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Feeding Problems, Nutrition Status and Gastrointestinal Problems of Children and Adolescents with Neurodisability in a Clinical Care Setting in Kenya

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ABSTRACT

The prevalence of neurological impairment and disability in children ranges from 8 to 180 per 1,000 in low- and middle-income countries (LMICs). In Kenya, 2.2% of the population (0.9 million people) live with some form of disability. Neurodevelopmental delay, neurodisability, and malnutrition significantly contribute to the burden of disease globally and in Africa. This study aimed to assess mealtime problem behaviors, nutritional status, and gastrointestinal (GI) issues among children and adolescents with neurodevelopmental disorders (CAWND) in clinical care settings in Kenya. A cross-sectional study was conducted at Kenyatta National Hospital involving CAWND aged 3-17 years from June 2021 to June 2023. The Daniel 1999 formula was used to determine the sample size. Data collection and coding were performed using the Open Data Kit. Data analysis was conducted using the R programming language (R Core Team, 2022). The Brief Autism Mealtime Behavior Inventory (BAMBI) tool was used to assess feeding problems. Descriptive statistics were used to summarize socio-demographic characteristics. Linear discriminant analysis was employed to assess differences in nutritional status indicators by neurodevelopmental diagnosis. Associations between feeding problems and GI issues in CAWND were tested, with significance set at $p < 0.05$. The study included 81 CAWND, comprising 40% with autism, 28% with epilepsy, 11% with cerebral palsy, and 21% with trauma. The median age was 12 years. Malnutrition was highest among children with cerebral palsy (56% stunting, 44% wasting, and 55% underweight). Regarding feeding problems, 100% of CAWND with cerebral palsy disliked sweet foods ($p = 0.024$). Conversely, 91% of CAWND with epilepsy were most willing to try new foods ($p = 0.024$) and 65% preferred crunchy foods ($p = 0.011$). Additionally, 75% of CAWND with autism disliked foods requiring extensive chewing ($p = 0.000$), and 100% of CAWND with trauma disliked foods prepared in a specific way ($p = 0.039$). The most common GI symptoms observed were constipation and diarrhea. CAWND experience feeding problems and GI issues that adversely affect their nutritional status. Tailored strategies addressing the mealtime experiences, requirements, and preferences of CAWND are necessary. Interventions to improve nutritional status and manage GI problems are crucial for enhancing health and nutrition outcomes. Future research should explore the impact of feeding and GI problems on the health and nutrition of CAWND.

Keywords: feeding, malnutrition, neurodisability, problems

INTRODUCTION

Neurodisability (ND) describes a group of congenital or acquired long-term conditions attributed to impairment of the brain and or neuromuscular system creating functional limitations. This consequently results in conditions such as cerebral palsy, intellectual disorders, autism, epilepsy, sensory and emotional difficulties (Morris et al., 2013). Malnutrition underlies 3 million child deaths worldwide (Bailey *et al.,* 2020). The prevalence of neurological impairment (NI) and disability ranges from 8–180 per 1,000 children in low- and middle-income countries (LMICs) (Bitta *et al.,* 2017).

Malnutrition and neurodisability are both major public health problems in Africa. Maternal malnutrition leads to perinatal complications that may lead to neurologic damage. This consequently leads to macro and micronutrient malnutrition through mechanisms such as decreased food intake, increased nutrient losses and increased nutrient requirements (Kerac et al., 2014).

Neurodevelopmental delay, neurodisability, and malnutrition interact to contribute a significant burden of disease in global settings. In Africa, assessments of children with ND and malnutrition are limited (Gladstone et al., 2014). Pediatric feeding disorders are common in 25% of children and this number increases to 80% in developmentally delayed children(Manikam & Perman, 2000). Consequences of feeding disorders can be severe, including growth failure, susceptibility to chronic illness, and even death (Manikam & Perman, 2000).The term "feeding problems" encompasses a range of concerns, such as food selectivity ("picky eating"), problematic mealtime behavior, and oral/motor difficulties (Peverill et al., 2019).

Kenya is faced with a triple burden of malnutrition which is multi-faceted with health and socio-economic implicationsand inadequate resource allocation to the nutrition sector (Codjia et al., 2022). Research on autism in the Kenyan Coast region indicates that parents, caregivers, and special needs providers encounter various challenges in the diagnosis, and treatment. Research in ASD matters are hindered by cultural factors, and there is a lack of treatment protocols, lack of institutional and government support. The ASD treatment is expensive for the families already facing a lot of social stigmas, isolation and brokenness (Gona et al., 2016).There is lack of awareness and limited research in ASD matters in Kenya (Obara et al., 2023).

Nutritional management for children with ND is challenging and there is an increasing risk of malnutrition. These challenges are due to factors such as lack of oromotor coordination and discomfort associated with reflux esophagitis or gastrointestinal dysmotility. Neurodisability alters the perception of pain and discomfort in CAWND making them extremely sensitive to certain textures and rigid to feeding schedules (Manikam & Perman, 2000). Existing evidence also suggests that children with disabilities are at greater risks of malnutrition. Children with disabilities are normally excluded from nutrition programs and likely to die from

severe acute malnutrition compared to children without disabilities (Rotenberg et al., 2024).

