DIETARY HABITS AND NUTRITION STATUS OF SCHOOL-GOING CHILDREN 5-12 YEARS WITH AUTISM IN CITY PRIMARY, NAIROBI COUNTY, KENYA

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ABSTRACT

Background: **Autistic children experience challenges and disorders with unpredictable eating behaviors, such as preferring one food to another. Prevalence of autism among children in Kenya is high (4%) with little research being done on their eating habits and nutritional status.**

Objective: **To investigate eating habits and nutritional status of children 5-12 years old with autism.**

Design: **A cross-sectional survey design.**

Setting: **City Primary School, Nairobi, Kenya.**

Subjects: **Forty-four school children aged 5-12 years with autism.**

Results: **Dietary habits results show that 95.5% of children consumed grains, grain products, and other starches, 72.7% dark green leafy vegetables (i.e. kales), 93.2% other vegetables (i.e. tomatoes), and 52.3% vitamin A-rich foods. 47.7% of children took animal-source foods, 27.3% eggs, 34.1% milk, and milk products, and 55% pulses and legumes. While 4.5% consumed nuts and seeds, 97.7% consumed oils and fats. The results indicate inadequate consumption of eggs, meat, milk, nuts, and seeds, which can be a risk factor for nutrient deficiencies among children. At least 40.9% of children had normal BMI-for-Age, 29.5% had MAM, and 22.7% were overweight, only 6.8% had SAM. There was a relationship between dietary habits and nutrition status $x^2(3, n=44)>=8.255$ with a p-value of 0.041.**

Conclusion: **Autistic children are at risk of double burden of malnutrition due to bad eating behaviors. The study concludes that it is important to watch dietary behaviors of autistic children, which may influence their nutritional status. There is need for development of Kenyan dietary intake reference guidelines for autistic people targeting different age groups.**

INTRODUCTION

Autism is a neuro-developmental disorder classified under the bigger umbrella of autism spectrum disorders (ASD) [1]. There is no definite cause of autism that has been documented, however, genetic and non-genetic risk factors have been implicated in the development of ASD [2]. It is characterized by impaired capacity for reciprocal socio-communicative interaction, and a restricted, stereotyped repetitive repertoire of interests and activities [3]. Globally, it is estimated that about 1 out of 100 children are diagnosed with ASD [4]. In Sub-Saharan Africa (SSA), there is no official data on the prevalence of ASD, due to a lack of a gold standard in ASD diagnosis [5,6]. However, this does not imply that the prevalence of ASD in SSA is lower than in any other region of the world. Similarly, Kenya does not have official data on the prevalence of autism. However, the Autism Society of Kenya (ASK), estimates the prevalence of autism to be 4% [30]. This means one autistic child for every 25 children [7]. Thus, the reported Kenyan prevalence tends to be higher than the global average, of 1 autistic child in 100 children, according to 2022 statistics by WHO [1].

Most field studies of ASD have focused on the evaluation of its etiological agents; minimal attention has been given to the evaluation of autistic children's dietary habits and nutritional status [8]. Autistic children have problematic feeding behaviors compared to typically developing children, many parents of autistic children complain of not being in control of their dietary habits due to the erratic health status of their children [9]. This complaint is supported by various studies that proved that autistic children are at higher risk of malnutrition than normal children [10,11].

Autistic children are more likely to refuse foods based on their, texture or consistency, smell/taste, mixtures, and brands [12]. Therefore, such children end up with limited food repertoire with an inadequate intake of various nutrients [13]. Although studies on the nutrient intake of children with autism have shown conflicting results [14], some have reported inadequate, while some excess intake of some minerals and vitamins [13, 14 & 16]. They may also select fewer food categories, which may jeopardize their dietary variety and diversity, compared with normal children [17]. Moreover, gastrointestinal ailments may compromise their digestive and absorption functions [18]. The interaction between different genetic backgrounds and nutrients may also result in different metabolic models and utility levels of nutrients, regardless of the quantity and quality of food intake [19]. For example, inadequate dietary iron intake was considered among the main causes of iron deficiency which is prevalent in autistic children [14]. This was highly associated with food selectivity, a behavior common among autistic children.

