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ORIGINAL ARTICLE

Infant, Child, and Adolescent Nutrition

Risk factors associated with Severe Acute Malnutrition (SAM) in children aged 6 – 59 months in the Mokolo Health District, Far North region of Cameroon

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ABSTRACT

Background: Childhood malnutrition remains a pressing public health concern in Cameroon particularly in the Far North region, where 5.2% of children under the age of five suffer from severe acute malnutrition (SAM), and 38.2% experience stunted growth. Chronic poverty, household food insecurity, lack of education and inadequate healthcare infrastructure contribute significantly to this alarming prevalence. This study aims to contribute to the mitigation of malnutrition in the Far North Region of Cameroon by identifying specific risk factors associated with SAM among children aged 6 – 59 months in the Mokolo health district. **Subjects and Methods:** A cross-sectional descriptive study enrolled 150 participants who met the inclusion criteria, employing consecutive sampling methodology. Data were collected through a face-to-face interview with participants, supplemented by a comprehensive assessment of hygienic practices and food security within the community. Bivariate and multivariate conditional logistic regression analysis were utilized to explore determinants of SAM. Independent variables with p values ≤ 0.05 were considered significantly associated with the nutritional status of children. **Results:** Gastroenteritis, Adjusted Odd Ration (AOR) = 12.3 (5.5 – 27.5, p < 0.001), malaria AOR = 6.2 (2.8 – 13.8, p < 0.006) and pneumonia AOR = 6.7 (1.3 – 34.4, p = 0.01) emerged as specific comorbidities associated with SAM. Moreover, late introduction of complementary feeding AOR = 2.98 (1.36 – 6.53, p = 0.014), low food diversification AOR = 5.3 (2.5 – 11.8, p < 0.001) and the use of unhygienic traditional concoctions AOR = 2.8 (1.4 – 5.6, p = 0.004) were identified as significant risk factors. Furthermore, 63.3% of the participants reported inadequate access to safe drinking water (e.g., boreholes, wells, and streams) and 46.7% of caretakers had no formal education. **Conclusion:** In addition to malaria, pneumonia and gastroenteritis, poor nutritional and hygienic practices serve as specific determinants of SAM. Addressing these challenges requires urgent attention to improve the nutritional status of children aged 6 – 59 months emphasizing nutrition education alongside comprehensive multi-sectorial interventions.

Key words: Risk factors, Severe Acute Malnutrition, Children aged 6-59 months, Mokolo, Far-North Cameroon.

ARTICLE INFORMATION

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1 Introduction

Malnutrition encompasses deficiencies, excesses or imbalances in nutrient intake, essential nutrient imbalances, or impaired nutrient utilization [1]. Globally, in 2020, an estimated 159 million children under 5 years suffered from stunting, 45 million were wasted and 38.9 million were overweight with 45% of deaths among this age group attributed to malnutrition. Malnutrition poses a significant challenge worldwide especially among children under five [2]. There is a notable variation in hunger levels and trends across the Sub-Saharan regions, with approximately 26.7% of

undernourished individuals residing in Western Africa and 20.3% in Central Africa [3]. This disparity may contribute to the stark survival odds faced by children in Sub-Saharan African countries, where 1 in 13 children dies before reaching the age of 5, a rate 20 times higher than that of regions such as Australia and New Zealand [4]. Although the prevalence of stunting in children under five in Africa has gradually decreased, it remains high at 30.7% [5].

In this context, Cameroon mirrors other countries, with a prevalence of 11 %, 29%, 4 % and 11 % for underweight, stunting, wasting and overweight, respectively, among children under 5 years with approximately 20 % of them experiencing diarrhea [6]. In 2019, the World Food Program (WFP) and the Cameroon government initiated the Blanket Supplementary Feeding Program (BSFP) in the Far North region, aiming to deliver various services, including household food assistance, specialized nutritious food, social and behavior change communication, healthcare and water, sanitation, and hygiene services. Although this program targeted children aged 6 to 24 months to prevent malnutrition and treats Moderate Acute Malnutrition (MAM), numerous other interventions and programs are ongoing in the region to combat malnutrition. Despite these efforts, the prevalence of Severe Acute Malnutrition (SAM) continues to rise.