Children with disabilities may be particularly vulnerable to malnutrition, as a result of exclusions and feeding difficulties. However, there is limited evidence currently available on this subject (Kuper et al., 2015) . Parents of children with autism (ASD) report struggling to manage their children's diets and nutrient intake, and also indicate increased anxiety and stress levels during mealtime. Up to 90% of children with ASD present with problems related to food selectivity and disruptive mealtime behavior(Zlomke et al., 2020).

Thereby, this study aimed at contributing to identification of the feeding problems and GI problems that may negatively impact on the nutrition status of CAWND in clinical care settings in Kenya. Consequently, these efforts are aimed at contributing to improving the health and nutrition status and outcomes of CAWND.

METHODS

This was a descriptive cross-sectional study of CAWND patients attending the Kenyatta National Hospital (KNH) pediatric wards, mental health clinic, and the paediatric outpatient clinics between June 2021 and June 2023. Cross-sectional design was the most relevant design as it assessed the prevalence of disease it was cost effective and it also examines burden of disease (Kesmodel, 2018). In this study the number of CAWND were determined using scientifically sound methods and recruited for the study between June 2021 and June 2023. The Daniel 1999 formula for calculation of prevalence was used (Naing et al., 2006) to determine the sample size: 81 participants were selected using proportionate-to-size sampling. A pretest was carried out at the Mbagathi hospital at the paediatric wards and outpatient clinic. The location was chosen because it has similar characteristics to the study location. 15 % of the participants were randomly selected for the purpose of the pretest. The participants were not to be part of the main study but had similar characteristics as those of the main study. This was conducted in order to make standardization to the tools and instruments and to ensure validity and reliability and assess tool understanding by patients. Data from pretest were analysed using SPSS (version 20.0, SPSS Inc., Chicago, IL, USA).

A. Data Analysis

The data was collected using the Open data kit (ODK) it was then taken through data cleaning to check for completeness and consistency, it was coded and downloaded in form of a Microsoft office excel spreadsheet. The data was later saved in comma separated values (.csv) format for analysis in the R programming language (R Core Team, 2022). Descriptive statistics of frequencies and mean and standard deviation or median were generated for the categorical and continuous variables, respectively, for the socio-demographic characteristics. The continuous variables were first tested for assumption of normal distribution (density plots and Wilk's Shapiro test), with distributions that violated these assumptions having the median values generated for descriptives. Anthropometric data were first tested for

assumptions of normality, since there were four different measures of nutrition status, linear discriminant analysis was used to assess the differences of the different indicators of nutrition status by the neuro-development diagnosis. Test for association was conducted for the feeding problems and gastrointestinal symptoms and the neuro-disability, where the assumption of chi-square test was violated such as expected count was less than 5, fisher's test was used. The analyzed data was then presented using graphical methods such as violin plots and by use of frequency distribution tables.

B. Inclusion and Exclusion Criteria

Included were CAWND clinically diagnosed by a specialist who were aged between 3 to 17 years and met the inclusion criteria. Excluded were CAWND on nutritional supplements for a period of six months or more preceding the study period, those with either liver impairment or kidney impairment, or with an eating disorder such anorexia nervosa and bulimia nervosa.

C. Data collection Procedure

Prior to the commencement of the study; approval to conduct the study was sought from Graduate School and clearance was sought from the Institutional Review Board of Kenyatta Hospital and University of Nairobi Ethical Review Committee (No P163/03/2020). A license to conduct research was also obtained from the National Commission for Science, Technology and Innovation (NACOSTI/P/23/24341). Consent was also obtained from the Kenyatta National Hospital Research department. Finally, a written informed consent was obtained from the parents and caregivers prior to enrollment of the children. A pre-test was done at the Mbagathi Hospital in order to test the research instruments. Research assistants and the clinical team were trained and briefed on various research aspects including tools and instruments. CAWND were identified, consent sought in writing. Data was then collected from CAWND using mobile phones open data kit application.

Data on demographic and socio-economic characteristics, feeding problems, nutrition status and gastrointestinal problems was collected.

The demographic and socio-economic data was determined using: a structured questionnaire that contained questions pertaining to demographic data (name, age, gender, nationality, residence, marital status, support group, and family structure), socioeconomic information (parents' education levels and family annual income), and medical history.

The feeding problems data was determined using: the Brief Autism Meal time Behavior Inventory (BAMBI). The mealtime behavior inventory questionnaire included an 18-point feeding behavior and problems tool modified from the Brief Autism Meal time Behavior Inventory (BAMBI) summarized into 4 main categories: Food Selectivity, Disruptive Mealtime Behaviors, Food Refusal and Mealtime Rigidity (Lamboglia et al., 2023).

The nutrition status data was determined using: WHO Anthro and Anthro Plus software (World Health Organization, 2009, Anthro for Personal Computers,

Version 3.01: Software for Assessing Growth and Development of the World's Children), using the WHO child growth standard 2005 version for children aged 0–5 years and the 2007 version for children and adolescents aged 5–19 years. *Z*-scores of less than −2 for Z_{WH}, Z_{HA}, and Z_{BMIA} were indicative of underweight, stunting/short stature, and wasting, respectively, while scores of higher than ٢+ were indicative of overweight, tall stature, and obesity.

