

RESEARCH ARTICLE

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Characterization of child malnutrition among under-five children in Northeastern Nigeria

Oluwasola Stephen Ayosanmi, John Agboola, Felix Elijah, Adeyemi Alaga, Gloria Ogunlade, Adaeze Okereke, Esosa Omoregie, Ayobami Ajayi, Osahon Omoregie, Blessing Eze

ABSTRACT

Aims: This study aims to characterize child malnutrition among under-five children in the Northeastern region of Nigeria.

Method: This study used northeastern region data extracted from the population-based 2018 Nigerian Demographic and Health Survey (NDHS). Data analysis was done using IBM-SPSS Statistics for Windows, Version 25.0. The means of the Z-scores for height-for-age (HFA), weight-for-height (WFH), and weight-for-age (WFA) are calculated as summary statistics representing the nutritional status of children in a population.

Oluwasola Stephen Ayosanmi¹, MD, MSc, CHES, John Agboola², MD, MSc, Felix Elijah³, MD, Adeyemi Alaga⁴, MD, Gloria Ogunlade⁵, MD, Adaeze Okereke⁶, MD, Esosa Omoregie⁷, MBBS, Ayobami Ajayi⁸, MD, Osahon Omoregie⁹, MD, Blessing Eze¹⁰, MD

Affiliations: ¹University of Saskatchewan, 105 Administrative Building, Saskatoon, Canada; ²Department of Health Sciences and Social Works, Western Illinois University, Macomb, IL 61455, USA; ³Wyckoff Height Medical Center, 374 Stockholm St., Brooklyn, NY, USA; ⁴CAIP Unit, Grand River Hospital, 835 King Street West, Kitchener, Ontario, N2G 4K9, Canada; ⁵Capital Primary Care, Greenway Centre Drive, Greenbelt, Maryland, USA; ⁶West Chase Health Clinic, 13450 Richmond Avenue #100, Houston, Texas 77082, USA; ⁷Health Education North East of England, NHS, England; ⁸Department of Family Medicine, National Hospital, 265, Independence Ave, Central Business District 900103, Abuja, Nigeria; ⁹NHS Education Scotland, Forth Valley Royal Hospital, NHS Forthvalley, Scotland; ¹⁰Texas Wellness and Rehabilitation Center, Grand Prairie, Texas, USA.

Corresponding Author: Oluwasola Stephen Ayosanmi, MD, MSc, CHES, Ph.D. Candidate, University of Saskatchewan, 105 Administrative Building, Saskatoon, Canada; Email: osa355@usask.ca

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Results: The odds ratio of wasting among children under 12 months old was 1.56 (95% CI: 0.77–3.17), and the odds of wasting among 12–23 months was 1.37 (95% CI: 0.69–2.69) higher than aged 48–59 months. Also, the odds ratio of wasting for lower socioeconomic class children was 1.08 (95% CI: 0.64–1.85), and the middle class was 1.03 (95% CI: 0.57–1.86) higher than upper socioeconomic class. Wasting level was higher among children whose mothers attained higher education than secondary with an odds ratio of 0.67 (95% CI: 0.28–1.62), primary 0.724 (95% CI: 0.29–1.83), and uneducated mothers 0.98 (95% CI: 0.43–2.27). The odds ratio of stunting was 0.68 (95% CI: 0.27–1.68; p=0.013) among children aged 36–47 months, lower than children aged 48–59 months. Also, the odds ratio of stunting was higher among children from lower 2.09 (95% CI: 1.24–3.53; p=0.006), and middle socioeconomic classes 1.39 (95% CI: 0.76–2.53; p=0.288) higher socioeconomic class. The odds ratio of stunting was 3.89 (95% CI: 1.13–13.43) higher among children of uneducated mothers, primary 3.31 (95% CI: 0.92–11.90; p=0.067), and secondary 1.67 (95% CI: 0.46–6.02; p=0.436) than mothers who attained higher education.

Conclusion: Maternal education should be encouraged, particularly on the nutrients that should be made available for children under five.

