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Original Research Article

Household Food Insecurity is a Predictor of Acute Malnutrition but Not Chronic Malnutrition among Children (6-59 Months Old): A Cross-Sectional in Tamale South Constituency

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Abstract: ***Background:*** The influence of household food insecurity on poor child growth has been widely studied. However, there is a lack of clarity in such relationships therefore, more studies are required. Hence, the present study evaluated household food insecurity and sciodemographic determinants of undernutrition in young children (6-59 months old) in Ghana. ***Materials and methods:*** This cross-sectional study was conducted in Tamale South using 240 mother-child pairs. Mothers and their children (6-59 months old) were recruited from child welfare clinics within the Constituency. Data were collected from face-to-face interviews using a structured questionnaire. Child anthropometric data were measured (weight and height/length) based on World Health Organization's prescribed procedures. Child anthropometric Z-scores for the determination of acute and chronic malnutrition were generated using WHO Anthroplus 1.0.4. Household food insecurity access scale (HFIAS) was used to estimate household food insecurity. Binary logistics regression models were run using Statistical Product and Service Solutions version 24.0 to estimate the odds of acute and chronic malnutrition following the independent variables (HFIAS and sciodemographic factors). ***Results:*** The prevalence of acute malnutrition (wasting) was 7.5%. Also, the prevalence of chronic malnutrition (stunting) was 29.2%. In multiple binary logistics regressions model, there was a significant relationship between higher scores of HFIAS and the odds of acute malnutrition [1.34(1.07-1.68); P=0.010]. In the study, children aged 6-23 months had lower odds for chronic malnutrition [0.36 (1.20-0.66); P=0.001] compared with their colleagues (24-59 months old). ***Conclusions****:* In the study, we found a medium and a high prevalence of acute and chronic malnutrition, respectively. Also, HFIAS was a significant predictor of acute malnutrition but not chronic malnutrition. Further, children less than 24 months old compared with those aged 24-59 months old had lower odds for chronic malnutrition. To reduce the odds for acute malnutrition, nutrition and health authorities in the Tamale South Constituency ought to intensify education on strategies to increase household food security status.

Keywords: chronic malnutrition, acute malnutrition, food insecurity, child, Ghana.

BACKGROUND

Malnutrition in children under-five years is a global problem with enormous consequences for health and economic development (UNICEF / WHO / World Bank, 2021).

In 2020, global reports showed that the lives of about 45.4 million and 149.2 million of children under-five years were threatened by wasting and stunting alone (UNICEF / WHO / World Bank, 2021). There is evidence that malnutrition in children younger than five years of age is still a serious public health concern in Ghana. In the Northern Region for instance, a high proportion of children aged five years or younger were found to be stunted (32.5%), wasted (12.9%), and underweight (21.8%) (Saaka, 2014). Further, in the Tamale Metropolis, closed to 40% of children were found to be stunted (Wemakor & Iddrisu, 2018). Globally, in 2020 alone between 720 million to 811 million people were faced with some form of hunger (FAO, 2021). In 2009, about 1.2 million people of Ghanaians were also faced with food insecurity with the highest proportions living in the Northern zone (World Food Programme, 2012).

Although the causes of malnutrition in children are multifaceted (Jonsson, 1992), the role of household food insecurity has been suggested (Betebo *et al*., 2017; Boulom *et al*., 2020). Many households facing food insecurity are often unidentified (Webb *et al*., 2006). Aside household food insecurity (Betebo *et al*., 2017; Boulom *et al*., 2020; Bukania *et al*., 2014; Mutisya *et al*., 2015), sociodemographic factors are also important correlates of child nutritional status (Amugsi *et al*., 2020; Hossain *et al*., 2020). For instance, some studies previously conducted in other countries revealed a positive relationship between household food insecurity and poor child nutritional status (Berra, 2020a; Betebo *et al*., 2017; Bukania *et al*., 2014; Mutisya *et al*., 2015), whereas, others have not *(Osei-Tutu & Anto, 2016; Osei et al.*, 2010). Moreover, in the Tamale Metropolis, a previous study did not find a relationship between HFIAS and indicators of child nutritional status (Saaka & Osman, 2013).

