with nutritional status of autistic children. All the underweight autistic children had history of feeding problems like selective food by either type or texture, behavioral problems during feeding, food allergy and diarrhea. The overweight autistic children had history of sitting position during feeding, more than three meals per day, and more than 30 minutes duration of meal. Pica is common in autistic children.

Key words: Autism, Feeding problems, Food selectivity, nutritional assessment, and Overweight/Obesity.

Introduction

Autism comprises a clinically heterogeneous group of disorders– collectively referred to as “autism spectrum disorders” (ASD) – that share common features of impaired social relationships, impaired language and communication, and repetitive behaviors or a narrow range of interests. For most children with autism, symptoms develop gradually, although approximately 30% have a "regressive" onset usually between ages 18 and 24 months. About 50%-70% of children with autism are identified as intellectually disabled by nonverbal IQ testing and

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approximately 25% develop seizures. Autism can be considered complex (i.e., presence of dysmorphic features and/or microcephaly) or essential (i.e., absence of physical abnormalities and microcephaly). About 25% of children who fit the diagnostic criteria for ASD at age two to three years subsequently begin to talk and communicate, and by age six to seven years blend to varying degrees into the regular school population. The remaining 75% have lifelong disability requiring intensive parental, school, and social support.[1]

Autism is a brain development disorder characterized by impaired social interaction and communication, and by restricted and repetitive behavior. These signs all begin before a child is three years old.[2-6]

The symptoms of ASDs are thought to result from a complex, variable interaction between genetics and environment though there is currently no genetic or biological test to diagnose the condition.[7]

Epidemiologic surveys suggest that the rate has remained relatively constant at 5 per 10,000 children. It is likely that more children with mental retardation have been diagnosed with autistic disorder or pervasive developmental disorders. Males are affected four to five times more frequently than females. When females are affected, they usually exhibit severe mental retardation.[8]

Children with autism spectrum disorder (ASD) may have restrictive and ritualistic behaviors that affect their eating habits. Some of them limit what they eat, in some instances so severely that it results in nutritional deficiencies that lead to weight loss, malnutrition and inadequate growth. So, that children with autism are much more likely than typically-developing children to be selective with food.[9,10]

Approximately 25% of all children experience eating problems during the early years of life, but this number may rise to as high as 80% in children with developmental difficulties.[11,12]

Nutritional status in children is an indicator of health and well-being at both the individual and the population level. An important part of the primary care well child visit focuses on nutrition and growth, because most families turn to pediatricians for guidance on child nutrition. Although dietary assessment is somewhat simple in infants who have a relatively monotonous diet, it is more challenging at older ages.[13,14]

The physical, cultural, and family environments in which the child lives should be kept in mind at all times, so that nutrition counseling is relevant and changes are feasible.[15] Understanding measures of nutritional status is critical for the interpretation of nutrition-related development outcomes.[13,14]

Nutritional assessment is often viewed according to the ABCD scheme which includes: (A) Anthropometry, i.e. physical growth and body size, (B) Biochemistry, used mostly for micronutrients, (C) Clinical evaluation, and (D) Dietary intake assessment.[13,14]

Aim of this study is to identify common feeding problems in children with autism and assess the nutritional status of children with autism.

Material and Method

Study Location: This study was carried out at three Institutes, two in Babylon city (Al Rehma Institute of Autism and Babil Specialized Institute of Autism) and one in Karbala city (Al Imam Al Husien Institute of Autism). Out of autism cases diagnosed in that institutes (70) child with autism had been collected at time of study application.

These (70) autistic children were previously diagnosed by psychiatrists work in psychiatric outpatient clinics, in psychiatric hospitals, general hospitals and in pediatric psychiatric departments in pediatric hospitals and from their private clinics and referred to special institutes for autism and delayed learning and speech.

Study Design: A cross – sectional study which conducted to determine feeding problems and to assess nutritional status in children with autism more than three years old age.

The study includes data collection (questionnaire) which is collected from caregiver either from parent or from teacher in the institute and focused on socio-demographic factors, feeding skills, feeding problems, associated problems, and drug history; and Anthropometric measures: Weight, Height, calculating BMI, and plotted them on growth chart.

A. Socio-demographic factors include (age, gender, residence, father occupation, mother occupation, father education, mother education, child sequence, maternal age at child delivery, paternal age at child delivery, and family history of autism).
B. Type of feeding during 1st six months of life, age at weaning, and care giver (family members: parents or other members: grandmother, grandfather,.....).
C. Feeding skills questionnaires include (position, number and duration of meals, signs of hungry, feeding him/herself, bite size, technique used to start feeding and setting meal time).
D. Feeding problems questionnaire include (food selectivity, food refusal, texture selectivity, oral motor problems, and mixing food).
E. Associated problems questionnaires include (pica, GOR, constipation, diarrhea, and food allergy)
F. Drug history: type of drug, duration of treatment, and any drug side effect.