Keywords: Malnutrition, Nutrition, Under-five children, Undernutrition

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INTRODUCTION

Adequate nutrition is critical for the growth and development of children during their formative years [1]. Malnutrition is a pathological state caused by a relative or absolute shortage or excess of one or more necessary nutrients in a given individual or population [2]. It is a deficiency or improper intake of energy and nutrients. It encompasses malnutrition (wasting, stunting, and underweight) and overnutrition (obesity, malignancies, and non-communicable illnesses) [3–6]. It is caused by the combination of poor diet and diseases, which is caused by either not having enough food to eat or not consuming enough of the right foods resulting in nutritional deficiencies in children under five years [1, 7–12].

Social, economic, biological, and environmental variables contribute to insufficient food intake or consuming foods containing proteins of poor nutritional quality, resulting in protein-energy malnutrition (PEM) [6, 13]. Wasting has a low weight-to-height ratio. It denotes current weight loss, which occurs when a child consumes insufficient food or is exposed to infectious diseases such as diarrhea [6, 13]. Stunting is a term that refers to children who are too short for their age [14]. Early childhood malnutrition can cause stunting, which can last a lifetime [6]. Around 149 million children under the age of five are stunted globally. Stunting is due to chronic malnutrition, which is often caused by low socioeconomic level, inadequate maternal nutrition, recurrent sickness, and insufficient infant feeding and cares [6].

Children's malnutrition is one of the leading causes of illness and mortality worldwide, especially in developing nations [1]. It is the primary risk factor for disease burden, accounting for approximately 300,000 deaths per year and more than half of all child deaths [1]. According to the World Health Organization, about 5.4 million children under the age of five die each year, with 2.7 million deaths occurring in Sub-Saharan African countries, including Nigeria [15]. Many studies have found that child malnutrition has a negative impact on their physical growth and a lower intellectual quotient (IQ), increased behavioral problems, poor social skills, and disease susceptibility [1]. Malnutrition in children can lead to greater rates of chronic illnesses in adulthood, which can have intergenerational consequences because malnourished women are more likely to deliver low-weight babies [16, 17].

The burden of chronic malnutrition, particularly undernutrition, experienced by the people of Northeast Nigeria is one of the highest globally, with the region's

population bearing its brunt [14]. Recent nutritional assessments in the region's three worst-affected states, Borno, Adamawa, and Yobe, show varying degrees of malnutrition among children under five and pregnant or nursing mothers [18]. The rate of global acute malnutrition (GAM) in six local government areas (LGAs) in Yobe state (Jakusko, Karasuwa, Machina, Nguru, Yunusari, and Yunufari) is above the 15% emergency threshold. At the same time, five LGAs in northern Borno (Abadam, Mobbar, Guzamala, Kukawa, and Nganzai) have a rate of GAM between 10% and 14% [18]. In general, 2.7 million women and children in Borno, Adamawa, and Yobe states require nutrition assistance, with 310,000 children in need of treatment for severe acute malnutrition (SAM) and 250,000 children suffering from moderate acute malnutrition (MAM) among the most vulnerable [18]. UNICEF helped draw attention to the unfolding crisis in Northeastern Nigeria in July, highlighting that an estimated 244,000 children faced severe malnourishment in Borno State alone and warning that an estimated 49,000 children would die if they did not receive treatment [19].

This study aims to characterize childhood malnutrition among under-five children in Nigeria's northeastern region and explore the factors associated with malnutrition among under-five children in the region.

MATERIALS AND METHODS

Study design

This cross-sectional study design used secondary data from the population-based 2018 Nigeria Demographic and Health Survey (NDHS). The NDHS collected data from August 14 to December 29, 2018, through a stratified three-stage cluster sample design using a sampling frame containing the enumeration areas prepared for 2006.

Population and sample

The study was carried out in Nigeria's northeastern states (Adamawa, Bauchi, Borno, Taraba, and Gombe). Nigeria comprises six geo-political zones (Northeast, Northwest, North-central, Southwest, Southeast, and South-south), with 36 states across these zones and the federal capital territory (FCT Abuja). The Hausas/Fulani and Igbos predominantly populate the northeastern states. The study population includes malnourished under-five children in the northeast part of Nigeria. Nigeria Demographic and Health Survey covers all under-five children. For this research that focuses on children, the under-five children group data was extracted from the female recode datasets of the NDHS data to arrive at the total sample size.