The gastrointestinal problem data was determined using: A structured questionnaire on gastrointestinal problems was given for care givers and parents to fill. This questionnaire detailed common GI problems: diarrhea, constipation, esophageal reflux/acidity, gas distention, bloating, and abdominal pain. The tool had details on symptom: frequency, severity, intensity, effect, duration, bowel status like stool color and type, and existing medication. The caregivers were asked to report their impressions on the frequencies of gastrointestinal problems by rating them according to the following scoring system: 0 = absent (never to seldom) or mild (sometimes); or 1 = severe (usually to always). Thus, the caregivers selected one of these two options to describe the severity of each problem.

D. Ethical consideration

The research was conducted according to the guidelines stated in the Declaration of Helsinki. All procedures were approved by the Institutional Review Board of Kenyatta Hospital and University of Nairobi Ethical Review Committee (No P163/03/2020). A license to conduct research was also obtained from the National Commission for Science, Technology and Innovation (NACOSTI/P/23/24341). Written informed consent was obtained from the parents and caregivers prior to enrollment of the children.

RESULTS

A. Demographic and Socio-Economic characteristics of CAWND patients attending Pediatric Clinics at the Kenyatta National Hospital

A total of 81 CAWND (median age 12 years old) were enrolled between June 2021-June 2022. There were more male children and adolescents 57 % compared to females 43%. The children were from four different ND groups: Autism 40%, Epilepsy 28 %, Cerebral palsy 11% and trauma 21%. A majority of the caregivers of these children were female 91%. Most children resided in Nairobi 63% followed by Kiambu 28%. Most care givers attained college education 59% and were married 90%. Majority of the families 98% reported that they did not belong to any ND support groups. The demographic characteristics of the children are shown in *Table1.*

Table 1: ***Socio-demographic characteristics of children and adolescents with neurodisability***

	Autism (n=32)	Cerebral palsy (n=9)	Epilepsy (n=23)	Trauma (n=17)
Child's gender				
Female (n=35)	41	56	39	47
Male (n=46)	59	44	61	53
Child's age (n=81)	13	12	8	11
Gender of primary caregiver				
Female (n=74)	94	100	83	94
Male (n=7)	6	0	17	6
Age of primary caregiver (n=81)	30	30	35	33
Residence (County)				
Kajiado (n=2)	3	0	4	0
Kiambu (n=23)	42	33	17	12
Kitui (n=2)	0	0	0	12
Meru (n=2)	0	0	9	0.0
Nairobi (n=51)	53	67	65	77
Nyeri (n=1)	0	0	4	0.0
Level of education of the caregiver				
College (n=48)	78	100	30.4	41
Primary school (n=10)	3	0	22	24
Secondary level (n=15)	6	0	39	24
Dropped out (4)	3	0	9	6
University (4)	9	0	0	6
Marital status of the caregiver				
Divorced (n=1)	0	0	4	0
Married (n=73)	91	100	91	82
Single (n=7)	9	0	4	18
Support Group membership				
Yes (n=2)	6	0	0	0
No (n=79)	94	100	100	100

All values in are in percentages except for the age of the child and the caregiver which are median values.

Majority of the families' caregivers came from low social economic households with an average monthly income below Kenya shillings 20000. Most of the toilet facilities 63% were pit latrines and the main water source for the families was communal piped water 65%.

This study established that only 6% of families with CAWND belonged to a peer support group. This is as shown in *Table 2.*

Table 2: ***Socio-economic characteristics of the households of children and adolescents with neurodisability***