This paradox is evident in the Far North region of Cameroon, where chronic malnutrition remains a significant threat of children under the age of five, with 38.2% suffering from this condition, while 1.4% are severely acutely malnourished [7]. The nutritional status of children in this age group is crucial for assessing the economic and health conditions of the country. Given this scenario, there is an urgent need to investigate additional factors contributing to malnutrition among children under five in this region.

SAM represents the most extreme and visible form of undernutrition, often intertwined with chronic poverty, household food insecurity and lack of education. Economic status stands as a fundamental determinant of malnutrition and serves as a pathway to various underlying causes. In a community-based matched case-control study, Dahal et al. [8] identified low economic status, birth intervals of less than 2 years, breastfeeding frequency of less than 8 times per day and household food insecurity as significant determinants of SAM. Similarly, a study conducted in the Bara district of Nepal, found that maternal age at birth (<20 years) and short birth intervals (<12 months) were associated with SAM [9].

Malnutrition appears to be a complex outcome influenced by various factors, including cultural, religious, and hygienic practices. Research conducted by Karim et al. [10] on acute malnutrition and its determinants of preschool children in Bangladesh provides evidence of this. In this cross-sectional study, households with unhygienic latrines were found to be associated with SAM. Additionally, in the Rajshahi district of Bangladesh, religion was identified also a risk factor of SAM with families belonging to the Hindu or other religions exhibiting higher rates of SAM. This suggests that religious beliefs may impact children's nutritional status, potentially influencing their food preferences.

Malnutrition remains a significant challenge in Cameroon especially among children in the Far North region. Since 2013, Boko-Haram has escalated its attacks in the region, resulting in civilian casualties, property destruction and kidnappings. These attacks have created an unstable environment disrupting food availability and forcing people to flee their farmlands. Consequently, access to adequate food and healthcare has become challenging, significantly impacting children's nutritional status [11]. The current study aims to identify specific risk factors and practices associated with SAM in the Mokolo Health District. The findings will be instrumental in informing policymakers and stakeholders in the health sector to plan targeted interventions combating SAM in the Far North region of Cameroon.

2 Subjects and Methods

2.1 Target population

The current study was based on children aged 6 to 59 months within the Mokolo health district, specifically targeting those seeking consultation or admission to the Integrated Health Centre (IHC), ensuring strict adherence to predetermined inclusion criteria. Inclusion criteria comprised children aged 6 – 59 months presenting with SAM, delineated by a Mid-Upper Arm Circumference (MUAC) under 11.5 cm or a Weight-for-Height Z-score (WHZ) below -3 Standard Deviation (SD) the World Health Organization (WHO) reference median. Conversely, age-matched peers without SAM were included if their MUAC exceeded 13.5 cm and WHZ ranged between -1 SD and +1 SD from the WHO reference median [12]. Participation required the presence of a mother or caretaker as the informant. Exclusion criteria encompassed children outside the specified age range of 6 – 59 months, as well as any mother-child dyad within this age bracket declining participation in the study.

2.2 Study area

Cameroon, delineated into ten administrative regions allocates three of these regions – Adamawa, North and the Far North – to its northern domain. The expansive Far North region, spanning 34 246 km^2 hosts a populace exceeding 3000 000 individuals [13]. Mokolo positioned as the administrative hub and principal urban center within the

Mayo-Tsanaga Division of Cameroon's Far North region assumes prominence as the fourth most populous municipality in the region, succeeding Maroua, Yagoua, and Kousseri. It is in the Mandara Mountains that run along the Cameroonian-Nigerian border. The Mayo-Tsanaga Division is one of the most densely populated Division of Cameroon. Fulfulde, serving as the predominant lingua franca of the Far North region, holds sway as the prevailing vernacular within the environs of Mokolo, particularly concentrated within its urban nucleus. Mayo-Tsanaga constituting one of the six divisions within Cameroon's Far North region, designates Mokolo as its administrative capital with a population of approximately 333 305 inhabitants [13].