Study variables

Weight-for-age, height-for-age, and body mass index (BMI)-for-age were derived from the new WHO standard/reference. Computed Z scores for BMI-for-age, weight-for-age, and height-for-age were then used to assess underweight, wasting, stunting, overweight, and obesity using the recently published WHO reference standards. Normal height was defined as height-for-age between 2 and +2 Z score, while normal weight was defined as age between 2 and +2 Z score. Stunting and underweight were defined as height and weight-for-age less than -2 Z score, respectively. Wasting was defined as BMI-for-age less than -2 Z score, while obesity was defined as BMI greater than +2 Z score. Overweight was defined as BMI-for-age between +1 and +2 Z score.

Operational definition of variables

In the data set, we identified the anthropological measures and categorized the nutritional status of the subjects based on the WHO standards. Thus, the dependent variable was the nutritional status, while the independent variables were the sociodemographic characteristics of the study population. A class socioeconomic status was used to categorize the economic status of the women to understand how the social economic class influences childhood malnutrition.

Study instruments

The primary data was collected using questionnaires designed for the study. Details about the development, collection, and storage of the data had been previously reported [14]. Essentially, anthropological measurements used for this analysis were obtained by directly measuring the subjects using standardized measuring tools such as weighing scales, height measuring rulers, and tape measurements.

Data analysis

Data analysis was done using IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp. The means of the Z-scores for height-for-age, weight-for-height, and weight-for-age are calculated as summary statistics representing the nutritional status of children in a population. These mean scores describe the nutritional status of the entire population of children without the use of a cut-off point. A mean Z-score of less than 0 (i.e., a negative mean value for stunting, wasting, or underweight) suggests a downward shift in the entire sample population's nutritional status relative to the reference population. The farther away

the mean Z-scores is from 0, the higher the prevalence of malnutrition. A logistics regression analysis was used to estimate the associations between independent variables (age, socioeconomic status, maternal education) and the dependent variable (child malnutrition). The odds ratios were estimated, and all statistically significant association were reported at a p-value less <0.05 and confidence interval of 95%.

Research ethics

Permission to use the 2018 DHS data for this study was obtained from ORC Macro Inc. through email. No individual identifier that could be used to track any respondent was present in the data used.

RESULTS

Sample characteristics

Table 1 shows the sociodemographic data of respondents. Children 12–23 months old made a higher proportion of the study population (36.6%), followed by children under 12 months, while 48–59 months had the least number (8.3%). A significant number of mothers were not educated (64.6%), many (17.1%) had only secondary education, higher than primary (13.9%), and higher education (4.4%). The majority of the respondents were of low socioeconomic class (64.5%), followed by the middle class (19.5%) and upper class (16%). A significant number of the children had normal nutritional status (60.9%).

Table 2 displays the anthropometric information of under-five children in Northeast Nigeria. Children younger than 12 months and 12–23 months had a mean HFA of 0.08, while 24–35 months had a mean HFA of -0.04, 36–47 months (-0.03), and 48–59 months had an HFA of -0.10. Children under 12 months had a mean WFH of -0.05, 24–35 months, -0.02, 48–59 months -0.07, compared to 12–23 months and 36–47 months old who recorded a WFH of 0.08 and 0.04, respectively. The mean weight-for-age (WFA) was 0.28 among children under 12 months, 0.10 for 12–23 months, 0.04 for 24–35 months, 0.05 for 36–47 months, and 0.14 for 48–59 months old children.

Table 3 shows the distribution of nutritional status with sociodemographic and socioeconomic information of the study subjects. The percentage of malnourished children in the northeast was 39.1%, which shows that a significant proportion had normal nutritional levels (60.9%). Normal nutrition constituted 66.7% of children aged 48–59 months, but wasting was found among 21.2% of children below 12 months. A considerably high proportion of children aged 36–47 months were stunted (37.0%), followed by 32.7% among children ages 23–35

Table 1: Sociodemographic characteristics of the study subjects

	Frequency	Percent
Child's age		
<12 months	203	18.8
12–23 months	396	36.6
24–35 months	257	23.8
36–47 months	135	12.5
48–59 months	90	8.3
Maternal education		
No education	698	64.6
Primary	150	13.9
Secondary	185	17.1
Higher	48	4.4
Socioeconomic class		
Lower	697	64.5
Middle	211	19.5
Upper	173	16
Nutritional status		
Normal	658	60.9
Wasting	157	14.5
Stunting	249	23.0
Underweight	5	0.5
Overweight	3	0.3
Obesity	9	0.8
Total	1081	100