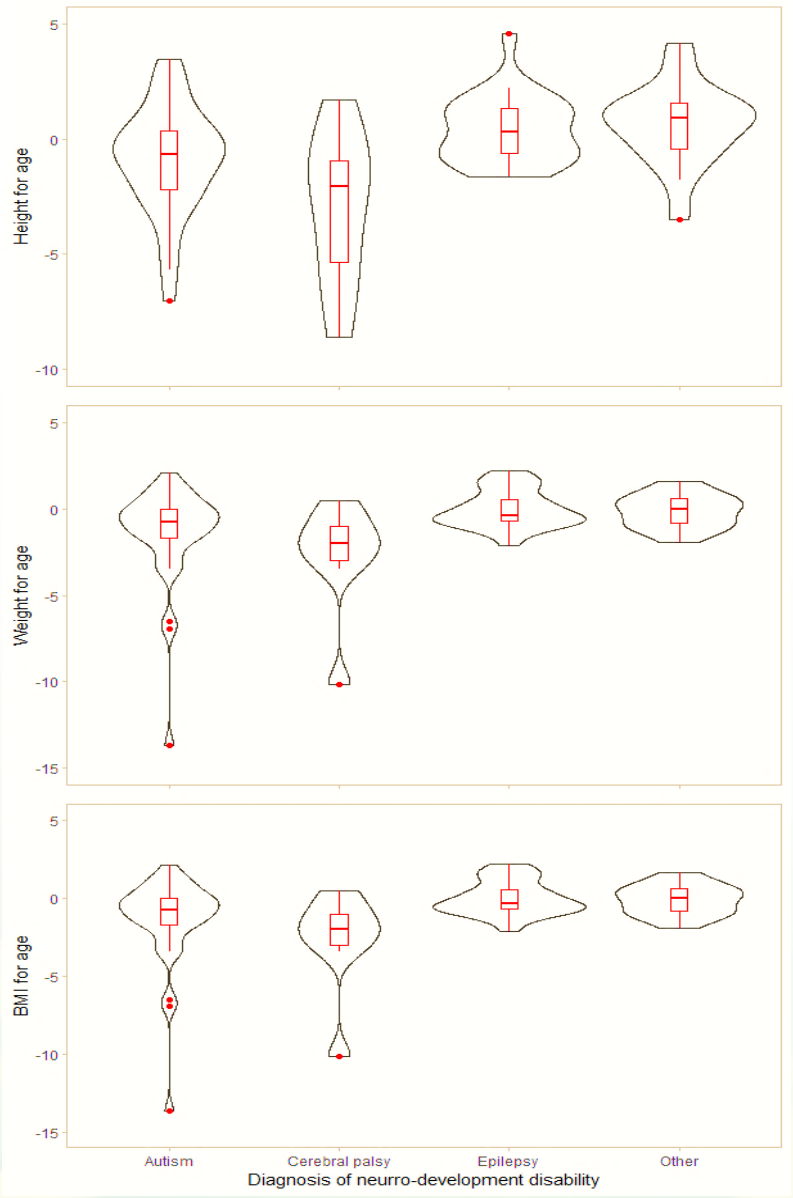
Household characteristics Autism (n=32)		Descriptive statistics			
		Cerebral palsy (n=9)	Epilepsy (n=23)	Trauma (n=17)	
Household size	81	5	5	4	6
Number of children under 5 years	81	3	3	1	1
Average household income, KES.	81	20000	20000	15000	20000
Main source of household income	Casual labor (n=13)	6	0.0	30	24
	Others (n=43)	78	100	22	24
	Salaried employment (n=4)	9	0	0	6
	Self-employed (n=21)	6	0	48	47
Toilet facilities	Communal flush toilet (n=7)	0	0	22	12
	Indoor flush toilet (n=23)	22	0	39	41
	Pit latrine (n=51	78	100	39	47
Main source of water	Communal borehole (n=4)	3	0	13	0
	Communal piped water (n=53)	75	100	52	47
	Others (n=2)	3	0	4	0
	Piped water in the house (n=19)	19	0	26	41
	River/stream (n=3)	0	0	4	12

All values are in percentages except for household size, number of children under 5 years and household income which are median values.

B. *Nutrition Status of CAWND attending Pediatric Clinics at the Kenyatta National Hospital:*

The current study had a high prevalence stunting which is low Height for Age Z scores (Z_{HA}). The percentage of CAWND with stunting were as follows: cerebral palsy 56%, Autism 32%, and trauma 6%. The study had high prevalence of wasting which is low BMI for Age Z scores (Z_{BMIA}). The percentage of CAWND with wasting were as follows: Cerebral palsy 44%, autism 22%, epilepsy 21% and trauma 12%. The study had a high prevalence of underweight which low weight for age Z scores (Z_{WA}). The percentage of CAWND who were underweight were as follows: cerebral palsy 55% autism 22% and epilepsy 4%. The summary of the CAWND weight for age Z scores (Z_{WA}), Height for age Z scores (Z_{HA}) and body mass index for age Z scores (Z_{BMIA}) are as shown in *Figure 2.*

Figure 2: ***Height for Age Z scores, Weight for age Z scores and BMI for Age Z scores for children and adolescents with neurodisability***



NB: 'Other' category represents various forms of trauma

C. *Feeding problems in CAWND attending Pediatric Clinics at the Kenyatta National Hospital:*

The study established that 100% of CAWND with cerebral palsy disliked eating sweet foods (p=0.024) compared to those with epilepsy and trauma. Also 91% of CAWND with epilepsy were most willing to try new foods (p=0.024) and 65% of preferred crunchy foods p=0.011. It was also established that 75% OF CAWND with autism disliked foods requiring a lot of chewing (p=0.000). Children with trauma disliked foods cooked in a particular way (p=0.039). The gastrointestinal problems (GI) most displayed in CAWND was constipation.

All children with ND (autism, cerebral palsy, epilepsy, and trauma) preferred a flexible routine while having meals the differences however were not statistically significant. Children with autism had restricted food preferences compared those with trauma the differences however were not statistically significant. The feeding problems of children with autism, cerebral palsy, epilepsy and traumas were compared in *Table 3*.