Despite studies being done on autistic children, very few studies have conclusively reported an association between the dietary intake of children with autism and their nutritional status. Some studies have reported dietary intake patterns alone and the psychological complications associated with autism. More specifically in Kenya, very little is known about the dietary habits and nutritional status of autistic children, yet the prevalence of children with autism is increasing. This study aimed to determine the dietary habits and nutrition status of children with autism attending City Primary School, Nairobi County, Kenya.

MATERIALS AND METHODS

A cross-sectional survey study was done in City Primary School, Nairobi, Kenya from March 2022 to April 2022. Non-probabilistic design was used to select Nairobi County, while City Primary School was purposively selected. Calculated sample size from Fisher's formula was 59, finite population correction formula was used to get a sample size of 44 autistic children. The census sampling method was adopted to include and study all 44 children with autism.

Autistic children aged 5-12 years whose parents consented to participate in the study were included. Autistic children aged below five years and those aged 5-12 years whose parents did not consent to participate in the study were excluded.

Semi-structured questionnaire was used to collect socio-demographic characteristics of caregivers, autistic children, and dietary practices. Food Frequency Questionnaire consisting of locally available foods was used to assess dietary diversity and food frequency of specific foods. 24-hour recall was used to collect information on what the children were fed in the last 24 hours preceding the interview.

Anthropometric measurements were taken using electronic weighing scale for weight and a Stadiometer for height. The researcher and research assistants followed WHO procedures in taking anthropometric measurements. The caregivers confirmed the diagnosis of autism, as they also recalled the age at which the diagnosis was made. An observation checklist was used to record clinical signs and symptoms of micronutrient deficiencies. Statistical Package for Social Sciences (SPSS) version 26.0 was used to analyze descriptive and inferential statistics of data collected.

Informed Consent was sought from caregivers by the researcher and research assistants. The principle of autonomy, risks, and benefits, voluntary participation, privacy and confidentiality, and data security was observed during data collection.

Ethical approval was obtained from Masinde Muliro University Ethics and Review Committee (REF: MMUST/IERC/003/2022) and NACOSTI (Permit No: NACOSTI /P/224895).

RESULTS

Demographic characteristics of parents/caregivers of autistic children aged 5-12 years attending City Primary School, Nairobi

Majority of caregivers had college/university level of education (56.8%; n=25), 25.0% (n=11) had secondary education and only 18.2% (n=8) had primary education. About 61.4% (n=27) of the respondents were employed, with 38.6% (n=17) being unemployed. The majority of the respondents 63.6% (n=28) had 2-3 children, 22.7% (n=10) had more than three children, and only 13.6% (n=6) had one child in the household.

Table 1
Parents/caregivers Socio-demographic Characteristics

Demographic Characteristic	Category	Frequency (n)	Percentage (%)
Parent/Caregiver level of education	Primary	8	18.2
	Secondary	11	25.0
	College/University	25	56.8
Parent/Caregiver occupation	Employed	27	61.4
	Unemployed	17	38.6
No. of children in the house	1	6	13.6
	2-3	28	63.6
	More than 3	10	22.7

Demographic Characteristics of autistic children aged 5-12 years attending City Primary School, Nairobi

Table 2 indicates that most children were males (75%; n=75.0), with majority of them being aged 10-12 years 52.3% (n=23) while 47.7% (n=21) representing those aged 5-9 years.

From the results, it is evident all the children were diagnosed with autism (100%; n=44), with majority being diagnosed between 0-4 years of age (70.5%; n=31), 25% (n=11) were diagnosed between 5-12 years of age and 4.5% (n=2) were not sure of the diagnosis age.

Table 2
Socio-Demographic Characteristics of autistic children aged 5-12 years attending City Primary School, Nairobi

Demographic Characteristic	Category	Frequency (n)	Percentage (%)
Sex of the child	Male	33	75.0
	Female	11	25.0
age group of the child (years)	5-9	21	47.7
	10-12	23	52.3
Child autism diagnosis	Yes	44	100.0
The age at which the diagnosis was done (years)	0-4	31	70.5
	5-12	11	25.0
	Not sure of the age	2	4.5

Dietary Diversity of autistic children aged 5-12 Years attending City Primary School, Nairobi

Table 3 shows that 95.5% (n=42) of children consumed grains, grain products, and other starches, 72.7% (n=32) ate dark green leafy vegetables (i.e. kales), 93.2% (n=41) other vegetables (i.e. tomatoes) and 52.3% (n=23), ate Vitamin A rich foods. Almost half of the study population 47.7% (n=21) took flesh foods with only 27.3% (n=12) eating eggs. About, 54.5% (n=24) of the children took pulses and legumes, while 34.1% (n=15) took milk and milk products, 97.7% (n=43) took oils and fats with only 4.5% (n=2) taking nuts and seeds. The study also looked at the daily minimum meal consumption of autistic children. The findings indicate that majority of children took 5 or more meals per day representing 54.5% with only 2.3 % taking 2 meals a day.