Table 2: Anthropometric information of under-five children in Northeast, Nigeria

	Minimum	Maximum	Mean	Std. deviation
<12 months (n = 203)				
HFA	−0.38	8.09	0.08	1.00
WFH	−0.49	10.59	−0.05	0.77
WFA	−2.69	4.52	0.28	0.96
12–23 months (n = 396)				
HFA	−0.43	8.09	0.08	1.23
WFH	−0.52	10.59	0.09	1.42
WFA	−3.20	4.23	0.10	0.96
24–35 months (257)				
HFA	−0.43	8.09	−0.04	0.90
WFH	−0.52	10.59	−0.02	0.67
WFA	−3.34	2.95	0.04	0.87
36–47 months (n = 135)				
HFA	−0.39	8.09	−0.03	1.01
WFH	−0.42	10.59	0.04	0.92
WFA	−2.19	2.06	0.05	0.81

Table 2: (Continued)

	Minimum	Maximum	Mean	Std. deviation
48–59 months (n = 90)				
HFA	–0.41	0.28	–0.10	0.13
WFH	–0.41	0.45	–0.07	0.13
WFA	–2.10	3.21	0.14	0.85
Total = 1081				
HFA	–0.43	8.09	0.02	1.03
WFH	–0.52	10.59	0.02	1.03
WFA	–3.34	4.52	0.12	0.92

WFH: Weight-for-height/length. HFA: Height/length-for-age

Table 3: Distribution of nutritional status with sociodemographic information of the study participants

	Normal	Wasting	Stunting	Underweight	Overweight	Obesity	χ^2 p-value
Child's age							
<12 months	135 (66.5)	43 (21.2)	21 (10.3)	3 (1.5)	0 (0.0)	1 (0.5)	74.064 <0.001*
12–23 months	244 (61.6)	68 (17.2)	76 (19.2)	1 (0.3)	1 (0.3)	6 (1.5)	
24–35 months	146 (56.8)	24 (9.3)	84 (32.7)	0 (0.0)	2 (0.8)	1 (0.4)	
36–47 months	74 (54.1)	10 (7.4)	50 (37.0)	1 (0.7)	0 (0.0)	1 (0.7)	
48–59 months	60 (66.7)	12 (13.3)	18 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Socioeconomic class							
Lower	392 (56.2)	100 (14.3)	190 (27.3)	5 (0.7)	3 (0.4)	7 (1.0)	29.711 0.001*
Middle	141 (66.8)	31 (14.7)	37 (17.5)	0 (0.0)	0 (0.0)	0 (0.0)	
Upper	125 (72.3)	26 (15.0)	22 (12.7)	0 (0.0)	0 (0.0)	0 (0.0)	
Maternal education							
No education	389 (55.7)	105 (15.0)	188 (26.9)	5 (0.7)	3 (0.4)	8 (1.1)	37.332 0.001*
Primary	96 (64.0)	19 (12.7)	34 (22.7)	0 (0.0)	0 (0.0)	1 (0.7)	
Secondary	137 (74.1)	24 (13.0)	24 (13.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Higher	36 (75.0)	9 (18.8)	3 (6.3)	0 (0.0)	0 (0.0)	0 (0.0)	

*Significant at $p < 0.05$; figures in brackets are row percentages.

months. Only five children were underweight, three were overweight, and nine were obese ($p < 0.001$). Wasting was higher among children from the upper socioeconomic class (15.0%), whereas 27.3% were stunted (27.3%). All the underweight, overweight, and obese children were from lower socioeconomic classes ($p < 0.05$). Similarly, the highest proportion of children from mothers with higher education were wasted (18.8%), but 26.9% of children whose mothers were uneducated were stunted. All underweight and overweight children were from mothers without formal instruction ($p < 0.05$).

