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Original Research Article

Assessment of nutritional status of children aged 6–59 months among internally displaced populations in Dongola locality, Northern State, Sudan

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ABSTRACT

Background: Malnutrition remains a major public health problem among children under five years, especially in conflict settings. Internally displaced children are more vulnerable to malnutrition due to food insecurity, poor living conditions, and limited access to health and nutrition services. This study aimed to assess the nutritional status of internally displaced children in Northern State, Sudan, in 2024.

Methods: A community-based analytical cross-sectional study was conducted from April to May 2024 among internally displaced children aged 6–59 months residing in school shelters in Dongola locality, Northern State, Sudan. A multistage sampling technique was used to recruit 150 children. Data were collected using interviewer-administered questionnaires and anthropometric measurements. Nutritional status was assessed using World Health Organization growth standards. Chi-square, bivariate, and multivariable logistic regression analyses were performed to identify factors associated with wasting and stunting.

Results: The prevalence of wasting and stunting was 39.3% and 51.3%, respectively. Wasting was significantly associated with lack of maternal education (AOR=7.38; 95% CI: 1.93–28.18) and poor maternal health status (AOR=17.93; 95% CI: 5.57–57.85). Stunting was significantly associated with younger child age (<12 months AOR=14.66, 95% CI: 3.37–63.83), poor maternal health (AOR=4.59; 95% CI: 1.52–13.83) and early discontinuation of breastfeeding (AOR=3.38; 95% CI: 1.51–7.63).

Conclusions: There is a high burden of wasting and stunting among internally displaced children in Dongola locality. Maternal education, maternal health, and infant feeding practices were significant determinants. Strengthening nutrition and maternal-child health interventions is urgently needed.

Keywords: Under nutrition, Internally displaced children, Wasting, Stunting, Sudan

INTRODUCTION

Malnutrition remains one of the most significant public health challenges affecting children under five years of age worldwide. Nutritional status refers to the balance between nutrient intake and the body's requirements for growth, development, reproduction, and overall health maintenance.[1] Adequate nutrition during early childhood is essential for optimal physical growth, cognitive development, immune function, and long-term health outcomes.[2] Conversely, inadequate nutrition during this critical period can impair physical and cognitive development and increase children's susceptibility to infectious diseases and chronic health conditions later in life.[3]

Children under five years of age are particularly vulnerable to the effects of under nutrition because of their rapid

growth and high nutritional requirements.[4] As a result, nutritional indicators among children in this age group are widely used as sensitive markers of community health and socioeconomic development.[5] Under nutrition among children arises from a complex interaction of multiple factors operating at individual, household, and community levels. These factors include low birth weight, suboptimal breastfeeding and complementary feeding practices, inadequate dietary diversity, poor maternal education, low household socioeconomic status, place of residence, and recurrent childhood infections.[6] The immediate causes of under nutrition are insufficient dietary intake and repeated infections, which together compromise children's growth, development, and survival.[7]

Globally, malnutrition continues to represent a major public health concern despite decades of nutrition interventions. In 2022, an estimated 149 million children under five years of age were stunted, 45 million were wasted, and 37 million were overweight.[8] The burden of under nutrition remains disproportionately concentrated in low- and middle-income countries. Under nutrition is responsible for approximately 45% of deaths among children under five years of age, highlighting its substantial contribution to global child mortality.[9]

In the African and Middle Eastern regions, malnutrition remains highly prevalent due to poverty, food insecurity, political instability, and population displacement.[10] Regional analyses indicate that stunting prevalence ranges between 20% and 50%, while wasting prevalence varies between 3% and 21% in several countries across the region[10]. Studies consistently identify maternal education, household income, and child feeding practices as major determinants of child nutritional status.[11,12] Evidence further shows that children born to mothers with limited education are significantly more likely to experience under nutrition compared to those born to educated mothers.[12]

Sudan continues to experience one of the highest burdens of child malnutrition in the region. Even before the escalation of armed conflict in 2023, malnutrition among children under five years of age was already a major public health concern.[13] Approximately three million children were affected by acute malnutrition, including more than 600,000 cases of severe acute malnutrition.[13] Poverty, limited access to healthcare services, maternal malnutrition, and food insecurity has contributed significantly to the persistence of child malnutrition in the country.[14]