Anthropometric measures used in this study include weight measurement by using well calibrated weighing device in which weight was measured in (kilogram) using the balanced scale for all subject (wearing light clothing), (also, children who wear diabers removed from those children) with an accepted error of 0.1 kg ; height measurement by using well calibrated stadiometer by which height was measured (in meter) using a fixed board measures to the nearest 0.5 cm with the child standing without shoes, heals together and the head in the horizontal plane. In assessing anthropometrics in this study we used WHO age and sex appropriate growth charts (3rd – 97th percentile) and after choosing appropriate growth charts, all indices had been plotted on them. The indices used are height for age, weight for age, weight for height, and BMI for age.

BMI percentile interpretation:

UNDUR WEIGHT	PERCENTILE < 5
NORMAL WEIGHT	≥ 5 and < 85
OVER WEIGHT	≥ 85 and < 95
OBESITY	≥ 95

Study Population: A convenient sample of (70) child with autism was collected from Al Rehma Institute of Autism and Babil Specialized Institute of Autism in Babylon city and Al Imam Al Husien Institute of Autism In Karbala city. The study duration continued from the 1st of February to the 31th of May 2014.

Data Collection

A. Inclusion Criteria: The (70) autistic children were previously diagnosed by psychiatrists according to diagnostic criteria for autism in : International Classification of Diseases-Tenth Revision (ICD-10) and in: Diagnostic and Statistical Manual of Mental Disorders-Forth Edition (DSM-IV) who referred to special institutes for autism and delayed learning and speech, more than three years old age of both sex, whom their parents and institutes administrators accept to participate in the study.

B. Exclusion Criteria: Non autistic children in Institutes included by the study and autistic children whom parents refuse to participate in the study had been excluded from this study. Also children who are difficult to deal and to take measurement for them are excluded from the study.

Study Variables:

A. Dependent Variables: The dependent variables for this study are feeding

problems and nutritional assessment of children with autism.

B. Independent Variables: The independent variables of this study include socio-demographic characteristics.

Data Analysis: Statistical analysis was carried out using SPSS - version 17..

Approval and Official permission: The study protocol was reviewed, approval and official permission were obtained from (Department of Community Medicine) – College of Medicine / Babylon University to conduct the study.

Pilot Study: A Pilot study was carried out on a sample of (7) of autistic children from one institute to test the questionnaire, the purpose of pilot study were :

1. To know the response rate of participation in the study by the parents and teachers.
2. To find out if there is any difficult, or unclear questions.
3. To have an idea about time needed to get answered questionnaires.
4. To know the possibility of taking anethropometric measurements.

Results

The overall mean age of children with autism was (5.95 ± 1.77) years old. The mean age of male was (5.97 ± 1.89) years old, while the mean age of female was (5.86 ± 1.26) years old.

The overall mean BMI for participant children was (17.9 ± 3.07) kg/m^2 , 4 (5.7%) of them were under weight and 28 (40%) were normal weight and 38 (54.3%) were overweight/obese according to nutritional status (BMI for age). The overall mean age of mothers was (29.01 ± 5.41) years old, while the mean age of fathers was (32.24 ± 6.42) years old.

Table 1 shows 44 (62.9%) of children with autism were 3 – 6 years old age from them 24 (54.5%) were overweight and 20 (45.5%) were normal weight and no one was underweight while those whom are > 6 years of age were 26 (37.1%) from them 4 (15.4%) were under weight and 8 (30.8%) were normal weight and 14 (53.8%) were overweight with significant association between child age and nutritional status (p–value = 0.024). There was significant association between birth order and nutritional status (p–value < 0.001) that 24 (34.3%) were First birth order, Three of them were under weight, 16 normal weight, and 5 over weight/ obesity, while 46 (65.7%) were 2nd and more birth order.

Table 2 shows that mother age at child birth was 80% (between 25 and 45 years), 3 of their children were under weight, 22 were normal weight and 31 were overweight\obese. (57.1%) of those mothers were higher education, 3 of their children were under weight, 17 were normal weight and 20 were overweight\obese. While, (21.4%) had secondary school education, (12.9%) had primary school education and (8.6%) were illiterate.

Table 3 shows that father age at child birth was (67.1%) below 35 years, 3 (8.5%) of their children were under weight, 18 (38.3%) were normal weight and 25 (53.2%) were overweight\obese. 53 (75.7%) of those fathers had higher education, 4(7.5%) of their children were under weight, 21(39.6%) were normal weight and 28 (52.8%) were overweight\obese. While, 11(15.7%) of those fathers had secondary school education, 5 (7.1%) had primary school education and 1(1.4%) were illiterate. 58(82.9%) of those fathers were employed, 4 of their children were under weight, 21 were normal weight and 33 were overweight\obese.

Table 4 shows that child feeding during first six months of life were (24.3%) had breast feeding, 28.6% had formula feeding and 47.1% had mixed feeding, all the 4 underweight children had mixed feeding. 29 of those children weaned at 6-12 month of age, 3 of them were under weight, while 41 children weaned after one year of age, one of them was under weight. There was significant association between drug

history and nutritional status of children (p–value <0.001) that 18 (25.7%) of children had drug history, 2 of them were under weight, 13 were normal weight and 3 were overweight\obese.