2.3 Study type and study period

An observational, cross-sectional descriptive study employing face-to-face interviews with admitted to or seeking care at integrated health centers within the Mokolo health district on the survey date was undertaken. The study period spanned from April 30th to June 30th, 2022, encompassing a total of 10 integrated health centers situated within he Mokolo health district.

2.4 Sample size

A non-probability convenience sampling method was employed to conduct the survey within a selection of 10 integrated health centers situated in the Mokolo health district. In consideration of various factors including financial constraints, security concerns, geographical accessibility, and operational capacity, the sampling strategy prioritized efficiency and feasibility. Consequently, the following health areas were selected: Magoumaz, Mandaka Chechem, Mokolo 2, Mokolo 1, Ouro-Tada, Zamai Grede, Ldamang, Ziling, and Minawao, reflecting a balanced representation across the 25 health areas within the Mokolo Health District.

Utilizing the statistical formula delineated in reference [14] the calculation of a feasible sample size proceeded as follows:

$$n = t^2 \frac{p\,(1-p)}{m^2}$$

Where:

n= required sample size.

t= reliability coefficient at 95% confidence interval.

P=prevalence of 1.4% for SAM of in the far north region of Cameroon [7]

m= Margin of error at 5% (standard value 0.05).

$$n = 1.96^2 \frac{0.014\,(1-0.014)}{0.05^2} = 21$$

Using this formula, n=21 was the required sample size.

Using the ratio 1:2 for severely acute malnourished cases to non-severely acute malnourished cases, the minimum sample size required was 63 participants (21 severely acute malnourished cases against 42 non-severely acute malnourished cases). To mitigate potential non-retention or loss to follow up, an additional 87 parent/infant pairs were included, resulting in a total sample size of 150. This comprises 50 cases of SAM and 100 cases of non-SAM.

2.5 Tools and data collection technique

The tools used in collecting data were a questionnaire to assess some sociodemographic characteristic, comorbidities feeding, hygienic and other individual household and child care practices; an observation guide to provide pictures of some foodstuffs being sold in the market and the nature of the main sources of drinkable water and toilets of participants and lastly a MUAC tape to determine the nutritional status of children aged 6 – 59 months weather they are malnourished or not according to the "*Protocole National de Prise en Charge Intégrée de la Malnutrition Aigüe*" (PCIMA) protocol 2013 [12]. Participants who met the inclusion criteria were invited to a designated area within the health center. The study's aims and objectives, along with its potential benefits, were thoroughly elucidated to them, following which their consent was sought. Those who consented signed the assent sheet after which the questionnaire was verbally administered, and their responses duly recorded. For participants unable to communicate in either French or English, the assistance of a translator was enlisted. Furthermore, utilizing an observation guide, fieldwork extended into select communities to conduct a comprehensive assessment of their hygienic practices and the prevailing status of food security.

2.6 Tools and data collection technique

The questionnaire was developed with the assistance of the Sphinx Plus², Lexica-V5 edition. Subsequently, the collected data underwent thorough verification for accuracy and consistency using Statistical Package for the Social Sciences (SPSS) version 26. Initially, frequency tables were generated for the various variables and cross-tabulations were conducted using Epi-Info-7 as appropriate. Descriptive statistics including proportions, means and medians were computed. Bivariate and multivariable binary logistic regression analyzes were employed to identify predictors of SAM. Variables demonstrating a p-value of less than 0.05 were deemed to exhibit a significant association with the outcome variable in the multivariate binary logistic regression analysis. Lastly, the strength of association was determined utilizing odds ratios along with their corresponding 95% confidence intervals (CI.