The situation has worsened considerably following the outbreak of armed conflict in Sudan in April 2023, which resulted in widespread population displacement and disruption of health and nutrition services.[15] By late 2023, millions of people had been internally displaced, placing immense pressure on already fragile health systems and humanitarian resources. The crisis has also been compounded by shortages of essential health resources and a high burden of communicable diseases, including malaria, pneumonia, and diarrheal illnesses.[16]

Food insecurity has intensified considerably in the context of conflict and displacement. According to the integrated food security phase classification, large parts of Sudan have remained in serious or critical food insecurity phases since 2020.[17] As a result, many households have adopted crisis coping strategies such as reducing meal frequency and compromising dietary quality. Although Northern State has historically been relatively more food secure than other regions, the influx of internally displaced persons, rising food prices, and disruptions to agricultural production have increased the risk of food insecurity in the state.[18]

Northern State has received a large number of internally displaced persons fleeing conflict-affected areas such as Khartoum and Darfur. Many displaced families are currently living with relatives, in rented houses, or in public buildings such as schools.[19] The influx of displaced populations has placed additional pressure on local food systems, healthcare services, water supply, and sanitation infrastructure. Children living in these conditions are particularly vulnerable to malnutrition and infectious diseases due to limited access to adequate nutrition, safe water, sanitation, and healthcare services.

Despite the increasing humanitarian burden in Northern State, there is limited empirical evidence describing the nutritional status and associated determinants among internally displaced children aged 6–59 months in Dongola locality.[20] The absence of localized data limits the ability of policymakers and humanitarian organizations to design effective nutrition interventions and allocate resources efficiently.[21] Therefore, assessing the nutritional status of internally displaced children and identifying the factors associated with malnutrition in this setting is essential for guiding evidence-based interventions and improving child health outcomes.

Research questions

What is the prevalence of malnutrition among children aged 6–59 months living in IDP settings in Dongola locality, Northern State, Sudan? What socio-economic and demographic factors are associated with the nutritional status of these children? And how do dietary intake and infant feeding practices influence their nutritional status?

METHODS

Study design

A community-based analytical cross-sectional study was conducted from April to May 2024 to assess the nutritional status of internally displaced children aged 6–59 months in Dongola locality, Northern State, Sudan.

Study area

The study was conducted in Dongola locality, the administrative center of Northern State, Sudan, located on the western bank of the River Nile approximately 534 km north of Khartoum. The locality consists of four administrative units with an estimated population of about 154,733 people.[22] The climate is characterized by hot dry summers and relatively cold winters.[23] Agriculture, trade, and artisanal gold mining represent the main economic activities in the area.[24]

Following the armed conflict in Sudan in 2023, Dongola locality received internally displaced persons from Khartoum State, many of whom were accommodated in schools and other public buildings used as temporary shelters.[24]

Study population

The study population consisted of internally displaced children aged 6–59 months who were residing in school shelters in Dongola locality during the study period.

Sampling technique

A multistage sampling technique was used. School shelters hosting displaced families were considered clusters, and a random selection of shelters was conducted. Lists of eligible children were obtained from shelter administrators, and participants were selected using simple random sampling.

Sample size

The minimum sample size was calculated using the finite population.

$$Finite\ population: n' = \frac{n}{1 + \frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2\ N}}$$

The finite population formula was used because the total population of children in the study area is limited.

Where: z is the z score, ε is the margin of error, N is the population size, and $\hat{p}$ is the population proportion.

With expected prevalence of 32% and marginal error of 5%, and with confidence interval 95%, Z equal to 1.96. A total of 150 internally displaced children aged 6-59 months were included in the study.

Data collection

Data were collected using a structured questionnaire administered to mothers or caregivers. Anthropometric measurements were conducted according to the standards of the World Health Organization. Weight and height or lengths were measured to assess nutritional status using weight-for-height, height-for-age, and weight-for-age indicators. Mid-upper arm circumference (MUAC) and oedema were also assessed.

Data analysis

Data were entered and analyzed using statistical package for the social sciences (SPSS) version 25. Descriptive statistics were used to summarize the variables. The Chi-square test and logistic regression analysis were applied to identify factors associated with wasting and stunting. Statistical significance was considered at $p<0.05$.