Table 3: ***Feeding problems of children and adolescents with neuro-disability***

Feeding problems	Autism		Cerebral palsy		Epilepsy		trauma		
	n	%	n	%	n	%	n	%	p-value
Cries during mealtime	2	6.3	0	0.0	1	4.3	1	8.3	1
Turns away from food	7	21.9	4	44.4	2	8.7	1	8.3	0.154
Unable to swallow food adequately	3	9.4	2	22.2	1	4.3	0	0.0	0.334
Spits food	10	31.3	2	22.2	2	8.7	0	0.0	0.072
Aggressive during eating	4	12.5	1	11.1	2	8.7	2	16.7	0.923
Displays self-injurious behaviors during mealtimes	5	15.6	0	0.0	0	0.0	1	8.3	0.222
Disruptive during meals	4	12.5	1	11.1	0	0.0	0	0.0	0.255
Closes mouth when given food	5	15.6	2	22.2	3	13.0	1	8.3	0.885
Flexible routine with meals	28	87.5	8	88.9	20	87.0	8	66.7	0.486
Willing to try new foods	18	56.3	8	88.9	21	91.3	8	66.7	0.024*
Dislikes some foods	14	43.8	3	33.3	9	39.1	7	58.3	0.708
Dislikes foods that require a lot of chewing	24	75.0	4	44.4	5	21.7	2	16.7	0.000*
Prefers same foods during meals	6	18.8	0	0.0	3	13.0	0	0.0	0.362
Prefers crunchy foods	8	25.0	2	22.2	15	65.2	6	50.0	0.011*
Takes variety of foods	21	65.6	7	77.8	19	82.6	11	91.7	0.378
Prefers foods served in a particular way	3	9.4	0	0.0	6	26.1	1	8.3	0.303
Prefers sweet foods	1	3.1	0	0.0	7	30.4	2	16.7	0.024*
Prefers foods prepared in a particular way	2	6.3	2	22.2	7	30.4	0	0.0	0.039*

KEY: p-values are based on Fisher's Exact Test; the n shows dichotomous values for presence of a habit, to get the absence of the habit subtract ***n*** *from the total of each condition (Autism 32, cerebral palsy 9, Epilepsy 23 and Trauma 12).*

A. Gastrointestinal (GI) problems in CAWND attending Pediatric Clinics at the Kenyatta National Hospital:

The GI problem displayed in most CAWND was constipation 9%. The other GI problem symptom displayed include: diarrhea 6%, gas distention and bloating 5%, esophageal acidity 5%, and abdominal pain 4%. The gastrointestinal problems (GI) of the children with autism, cerebral palsy, epilepsy and other ND were compared in *Figure 3.*

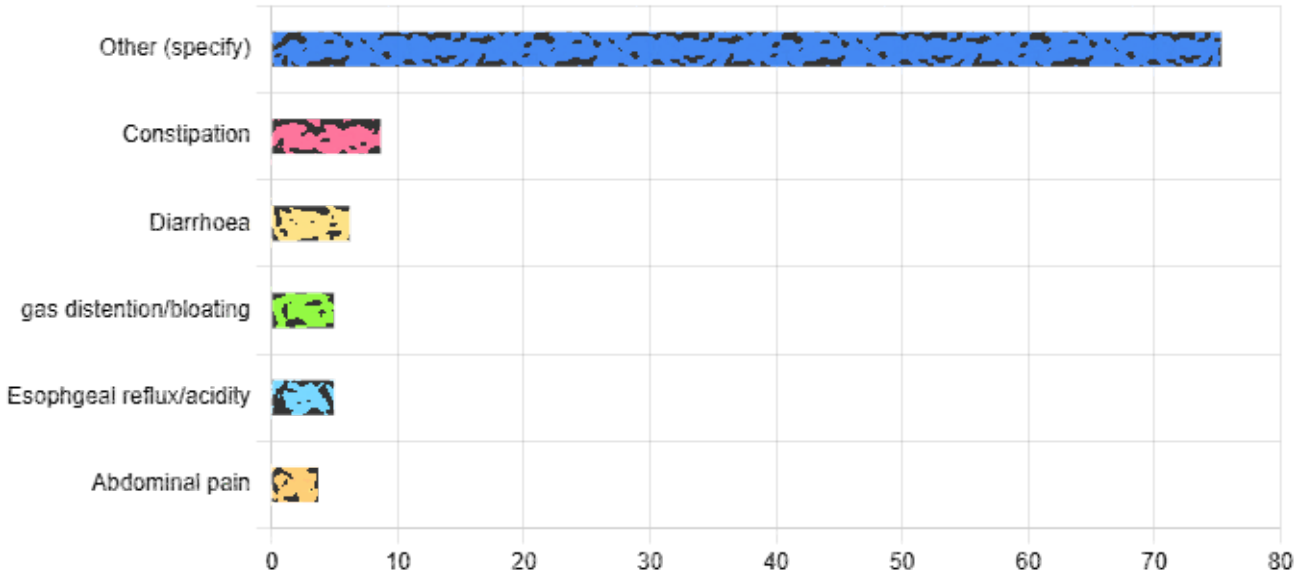


Figure 3: ***Gastrointestinal problems in children and adolescents with neurodisability***

DISCUSSION

This cross-sectional study assessed the nutrition status, feeding problems and GI problems, of CAWND from 4 groups (autism, cerebral palsy, epilepsy and trauma). Majority of the families' caregivers came from low social economic households with an average monthly income below Kenya shillings 20,000. The results indicated that there was high prevalence of malnutrition, stunting, wasting and underweight. The children in this study had several feeding problems. Constipation was the most common GI problem symptom among the study children.