Bivariate analysis

As shown in Table 4, the odds ratio of wasting was 1.56 (95% CI: 0.77–3.17) among children less than 12

months old and 0.37 (95% CI: 0.69–2.69) among 12–23 years which was higher than 48–59 years though not statistically significant ($p > 0.05$). Also, the odds ratio of wasting for lower socioeconomic class children was 1.08 (95% CI: 0.64–1.85), and the middle class was 1.03 (95% CI: 0.57–1.86), higher than upper socioeconomic class. Wasting level was higher among children whose mothers attained higher education than secondary, odds ratio 0.67 (95% CI: 0.28–1.62), primary 0.724 (95% CI: 0.29–1.83), and uneducated mothers 0.98 (95% CI: 0.43–2.27). The odds ratio of stunting was 0.68 (95% CI: 0.27–1.68; $p = 0.013$) for children 36–47 months, significantly lower than children aged 48–59 years. Also, the odds ratio of stunting was higher among children from lower socioeconomic class, 2.09 (95% CI: 1.24–3.53; $p = 0.006$), and middle class 1.39 (95% CI: 0.76–2.53; $p = 0.288$) than higher socioeconomic class. The odds ratio

Table 4: Logistics regression showing the effects of age, socioeconomic status, and maternal education on child's malnutrition

Variable	Wasting OR (95%CI)	p-value	Stunting OR (95%CI)	p-value
Age in months				
<12	1.56 (0.77–3.17)	0.222	0.49 (0.24–1.00)	0.051
12–23	1.37 (0.69–2.69)	0.366	0.99 (0.54–1.80)	0.970
24–35	0.81 (0.38–1.73)	0.585	1.96 (1.07–3.58)	0.029*
36–47	0.68 (0.27–1.68)	0.402	2.29 (1.19–4.40)	0.013*
48–59	Ref	–	Ref	–
Socioeconomic status				
Lower	1.08 (0.64–1.85)	0.770	2.09 (1.24–3.53)	0.006*
Middle	1.03 (0.57–1.86)	0.928	1.39 (0.76–2.53)	0.288
Upper	Ref	–	Ref	–
Maternal education				
No education	0.98 (0.43–2.27)	0.968	3.89 (1.13–13.43)	0.032*
Primary	0.724 (0.29–1.83)	0.495	3.31 (0.92–11.90)	0.067
Secondary	0.67 (0.28 – 1.62)	0.376	1.67 (0.46 – 6.02)	0.436
Higher	Ref	–	Ref	–

OR-odds ratio; CI-Confidence interval; * Significant at $p < 0.001$

of stunting was higher 3.89 (95% CI: 1.13–13.43) among children of uneducated mothers, primary 3.31 (95% CI: 0.92–11.90; $p = 0.067$), and secondary 1.67 (95% CI: 0.46–6.02; $p = 0.436$) than those whose mothers attained higher education.

DISCUSSION

The prevalence of malnourishment in this study was 39.1%, with 14.5% wasting and 23.0% stunting. Child malnutrition is widespread in most underdeveloped nations, including Nigeria, and various studies have shown the extent and type of malnutrition children suffer. The proportions of wasting and stunting in this study are similar to the report of Babatunde et al. [20], who estimated that stunting and wasting were prevalent in Kwara state at 23.6% and 14.2%, respectively. The prevalence of malnourishment found in this study is slightly higher than 38.7% reported by Kuku-Shitu et al. [11] in southwest Nigeria and also lower than the reports from a cross-sectional study in Ethiopia that 47.3%, 25.6%, and 8.9% of the total 844 children included in the survey were stunted, underweight, or wasting, respectively [7].

This study discovered that while significant numbers of children across all age groups had a normal nutritional status, considerable proportions were still wasting and stunting, with a lower percentage being underweight or overweight. The study discovered that the number of stunted children increased with age, from under 12 months through 36–47 months, then reduced between 48 and 59 months. The study found that children aged

24–35 and 36–47 years were more likely to be stunted. A possible explanation for this may be that stunting results from undernutrition in the first year of life, which becomes increasingly apparent with age. Multiple studies have shown that stunting prevalence increases with age [7, 10]. According to a survey conducted in Imo, Nigeria, most stunted children were between 13 and 24 months [21]. Menalu et al. reported how a child's age was a strong predictor of stunting [7]. Children aged 24–59 months were shown to have a 3.2-fold increased risk of stunting than children aged 0–6 months. The United States Agency for International Development (USAID) discovered that stunting prevalence increases with age, peaking at 46% among children 24–35 months. A cross-sectional study conducted in Ethiopia also revealed that children aged 12–23, 25–34, and 35–59 months were approximately 4.4 times more likely to be stunted than children aged 6–11 months, respectively [1]. This result may be because stunting is a cumulative process that begins in utero and continues approximately five years after birth [1]. Further, Teshome et al. explained that this could be due to care practices, which typically decline as children transition from infant to adult diets [22].