Table 5 shows significant association between food selectivity and nutritional status of children (p–value = 0.001) that 33 (47.1%) had history of selective food items, distributed as : (carbohydrate 63.6%, protein 9.1% and fruit & vegetables 27.3% **as shown in Table 9**), of those 4 (12.1%) children were under weight, 18 (54.5%) were normal weight and11(33.3%) were overweight/obese, 37(52.9%) of those children had selective food texture which significantly associated with nutritional status (p–value = 0.001), distributed as : smooth food (pure baby food) 48.6%, thick food (relatively smooth) 37.8%, and chopped food (pieces) 13.5% **(as shown in Table 9)** , 4 of them were under weight, 12 children had selective food color, 45 (64.3%) had acceptance for introducing new food, 28 (40%) had history of food refusal which significantly associated with nutritional status (p–value < 0.001), 4 (14.3%) of them were under weight, 22 (78.6%) were normal weight and 2 (7.1%) were overweight/obese. Food allergy (casein\glutin allergy) was significantly associated with nutritional status (p–value <0.001) , that all the underweight children had food allergy.

Table 6 shows significant association between number of meals during day and nutritional status of children (p–value = 0.034) that 16 (22.9%) had less than 3 meals, 3 of them were under weight. While, 54 (77.1%) had more than 3 meals per day, 1 of them was under weight, 21 were normal weight and 32 were overweight\obese. Also, there was significant association between duration of meal and nutritional status of children (p–value <0.001) that 53 (75.7%) had duration of meal < 30 minutes, 4 of them were under weight.

Table 7 shows significant association between using specific technique during feeding and nutritional status of children (p–value <0.001) that 29 (41.4%) of children require such technique like, setting food table (17.2%), coaxing\bigging (27.6%), toys (airplane\train) (41.4%), and random threat (13.8%), **(as shown in Table 9)**, that 3 of those children were under weight, 23 were normal weight and 3 were overweight/obese**.** Food bite size was significantly associated with nutritional status of children (P–value <0.001) that 55 (78.6%) of children had typical age appropriate bite size, 20 of them were normal weight and 35 were overweight\obese. 30 (42.8%) of children had behavioral problems when introduce new food item which significantly associated with nutritional status of children (p–value < 0.001), which distributed as (throwing food 50%, covering face 23.3%, head turning 16.6%, aggression 3.3% and self-injury 6.6% **as shown in Table 9**), 4 of those were under weight, 18 were normal weight and 8 were overweight. While, 40 (57.2%) not had such behaviors, 10 of them were normal weight and 30 were overweight/obese.

Table 8 shows that pica was significantly associated with nutritional status (p–value < 0.001) that 18 (25.7%) of children exhibit pica behavior, 2 of them were under weight, 15 were normal weight and 1 was overweight. Diarrhea was significantly associated with nutritional status of children (p–value = 0.002), that 8 (11.4%) of children had history of chronic diarrhea, of them 1 was under weight and 7 were normal weight. While 3 (4.3%) of the children had history of chronic constipation, One was normal weight and 2 were overweight.

Table 1. Association of child nutritional status by demographic factors.

Variable	Nutritional status			Total No.(%)	X^2	df	p – value
	Under weight No. (%)	Normal weight No. (%)	Over weight/ Obese No. (%)				
Age							
3-6 year	0(0)	20(45.5)	24(54.5)	44(62.9)	6.963 [a]	2	**0.024***
>6 year	4(15.4)	8(30.8)	14(53.8)	26(37.1)			
Gender							
Male	4(7.1)	21(37.5)	31(55.4)	56(80)	1.001[a]	2	0.624
Female	0(0)	7(50)	7(50)	14(20)			
Residence							
Urban	4(6.8)	23(39)	32(54.2)	59(84.3)	0.412 [a]	2	1.000
Rural	0(0)	5(45.5)	6(54.5)	11(15.7)			
Family history of autism							
Yes	0(0)	4(36.4)	7(63.6)	11(15.7)	0.510 [a]	2	0.875
No	4(6.8)	24(40.7)	31(52.5)	59(84.3)			
Care giver							
Family member	2(3.8)	21(40.4)	29(55.8)	52(74.3)	1.522 [a]	2	0.555
Other member	2(11.1)	7(38.9)	9(50)	18(25.7)			
Birth order							
1st baby	3(12.5)	16(66.7)	5(20.8)	24(34.3)	17.114 [a]	2	**<0.001***
2nd &more	1(2.2)	12(26.1)	33(71.7)	46(65.7)			

* p – value ≤ 0.05 was significant a: fisher exact test

Table 2. Association of child nutritional status by mother demographic factors.

