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Effect of Household Food Insecurity on the Nutritional Status of Children under Five in North Kassala; Kassala State, Eastern Sudan

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Abstract **Background:** Food insecurity still a major public health problem in Sudan. This study aim to assess the effect household food insecurity - which was about 38.7% of household in the study area - on the nutritional status of children less than five years in north Kassala localities, Kassala State, eastern Sudan. **Method:** The study was cross-sectional including 445 household distributed in 16 villages using specially designed questionnaire. Multi-cluster random technique was used to collect data. Only HH with children under five years were included in the study. **Results:** Stunting, wasting and underweight were reported in 52.1%, 35.6% and 53.9% respectively. The relationship of nutrition status of children and HH food security was statistically non-significant. **Conclusion:** The prevalence of malnutrition among children in the study area was very high. Improving household food security may be necessary but not sufficient to improve the nutritional status. Other risk factors such as maternal education, avoiding certain types of food and controlling childhood infections must be corrected.

Keywords: *food security, stunting, wasting and underweight*

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1. Introduction

In Sudan, approximately 2.7 million children under five suffer from malnutrition annually, out of whom 522,000 suffer from severe acute malnutrition.

Food insecurity is a major public health problem in Sudan, affecting some 38.7% of households in the study area [1]. Food security exists when all people at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preference for an active and healthy life. [2] It is usually measured by food availability, accessibility, and utilization [3].

The magnitude of HH food insecurity in Sudan is still not well estimated and its contribution on the nutritional status in children under five is unclear. This study aim at addressing the relationship between households food insecurity and malnutrition in children in North Kassala localities.

Malnutrition is defined as 'the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions'. [4] Malnutrition is a significant public health problem in developing countries; more than 50% of the 10 million deaths each year are attributed either directly or indirectly to malnutrition in children younger than 5 years. In sub-Saharan Africa, 30% of children have protein-energy malnutrition (PEM). [5]

Lack of access to highly nutritious foods, especially in the present context of rising food prices, is a common cause of malnutrition. Poor feeding practices, such as inadequate breastfeeding, offering the wrong foods, and not ensuring that the child gets enough nutritious food, contribute to malnutrition. Infection, particularly frequent or persistent diarrhea, pneumonia, measles and malaria

also undermines a child's nutritional status. [5] Sudan has one of the highest malnutrition rates in the Middle East and North Africa regions. [6] In addition to the above mentioned factors; other elements such as unusual exclusive breast feeding during the first six months of life ; use of outdoors open defecation instead of a proper toilet; lack of hand washing, and very young mothers are more likely to deliver low weight babies. Exclusive breastfeeding for the first six months is critically important to a child surviving and thriving. But there is a belief amongst mothers in Sudan that breast milk turns bad once the mother gets pregnant, so it should no longer be used to feed young children. [6]

In Kassala state the percentage of stunted (low height for age) in children under five is 55%, where as 15% are wasted. [6] The etiology of malnutrition is very complex and it appears that food insecurity does not necessarily result in malnutrition especially among children. The aim of this study was to assess the effect of households food insecurity- already estimated by the research team as 38.7% [1]- on the nutritional status of children in North Kassala localities, namely Hamishkoreib, Telkook, and North Delta.

2. Methods

A cross-sectional community based study was conducted in three localities in North Kassala State (Hamiskoreib, Telkok, North Delta), during 2016- 2017, as part of the project titled “Effect of Household food insecurity on the nutritional status of women and children under five in North Kassala localities” that was funded by Ministry of Higher Education and Scientific research. Multi-cluster random technique was used to collect data from 445 HH from three localities. Participation from each locality depends on the proportionality of the number of HH in each locality and each selected HH should include at least one child less than five years.