The HFIAS has been a valid tool in detecting households facing various form of food insecurity in developing countries (J Coates *et al*., 2006; Jennifer Coates *et al*., 2007; Maxwell *et al*., 2013). Therefore, the present study evaluated associations of HFIAS and sociodemographic variables with anthropometric indicators of acute and chronic malnutrition in the Tamale South Constituency.

METHODOLOGY

This cross-sectional study was conducted in Tamale South, Ghana. The objective of the study was to assess association of HFIAS and sociodemographic variables with nutritional status of children (6 to 59 months old) using binary logistic regressions model. Therefore, 240 mother-child pairs were randomly selected from child welfare clinics (CWCs) within the constituency guided by recommended criteria for calculating sample sizes for conducting regression analyses (Green, 1991; Jenkins & Quintana-Ascencio, 2020). Data on HFIAS and sociodemographic variables were obtained using semi-structured questionnaires. The HFIAS covers three domains of food insecurity thus, households that experience anxiety and uncertainty regarding the household food supply; households that alter the quality of; and those that reduce the quantity of food they consume. Specifically, HFIAS has nine (9) questions which estimate frequency of occurrence of changes households make regarding quality and quantity of food intake. The reference period is the past 30 days. A household modification of diet quality or quantity can only assume one of a possible three (3) outcomes. The three outcomes were: rare, coded 1 (once or twice in the past 30 days); sometimes, coded 2 (3 to 10 times in the past 30 days); often, coded 3 (> 10 times in the past 30 days). Hence, in the study, total HFIAS ranged from 1-27. A higher score means an increased severity in food security (J Coates *et al*., 2007). The validity of HFIAS in developing countries has been confirmed (J Coates *et al*., 2007).

Child nutritional status was defined using WHO growth standards z-scores. To obtain the Z-scores as indicators of nutritional status of the children, recumbent length and height were computed in children less than 24 months old and those aged 24 months to 59 months old, respectively. These were assessed according to World Health Organization's recommended standards (WHO, 2008). In addition, the sex and date of birth of every child was obtained to help determine age and sex appropriate standard deviations (Z-score). In the study, acute malnutrition was defined according to updates published by WHO thus, weight-for-length/height ≤–2 Z-score Similarly, chronic malnutrition was defined as length/height-for-age ≤–2 Z-score (World Health Organization, 2017).

DATA ANALYSIS

Data analysis was done using statistical product and service solutions version 24.0. Anthropometric Z-scores for the determination of child nutritional status were generated using WHO Anthroplus software version 1.0.4. The effect of HFIAS, mothers' education, sex of household head, sex and age of child on odds for malnutrition indicators were assessed using the binary logistic regressions model. First, bivariate tests were conducted (unadjusted) and in model 2, a

multivariate logistic regressions model was also conducted to estimate adjusted odds ratios at 95% confidence intervals. In the analyses, a p-value less than or equal to 0.05 was considered to be statistically significant.

RESULTS

In study, majority of the mothers lacked formal education (81.2%) and they were mainly farmers (66.3%). Also, the vast majority of the mothers were married (97.1%) and they could be described as a young population since over 80% of them were less than 40 years of age. The study was conducted in a predominantly Dogomba (78.3%) community. Regarding the sex distribution of the children, the proportion of females (58.3%) was slightly higher than the males. Similarly, the proportion of children within 6-23 months old was slightly higher (51.7) than those aged 24-59 months (Table 1).

Table-1: Sociodemographic data of mother-child pairs

Variable	Response Categories	Frequency	Percentage (%)
Education of mother	No formal education	195	81.2
	Formal education	45	18.8
Marital Status	Married	233	97.1
	Not married	1	0.4
	Divorced	6	2.5
	20-29	97	40.4
	30-39	105	43.8
Mother's age/years	40-49	35	14.6
	50-56	3	1.3
Religion	Christianity	14	5.8
	Islam	226	94.2
Ethnicity	Dagomba	188	78.3
	Minority (Akan, Gonja, Frafra, Waala)	52	21.7
	Trader	33	13.7
Mother's occupation	Farmer	159	66.3
	Unemployed	48	20.0
	Male	100	41.7
Sex of child	Female	140	58.3
	6 - 23	124	51.7
Child's age/months	24 - 59	116	48.3

In all, the prevalence of acute malnutrition (low weight-for-height z-score) was 7.5%. Also, the prevalence of chronic malnutrition (low height-for-age z-score) was 29.2% (Table 2).