2.7 Ethical considerations

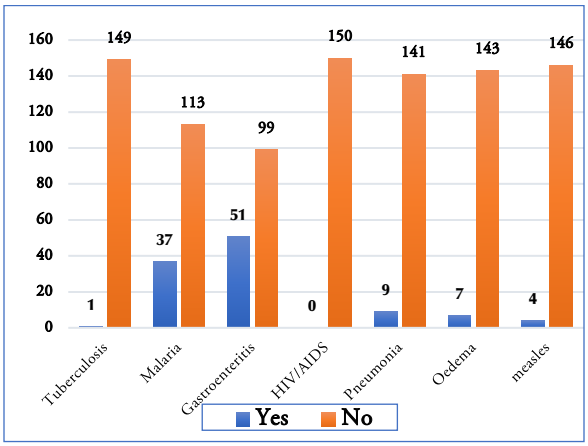
Administrative authorization was initially secured from the Regional Delegate for Public Health of the Far North region of Cameroon, followed by approval from the Mokolo Health

District. Subsequently, verbal and written consent were obtained from mothers accompanying children aged 6 – 59 months, facilitated by the use of a consent form. Prior to providing consent or refusal to participate, mothers were afforded the opportunity to pose questions for clarification. The study's objectives were elucidated to them with the aid of an Information sheet. Throughout the process, utmost care was taken to uphold the privacy and confidentiality of all collected information.

3 Results

3.1 Sociodemographic characteristics and food diversity of participants

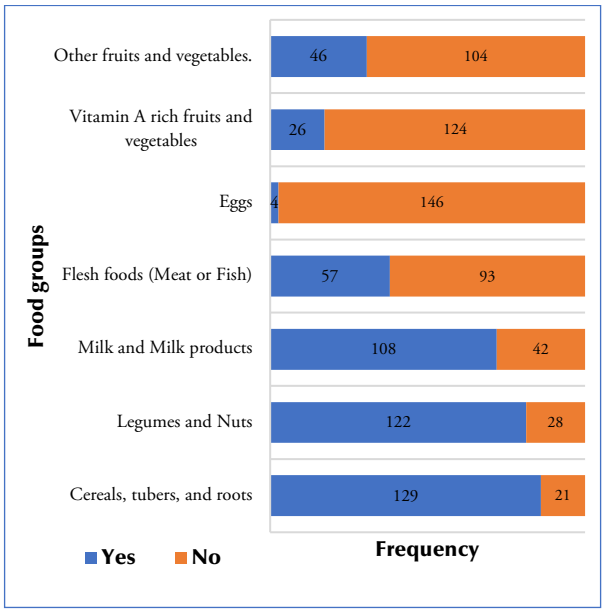
A total of 150 children aged 6 – 59 months were enrolled in this study, with 50 of them diagnosed with SAM. As depicted in Table 1, it is noteworthy that 77 (51.3%) of the participants were males, representing the demographic with the highest prevalence of SAM. The age group of 6 – 11 months exhibited the highest proportion at 46%, while a substantial proportion at 46.7% of caregivers had no formal education. Furthermore, a greater proportion of male children (51.30%) were observed, with the majority falling within the age range of 6 – 11 months (46.00%).



Yes: refers to children who were suffering from a comorbidity while; No refers to those not suffering the comorbidity during the survey.

Figure 1. Distribution of comorbidity in children aged 6 – 59 months.

Based on Figure 2 data, it was noted that the most consumed food group among the participants was cereals, tubers, and roots (129) followed by legumes and nuts (122) with milks and milk products also being frequently consumed. Conversely, the food group consisting of eggs exhibited the lowest consumption rate (4), followed by fruits and vegetables then flesh foods (meat or fish).



Yes: This refers to participants who affirmed to have consumed a food group within the past 24 hours at the time of the survey; No refers to those who did not consume the food group.

Figure 2. Distribution of dietary diversity

3.2 Comorbidities and feeding practices

As illustrated in Figure 1, gastroenteritis exhibited the highest prevalence, followed by malaria and pneumonia with prevalence rates of 51 (34%), 37 (24%) and 9 (6%) respectively. Conversely, conditions such as oedema, measles, and tuberculosis showed no significant association with SAM, with prevalence rates of 7, 4 and 1 respectively. Notably, no cases of Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome (HIV/AIDS) were reported throughout the survey period. Subsequent statistical analysis revealed that tuberculosis ($p = 0.478$), measles ($p = 0.073$), and HIV/AIDS were not statistically significant, as indicated in Table 2. Conversely, comorbidities including malaria, gastroenteritis and pneumonia demonstrated statistically significant associations ($p < 0.001$, < 0.001 and 0.01 respectively) with SAM.