Ethical considerations

Ethical approval was obtained from the Ethics Committee of the Ministry of Health, Northern State, Sudan. Written informed consent was obtained from parents or guardians before participation, and confidentiality of the participants' information was strictly maintained.

RESULTS

Socio-demographical characteristics

As shown in Table 1, a total of 150 children aged 6 to 59 months were included in the study. Slightly more than half of were male (54.7%), compared to females (45.3%). The majority of children were aged 12 and 35 months (44.0%), followed by 48–59 months (23.3%), 36–47 months (20.0%), and under 12 months (12.7%). The median age of the children was 30.00 months (IQR=29).

Most of households consisted 5-8 members (54.0%), while 38.0% had fewer than five members, and 8.0% had more than eight. The median family size was five members (IQR=2).

In terms income, more than half of the families (56.0%) reported no income, 28.7% earned between 9,000–35,000 SDG, 6.0% earned between 36,000–162,000 SDG, and only 9.3% earned more than 162,000 SDG.

Regarding maternal education, only 8.7% had no formal education, while 91.3% were educated at different levels. Additionally, 80.7% of mothers were reported healthy, whereas 19.3% were categorized as not healthy.

In addition to socio-demographic information, the nutritional history and feeding practices of the children were examined to understand the factors influencing their nutritional outcomes.

Nutritional history and feeding practices

According to Table 2, the majority of children (81.3%) had birth weights between 2,500 and 3,500 grams, while 14.7% were born weighing less than 2,500 g and 4.0% weighed more than 3,500 g.

Table 1: Basic characteristics of children aged (6 to 59 months) among internally displaced people in Dongola locality, Northern state, Sudan, 2024 (n=150).

Variable	Frequency	Percent (%)
Gender		
Male	82	54.7
Female	68	45.3
Age group (months)		
<12	19	12.7
12-35	66	44.0
36-47	30	20.0
48-59	35	23.3
Median (IQR) of age	30.00 (29) months	
Family size (members)		
<5	57	38.0
5-8	81	54.0
>8	12	8.0
Median (IQR) of family size	5.00 (2) members	
Average monthly income of the family provider		
Not working	84	56.0
9,000-35,000	43	28.7
36,000–162,000	9	6.0
>162,000	14	9.3
Mothers' educational level		
Not educated	13	8.7
Educated	137	91.3
Mothers' health status		
Healthy	121	80.7
Not healthy	29	19.3

Complementary feeding was introduced before 6 months in 41.3%, of the children, at 6 months in 40.0%, and after 6 months 18.7% of children. Continuous breastfeeding up to 24 months was reported for 42.7% of children, while 57.3% discontinued before that age. Most children (60.0%) consumed fewer than three meals per day, while 30.7% had at least three meals, and 9.3% had more than three. Shelter meals constituted the main diet for 65.3% of the children, followed by special meals prepared by their families (27.3%), combined meals (5.3%), and nutritional meals from healthcare centers (2.0%). only 6.0% of children consumed snacks, indicating low snack consumption among the study population.

To assess dietary diversity, the frequency of consumption of different food groups (nuts and seeds, vegetables, meat, fish and eggs, and oils/fats) was analyzed. The results are presented in Table 3. The findings indicate that 44.7% of the children did not consume any nuts/seeds, 68.7% did not consume vegetables, 70.0% did not consume meat/fish/eggs, and 75.3% did not consume oils/fats. Only a small portion of participants consumed these items one to three times per week, indicating poor dietary diversity among them.

To assess the actual nutritional condition of the children, anthropometric measurements were collected and analyzed.

Table 2: Nutritional history and feeding practices among children aged (6 to 59 months) in internally displaced people in Dongola locality, Northern state, Sudan, 2024 (n=150).