However, several studies reported contradictory findings such as the highest risk of stunting being observed in children aged 12–23 months (12%), but these studies also indicated a high rate of stunting in children aged 36–47 months (12%), which partially correlates with our study [22–24]. Although the prevalence of stunting among under-five children has decreased below 41% seen in 2008; wasting has since increased from 14% in 2008 to 18% in 2013 [10, 25, 26]. Compared to stunting, children under 12 months were more likely to be wasted than

older children, as evidenced by this study. This result may be due to poor food consumption and the increased vulnerability of younger children to illness/infections such as diarrhea [23, 27].

Maternal education was also a predictor in this study in determining the nutritional status of participants. Mothers with higher education were found to have normal children than those with lower educational status. This result may be explained by the increased information and exposure that higher education affords a woman. It was most evident in the stunting category, where women with higher education had the fewest stunted children. Menalu et al. [7] corroborated this finding by stating that children born into families unable to read or write and informally educated had a 4.2- and 2.5-fold increased risk of stunting and malnutrition, respectively, compared to children born into university or college-educated families. This conclusion may be explained by the fact that education can help by empowering mothers to make informed decisions about the type and use of preventative medicine. Without understanding the importance of nutrients, an individual may suffer from malnutrition due to an inability to maintain a healthy, balanced diet. This study's result also relates to Gebre et al., who found that a mother's educational status was a significant predictor of a high prevalence of underweight [1]. The study further explained that the risk of developing underweight was 4.1 times greater for children whose mothers were illiterate than for children whose mothers were literate, indicating that as a mother's educational level grows, the nutritional well-being of her children increases as well [1]. This finding could be because educated mothers would manage their resources more effectively, engage in more health-promoting behaviors, and establish more child-centered caring practices. Yalew also found marginal significance among mothers with no formal education, four times as likely to have stunted children as mothers with at least a primary education [23]. Although Amare et al. indicated that in a setting with a higher illiteracy rate, a low level of parental education, typically below junior secondary, have no significant effect on child undernutrition, this may explain why a higher maternal education had no beneficial effect on children who are wasting in this study [14]. According to Amare et al. "maternal educational status was independently linked with outcome variables." However, Gelu et al. found no significant association between maternal education and children's nutritional status, which may be because the bulk of the sample size was illiterate in Northeast Ethiopia [14, 28]. However, it has been demonstrated that mothers' knowledge of health and nutrition can be used in formal education to reduce malnutrition [9]. Nevertheless, Fadare et al. reported that the current level of mothers' education in Nigeria, particularly in rural areas, appears insufficient to reinforce knowledge and improve nutrition outcomes for children [9].

Our study also found socioeconomic status as a predictor of participants' nutritional status. Children from the upper socioeconomic were significantly more nourished than the middle and lower classes. This result may be due to wealthy households having the resources and being likely to have received the knowledge necessary to provide good nutritional care and suitable diets for their young children. Yalew reported that children from the lowest wealth quintile (16%) were more likely to suffer from stunting than children from the highest wealth quintile (9%) [23]. National Population Commission (NPC) also reported how children in the poorest households are three times as likely to be stunted (54%) as children in the wealthiest families (18%) [25].

Additionally, upper-class individuals are more likely to have access to vital foods for good maternal nutrition, promoting healthy breastfeeding and encouraging breastfeeding for an acceptable length, minimizing the likelihood of malnutrition in children. According to a study conducted in Kwara, Nigeria, children from wealthier quintiles are more likely to be exclusively breastfed for the first six months than those from poorer [11]. However, a study conducted in northern Nigeria discovered that wealth alone does not appear to be sufficient to prevent stunting in young children [14]. This result could be because some upper-class families may be unaware of the nutrients required to nourish a child, make less use of health services, have thinner mothers, or polygamy may unnecessarily divert maternal attention away from the baby [14].