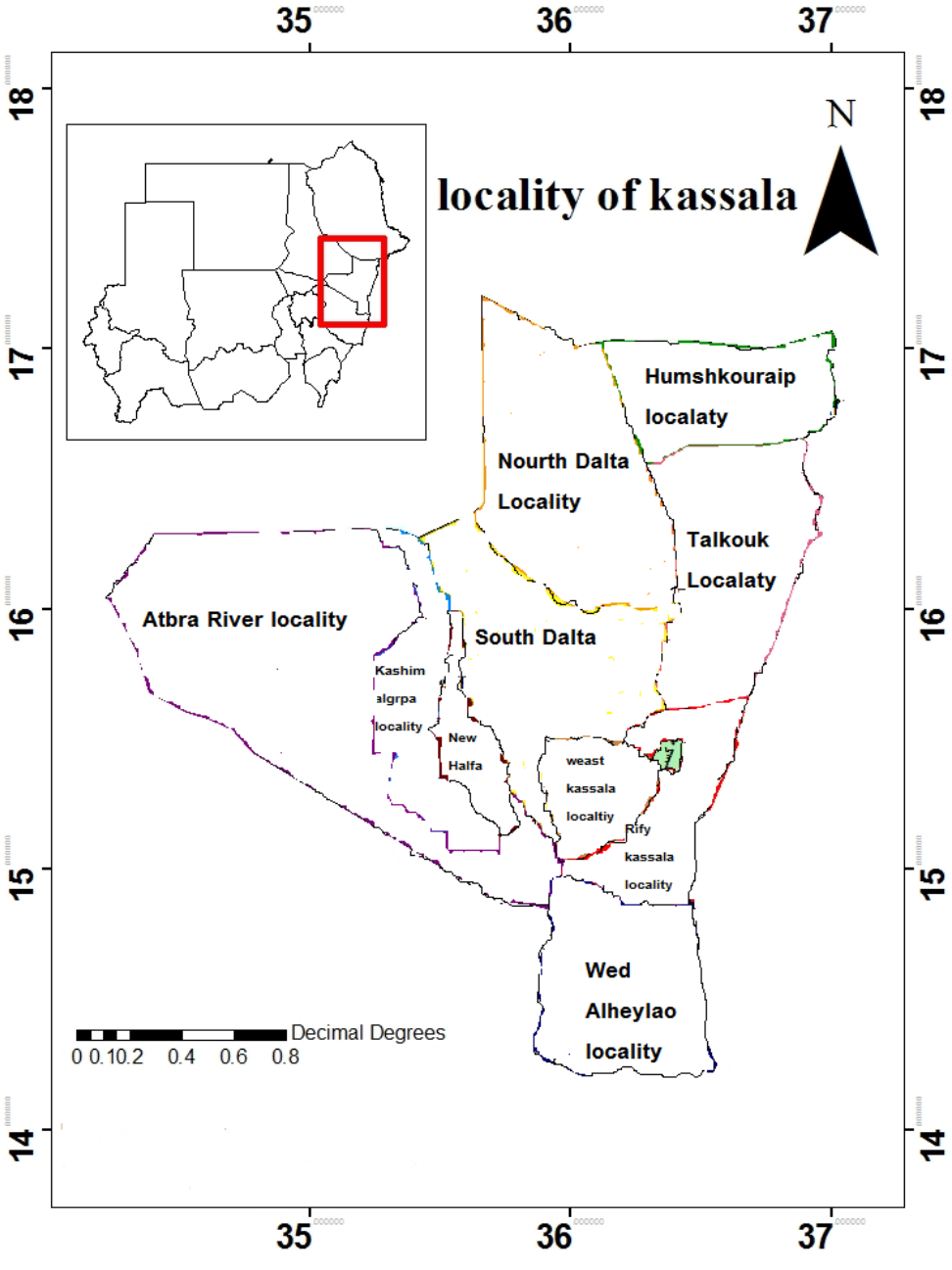

Figure 1. Kassala state map

Inclusion criteria: Households with women in reproductive age (15 - 49 years) with children aged 6 to 59 months resident in North localities. Mother/child pairs were chosen at the household level.