Variable	Frequency	Percent (%)
Birth weights (in grams)		
<2500	22	14.7
2500-3500	122	81.3
>3500	6	4.0
Age of complementary food introduction		
Before 6 months	62	41.3
At 6 months	60	40.0
After 6 months	28	18.7
Breastfeeding continuity (up to 24 months)		
Continued	64	42.7
Discontinued	86	57.3
Daily meal frequency		
<3	90	60.0
At least 3	46	30.7
>3	14	9.3
Type of meal		
Shelter meal	98	65.3
Special meals	41	27.3
Nutritional meals	3	2.0
Combined	8	5.3
Snacks eating		
Yes	9	6.0
No	141	94.0
Previous history of malnutrition		
Yes	16	10.7
No	134	89.3

Nutritional status based on anthropometry and associated risk factor

As demonstrated in Table 4, based on weight-for-height (WFH) classification, the majority (60.7%) of children had a normal nutritional status, 20% were mildly wasted, 9.3% moderately wasted, and 10% severely wasted. The median WFH Z-score was -0.45 (IQR=2.35).

For height-for-age (HFA), classification that 48.7% of children were classified as normal, 22.7% as mildly stunted, 16.7% as moderately stunted, and 12.0% as severely stunted. The median HFA Z-score was -1.08 (IQR=2.01).

In addition to WFH and HFA indicators, MUAC was also assessed as an additional indicator of acute malnutrition. MUAC, measurements 94.7% of children had normal measurements, while 5.3% were classified as having mild-

to-moderate malnutrition, the median MUAC was 14.50 cm (IQR=2.00 cm). Subsequently, bivariate analysis was conducted to explore the relationship between child characteristics and malnutrition indicators.

Table 3: Type of meal among the studied children aged (6 to 59 months) in internally displaced people in Dongola locality, Northern state, Sudan, 2024 (n=150).

Type	Frequency per week	Frequency	Percent (%)
Nuts and seeds	Once per week	47	31.3
	Twice per week	16	10.7
	Three times per week	13	8.7
	More than three times per week	7	4.7
	None	67	44.7
Vegetables and their products	Once per week	28	18.7
	Twice per week	16	10.7
	Three times per week	3	2.0
	More than three times per week	0	0
	None	103	68.7
Meat, fish, and eggs	Once per week	28	18.7
	Twice per week	15	10.0
	Three times per week	2	1.3
	More than three times per week	0	0
	None	105	70.0
Oils and fats	Once per week	24	16.0
	Twice per week	12	8.0
	Three times per week	1	0.7
	More than three times per week	0	0
	None	113	75.3

Table 4: Nutritional status based on anthropometry among children aged (6 to 59 months) in internally displaced people in Dongola locality, Northern state, Sudan, 2024 (n=150).

Variable	Subgroup	Frequency	Percent (%)
WFH Z score classification (wasting status)	Normal	91	60.7
	Mild	30	20.0
	Moderate	14	9.3
	Severe	15	10.0
	Median (IQR)	-0.45 (2.35)	
HFA Z score classification (stunting status)	Normal	73	48.7
	Mild	34	22.7
	Moderate	25	16.6
	Severe	18	12.0
	Median (IQR)	-1.08 (2.01)	
MUAC classification (in cm)	Normal	141	94.7
	Mild-to-moderate	8	5.3
	Severe	0	0
	Median (IQR)	14.50 (2.00)	

Bivariate associations

As shown in Table 5, wasting was significantly associated with previous malnutrition (68.8% versus 35.8% p=0.011), discontinued breastfeeding (47.7 versus 28.15, p=0.015), low maternal education (69.2% versus 36.5% p=0.021), and poor maternal health (86.7% versus 27.5% p<0.001).

Table 6 shows stunting was significantly associated with younger age (<12 months: 78.9% versus 53.0-31.4% p=0.009), previous malnutrition (75.0% versus 48.5% p=0.045), discontinued breastfeeding (62.8% versus 35.9% p=0.001), lower household income (58.1% versus 14.3% p=0.016), and maternal health status (70.0% versus 46.7% p=0.022).

Table 7 indicates that MUAC classification was significantly associated only with child age, where children under 12 months had higher abnormal MUAC (15.8% versus 7.6% p=0.029). For contingency tables

where expected cell counts were less than five, Fisher's exact test was applied instead of the Chi-square test, as it provides more accurate p values under these conditions. This approach enhances the validity of the bivariate analysis. To identify the independent predictors of malnutrition, binary logistic regression was performed.