Strengths and limitations of the study

This study is the first to characterize childhood malnutrition and highlight the correlates in the northeastern part of Nigeria to the best of our knowledge. Previous studies focused on other part of the country. Our study observed how poverty and lack of education contributed to children nutrition in the region mostly challenged by insecurity in the country. We highlighted that food insecurity is as terrible as banditry in this part of the country. We also show that promoting tertiary education among women could improve their children's nutritional status. However, one of the study's limitations is that secondary data restricts the researchers to the data already collected. Therefore, we could not provide additional input to the already available data. However, the study's findings provide a sufficient representation of the description of child malnutrition in this region of Nigeria.

CONCLUSION

We observed that a high proportion of under-five children in the northeastern region of Nigeria are

malnourished, which calls for the attention of both the government and non-government organizations, particularly at this period of unrest due to insurgency activities in the region. In addition, the actions of Boko Haram insurgents have deprived many people in this region of their livelihood through farming, which is the primary occupation of the people, resulting in a lack of food and the high level of malnutrition found in our study. Therefore, attention should focus on improving maternal education, encouraging tertiary education among women and alleviation of poverty to improve food security.

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Author Contributions

Oluwasola Stephen Ayosanmi – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

John Agboola – Conception of the work, Design of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Felix Elijah – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Adeyemi Alaga – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be

accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Gloria Ogunlade – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Adaeze Okereke – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Esosa Omoregie – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Ayobami Ajayi – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Osahon Omoregie – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Blessing Eze – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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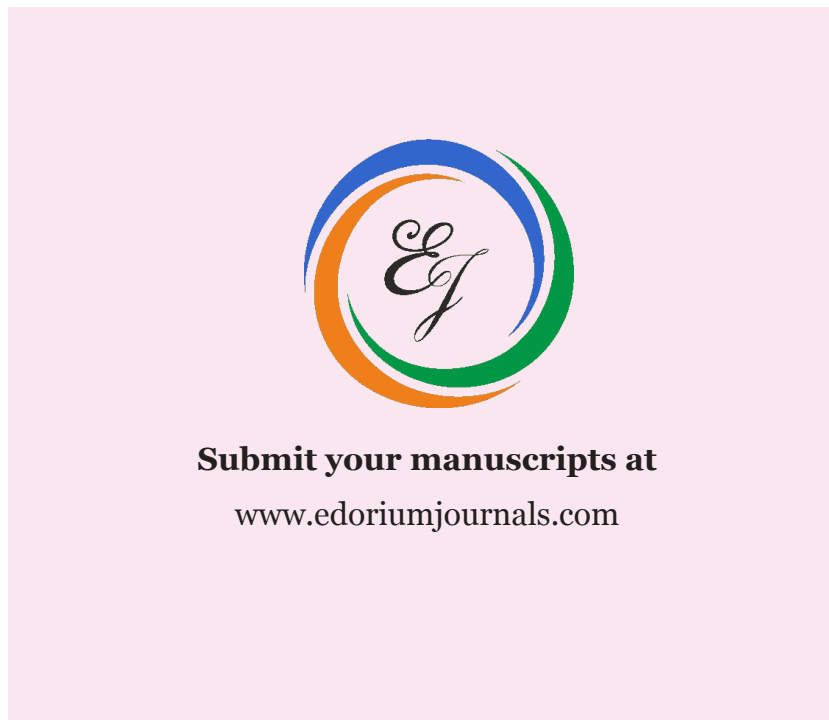
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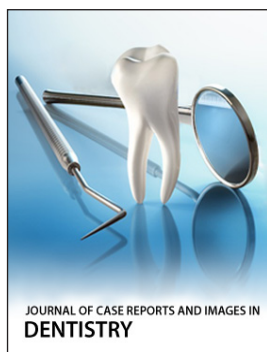
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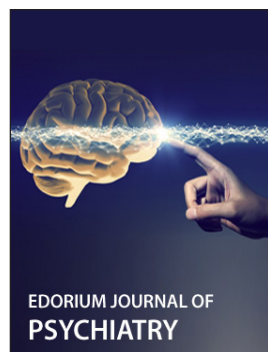
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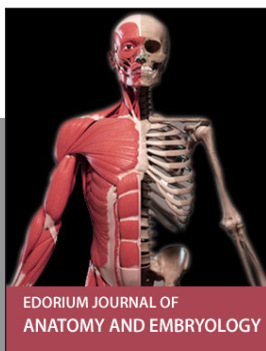
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