As depicted in Table 2, individuals afflicted with gastroenteritis exhibited the highest risk (AOR 12.3, CI 5.5 – 27.5) of experiencing malnutrition compared to those with malaria or pneumonia.

Table 1. Sociodemographic characteristics of participants

Sub-groups	n (%)	Nutrition status	
		Malnourished n=50	Not malnourished n=100
	Child's age range		
6-11months	69 (46%)	17	52
12-23months	53 (35.3%)	21	32
24-59months	28 (18.7%)	12	16
	Mothers level of education		
Primary	32 (21.3%)	7	25
Secondary	38 (25.3%)	7	31
Higher institutions	10 (6.7%)	0	10
Never went to school	70 (46.7%)	36	34
	Zone of residence		
Urban	81 (54%)	7	74
Rural	69 (46%)	43	69
	Type of Marriage		
Monogamy	83 (55.3%)	20	63
Polygamy	67 (44.7)	30	37
	Religion		
Christians	94 (62.7%)	31	63
Muslim	46 (30.7%)	10	36
Animism	10 (6.7%)	9	1
	Demographic status		
Host	115 (76.7%)	30	85
Refugee	17 (11.3%)	15	2
IDPs	18 (12%)	5	13
Sex of children	**Frequency (f) n=100**	**Percentage (%)**	
Male	77	51.3	
Female	73	48.7	
	Age		
Mean ± SD	15.61±11.67		
Median	12		

[1] f=frequencies of different variables and % = represent the percentages. IDP represents Internally Displace, the age represents the mean age, median age in months SD=standard deviation and n represents the total sample space.

A substantial proportion of participants adhered to exclusive breastfeeding practices (70.7%), with the majority introducing complementary feeding after the age of 6 months. However, delayed introduction of complementary feeding significantly increased the risk of severe acute malnutrition (SAM) by 2.98 times. Furthermore, half of the caregivers of SAM cases (50%) reported providing only two meals per day. The data indicates that low food diversity among all the participants (44.7%) significantly elevated the risk of SAM (AOR 5.3, CI (2.5 – 11.8) with $p < 0.001$.

3.3 Hygienic and other practices

According to Table 3, a significant proportion of participants reported practicing handwashing before eating (81.3%) and after using the toilet (77%). However, 24% admitted to disposing of feces in open spaces, thus exposing children to heightened infection risks. Consequently, children in these circumstances faced a 6.5-fold risk of developing SAM. Furthermore, the utilization of unhygienic traditional concoctions was more prevalent among SAM cases (52%) compared to non-SAM cases. Those employing such remedies faced a 2.2-fold increased risk of SAM. Although the majority of participants reported sleeping under mosquito nets (88.7%) and supplementing their children with vitamin A, a notable 27.3% delivered their children at home. This scenario significantly elevated the risk of SAM among these (AOR 3.5, CI =1.6-7.4).

4 Discussion

This study examining the risk factors associated with SAM in children aged 6 to 59 months provides valuable insights into the complex interplay among sociodemographic variables of mother-child pairs, comorbidities, feeding practices, hygiene, and other relevant factors impacting SAM prevalence. Notably, a substantial proportion of the 150 participants, (46.00%) were found to fall within the critical age range of 6 to 11months, coinciding with the pivotal early stages of the first 1000 days of a child's life. This could also be due to the early or late introduction of adequate complementary feeding and lack of adherence to proper hygiene practices in mitigating the risk of SAM among infants. The findings of this study resonate with prior research, such as that conducted by Dahal et al. [8] who similarly observed a heightened prevalence of malnutrition among children aged 6 to 12 months compared to their older counterparts (24 to 59 months) in a community-based matched case-control study. Moreover, maternal educational attainment emerged as a significant determinant of SAM. According to the results, almost half of the participants (46.7%) reported no formal education. This aligns with the conclusions drawn by Kalu and Etim [15] suggesting that higher parental education levels are associated with enhanced child-rearing and caregiving practices, which may contribute to a reduced risk of malnutrition among children. This finding is consistent with previous studies by Endris et al. [16] and Vyas et al. [17] both of which identified a direct association between the educational status of mothers and the prevalence of SAM.