Table-2: Prevalence of acute malnutrition and chronic malnutrition

Variable	Nutritional status category	Frequency	Percentage (%)
Weight for Height Z-score Classification	*Normal*	222	92.5
	Moderate Acute Malnutrition	17	7.1
	severe Acute Malnutrition	1	0.4
Height for Age Z-score Classification	Severely stunted	4	1.7
	Moderately stunted	66	27.5
	Normal	170	70.9

Moderate acute malnutrition=weight-for-length/height ≤–2 SD and ≥–3 SD of the median, normal = weight-for-length/height > –2 to ≤ +2 SD of the median, overweight=weight-for-length/height >2 SD and ≤3 SD of the median; Severely stunted (severe chronic malnutrition) =length/height-for-age <–3 SD of the median, moderately stunted (moderate chronic malnutrition) =length/height-for-age ≤–2 SD and ≥–3 SD of the median, normal= height/length-for-age > –2 to < +2 SD of the median.

In the unadjusted model, it was found that an increased in the score of HFIAS by one (1) unit was associated with a corresponding increase in the odds of acute malnutrition by almost 1.3 which was statistically significant [1.29(1.05-1.60); P=0.018]. In the multiple covariate model, this relationship was still significant [1.34(1.07-1.68); P=0.010]. In contrast, maternal education, sex of household head, age and sex of child did not reveal a significant association with odds of chronic malnutrition (Table 3).

Table-3: HFIAS and sociodemographic determinants of acute malnutrition (low Weight-for-height Z-score)

	Unadjusted		**Adjusted**	
Variable	OR (CI at 95%)	P-value	OR (CI at 95%)	P-value
HFIAS Total	1.29(1.05-1.60)	0.018	1.34(1.07-1.68)	0.010
Mothers' education				
No formal education (0) (**Ref.**)				
Formal education (1)	0.74(0.23-2.37)	0.610	0.57(0.17-1.99)	0.379
Sex of household head				
Female (0) **(Ref.)**				
Male (1)	1.50(0.19-11.92)	0.703	1.47(0.17-12.37)	0.725
Age of child				
24 - 59 (0) **(Ref.)**				
6 - 23 (1)	1.77(0.63- 4.95)	0.278	1.99(0.68-5.78)	0.209
Sex of child				
Male (0) **(Ref.)**				
Female (1)	0.61(0.23-1.63)	0.321	0.64(0.23-1.76)	0.384

Without the control for the effects of covariates, children aged 6-23 months had lower odds for chronic malnutrition [0.40 (0.22-0.71); P=0.002] compared with their counterparts (24-59 months old). Moreover, in the multiple binary logistics regressions model, the relationship remains unchanged [0.36 (1.20-0.66); P=0.001]. However, HFIAS, maternal education status, sex of household head, and sex of child did not reveal a significant association with odds of chronic malnutrition (Table 4).

Table-4: HFIAS and sociodemographic determinants of chronic malnutrition (low height-for-age Z-score)

	Unadjusted		**Adjusted**	
Variable	OR (CI at 95%)	P-value	OR (CI at 95%)	P-value
HFIAS Total	0.97 (0.87-1.09)	0.616	0.97 (0.86-1.09)	0.573
Mothers' education				
No formal education (0) (**Ref.**)				
Formal education (1)	0.615 (0.31-1.21)	0.161	0.55 (0.27-1.15)	0.112
Sex of household head				
Female (0) **(Ref.)**				
Male (1)	0.38 (0.15-0.95)	0.038	0.42 (0.16-1.09)	0.076
Age of child				
24 - 59 (0) **(Ref.)**				
6 - 23 (1)	0.40 (0.22-0.71)	0.002	0.36 (1.20-0.66)	0.001
Sex of child				
Male (0) **(Ref.)**				
Female (1)	0.86 (0.49-1.51)	0.598	0.84 (0.47-1.51)	0.566