Exclusion criteria: Household who live in the area for less than six months, mothers in reproductive age and had child greater than 5 years, and also those who refused to participate.

2.1. Data Collection

General information including demographic characteristics, socioeconomic status, dietary habits and pattern of food consumption were collected. Height and weight of children under five was measured to assess their nutritional status. Anthropometric measurements such as height, weight, and age of children 6 to 59 months were converted into z-scores using the WHO reference growth curves. Weight-for-height, height-for age, and weight-for-age were calculated. The collected data was cleaned, analyzed using SPSS software (v20.0). Frequencies, logistic regression and chi-square tests were used to assess statistical significance.

2.2. Anthropometric Measurements and Reference Indices

Health scales were used for anthropometric measurement. They were standardized before using. The instruments were checked and calibrated on a daily basis. Height measurement was in centimeters (cm) to the nearest 0.1 cm and weight was measured in kilogram (kg) to the nearest 0.5 kg. All measurements were taken in light closes without shoes to children in age 24 to 59 months. For children in age 6 to 23 month, the measurement of length was done using a portable infantometer (specialized wooden device). The child was placed on his/her back and the head was placed so that it is against the top end. The knees were gently pushed down by a helper. WHO AnthroPlus was used to compute nutrition indices and the results were classified according to World Health Organization cut-off points. Underweight, wasting, and stunting among children were defined as WAZ, WHZ, and HAZ less than 2 SD below the WHO growth standards, respectively.

3. Results

A total of 778 of children were eligible to assess their nutrition status, however, 119 (15.3%) were excluded due to incomplete data, leaving 659 (84.7%) for evaluation. The assessed children sex ratio was 1.1 male to female, their age ranged from 6 to 59 months with mean (30.18 ± 14.34 M); they were grouped in ≤ 24 months 294 (44.6%) and > 24 months 365 (55.4%). Table 1 shows the general characteristics of studied group. Their HH sized ranged from 3 to15 with median 6. Among the total children, 457 (69.35%) were food secure

Table 1. General characteristics of the studied group

Character	Children age 6 to 24 months	Children age 25 to 59 months	Total
Sex:			
male	156	182	338
Female	138	183	321
Locality:			
Hamishkoreib	102	158	260
North Delta	58	64	122
Telkook	134	143	277
HH size:			
≤ 6 members	94	125	219
>6 members	200	240	440
Food security:			
secure	212	245	457
insecure	82	120	202

3.1. Anthropometric Measurement

Height and weight were measured for 659 of total number of children. Statistically there were significant differences (P= .000) in mean of height (82.376± 12.0 cm) and weight (9.967 ± 2.9 kg) at 95% CI (-73.17, -71.64).