As shown in Figure 2, the comorbidities assessed for significant association with SAM included tuberculosis, malaria, gastroenteritis, measles, HIV/AIDS, and pneumonia. Analysis of Table 2 revealed that the comorbidities significantly associated with SAM were Gastroenteritis, malaria, and pneumonia/respiratory

infections. The prevalence of gastroenteritis may be attributed to recurrent diarrhea in children, often stemming from inadequate access to clean drinking water and poor food hygiene practices.

Table 2: Effect of some feeding practices and comorbidities on the nutritional status of the child

Characteristics Sub-groups	n (%)	Nutrition status Malnourished n=50	Not malnourished n=100	AOR (95% CI)	p-value
Feeding Practice					
Exclusive breastfeeding					
- Yes	106 (70.7%)	29 (58%)	77 (77%)	1	
- No	44 (29.3%)	21 (42%)	23 (23%)	0.41(0.199 – 0 .856	0.016
Age for introduction of complementary feeding					
- Before 6 months	27 (18%)	10 (20%)	17 (17%)	1.9 (0.72 – 4.92)	0.181
- At 6 months	75 (50%)	17 (32%)	55 (55%)	1	
- After 6 months	48 (32%)	23 (46%)	25 (25%)	2.98 (1.36 – 6.53)	0.006 *
Food frequency of mothers					
- 1 meal	9 (6%)	4 (8%)	5 (5%)	2.7 (0.67 – 11.1)	0.15
- 2 meals	44 (29.3%)	25 (50%)	19 (19%)	4.47 (2.1 – 9.7)	< 0.001*
- 3 meals	88 (58,3%)	20 (40%)	68 (68%)	1	
- 4 meals	8 (5,3%)	1 (2%)	8 (8%)		
Food diversity					
- Yes	67 (44.7%)	10 (20%)	57 (57%)	1	
- No	83 (55.3%)	40 (80%)	43 (43%)	5.3 (2.5 – 11.8)	< 0.001*
Effect of some Comorbidities on the nutritional status of the child					
Malaria					
- Yes	37 (24.7%)	24 (48%)	13 (13%)	6.2 (2.8 – 13.8)	< 0.001*
- No	113 (75.3%)	26 (52%)	87 (87%)	1	
Gastroenteritis					
- Yes	51 (34%)	35 (70%)	16 (16%)	12.3 (5.5 – 27.5)	< 0.001*
- No	99 (66%)	15 (30%)	84 (84%)	1	
Pneumonia					
- Yes	8 (5.3%)	6 (12%)	2 (2%)	6.7 (1.3 – 34.4)	0.01 *
- No	142 (94.7%)	44 (88%)	98 (98%)	1	
HIV/AIDS					
- Yes	0 (0%)	0	0		
- No	150 (100%)	50	100	1	
Tuberculosis					
- Yes	1 (0.7%)	0	1		0.478
- No	149 (99.3%)	50	99	1	
Measles					
- Yes	4 (2.7%)	3	1		0.073
- No	146(97.3%)	47	99	1	

% = represent the percentages. AOR= Adjusted Odd Ratios, CI: Confidence Interval at 95% and n represents the total sample space for each case.

Among the participants surveyed, it was observed that out of the 51 cases presenting with diarrhea, 35 of them were identified as severely acute malnourished which correlates with the works of Gayhi et al. [18] who had similar results. Additionally, malaria emerged as the second comorbidity with a significant p-value <0.05, similar to gastroenteritis. This association may be attributed to the onset of the rainy season and the presence of suitable breeding grounds for mosquitoes, which often coincides with increased transmission rates of malaria.

of child mortality. Additionally, pneumonia infection emerged as another significant comorbidity with a p-value 0.01 and AOR=6.7 (1.3-34.4) indicating an association with SAM. This association could be attributed to factors such as lack of vaccination or exposure to air pollution, which which may compromise the child's respiratory track and increase susceptibility to viral and bacterial infections. These results are in line with that of Gavhi et al. [18] who observed pneumonia as the second most common complications associated with SAM with 42.2% of the participants affected with pneumonia during a cross-sectional study.