DISCUSSION

The prevalence of acute malnutrition (wasting) and chronic malnutrition (stunting) were 7.5%. and 29.2%, respectively. Comparing these values with expert recommended cut-off points, the prevalence of chronic malnutrition is said to be high, whereas the level of acute malnutrition is within the medium range (De Onis *et al*., 2019). In Ethiopia, findings from a community based cross-sectional study using 6 to 59 months old children found a very high (45.6%) and a high (14.6%) prevalence of stunting and wasting, respectively (Betebo *et al*., 2017). Another cross-sectional study found a medium prevalence of for stunting (16.2%) and wasting (6.3%) (Berra, 2020b). Additionally, a low prevalence (9.4%) of stunting and a very high (17.9%) prevalence of wasting were earlier reported among Ghanaian children in Tamale (Bukari *et al*., 2020). However, in same Tamale, a much higher (39.0%) prevalence of stunting was reported but the prevalence of wasting (8.0%) was within the medium range (Wemakor *et al*., 2018). Based on the above results, it is evident that a regular screening of children for indications of malnutrition would be useful since decisions by policy makers cannot depend on findings from a one-point study. The variations in results as described above may have also resulted from differences in the methodological approaches employed by the studies.

Further, children less than 24 months old compared with those aged 24-59 months old had lower odds for chronic malnutrition. This may be because at 24 months and beyond, the quality of feeding for older infant reduces after 23 months of age. Similalrly, majority of children around 24-59 months are completely weaned from breastmilk hence, they lose the protective effect of the breast milk which may be a possible reason they suffer showed higher odds for

stunted growth than those with 6-23 months. In line with this, a previous study found that being an older child (Khamis *et al*., 2020) was associated with an increased risk of undernutrition in children.

In the present study, higher values of HFIAS were associated with higher odds of acute malnutrition but not chronic malnutrition. Unlike the present findings, results from the earlier study reported from Ethiopia showed that household food insecurity was significantly associated with chronic malnutrition (stunting) but not with wasting (Betebo *et al*., 2017). The relationships between household food security and nutritional status of children remains a controversial topic. For instance, in Ghana within the Tamale Metropolis, a previous study did not also find a relationship between HFIAS and indicators of child nutritional status (Saaka & Osman, 2013). However, in Ethiopia, it was found that higher scores of HFIAS were significantly associated with both chronic malnutrition and acute malnutrition (Berra, 2020b). It is important to prioritize child nutritional status because data show that malnourished children are susceptible to infections (Walson & Berkley, 2018) and a higher risk for poor academic performance (Abebe *et al*., 2017; Graff *et al*., 2010). The findings of the study may guide nutrition and health decision makers in the Northern region to formulate strategies that are required for the promotion of child nutritional status. However, the cross-sectional design used in the present study made it impossible to assess causal relationship between HFIAS and child malnutrition indicators. Further, the 240 mother-child pairs used in the study was also relatively small hence, may have a high statistical power to clearly establish patterns in relationships between sociodemographic variables and the odds of child nutritional status. Notwithstanding that, the adjusted logistics regressions model conducted may have ruled out potential confounding effects among the independent variables.

CONCLUSION

In all, a medium (7.5%) and a very high (29.2%) prevalence of acute malnutrition and chronic malnutrition were found among the children, respectively. Also, higher scores of HFIAS were associated with higher odds for acute malnutrition. Moreover, a positive association was found between age of children and odds of chronic malnutrition. To reduce the odds for acute malnutrition, nutrition and health authorities in the Tamale South Constituency ought to intensify education on strategies to increase household food security status. Also, mothers of children aged 24-59 months old ought to be encouraged to adhere to appropriate feeding practices to protect the children against chronic malnutrition.

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