Table 5: Relationship between child basic characteristics and WFH classification among children aged (6 to 59 months) in internally displaced people in Dongola locality, Northern state, Sudan, 2024.

Variable	Normal		Abnormal		P value
	N	%	N	%	
Sex					
Male	49	59.8	33	40.2	0.802
Female	42	61.8	26	38.2	
Age of the children (in months)					
<12	13	68.4	6	31.6	0.178
12-35	41	62.1	25	37.9	
36-47	21	70.0	9	30.0	
48-59	16	45.7	19	54.3	
Family size (members)					
<5	31	54.4	26	45.6	0.462
5-8	52	64.2	29	35.8	
>8	8	66.7	4	33.3	
Average monthly income of the family provider					
Not working	54	64.3	30	35.7	0.660
9,000-35,000	23	53.2	20	46.5	
36,000–162,000	6	66.7	3	33.3	
>162,000	8	57.1	6	42.9	
Educational level of the mother					
Educated	87	63.5	50	36.5	0.021*
Not educated	4	30.8	9	69.2	
Health status of the mother					
Healthy	87	72.5	33	27.5	<0.001*
Not healthy	4	13.3	26	86.7	
Birth weight (grams)					
<2500	9	40.9	13	59.1	0.102*
2500-3500	79	64.8	43	35.2	
>3500	3	50.0	3	50.0	
Age of food introduction					
Before 6 months	34	54.8	28	45.2	0.192
At 6 months	36	60.0	24	40.0	
After 6 months	21	75.0	7	25.0	
Continuous breastfeeding (24 months)					
Continued	46	71.9	18	28.1	0.015
Discontinued	45	52.3	41	47.7	
Previous malnutrition					
Yes	5	31.3	11	68.8	0.011
No	86	64.2	48	35.8	

*Fisher's Exact test used when expected cell count <5, p<0.05. Chi-square test was used for categorical variables where all expected cell counts were ≥5, while Fisher's exact test was used when expected counts were <5.

Binary logistic regression

Results from table 8 reveal the predictors of abnormal WFH among the studied children. Logistic regression analysis showed that low maternal education (AOR=7.38, 95% CI: 1.93-28.18, p=0.003), poor maternal health (AOR=17.93, 95% CI: 5.57-57.58, p<0.001) were independent predictors of abnormal WFH among children aged 6-59 months. Discontinued breastfeeding showed an elevated risk but did not reach statistical significance (AOR=2.20, 95% CI: 0.96-5.07, p=0.064).

Table 9 highlights the predictors of abnormal HFA identified through logistic regression analysis. Younger child age was a strong predictor of stunting (<12 months: AOR=14.66, 95% CI: 3.37-63.83, p<0.001, 12-35 months:

AOR=4.02, 95% CI: 1.42-11.35, p=0.009, 36-47 months: AOR=4.78, 95% CI: 1.45-15.73, p=0.010). Low household income was also significant not working: (AOR=9.98, 95% CI: 1.79-54.55, p=0.009, 9,000-35,000 SDG: AOR=10.30, 95% CI: 1.73-61.18, p=0.010). poor maternal health (AOR=4.59, 95% CI: 1.52-13.83, p=0.007), and discontinued breastfeeding (AOR=3.38, 95% CI: 1.51-7.63, p=0.003) were also significant predictors. "A logistic regression model was not performed for the MUAC variable because the number of abnormal cases was very small (only 8 out of 150 children). Logistic regression models require an adequate number of events per variable (EPV), with at least 10 events recommended for each predictor to obtain stable and unbiased estimates (Harrell et al and Vittinghoff and McCulloch). In this study, the EPV for MUAC was for below this threshold (EPV<1). Sparse outcome data also increase the risk of odel separation and non-convergence, making regression analysis unreliable (Van Semden et al). Therefore, MUAC was excluded from the regression analysis." In summary, maternal health and education, breastfeeding practices, and household income emerged as key determinants of malnutrition among displaced children in Dongola. These results underscore the need for integrated public health interventions.

Table 6: Relationship between child basic characteristics and HFA classification among children aged (6 to 59 months) in internally displaced people in Dongola locality, Northern state, Sudan, 2024.