Table 3: Effect of Individual, household, and childcare characteristics on the nutritional status of the child

Characteristics		Nutritional status			
Sub-groups	n (%)	Malnourished n=50	Not malnourished n=100	AOR (95% CI)	p-value
Vaccination status					
Yes	127 (84.7%)	33 (66%)	94 (94%)	1	
No	23 (15.3%)	17 (34%)	6 (6%)	8.1 (2.9 – 22.2)	< 0.001
Sleeping under mosquito nets					
yes	133 (88.7%)	39 (78%)	94 (94%)	1	
No	17 (11.3%)	11 (22%)	6 (6%)	4.4 (1.5 – 12.8)	0.04
Status of Vit. A supplementation in children					
Yes	127 (84.7%)	42 (84%)	99 (99%)	1	
No	23 (15.3%)	8 (16%)	1 (1%)	18.9 (2.3 – 155.5)	< 0.001
Place of delivery					
Hospital	108 (72%)	28 (56%)	80 (80%)	1	
At home	41 (27.3%)	22 (44%)	18 (18%)	3.5 (1.6 – 7.4)	< 0.001
Other places	1 (0.7%)	0 (0%)	1 (1%)		
Water hygiene and sanitation practices					
Washing of hands before eating					
Yes	112 (81.30%)	31 (2%)	91 (91%)	1	
Not-always	4 (2.7%)	1 (2%)	3 (3%)	0.98 (0.01 – 9.6)	0.99
Never	24 (16%)	18 (36%)	6 (6%)	8.8 (3.2 – 24.2)	< 0.001*
Washing of hands after using the toilet					
Yes	116 (77. %)	29 (58%)	87 (87%)	1	
Not-always	7 (4.7%)	3 (6%)	4 (4%)	2.3 (0.5 – 10.7)	0.3
Never	27 (18%)	18 (36%)	9 (9%)	6 (2.4 – 14.8)	< 0.001*
Source of drinking water					
"borehole"	63 (42%)	24 (48%)	39 (3 9%)	1	
Stream	10 (6.7%)	6 (12%)	4 (4%)	2.4 (0.6 – 9.5)	0.19
Well	22 (14.7%)	16 (32%)	6 (6%)	4.3 (1.5 – 12.6)	0.05
Tap	55 (36.7%)	4 (8%)	55 (55%)		
Where the child dispose feces					
Toilet/pot	110 (73.3%)	26 (52%)	84 (84%)	1	
Bushes	4 (2.7%)	0 (0%)	4 (4%)		
Empty space	36 (24%)	24 (48%)	12 (12%)	6.5(2.8 – 14.7)	< 0.001*
Use of unhygienic traditional concoctions from herbalist					
Yes	7	26 (52%)	28 (28%)	2.8 (1.4 – 5.6)	0.004 *
No	96 (64%)	24 (48%)	72 (72%)	1	

% = percentages of variables. AOR= Adjusted Odd Ratios, CI: Confidence Interval at 95%; and n represents the total sample space for each case.

This work is akin to the study conducted by Cumber et al. [21] where 15.1% of the participants were diagnosed with malaria, which was found to be associated with an increased likelihood

The timing of introducing complementary feeding plays a pivotal role in ensuring consistent nutritional intake for children. Following bivariate analysis with SAM, a

significant association was found between the delayed introduction of complementary feeding (after 6 months) with SAM. This delay may be attributed to a lack of awareness among women or caregivers regarding the importance of timely and adequate complementary feeding practices. Consequently, relying solely on breast milk may not suffice to provide the necessary nutrients for optimal growth. These findings are consistent with those of Das et al. [20] where inappropriate introduction of complementary feeding was similarly found to be significantly associated with SAM. Notably, our study revealed that only 50% of participants introduced complementary feeding in a timely manner, a rate lower than the regional average of 66.7% [7]. Food frequency and diversity, both in mothers and children are key indicators of optimum feeding practices. Analysis of data from mother-child pairs revealed a significant association between low food frequency in mothers and low food diversity in mothers and children, and SAM. This may be indicative of food insecurity and a lack of awareness regarding the importance of food diversity in child nutrition. Comparable results were reported by Cumber et al. [21] in their study. As illustrated in Figure 1, our findings indicate that only 2.7% of participants consumed eggs in the preceding days, a figure slightly lower than the regional average of 4% [7]. This underscores the need for interventions to promote diverse and nutritious food consumption among children.