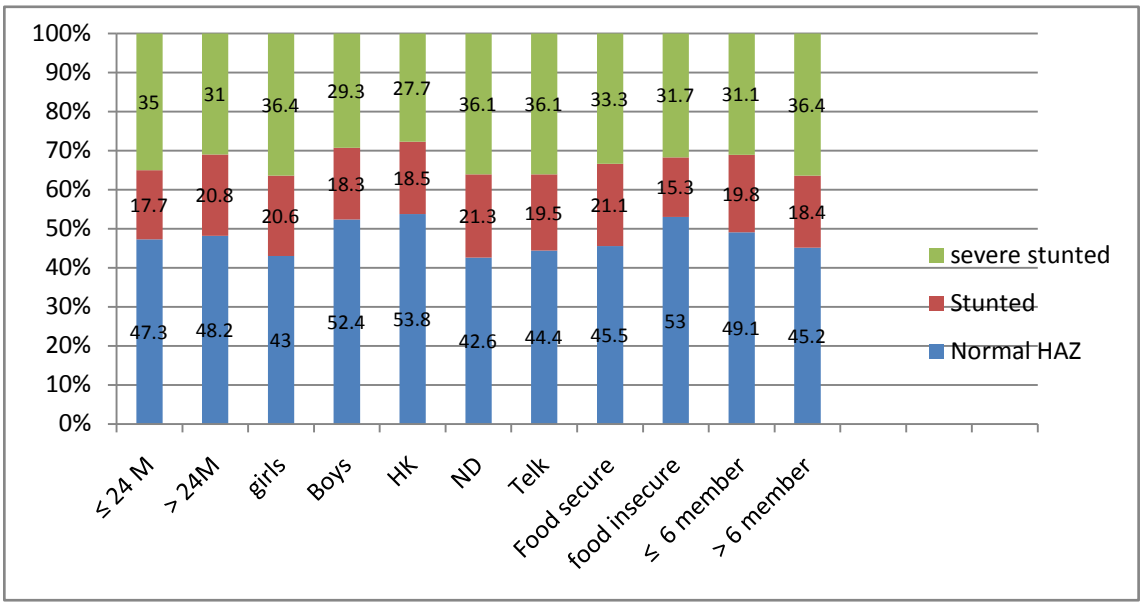

Figure 2. Illustrates Height for age (HAZ) according to age, sex, localities, food security and HH size

Stunted was prevalent in 344(52.1%) of children that ranged from moderate 19.4% to severe 32.8%. It was high among girls (55.1%) with significant difference (P=0.049) compared to boys, and it was slightly greater in age ≤ 24M with non-significant differences.

Among the food secure HH 54.5% of children were stunted, contrary the prevalence of stunted was less in food insecure HH (47%).

Wasting (weight for height) was reported in 235 (35.7%) which was ranged from moderate 91(13.8%) to severe 144(21.9%). The prevalence of wasted looked similar between boys and girls. The prevalence was slightly high among the group of age >24 M. Surprisingly, it was significantly (P< 0.01) high (36.8%) among children from food secure HH compared to 33.1% of chidern from food insecure HH.

Weight for age (underweight) was prevalent in 355 (53.9%). The prevalence of underweight was slightly high among boys 57.1% compared to girls 51.5%, and greater in age group >24months. The prevalence of underweight among children from food secure HH was 53.4%, which was relatively near to those from food insecure HH (55%).

Among the studied children, only 130 (19.7%) were not suffered from any form of malnutrition, while 84 (12.7%) had experience of all forms of malnutrition (stunted, underweight and wasted), while the remaining (67.6%) had experience of one or two forms of malnutrition.