Variable	Nutritional status			Total No.(%)	X^2	Df	p – value
	Under weight No. (%)	Normal weight No. (%)	Overweight/ Obese No. (%)				
Age at child birth							
<25 years	1(7.1)	6(42.9)	7(50)	14(20)	0.519 [a]	2	0.901
25-45 years	3(5.4)	22(39.3)	31(55.4)	56(80)			
Education level							
Illitrate	0(0)	3(50)	3(50)	6(8.6)			
Primary	0(0)	3(33.3)	6(66.7)	9(12.9)	1.823 [a]	6	0.973
Secondary	1(6.7)	5(33.3)	9(60)	15(21.4)			
Higher edcation	3(7.5)	17(42.5)	20(50)	40(57.1)			
Occupation							
Employee	3(8.3)	14(38.9)	19(52.8)	36(51.4)	0.904 [a]	2	0.738
Not employee	1(2.9)	14(41.2)	19(55.9)	34(48.6)			

* p – value ≤ 0.05 was significant a : fisher exact test

Table 3. Association of child nutritional status by father demographic factors.

Variable	Nutritional status			Total No.(%)	X^2	Df	p – value
	Under weight No. (%)	Normal weight No. (%)	Overweight/Obese No. (%)				
Age at child birth							
<35 years	4(8.5)	18(38.3)	25(53.2)	47(67.1)	1.694 [a]	2	0.500
≥35 years	0(0)	10(43.5)	13(56.5)	23(32.9)			
Education level							
Illitrate	0(0)	0(0)	1(100)	1(1.4)			
Primary	0(0)	3(60)	2(40)	5(7.1)	3.519 [a]	6	0.902
Secondary	0(0)	4(36.4)	7(63.6)	11(15.7)			
Higher edcation	4(7.5)	21(39.6)	28(52.8)	53(75.7)			
Occupation							
Employee	4(6.9)	21(36.2)	33(56.9)	58(82.9)	1.890 [a]	2	0.361
Not employee	0(0)	7(58.3)	5(41.7)	12(17.1)			

* p – value ≤ 0.05 was significant a : fisher exact test

Discussion

The total number of autistic children were (underweight 4 (5.7%), normal weight 28 (40%), and overweight/obese 38 (54.3%). The high prevalence of overweight/obese may be attributed to that children with autism were more often over weight compared to those with ADHD and to an age – matched reference population.[16] Other reveal that overeating is one of most common adverse effect of medication used for stress related behaviors in autism.[17]

Table 4. Association of child nutritional status by type of feeding during 1st 6 month of life, age at weaning, signs of hunger, & drug history.

Variable	Nutritional status			Total No.(%)	X^2	df	p – value
	Under weight No. (%)	Normal weight No. (%)	Overweight/ Obese No. (%)				
Type of feeding during First six months of life							
Fully Breast feeding	0(0)	6(35.3)	11(64.7)	17(24.3)			
Formula feeding	0(0)	11(55)	9(45)	20(28.6)	5.212 [a]	4	0.234
Mixed feeding	4(12.1)	11(33.3)	18(54.5)	33(47.1)			
Age at weaning							
6-12 month	3(10.3)	10(34.5)	16(55.2)	29(41.4)	2.142 [a]	2	0.355
>12 month	1(2.4)	18(43.9)	22(53.7)	41(58.6)			
Signs of hungry							
Present	2(4.3)	18(39.1)	26(56.5)	46(65.7)	0.799 [a]	2	0.713
Absent	2(8.3)	10(41.7)	12(50)	24(34.3)			
Drug history							
Yes	2(11.1)	13(72.2)	3(16.7)	18(25.7)	14.352 [a]	2	**<0.001***
No	2(3.8)	15(28.8)	35(67.3)	52(74.3)			

* p – value ≤ 0.05 was significant a : fisher exact test

Table 5. Association of child nutritional status by food related factors.

Variable	Nutritional status			Total No.(%)	X^2	df	p – value
	Under weight No. (%)	Normal weight No. (%)	Over weight/ Obesity No. (%)				
Select food type							
Yes	4(12.1)	18(54.5)	11(33.3)	33(47.1)	12.507[a]	2	**0.001***
No	0(0)	10(27)	27(73)	37(52.9)			
Select food texture							
Yes	4(10.8)	20(54.1)	13(35.1)	37(52.9)	12.380 [a]	2	**0.001***
No	0(0)	8(24.2)	25(75.8)	33(47.1)			
Prefer food color							
Yes	1(8.3)	7(58.3)	4(33.3)	12(17.1)	2.951 [a]	2	0.255
No	3(5.2)	21(36.2)	34(58.6)	58(82.9)			
Introduce mixing food							
Yes	4(8.9)	17(37.8)	24(53.3)	45(64.3)	2.033 [a]	2	0.428
No	0(0)	11(44)	14(56)	25(35.7)			
Food refusal							
Yes	4(14.3)	22(78.6)	2(7.1)	28(40)	45.836 [a]	2	< **0.001***
No	0(0)	6(14.3)	36(85.7)	42(60)			
Food allergy							
Yes	4(50)	3(37.5)	1(12.5)	8(11.4)	19.270 [a]	2	**<0.001***
No	0(0)	25(40.3)	37(59.7)	62(88.6)			

* p – value ≤ 0.05 was significant a : fisher exact test

Table 6. Association of child nutritional status by meal related factors.