Malnutrition in children and adolescents with neurodisability:

The present study established that the highest percentage of CAWND with malnutrition were those with cerebral palsy: (stunting Z_{HA} 56%, wasting Z_{BMIA} 44% and underweight Z_{WA} 55%) the summary is as shown in *Figure 2*. Samson-Fang *et al.*, in a study done in the United States of America found similar results to our study. He found that prevalence of malnutrition in children with cerebral palsy was between 29-46% increasing with age and neurological disease progression (Samson-Fang & Stevenson, 2000). Israt *et al.*, 2019 in a study done in Bangladesh among cerebral palsy children established similar results to the current study. More than two-third of children were underweight (70.0%) and stunted (73.1%). The study by Israt also established that the mean z score for weight for age, height for age and weight for height were -2.8 indicating significantly high levels of

malnutrition(Jahan et al., 2019).

The children with autism (ASD) in the present study had the second highest prevalence of malnutrition among CAWND: (stunting Z_{HA} 32%, wasting Z_{BMIA} 22% and underweight Z_{WA} 22%). Liu *et al.,* in a study done in China in 2016 established similar results to the current study findings, in his study the nutrition status of ASD children was worse than in the neurotypical controls(Liu et al., 2016).

The current established that children with epilepsy had the third highest levels of malnutrition among CAWND: (wasting Z_{BMIA} 21% and underweight Z_{WA} 4%). None of the children with epilepsy was stunted. Thowfeek *et al.,*2023 in systematic review of dietary intake and nutrition status in epilepsy in Australia, established similar results to this study. The study found that nutrition status was poorer in CAWND with epilepsy than in controls and reference standards (Thowfeek et al., 2023).

The current study also established that children with trauma had the least levels of malnutrition compared to the other CAWND: (stunting Z_{HA} 6%). These CAWND with trauma were not wasted or underweight. Since children with CAWND exhibited severe levels of malnutrition, assessment strategies and protocols aimed in management of the factors causing it is critical in clinical management and improved health and nutrition outcomes.

Feeding problems in children and adolescents with neurodisability:

The CAWND had various problem feeding behavior as summarized in *Table 3.* The present study established that children with cerebral palsy disliked eating crunchy foods p=0.011 and sweet foods (p=0.024) compared to those with epilepsy and trauma. Bell *et al.,* 2019 in Australia in a systematic review done on feeding and swallowing challenges in cerebral palsy obtained similar findings as the current study. The study established that feeding difficulties impacted on swallow safety in 29% of the children and 29% were moderately and severely wasted(Bell et al., 2019). The present study also found that children with autism disliked sweet food p=0.010 and food that required a lot of chewing (p=0.000) compared to those with trauma. Braskenwich *et al.,*2021 in a study done in Canada established similar results. Their study found that feeding problems, such as picky eating and food avoidance, were common in youth with autism. They also established that eating disorder symptoms such as restricting food intake or preoccupation with body shape or weight and insistence on specific food presentation were also common in autistic individuals(Baraskewich et al., 2021).

Findings from the present study show that children with epilepsy were most willing to try new foods (p=0.024) than other CAWND and preferred to eat crunchy foods (65%). Children with epilepsy also preferred foods cooked in a particular way (p=0.039). It was also observed that all CAWND preferred a flexible feeding routine while having meals this could be attributed to the eating drinking and swallowing challenges, they experience the differences were however not statistically significant.

Sullivan in a study done among cerebral

palsy children in the United Kingdom in 2013 confirmed our study findings. Their study established that causes of the feeding problems in children with cerebral palsy were multiple including: reduction in nutritional intake due to oropharyngeal incoordination leading to slow rates of feeding, prolonged feeding times, excessive spillage of food and compromise to the safety of the swallow. In addition, these children were prone to vomiting, poor dentition, early satiety, communication defects and behavioral disturbances(Sullivan, 2013). Since CAWND exhibited severe problem feeding behavior, management for these factors is critical in clinical management and improved health and nutrition outcomes.

Gastrointestinal (GI) problem symptoms in children and adolescents with neurodisability:

Results from the present study indicate that CAWND suffered from various GI problems such as diarrhea, constipation, esophageal reflux, gas distention or bloating and abdominal pain. It was however observed the GI problem symptom displayed in most CAWND is constipation this is as shown in Figure 2. Batra *et al.,* in 2022 in a study done on challenges of feeding children with ND established different findings to the present study (Batra & Beattie, 2020). In their study it was established that feeding difficulties could be the result of physical causes like lack of oromotor coordination, discomfort associated with esophageal reflux or gastrointestinal (GI) dysmotility. Madra *et al.,* 2020 in a study done in the United States of America also confirmed that GI disorders were the most common medical conditions that were comorbid with ASD which could also worsen severity of ASD symptoms consequently lowering quality of life(Madra et al., 2021). Emmanuel *et al.,* 2019 in a study done on bowel dysfunction in people with ND established similar findings to the current study. They established the symptoms of neurogenic bowel dysfunction (NBD) comprise of constipation and fecal incontinence(Emmanuel, 2019). Obara *et al.,* 2023 conducted a systematic review in Kenya on dietary and nutritional interventions available for the management of autism spectrum disorders symptoms. Their study established the benefits of use of dietary and nutritional interventions in management of gastrointestinal problems of ASD children and adolescents (Obara et al., 2023). Since CAWND exhibited various GI problem symptoms their management is essential for ensuring the achievement of positive clinical and nutrition outcomes.