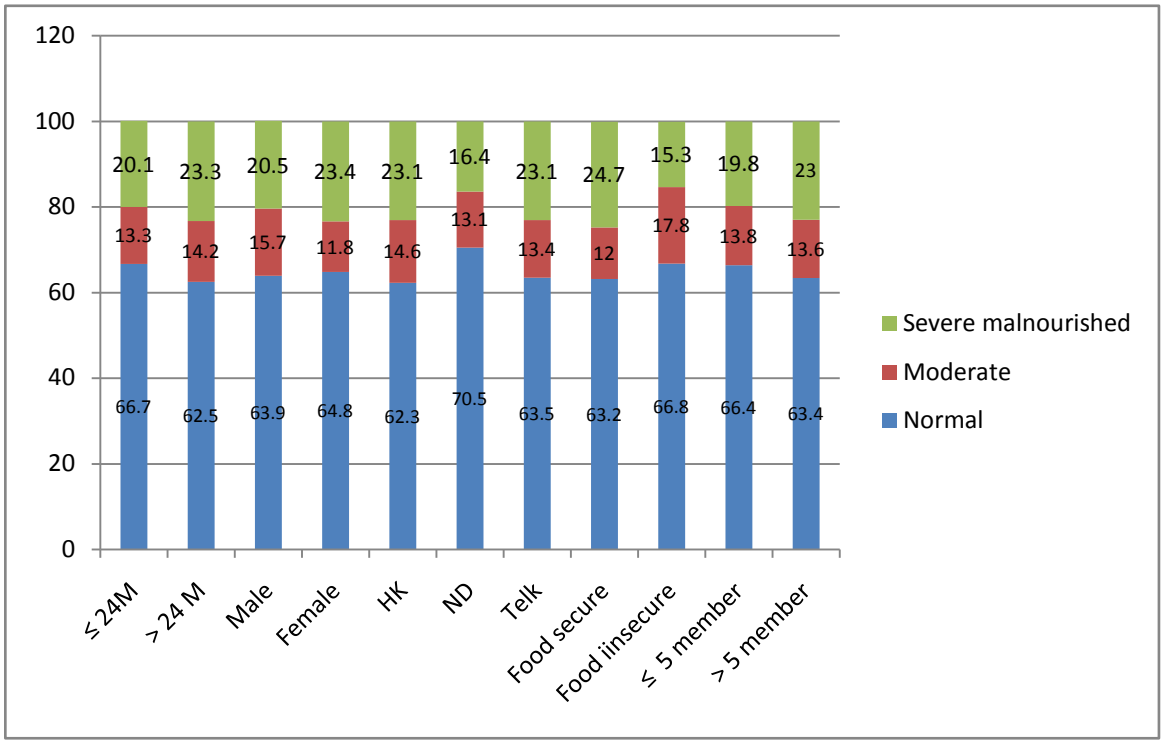

Figure 3. Illustrates weight for height (WHZ) according to age, sex, localities, food security and HH size

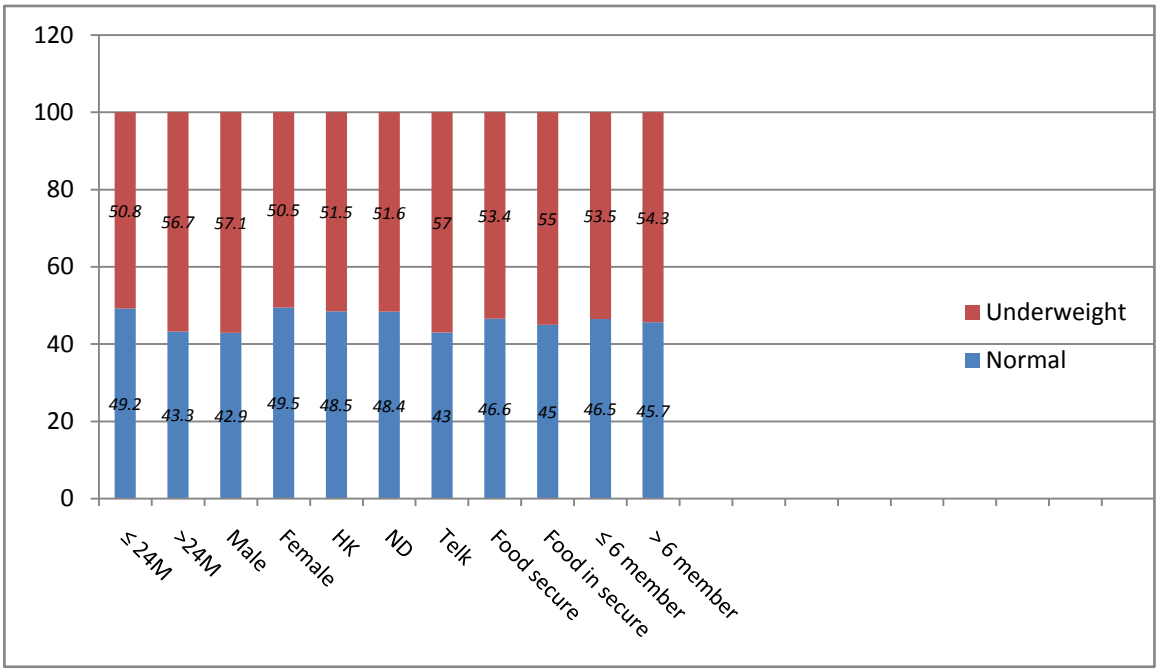

Figure 4. Illustrates weight for age(WAZ) according to age, sex, localities, food security and HH size