Variable	Nutritional status			Total No.(%)	X^2	df	p – value
	Under weight No. (%)	Normal weight No. (%)	Over weight/ Obesity No. (%)				
Number of meals							
<3 meals	3(18.8)	7(43.8)	6(37.5)	16(22.9)	6.178 [a]	2	**0.034***
≥3 meals	1(1.9)	21(38.9)	32(59.3)	54(77.1)			
Setting meal time							
Yes	2(3.4)	22(37.9)	34(58.6)	58(82.9)	4.430 [a]	2	0.078
No	2(16.7)	6(50)	4(33.3)	12(17.1)			
Duration of meal							
<30 minutes	4(7.5)	27(50.9)	22(41.5)	53(75.7)	14.495 [a]	2	**<0.001***
≥30 minutes	0(0)	1(5.9)	16(94.1)	17(24.3)			

* p – value < 0.05 was significant a : fisher exact test

The present study shows (62.9%) of the children with autism were 3 – 6 years old, from them (54.5%) were overweight/obese and this high percent of overweight/obese might be related to play skills in autistic children which are typically aberrant, characterized by little symbolic play, ritualistic rigidity, and preoccupation with parts of objects, so they are often withdrawn and spends hours in solitary play, often with restrictive behaviors and movement making them more liable for overweight/obesity.[18] There is significant association between child age and nutritional status as all the underweight children were > 6 years old.

Table 7. Association of child nutritional status by feeding skills factors.

Variable	Nutritional status			Total No.(%)	X^2	df	p – value
	Under weight No. (%)	Normal weight No. (%)	Over weight/ Obesity No. (%)				
Use specific technique during feeding							
Yes	3(10.3)	23(79.3)	3(10.3)	29(41.4)	41.500 [a]	2	**<0.001***
No	1(2.4)	5(12.2)	35(85.4)	41(58.6)			
Position during feeding							
Sitting	1(2.8)	15(41.7)	20(55.6)	36(51.4)	1.144 [a]	2	0.686
Moving	3(8.8)	13(38.2)	18(52.9)	34(48.6)			
Eat him/her self							
Yes	1(2.6)	11(28.9)	26(68.4)	38(54.3)	6.854	2	**0.023***
No	3(9.4)	17(53.1)	12(37.5)	32(45.7)			
Food bite – size							
Typical	0(0)	20(36.4)	35(63.6)	55(78.6)	16.225 [a]	2	**< 0.001***
Atypical	4(26.7)	8(53.3)	3(20)	15(21.4)			
Behavioral problems when introduce new food items							
Yes	4(13.3)	18(60)	8(26.6)	30(42.8)	17.760[a]	2	**< 0.001***
No	0(0)	10(25)	30(75)	40(57.2)			

* p – value < 0.05 was significant a : fisher exact test

Table 8. Association of child nutritional status by medical conditions.

Variable	Nutritional status			Total No.(%)	X^2	Df	p – value
	Under weight No. (%)	Normal weight No. (%)	Overweight/ Obese No. (%)				
Pica							
Yes	2(11.1)	15(83.3)	1(5.6)	18(25.7)	25.158 [a]	2	**<0.001***
No	2(3.8)	13(25)	37(71.2)	52(74.3)			
Gastro- Esophageal Reflux Disease	1(8.3)	8(66.7)	3(25)	12(17.1)			
Yes	3(5.2)	20(34.5)	35(60.3)	58(82.9)	5.359 [a]	2	0.051
No							
Diarrhea							
Yes	1(12.5)	7(87.5)	0(0)	8(11.4)	11.993 [a]	2	**0.002***
No	3(4.8)	21(33.9)	38(61.3)	62(88.6)			
Constipation							
Yes	0(0)	1(33.3)	2(66.7)	3(4.3)	0.650 [a]	2	1.000
No	4(6)	27(40.3)	36(53.7)	67(95.7)			

* p – value < 0.05 was significant a : fisher exact test

Table 9. Distribution of feeding problems in children with autism.

Variable	Number	%
Use specific technique during feeding	**29**	**41.4**
Setting food table	5	17.2
Coaxing/Bigging	8	27.6
Toys (airplane, train)	12	41.4
Random threats	4	13.8
Select food items	**33**	**47.1**
Fruit & vegetables	9	27.3
Carbohyrate	21	63.6
Protein	3	9.1
Select food texture	**37**	**52.9**
Smooth food (pure baby food)	18	48.6
Thick food (relatively smooth)	14	37.8
Chooped food (pieces)	5	13.5
Behavioral problems when introduce new food items	**30**	**42.8**
	7	23.3
Covering face	15	50
Throwing food	5	16.6
Head turning	1	3.3
Aggression	2	6.6
Self injury		

We found that 59 (84.3%) were from urban area, this might be due to remote site of institutes from rural area or lack of awareness of autism signs by parents and even doctors. [19]

Also we found that care giver of participant children were family member (parents) (74.3%) and (25.7%) were other member (teacher, grandmother, grand-father, ...) and this may explain that majority of children were normal and over

weight because of better care by their parents.