CONCLUSION

Children and adolescents with neuro-disability (CAWND) experience various feeding problems such as selectivity and rigidity based on food texture, flavor, variety, and food consistency. They also experienced various GI problems such as constipation and diarrhea and these consequently led to high prevalence of malnutrition.

RECOMMENDATIONS

The investigation revealed high prevalence of malnutrition, various feeding problems and gastrointestinal problem symptoms. Therefore, Strategies to tailor mealtime experiences to preferences and requirements of the CAWND and those aimed at improving nutrition assessment hospital protocols and those managing gastrointestinal problem

symptoms are required to improve clinical care outcomes of CAWND. Future research is required to address impact of feeding problems and GI problem symptoms on the health and nutrition status of CAWND.

LIMITATIONS

The unavailability of literature on feeding problems, nutrition assessment and GI problem symptoms of CAWND specific to clinical settings in Kenya, may have limited the comparisons in the local context.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

Bailey, J., Opondo, C., Lelijveld, N., Marron, B., Onyo, P., Musyoki, E. N., Adongo, S. W., Manary, M., Briend, A., & Kerac, M. (2020). A simplified, combined protocol versus standard treatment for acute malnutrition in children 6–59 months (ComPAS trial): A cluster-randomized controlled non-inferiority trial in Kenya and South Sudan. *PLoS Medicine*, *17*(7). https://doi.org/10.1371/journal.pmed.1003192

Baraskewich, J., von Ranson, K. M., McCrimmon, A., & McMorris, C. A. (2021). Feeding and eating problems in children and adolescents with autism: A scoping review. *Autism: the international journal of research and practice*, *25*(6), 1505–1519. https://doi.org/10.1177/1362361321995631

Batra, A., & Beattie, R. M. (2020). Recognising malnutrition in children with neurodisability. *Clinical nutrition (Edinburgh, Scotland)*, *39*(2)327–330. https://doi.org/10.1016/j.clnu.2019.08.011

Bell, K. L., Benfer, K. A., Ware, R. S., Patrao, T. A., Garvey, J. J., Arvedson, J. C., Boyd, R. N., Davies, P. S. W., & Weir, K. A. (2019). Development and validation of a screening tool for feeding/swallowing difficulties and undernutrition in children with cerebral palsy. *Developmental medicine and child neurology*, *61*(10), 1175–1181. https://doi.org/10.1111/dmcn.14220

Bitta M, Kariuki SM, Abubakar A, Newton C. Burden of neurodevelopmental disorders in low and middle-income countries: A systematic review and meta-analysis. Wellcome Open Res. 2017; 2:121. pmid:29881784

Codjia, P., Kutondo, E., Kamudoni, P., Munga, J., Ahluwalia, A., Sharma, I., de Jong, Y., Amolo, T., Maina-Gathigi, L., Mwenda, V., Chaudhry, H., & Bukania, Z. (2022). Mid-term evaluation of Maternal and Child Nutrition Programme (MCNP II) in Kenya. *BMC Public Health*, *22*(1). https://doi.org/10.1186/s12889-022-14627-2

Emmanuel A. (2019). Neurogenic bowel dysfunction. *F1000Research*, *8*, F1000 Faculty Rev-1800. https://doi.org/10.12688/f1000research.20529.1

Jahan, I., Muhit, M., Karim, T., Smithers-Sheedy, H., Novak, I., Jones, C., Badawi, N., & Khandaker, G. (2019). What makes children with cerebral palsy vulnerable to malnutrition? Findings from the Bangladesh cerebral palsy register (BCPR). *Disability and rehabilitation*, *41*(19), 2247–2254. https://doi.org/10.1080/09638288.2018.1461260

Gladstone, M., Mallewa, M., Alusine Jalloh, A., Voskuijl, W., Postels, D., Groce, N., Kerac, M., & Molyneux, E. (2014). Assessment of Neurodisability and Malnutrition in Children in Africa. *Seminars in Pediatric Neurology*, *21*(1), 50–57. https://doi.org/https://doi.org/10.1016/j.spen.2014.01.002

Gona, J. K., Newton, C. R., Rimba, K. K., Mapenzi, R., Kihara, M., Vijver, F. V., & Abubakar, A. (2016). Challenges and coping strategies of parents of children with autism on the Kenyan coast. *Rural and remote health*, *16*(2), 3517.

Kerac, M., Postels, D. G., Mallewa, M., Alusine Jalloh, A., Voskuijl, W. P., Groce, N., Gladstone, M., & Molyneux, E. (2014). The interaction of malnutrition and neurologic disability in Africa. *Seminars in pediatric neurology*, *21*(1), 42–49. https://doi.org/10.1016/j.spen.2014.01.003

Kesmodel U. S. (2018). Cross-sectional studies - what are they good for? *Acta obstetricia et gynecologica Scandinavica*, *97*(4), 388–393. https://doi.org/10.1111/aogs.13331

Kwasa T. O. (1992). The pattern of neurological disease at Kenyatta National Hospital. *East African medical journal*, *69*(5), 236–239.