Table 2. Prevalence of malnutrition and related factors

Nutrition status	Stunted		Wasted		Underweight	
Factor	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Mother education	-0.47	0.06	-0.011	0.966	-0.21	0.41
Household Size	-0.27	0.12	0.26	0.16	0.094	0.58
HH illness	0.116	0.49	-0.22	0.21	0.12	0.99
HH assets	-.054	0.05	-0.022	0.49	-0.01	0.7
Food avoidance	0.113	0.55	0.28	0.16	0.65	0.001
HH Food insecurity	0.08	0.65	-0.07	0.67	0.07	0.68
Constant	-0.01	0.9	-0.78	0.004	-0.4	0.11

3.2. Nutrition Status and Related Factors

Coefficient of correlation was used to test for relationship of nutrition status of children (z-scores of height for age, weight for height and weight for age) with mother education, HH size, HH illness, assets, avoidance of certain type of food and overall HH food security.

As shown below (Table 2) there was a negative correlation of mother education with prevalence of malnutrition, and as expected, improving mother education decreases the prevalence of stunting and underweight by 47% and 21% respectively. Avoiding certain type of food that is rich of animal protein, for example chicken and fish, increased the prevalence of stunted, wasting and underweight by 11.3%, 28.0% and 65.0% respectively. Unexpectedly, the result showed that the relationship between the prevalence of malnutrition and food security was statistically non-significant despite that both stunted and underweight were increased by 8% and 7% respectively in food insecure.

4. Discussion

The purpose of this study was to determine the effect of household food insecurity on the nutritional status of children aged 6 to 59 months in North Kassala localities. Inadequate food security is one of the underlying causes of malnutrition and therefore it would be expected to see a link between indicators of food insecurity and those of malnutrition. As a part of this survey the prevalence of food insecurity was 38.7% in the study area. [1]

Coefficient of correlation was used to test for relationship between household food insecurity and the three indices of nutritional status of children controlling the effect of other independent variables. It is one of the few studies which assess this relationship in Sudan. Children in the present study showed growth retardation, where the overall prevalence of stunting, wasting and underweight was 52.1%, 35.6% and 53.9% respectively. This high rate of malnutrition in the study area is higher than the global rate where the prevalence of stunting, wasting and underweight for children under-five was estimated as 26%, 8% and 16% respectively. [7]

It was also higher than the Sudan National Survey from 2018 which revealed a malnutrition rate around 36.6% and 14.1% for stunted and wasting respectively for all over the country. Even in Kassala State the same survey reported rates of 43.8%, 8.1% for stunted and wasting respectively [8]. According to WHO classification this rate of stunting among the study group is classified as very high (higher than 40%) [9].

Wasting, stunting and underweight were higher in the present study than in other comparable studies. One study conducted in Ethiopia showed that the overall prevalence of malnutrition among under-five children was 45.6% for stunting, 14.6% for wasting and 26.3% for underweight [10].

The rate was also higher compared with a study performed in Nigeria which showed that the rates of stunting, wasting and underweight were 39.3%, 6.3% and 14.1% respectively. [11]

Another study conducted in Nepal indicated that the rate of malnutrition among children is one of the highest in the world. Data from the 2011 Nepal Demographic and Health Survey (NDHS 2011) indicated that 41% of children under 5 years of age were stunted, 11% were wasted, and 29% were underweight [12], but this is still lower than the rate in our present study.