(%51.4) of autistic children had employed mothers, and (48.6%) of them, their mothers not employed, while employed fathers were (82.9%) comparing to (17.1%) their fathers not employed with no statistical significance in nutritional status regarding parents occupation. The high percent of employed parents among participants explained by good economic status of the family allowing their children attending specialized centers of autism.

We found that the type of feeding during the First Six months of life, (24.3%) were fully Breast feeding, (28.6%) were Formula feeding, and (47.1%) were Mixed feeding with no statistical significance regarding nutritional status and type of feeding during 1st 6 months of life (X2 = 5.212, df = 4, p–value = 0.234). All underweight children were on Mixed feeding during First Six months of their life and (64.7%) of children on fully Breast feeding were overweight/obese compared to no underweight children. Celeste Land (2001) reported that human milk contains high concentrations of substances that are essential for healthy brain growth, such as the amino acid taurine and the fatty acids docosahexaenoic acid (DHA) and arachidonic acid (AA), breastfeeding may also be beneficial to the emotional development of the autistic child, since it provides a special opportunity for autistic children to experience close physical and emotional contact.[20] The breast feeding relationship also offers the mother of an autistic child a chance to bond more fully with a child who may not provide optimal emotional feedback, and mothers of breastfed autistic children have reported that their children appeared to be more responsive, better adjusted socially, more likely to engage in imaginative play, and more affectionate than their formula-fed autistic peers. [20] One study done by Stephen T Schultz et al. (2006), found that, overall, babies who were not breastfed had a 4 times higher risk of autism than babies who were on breast feeding.[21]

There was no association regarding age at weaning and nutritional status (p–value = 0.355) as 29 (41.4%) had history of weaning at age of 6-12 months, Three of them were under weight and (55.2%) were overweight/obese, while 41 (58.6%) weaned after one year old, from them 22 (53.7%) were overweight/obese children and (2.4%) were under weight. Tanoue etal. (1989) reported that more of the autistic children were weaned early because of the mother's rather than the child's condition, and these results suggest that early weaning may contribute to the cause of infantile autism.[22]

We found that 65.7% of autistic children had history of signs of hungry (crying, asking for food,....) compared to (34.3%) of autistic children had no signs of hungry, two of them (8.3%) were under weight and 12 (50%) were overweight/obese with no significant relationship between signs of hungry and nutritional status, which can be explained by that children with ASDs may have difficulty recognizing when they are full, when they are hungry, and how long they have been sitting at the table. The child might think he/she is "all done" after one bite or two of food.[23,24]

There is a significant association between taking medication and nutritional status in children with autism in our study (p–value < 0.001), as 18 (25.7%) have drug history (like, Atypical antipsychotic agents: risperidone; Stimulants: methylphenidate; Anticonvulsant mood stabilizers: carbamazepine), two of them (11.1%) were under weight, 13 (72.2%) were normal weight and only three (16.7%) of them were overweight/obese, compared to (74.3%) reported no history of taking medication, (67.3%) of children with no history of taking medication were overweight/obese. These results can be explained by medication side effects, such as increased appetite with antipsychotic medications (like, risperidone,

aripiprazole, and olanzapine) and reduced appetite with stimulant medications (like, methylphenidate, and dextroampheta-mine). [18,25]

Highly selective eating places children at risk for specific nutritional deficiencies. Almost two thirds of children with autism eat fewer than 20 foods and accept fewer foods from the basic food groups than typically developing children. Similar to typically developing children, children with autism consume starches and carbohydrates more than any other type of food. They are most often selective against fruits and vegetables (58–71%), meat or beans (24–35%), and milk and dairy (18%). Results from studies examining nutritional intake and deficiencies among children with autism have been mixed. Deficiencies in daily intake have been reported most often for calcium, iron, fiber, and Vitamins C and D. [26,27]

There was a significant association between food selectivity and nutritional status of children with autism (p–value = 0.001), as we found that 33 (47.1%) had food selectivity four of them (12.1%) were under weight, 18 (54.5%) were normal weight, and 11 (33.3%) were overweight/obese, comparing to 37 (52.9%) had no food type selectivity, from them (73%) were overweight/obese, (27%) were normal weight, and no one was under weight. Ledford (2006) reported that 60%–89% of autistic children are selective eaters.[27] Field (2003) found that children with ASD were significantly more likely to have problems with food selectivity by food type, than either children with Cerebral Palsy or Down's syndrome, and he also found that food selectivity by type was much more prevalent in the group of children with ASD (62%).[28] Williams (2005) also noted that older children were just as selective as the younger children, this may be because that parents offer food until it is eaten or stick to what they know the child likes.[29] Schreck (2004) found that 72% of Children with ASD were reported to eat a narrow variety of foods. The group also ate significantly fewer foods within each food group. [30] Lukens (2008) found that children with ASD consumed fewer servings of vegetables and had smaller percentages of their recommended nutrient intakes. [31] Schreck (2006) found that Children with autism generally achieve similar heights and weights as children without autism, suggesting that they usually consume sufficient calories for age appropriate growth. [26]