Variable	Normal		Abnormal		P value
	N	%	N	%	
Sex					
Male	43	52.4	39	47.6	0.310
Female	30	44.1	38	55.9	
Age of the children (in months)					
<12	4	21.1	15	78.9	0.009
12-35	31	47.0	35	53.0	
36-47	14	46.7	16	53.3	
48-59	24	68.6	11	31.4	
Family size (members)					
<5	25	43.9	32	56.1	0.557
5-8	41	50.6	40	49.4	
>8	7	58.3	5	41.7	
Average monthly income of the family provider					
Not working	18	41.9	25	58.1	0.016
9,000-35,000	6	66.7	3	33.3	
36,000–162,000	12	85.7	2	14.3	
>162,000	18	41.9	25	58.1	
Educational level of the mother					
Not educated	66	48.2	71	51.8	0.331
Educated	6	46.2	7	53.8	
Health status of the mother					
Healthy	64	53.3	56	46.7	0.022
Not healthy	9	30.0	21	70.0	
Birth weight (gram)					
<2500	11	50.0	11	50.0	0.838*
2500-3500	60	49.2	61	50.8	
>3500	2	33.3	4	66.7	
Age of food introduction					
Before 6 months	31	51.7	29	48.3	0.887
At 6 months	29	46.8	33	53.2	
After 6 months	13	46.4	15	53.6	
Continuous breastfeeding (24 months)					
Continued	41	64.1	23	35.9	0.001
Discontinued	32	37.2	54	62.8	
Previous malnutrition					
Yes	4	25.0	12	75.0	0.045
No	69	51.5	65	48.5	

*Fisher's Exact test. Chi-square test was used for categorical variables where all expected cell counts were ≥5, while Fisher's exact test was used when expected counts were <5

Table 7: Relationship between child basic characteristics and MUAC classification among children aged (6 to 59 months) in internally displaced people in Dongola locality, Northern state, Sudan, 2024.

Variable	Normal		Abnormal		P value
	N	%	N	%	
Sex					
Male	79	96.3	3	3.7	0.469*
Female	63	92.6	5	7.4	
Age of the children (in months)					
<12	16	84.2	3	15.8	0.029*
12-35	61	92.4	5	7.6	
36-47	30	100.0	0	0	
48-59	35	100.0	0	0	
Family size (members)					
<5	54	94.7	3	5.3	>0.999*
5-8	76	93.8	5	6.2	
>8	12	100.0	0	0	
Average monthly income of the family provider					
Not working	78	92.9	6	7.1	0.853*
9,000-35,000	41	95.3	2	4.7	
36,000–162,000	9	100.0	0	0	
>162,000	14	100.0	0	0	
Educational level of the mother					
Educated	130	94.9	7	5.1	0.525*
Not educated	12	92.3	1	7.7	
Health status of the mother					
Healthy	115	95.8	5	4.2	0.198*
Not healthy	27	90.0	3	10.0	
Birth weight (gram)					
<2500	21	95.5	1	4.5	>0.999*
2500-3500	115	94.3	7	5.7	
>3500	6	100.0	0	0	
Age of food introduction					
Before 6 months	60	96.8	2	3.2	0.509*
At 6 months	55	91.7	5	8.3	
After 6 months	27	96.4	1	3.6	
Continuous breastfeeding (24 months)					
Continued	63	98.4	1	1.6	0.139*
Discontinued	79	91.9	7	8.1	
Previous malnutrition					
Yes	21	95.5	1	4.5	0.204*
No	115	94.3	7	5.7	

*Fisher's Exact test

Table 8: Predictors of abnormal WFH among children aged (6 to 59 months) in internally displaced people in Dongola locality, Northern state, Sudan, 2024 (n=150).

Predictor	COR (95% CI)	P value	AOR (95% CI)	P value
Educational level of the mother				
Educated	1			
Not educated	3.92 (1.15-13.37)	0.029	7.38 (1.93-28.18)	0.003
Mother's health status				
Healthy	1			
Not healthy	17.14 (5.56-52.86)	<0.001	17.93 (5.57-57.85)	<0.001
Continuous breastfeeding (24 months)				
Continued	1			

Continued.