Table 3

Food groups consumed by autistic children aged 5-12 years attending City Primary School, Nairobi

Food Group	n	%
Grains, grain products, and other starches	42	95.5
Dark green leafy vegetables (e.g kale, spinach)	32	72.7
Other vegetables (e.g okra, tomatoes)	41	93.2
Vitamin A-rich fruits	23	52.3
Other fruits	11	25.0
Meat and meat products	21	47.7
Eggs	12	27.3
Pulses and legumes	24	54.5
Milk and milk products	15	34.1
Nuts and seeds	2	4.5
Oils and fats	43	97.7

Nutrition status by BMI for Age of children aged 5-12 years with autism attending City Primary School, Nairobi

Nutrition status of autistic children was assessed based on BMI-for-age. The mean age, weight, height, and mid-upper arm circumference of children were 10 years, 35.3kgs, 140.8cm, and 20.1cm respectively.

WHO reference chart for nutrition diagnosis was used to categorize BMI for age of autistic children. Table 4 shows that 40.9% (n=18) of the children had normal BMI for Age, 29.5% (n=13) had moderate acute malnutrition, 22.7% (n=10) were overweight and only 6.8% (n=3) had severe acute malnutrition.

Table 4

BMI for Age of Autistic children aged 5-12 years attending City Primary School, Nairobi

BMI for age	n	%
+1 Overweight	10	22.7
-1 Normal	18	40.9
-2 Moderate	13	29.5
-3 Severe	3	6.8

Clinical Signs of malnutrition among Autistic children aged 5-12 years attending City Primary School, Nairobi

Table 5 represents various signs and symptoms that were looked at which include, eyes presenting with ulceration, bitot's spot or pale, thus 22.7% (n=10) had these symptoms. Only 4.5% (n=2) had dry, flaky cracked skin and thin, sparse, and discolored hair, 9.1% (n=4) had pale, spoon-shaped nails, with only one (2.3%) child presenting with bow-shaped/ knocked knees. Of the total children assessed, 20.5% (n=9) had discolored teeth while 25.0% (n=11) had cracked lips. Generally, majority of children did not show any clinical signs of nutrient deficiencies.

Table 5

Clinical Signs of malnutrition among Autistic children aged 5-12 years attending City Primary School, Nairobi

Clinical Signs and Symptoms	Characteristics	Frequency (n)	Percentage (%)
Eye (Parlor, bitot's spot, ulceration)	Yes	10	22.7
	No	34	77.3
Skin (Dry flaky, parlor, cracked)	Yes	2	4.5
	No	42	95.5
Hair (Thin, sparse, discolored)	Yes	2	4.5
	No	42	95.5
Nails (Spoon shaped, parlor)	Yes	4	9.1
	No	40	90.9
Legs (Bow shaped, knocked knees)	Yes	1	2.3
	No	43	97.7
Teeth (Discolored)	Yes	9	20.5
	No	35	79.5
Lips (Cracked)	Yes	11	25.0
	No	33	75.0

Relationship between nutrition status and dietary habits among Autistic children aged 5-12 years attending City Primary School, Nairobi

The study used different parameters to address dietary habits of children with autism. A chi-square test was done to determine the relationship between these factors and nutritional status of autistic children. The researcher only found a relationship between children's picky behavior and nutrition status x^2(3, n=44)>=8.255 with a p-value of 0.041 which indicates that there is an association between nutrition status and dietary habits of autistic children. However, on performing regression analysis to assess the strength and direction of association between the variables, the study found a moderate positive association between nutrition status and dietary habits of autistic children (r=0.345, p-value 0.022 which is less than 0.05). Thus, the researcher rejected the null hypothesis that nutrition status of autistic children is not dependent on dietary habits.