Distribution of food item selectivity in our study was Carbohydrate (63.6%), Fruit and Vegetables (27.3%), and Protein (9.1%) (as shown in Table 9), while Ahearn et al. (2001) reported that food item selectivity was Carbohydrate (64.7%), Fruit and Vegetables (11.7%), and Proteins (17.6%) (32) and Williams (2005) found that starchy food was consumed twice as much as the other food groups.[29]

There was significant association between nutritional status of children and food texture (p–value = 0.001) that about (53%) of children had history of selective food texture, from them (10.8%) were under weight, (54.1%) were normal weight, and (35.1%) were overweight/ obese. It has been observed in the present study that children often have preferences for a particular texture mainly smooth or soft food (48.6%), which agree with Schreck (2004) who found that children with ASD were more likely to only accept foods of a low texture (smooth or soft), [30] while Schreck (2006) found that restriction was not related to food texture.(26) Williams (2005) found that 69% of parents felt that texture influenced food selection.[29] Field (2003) revealed that selectivity by texture was defined as refusal to eat food textures that were appropriate for the child's developmental stage.[28]

About 17% of children in the present study had selective food color like red color (tomato, strawbery,...) or orange

color like (orange, carrot,...) and about 83% of autistic children reported no history of preferring food color which can explained that the majority of participant children have no history of restricted intake due to color, that 58.6% of them were overweight/obese compared with 33.3% with such history and 58.3% of children who prefer food color were normal weight that can be explained by they usually consume sufficient calories for age appropriate growth, with no significant association regarding food color with nutritional status.

Introducing mixed food (mixing the non-preferred food with previously preferred food) which was reported by their caregivers, that about (64.3%) had history of introducing mixed food, (53.3%) of them were overweight\obese with no significant association between mixing food and nutritional status. Ledford 2006 reveal that very small amount of a non-preferred food may be paired or mixed with a preferred food; gradually the proportion of non-preferred food increases [(27)]. Schrek 2006, Contrast this to what often happens when a child refuses a food at home parents remove the refused food and replace it with something the child is more likely to eat, presenting preferred foods in response to refusal can encourage more refusal.[(26)] Ahearn 2003 reveal that various food-presenting methods to facilitate acceptance of new food or previously rejected food could be used in any age group, or to simultaneously present small amounts of non-preferred food to be eaten just before preferred food. Appreciated condiments such as Ketchup, or sweeteners such as honey, could be used initially to make the new food palatable. [(33)]

In the present study there was significant association between food refusal and nutritional status of participant children (p–value <0.001) that (40%) of children had history of food refusal, (14.3%) were under weight, (78.6%) were normal weight and (7.1%) were overweight\obese and 60% not reported such history ; from them 85.7% were overweight/obese that due to good appetite and eating variety of food items may be of high calories. Field, Garland, and Williams (2003) define food refusal as the rejection of all or most foods presented to the participant, which led to that the child not consuming enough food to meet caloric or nutritional needs [(28)]. Ahearn, Castine, Nault, and Green (2001) reported that (23.5%) of their participant had refused to eat any of the food presented to them during their assessments. rumination, the repetitive regurgitation of recently ingested food into the mouth with subsequent spitting or remastication and swallowing, is a problem in mental retardation and has been described in adolescents and adults with autism [(32)]. In rumination, gastric acids erode the teeth, and eating can be painful, which in turn can lead to food refusal.[(34)]

We found significant association between food allergy and nutritional status of children (p–value <0.001) that (11.4%) had food allergy (casien\gluten allergy), (50%) of them were under weight. Some people with autism have been reported to show an improvement in core and peripheral symptoms following the adoption of specific exclusion diets and/or the variable use of nutritional supplements such as vitamins, minerals and fatty acids. A diet devoid of gluten (the major protein in wheat, barley and rye) and/or casein (derived from mammalian diary product) has been one of the more popular interventions suggested to show some effect. [(35)] At the current time, no universal theory has been accepted to account for the effect (or non-effect) of gluten free casien free diet (GFCF) dietary intervention on behavior and development of ASCs, Given the heterogeneity observed in the presentation of overt symptoms in ASCs, it is likely that more than one model of dietary effect may pertain in different cases. [(36)]

Regarding number of meals during day, the present study show that there is significant association of them with nutritional status (p value 0.034), (77.1%) of all the participant eat ≥ 3 meals, and (59.3%) of them were overweight/obese, (38.9%) were normal weight and (1.9%) were under weight, this finding with 60% had no history of food refusal and limited activity can explain why 59.3% of participant were overweight/obese. Children and adolescent, mostly males, were more often over weight compared to those with attention deficit hyperactivity disorder (ADHD) and to an age – matched reference population. [16] Overeating is one of most common adverse effect of medication used for stress related behaviors in autism. [17]

About 58 (82.9%) of participant children had setting meal times, while 12 (17.1%) not reported such history. This result was adverse the feeding concern associated with autistic children "continually eating" rather than having mealtimes. [37]

There were significant association between duration of meal and nutritional status of children in our study (p–value < 0.001) that (75.7%) had duration of meal <30 minutes, 4 (7.5%) of them were under weight, 27(50.9%) were normal weight and 22 (41.5%) were overweight\obese, this can be explained that the participant children were taken from specified centers which had fixed durations for meals due to limited number of workers.