Again in Bangladesh the rate was lower where they recorded that about 36% children were stunted, 8% wasted and 24% underweight. [13]

Only one study carried in India was analogues to the present findings where stunting was observed in 53% of children, wasting in 28% and underweight in 60% of children. [14] This is probably because both areas are suffering from hot, dry climate and reduced rainfall season.

Correlation coefficients were used to test for relationship of nutrition status of children and HH food security. What was unexpected in this study was the statistically non-significant relationship although stunted and underweight were increased by 8% and 7% respectively in food insecure HH, though the prevalence of wasting was almost similar in food secure and insecure households. The above mentioned study from Ethiopia showed that household food insecurity was associated with stunting and underweight but not with wasting. Children living in food insecure households had higher risk to be underweight and stunted than children living in food secure households. [10]

Where as in the Nigerian Household study food security was significantly associated with wasting. Households that were food insecure were five times more likely to have wasted children than the households that were food secure. [11]

Again in Bangladesh household food insecurity was found to be associated with underweight and stunting but not with wasting. [13]

In Nepal stunting and underweight were significantly associated with household food insecurity. The association between household food insecurity and wasting was not significant. [11]

This non-significant correlation between nutrition status of children and HH food security, indicate that other contributing risk factors are involved in this high rate of malnutrition. Beside severe poverty predominant in this area, one of these factors is mother education which has a negative correlation with prevalence of stunted; improving of mother education will decrease the prevalence of stunting by 47%. On the other hand avoiding certain type of foods that are rich in animal protein will increase the prevalence of stunted by 11.3%. It is clear that improving food security is necessary but not sufficient to improve the nutritional status of children. These findings indicate that other risk factors of malnutrition should be corrected, such as improving maternal education, improving feeding practices regarding avoiding certain types of food and controlling childhood infections. Information on the association between household food insecurity and nutritional status of children is presently insufficient in Sudan.

5. Conclusion

The prevalence malnutrition among under five children in North localities was high. Improving household food security may be necessary but not sufficient to improve the nutritional status of children. Good eating habits can be achieved by designing education programs to improve knowledge, skills, and attitudes related to healthy eating and food preparation. More attention is needed towards maternal education. Malnutrition and other associated factors are a common source of considerable morbidity and mortality of children. If food insecurity is a contributing or causal factor in malnutrition, preventing it might reduce the stunting or underweight and other associated diseases. Necessary steps should be taken to ensure food security of these poor households to prevent highly prevalent under nutrition in this population and in similar settings elsewhere in Sudan.

6. Limitations of the Study

Although our hypothesis was that food insecurity leads to malnutrition, it must be emphasized that the cross-section nature of the study does not allow us to state that the associated factors are the definitive related risk factors. The study was not designed to assess the effect of seasonal variation in household food insecurity. Other related aspects such as genetics related information and the access to prenatal and child health services was not included in the study. Nevertheless, this study is the first in Sudan which describe the association of food insecurity and child nutritional status and further researches are needed to find out the dimensions of this issue and find appropriate interventions.

Abbreviations

HH: household; PEM: Protein-energy malnutrition; WAZ: Underweight; WHZ: Wasting; HAZ: Stunting; WHO: World health organization

Ethical Approval and Consent to Participate

Ethical clearance was obtained from the University of Kassala and health office. Communication was through formal official letters to localities under study that provided an official letter to local authorities of all selected areas. Informed verbal consent was obtained from each participant before the interview. The rights of members not to take part and not to answer the query they do not want to answer were ensured. To ensure the confidentiality of participants, anonymous coding was used.

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Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent for Publication

Not applicable.

Competing Interests

No conflict of interest

Authors' Contributions

MAD, FAK, AKM, MAA and AAM had contribution on Study design. Data collection: AMH, SSM, AOA, IMM, FAK and MAD. Data management and analysis were performed by FAK and MAD. Analyzed data were revised and approved by all the authors. Manuscript was written by FAK and MAD, revised by AAM and approved by all authors.

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