Kuper, H., Nyapera, V., Evans, J., Munyendo, D., Zuurmond, M., Frison, S., Mwenda, V., Otieno, D., & Kisia, J. (2015). Malnutrition and Childhood Disability in Turkana, Kenya: Results from a Case-Control Study. *PloS one*, *10*(12), e0144926. https://doi.org/10.1371/journal.pone.0144926

Lamboglia, A., Romano, R., Valente, D., Berardi, A., Cavalli, G., Giovannone, F., Sogos, C., Tofani, M., & Galeoto, G. (2023). Brief Autism Mealtime Behavior Inventory (BAMBI): Italian Translation and Validation. *Children (Basel, Switzerland)*, *10*(7), 1201. https://doi.org/10.3390/children10071201

Liu, X., Liu, J., Xiong, X., Yang, T., Hou, N., Liang, X., Chen, J., Cheng, Q., & Li, T. (2016). Correlation between Nutrition and Symptoms: Nutritional Survey of Children with Autism Spectrum Disorder in Chongqing, China. *Nutrients*, *8*(5), 294. https://doi.org/10.3390/nu8050294

Madra, M., Ringel, R., & Margolis, K. G. (2020). Gastrointestinal Issues and Autism Spectrum Disorder. *Child and adolescent psychiatric clinics of North America*, *29*(3), 501–513. https://doi.org/10.1016/j.chc.2020.02.005

Manikam, R., & Perman, J. A. (2000). Pediatric feeding disorders. *Journal of clinical gastroenterology*, *30*(1), 34–46. https://doi.org/10.1097/00004836-200001000-00007

Morris, C., Janssens, A., Tomlinson, R., Williams, J., & Logan, S. (2013). Towards a definition of neurodisability: a Delphi survey. *Developmental medicine and child neurology*, *55*(12), 1103–1108. https://doi.org/10.1111/dmcn.12218

1b) Morris, C., Janssens, A., Allard, A., Thompson Coon, J., Shilling, V., Tomlinson, R., Williams, J., Fellowes, A., Rogers, M., Allen, K., Beresford, B., Green, C., Jenkinson, C., Tennant, A., & Logan, S. (2014). *Informing the NHS Outcomes Framework: evaluating meaningful health outcomes for children with neurodisability using multiple methods including systematic review, qualitative research, Delphi survey and consensus meeting*. NIHR Journals Library.

Naing, L., Winn, T., & Rusli, B. N. (2006). Practical Issues in Calculating the Sample Size for Prevalence Studies. In

Archives of Orofacial Sciences (Vol. 1).

Obara, S C., Kaindi, D W, Okoth M W & Marangu, D. (2023). A review of dietary and nutritional interventions available for management of autism spectrum disorder symptoms in children and adolescents – Kenya. *African Journal of Food, Agriculture, Nutrition and Development* 23(121):23835-23858. DOI: 10.18697/ajfand.121.22955

Peverill, S., Smith, I. M., Duku, E., Szatmari, P., Mirenda, P., Vaillancourt, T., Volden, J., Zwaigenbaum, L., Bennett, T., Elsabbagh, M., Georgiades, S., & Ungar, W. J. (2019). Developmental Trajectories of Feeding Problems in Children with Autism Spectrum Disorder. *Journal of pediatric psychology*, *44*(8), 988–998. https://doi.org/10.1093/jpepsy/jsz033

R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Samson-Fang, L. J., & Stevenson, R. D. (2000). Identification of malnutrition in children with cerebral palsy: poor performance of weight-for-height centiles. *Developmental medicine and child neurology*, *42*(3), 162–168. https://doi.org/10.1017/s0012162200000293

Sara Rotenberg, Shanquan Chen, Xanthe Hunt, Tracey Smythe, Hannah Kuper med Rxiv; Are children with disabilities more likely to be malnourished than children without disabilities? Evidence from the Multiple Indicator Cluster Surveys in 30 countries. doi: https://doi.org/10.1101/2023.09.25.23296066

Sullivan P. B. (2013). Nutrition and growth in children with cerebral palsy: setting the scene. *European journal of clinical nutrition*, *67 Suppl 2*, S3–S4. https://doi.org/10.1038/ejcn.2013.222s

Thowfeek, S., Kaul, N., Nyulasi, I., O'Brien, T. J., & Kwan, P. (2023). Dietary intake and nutritional status of people with epilepsy: A systematic review. *Epilepsy & behavior: E&B*, *140*, 109090. https://doi.org/10.1016/j.yebeh.2023.109090

Zlomke, K., Rossetti, K., Murphy, J., Mallicoat, K., & Swingle, H. (2020). Feeding Problems and Maternal Anxiety in Children with Autism Spectrum Disorder. *Maternal and child health journal*, *24*(10), 1278–1287. https://doi.org/10.1007/s10995-020-02966-8

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