The absence of handwashing before meals or after using toilets exhibited a notable association ($p < 0.05$) with SAM as illustrated in Table 3. This correlation may be attributed to the potential contamination from unwashed hands, thereby facilitating the transmission of bacteria. Considering the vulnerable immune system of children, their heightened susceptibility to illness is plausible under such circumstances. Additionally, it was observed that some participants administered traditional concoctions to their children when they fell ill. Following statistical analysis, this practice revealed a significant association with SAM ($p < 0.004$). Such association could stem from factors such as the suboptimal hygienic conditions surrounding the preparation or administration of the concoction, or potentially inappropriate dosing. Those who engaged in this practice exhibited an AOR 2.8 (1.4 – 5.6) signifying an increased risk of suffering from SAM.

The absence of vaccination may potentially expose children to recurrent infections, which significantly contribute to the development of SAM [22]. Adequate supplementation of Vitamin A in both children and in mothers is imperative for ensuring the child's well-being. Vitamin A deficiency not only hampers growth but also compromises the immune system, thereby increasing susceptibility to infections, morbidity, and mortality [23]. Our observations revealed that a considerable proportion of severely malnourished children did not receive Vitamin A supplementation, resulting in a significant association between this factor and SAM (p-value < 0.001). This finding could also be attributed to the lack of postnatal visits by parents following childbirth. Notably, home birth, which serves as an indicator for severe malnutrition, was significantly associated with SAM. This circumstance increased the risk of SAM for these children as evidenced by (AOR 3.5, CI =1.6 – 7.4). This association may be attributed to the absence of immediate health care interventions and counselling regarding optimal feeding practices for both the child and the mother in question. These findings are consistent with the conclusions drawn by Olusanya and Renner [24], who suggested that infants delivered at home face elevated risks of SAM compared to those delivered in private hospitals in urban settings.

This study encountered several limitations that warrant acknowledgment. Firstly, the financial status of the participants was not evaluated as a determinant of SAM which could have provided valuable insight into socio-economic factors contributing to the condition. Additionally, a considerable portion of the data obtained was relied on self-reported information provided by the caretakers. Consequently, there may exist a tendency for caretakers to under-report certain aspects, potentially introducing social desirability bias into the findings. However, it is worth noting that privacy was ensured during the data collection and participants were assured anonymity when providing their responses. Despite these limitations, the study's findings offer valuable insights into the factors associated with severe acute malnutrition in the study population.

5 Conclusion

The diminished nutritional status observed among children under the age of 5 in the Mokolo community is attributable to a myriad of immediate and underlying factors. Among these, specific comorbidities such as pneumonia, gastroenteritis, and malaria have emerged as prominent contributors to SAM. Aside from illnesses, inadequate complementary feeding practices and suboptimal water and hygienic practices have been significantly associated with the compromised nutritional status observed in these children. These findings not only provide crucial insights into the determinants of poor nutritional outcomes but also underscore the urgent need for targeted interventions aimed at addressing these multifaceted challenges. Furthermore, the identified associations serve as a foundational basis for future research endeavors, guiding the formulation of effective

nutritional interventions tailored to the unique needs of the Mokolo health district.

In light of these observations, it is imperative that concerted efforts be directed towards improving the nutritional status of children aged 6 – 59 months in the Mokolo community. This requires the implementation of comprehensive strategies, including nutrition education initiatives complemented by multi-sectorial interventions, to mitigate the adverse effects of these underlying factors and foster sustainable improvements in childhood nutrition outcomes.

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