Table 6

Dietary habits and nutrition status

Independent variable	Chi-square value	df	p-value
children's picky behavior	8.255	3	0.041

Note: Dependent variable; Nutrition status. Relationship significant at p>0.05

DISCUSSIONS

The objective of the study was to identify the dietary habits and nutrition status of autistic children aged 5-12 years at City Primary School, Nairobi. ASD was found to be common among male children 75%, with the majority being between 10-12 years of age. A similar study carried out in Khartoum state, indicated a higher prevalence of autism among male children than females [9]. This corroborates with findings of the current study where male autistic children were three times more than females. The large variance between sexes among autistic children has been observed in several other studies, suggesting that ASD was

more common among males [4, 21-23]. Studies conducted in Morocco and China, revealed that the initial diagnosis of autism among children was done mostly between 2-4 years [24,25]. Which aligns with the current study findings where the diagnosis of autism was found mainly to be between 0-4 years of age.

A study by Zhu et al., [18], showed varied results on dietary diversity where autistic children were found to consume fewer whole grains, milk and milk products, beans and soy products, vegetables, and fruits when compared to normal children. The results are similar to current findings, however, they slightly differ with a study done in Libya where 50%-77% of autistic children took almost all food groups except fish and others such as junk foods and highly salted foods that were consumed invariably [11].

Micronutrient deficiencies are a major concern among autistic children. However, findings from the current study indicate adequate consumption of micronutrients across all food groups. This can be attributed to the efforts by the ASK to maintain proper nutrition for school-going children with Autism. This slightly differs from a study by Ranjan & Nasser, [26], who found inadequate micronutrient intake among autistic children, due to inadequate intake of green leafy vegetables and fruits. Zhu *et al*., [18] also observed that these children consumed fewer whole grains, fruits, and seafood. Other studies also reported low levels of various micronutrients such as iron, folate, calcium, vitamin A, Vitamin D, B vitamins, zinc, and vitamin C [18, 23].

Mbaabu, [22], in his study, found the majority (78.0%) of autistic children to be normal, 13.4% representing underweight with only 8.5% being overweight. This is similar to the current findings where the majority of children were normal with only a few presenting with SAM.

However, the findings differ with Islam *et al*., [27], who found the majority of children are overweight and obese, only a small percentage were underweight. However, the prevalence of obesity among autistic children has been inconsistent over a period with different studies reporting varied figures. However, some show similar prevalence for overweight as compared to obesity between autistic and normal children [13, 17, 21, 26, 27].

In a different study, the nutrition status of autistic children varied between genders, majority of those who turned out as underweight were females, while males only represented about half of the study population [9]. The study also revealed that most male autistic children tend to be normal and only a few appeared overweight. Similar study conducted in Jordan indicates a higher prevalence of both underweight and obesity among ASD children [15]. The study also found that boys who were autistic had higher chances of being overweight, unlike girls who had a higher prevalence of underweight and stunting than normal children [15]. The clinical signs and symptoms did not show any nutritional deficiency which was contrary to Sun *et al*., [14] who found that majority of autistic children exhibited varied forms of nutritional deficiencies, which were evident from physical examination.

The study found a significant relationship between dietary habits and nutrition status. This corroborates with a study by Kittana *et al*., [28] who reported a significant relationship between dietary habits and nutrition status of autistic children. He further suggests that restrictive diets because they tend to use elimination diets, have detrimental effects on nutrition status of these children. Additionally, some studies report that strong food preferences among autistic children and alterations in sensory processing may have a

strong impact on their health and nutrition status [29].

CONCLUSION AND RECOMMENDATIONS

The study found inadequate intake of eggs, milk, seeds, and nuts, which play an important role in providing key micro and macronutrients to human body. The study reported a significant positive association between dietary habits and nutritional status of children with autism. However, many studies looking at the relationship between dietary patterns and nutritional status of autistic children had varied findings with some showing a stronger relationship and some showing no relationship at all.

The study recommends further longitudinal studies be conducted to determine the effect of dietary intake on the nutrition status of children with autism in diverse settings. The study also recommends the development of diet reference guidelines for people with autism targeting different age groups. This will go a long way in addressing the dietary intake inadequacies and preferences of one diet over others.

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