Predictor	COR (95% CI)	P value	AOR (95% CI)	P value
Discontinued	2.33 (1.17-4.64)	0.016	2.20 (0.96-5.07)	0.064
Previous malnutrition				
Yes	3.94 (1.29-12.02)	0.016	2.89 (0.77-10.85)	0.117
No	1			

Table 9: Predictors of abnormal HFA among children aged (6 to 59 months) in internally displaced people in Dongola locality, Northern state, Sudan, 2024 (n=150).

Predictor	COR (95% CI)	P value	AOR (95% CI)	P value
Age of the children (in months)				
<12	8.18 (2.20-30.44)	0.002	14.66 (3.37-63.83)	<0.001
12-35	2.46 (1.04-5.83)	0.040	4.02 (1.42-11.35)	0.009
36-47	2.49 (0.91-6.86)	0.077	4.78 (1.45-15.73)	0.010
48-59	1			
Average monthly income of the family provider				
Not working	7.62 (1.61-36.19)	0.011	9.89 (1.79-54.55)	0.009
9,000-35,000	8.33 (1.66-41.90)	0.010	10.30 (1.73-61.18)	0.010
36,000–162,000	3.00 (0.39-23.07)	0.291	6.48 (0.64-65.86)	0.114
>162,000	1			
Mother's health status				
Healthy	1			
Not healthy	2.67 (1.13-6.30)	0.025	4.59 (1.52-13.83)	0.007
Continuous breastfeeding (24 months)				
Continued	1			
Discontinued	3.01 (1.54-5.89)	0.001	3.38 (1.51-7.63)	0.003
Previous malnutrition				
Yes	3.19 (0.98-10.38)	0.055	2.51 (0.61-10.41)	0.204
No	1			

DISCUSSION

Malnutrition among internally displaced children represents a major public health challenge in conflict-affected settings. Armed conflict and displacement increase the risk of under nutrition through food insecurity, poor living conditions, and limited access to health and nutrition services. Evidence suggests that displaced children often experience higher levels of wasting and stunting compared with non-displaced populations.[24,25]

The findings of this study showed a high prevalence of wasting (39.3%) and stunting (51.3%) among internally displaced children aged 6–59 months in Dongola locality, indicating a severe burden of both acute and chronic malnutrition. These findings are considerably higher than national estimates reported by the Sudan simple spatial survey method (S3M II), which documented lower prevalence rates of under nutrition among under-five children. The elevated prevalence observed in Dongola may be explained by the effects of displacement, food insecurity, and disruption of health and nutrition services following the recent conflict in Sudan.[15,26]

Maternal education and maternal health status were identified as important determinants of wasting. Children whose mothers had no formal education were significantly more likely to be wasted compared with those whose mothers were educated. Previous research has demonstrated that maternal education and maternal health strongly influence childcare practices, feeding behavior, and access to healthcare services, which ultimately affect child nutritional outcomes.[11,12]

Regarding stunting, younger age, low household income, poor maternal health, and early discontinuation of breastfeeding were significant predictors. Poverty and suboptimal infant feeding practices are well-established determinants of chronic under nutrition in low- and middle-income countries. These findings are consistent with global evidence highlighting the importance of optimal breastfeeding practices and improved household socioeconomic conditions in preventing stunting.[27,28]

Despite the important insights provided by this study, several limitations should be acknowledged. The cross-sectional design limits the ability to establish causal relationships between the identified determinants and nutritional outcomes. In addition, the study was conducted in a single locality, which may limit the generalizability of the findings to other displaced populations.[29]

CONCLUSION

In conclusion, this study demonstrates a high burden of wasting and stunting among internally displaced children

in Dongola locality. Strengthening maternal health services, improving maternal education, promoting optimal breastfeeding practices, and addressing household economic vulnerability are essential strategies to reduce under nutrition among displaced children in Sudan.

Recommendations

Maternal education should integrate nutrition counselling and support into health services. Maternal health services should prioritize antenatal/postnatal care and illness management. Breastfeeding support should be promoted for sustained breastfeeding up to 24 months with complementary feeding. Economic support should be given to strengthen social protection, including cash and food assistance. Future research should be conducted for longitudinal/interventional studies to evaluate program effectiveness.

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