There were significant association between using specific technique during feeding and nutritional status of children (p–value > 0.001), 29 (41.4%) had specific technique,(distributed as:17.2% need setting food table, 27.6% need coaxing/bigging, 41.4% using toys(airplane/train), and 13.8% random threats, as shown in table 9), while 41(58.6%) not had specific technique during feeding, from them (85.4%) were overweight/obese. Schreck (2004) found that children with ASD were more likely to be specific about utensils and food presentation. [30] Williams (2005) found that children with ASD were much more fussy and demanding of specific food presentation and they insisted on using the same utensils and dishes significantly more than the other groups [29]. Bruns & Thompson (2011) reported that children with autism using the same set of mealtime utensils at every meal [38].

Regarding position during feeding 36 (51.4%) exhibit sitting position, while 34 (48.6%) of children exhibit moving position during feeding, this may be explained by the over activity of autistic children with no significant association regarding position during feeding and nutritional status.

There were significant association between nutritional status of participant children in our study and the ability of those children to eat themselves (p–value = 0.023), 38 (54.3%) of them can eat him/herself, (2.6%) of them were under weight and 26 (68.4%) were overweight/obese, while 32 (45.7%) cannot eat themselves, (9.4%) of them were underweight compared to (53.1%) were normal weight and (37.5%) were overweight/obese.

Also, there was significant association between food bite size and nutritional status of children (p–value < 0.001) that 55 (78.6%) were typical age appropriate bite size, of them 20 (36.4%) were normal weight and 35 (63.6%) were overweight/obese, mostly because all the participant in this study were from specialized centers by trained caregivers.

Behavioral problems when introducing new food item was significantly associated with nutritional status of children (p–value < 0.001) that 30 (42.8%) of children had such behavioral problems distributed as the following: (50%) throwing food, (23.3%) covering face, (16.6%) head turning, (6.6%) self-injury and (3.3%) aggression (as shown in Table 9), 4(13.3%) of them were under weight, while 40 (57.2%) of children not had such behavioral problems during feeding, of

them 27 (75%) were overweight/obese, which explain the highest percentage of our participant were overweight/obese.

Piazza et al. (2003) applied functional analysis to self-injurious behaviors as inappropriate mealtime behaviors, and reported that children with autism who had such behavioral problem during feeding exhibit feeding disorders that resulted in failure to thrive, insufficient nutrition, or severe behavioral problems at mealtimes that interfered with food consumption [(39)]. Piazza etal. (2003) reveal that aversive behaviors include batting, gagging, head turning, negative vocalizations, aggression, throwing food, covering face, hand mouthing, and self-injury, and the result indicate that all parents provided attention in the form of soothing comments or coaxing when their children exhibited inappropriate behavior during mealtimes and remove bites of food following inappropriate behavior [(39)].

Regarding gasroesophageal reflux disease (GORD), 12(17.1%) of children complained from reflux in our study, one of them was under weight, eight were normal weight and three were overweight/obese. In a survey of parents of children with ASD by Williams (2000) 28% of parents reported that their children had GORD [(40)]. Williams (2005) found that (14%) of children in the ASD group had reflux and mentioned that those children developed a conditioned aversion to eating many foods because they were associated with pain and discomfort from the GORD [(29)]. Field (2003) report that GORD was the most prevalent condition (50% of his study had GORD), and was the factor most often associated with food refusal. So, children with ASD who had food refusal, may had GORD [(28)].

There were significant association between diarrhea and nutritional status of participant children (p–value = 0.002) that 8 (11.4%) had history of chronic diarrhea, 1(12.5%) was under weight and 7 (87.5%) were normal weight. Schreck (2006) reveal that approximately (24%) of children with autism experience loose stools [(26)]. Levy (2007) hypothesized that an increased frequency of loose stools was related to abnormal intake of carbohydrate [(41)].

In our study we found that three (4.3%) of participant children had history of chronic constipation, of them one was normal weight and tow were overweight/obese. Schreck (2006) reported that approximately (24%) of children with autism experience constipation, and (33%) strain to move their bowels(26). Field (2003) found constipation to be common in children with ASD and suggested that this was as a result of their poor diet [(28)]. Field also comments that in his experience resolving constipation in children with ASD can lead to improve feeding [(28)]. Williams (2005) found that the most common medical issue to have an impact on eating development was constipation [(29)].

Conclusion

More than half of children with autism were overweight/obese. Males affected more commonly than females. Most of the overweight/obese children were cared by family members. No significant association between type of feeding during first six months of life, age at weaning and signs of hungry with nutritional status of autistic children. All the underweight autistic children had history of feeding problems like selective food by either type or texture, behavioral problems during feeding, food allergy and diarrhea. The overweight autistic children had history of sitting position during feeding, more than three meals per day, and more than 30 minutes duration of meal. Pica is common in autistic children.

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