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Prevalence and determinants of severe acute malnutrition among children under five in Kisangani, Democratic Republic of the Congo

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ABSTRACT

Introduction
Malnutrition remains a major cause of morbidity and mortality among children under five in Kisangani, with Severe Acute Malnutrition (SAM) posing serious threats to survival and development. Ongoing ethnic conflicts in some municipalities exacerbate these risks.

Purpose
This study aimed to assess the nutritional status of children under five in Kisangani and identify key risk factors to inform targeted interventions.

Methods
A cross-sectional mixed-methods study was conducted from May to July 2025 among 913 children under five years of age. Quantitative data were collected using structured questionnaires on KoboCollect and analysed with ENA and SPSS version 27. Qualitative insights from focus group discussions and key informant interviews were coded and analysed with Atlas.ti to explore feeding practices and conflict-related vulnerabilities.

Results
The prevalence of SAM was 15.1%. Exclusive breastfeeding was low (7%), and only 5% of children consumed more than five food groups per day. Multivariate analysis identified significant determinants of SAM: children residing in Makiso-Kisangani (OR = 2.53; 95% CI [1.55, 3.49]; p = .004) and Lubunga (OR = 1.89; 95% CI [1.11, 3.21]; p = .019) had higher odds of SAM. Children aged 12–23 months were at increased risk (OR = 1.61; 95% CI [1.01, 2.57]; p = .044), refugees in foster care had elevated risk compared to indigenous children (OR = 2.32; 95% CI [1.55, 3.49]; p < .001), and those living in households with more than 11 members were more likely to be affected (OR = 1.92; 95% CI [1.11, 3.32]; p = .020).

Conclusion
Children in Kisangani remain highly vulnerable to malnutrition, largely due to inadequate infant feeding practices and conflict-driven household vulnerabilities. Immediate interventions to improve feeding practices and integrate conflict-sensitive measures are urgently needed to reduce malnutrition-related morbidity and mortality.

INTRODUCTION

Malnutrition is one of the leading causes of morbidity and mortality among children under five (BM, 2018). Globally, it contributes to nearly 45% of deaths in this age group (World Health Organization [WHO], 2017). In 2022, approximately 149 million children were stunted, 45 million wasted, and 37 million overweight (United Nations Children's Fund [UNICEF], 2022). These figures highlight the persistence of malnutrition as a global public health problem, particularly in low-income countries where poverty, food insecurity, and poor feeding practices are major drivers (Dama et al., 2023).

In Africa, malnutrition affects an estimated 22% of children under five (UNICEF, World Health Organization [WHO], & BM, 2024). It also increases the risk of infections such as diarrhoea, pneumonia, and malaria (WHO, 2017). The Democratic Republic of the Congo (DRC) faces a triple burden of malnutrition—undernutrition, micronutrient deficiencies, and overweight/obesity. According to the 2023 National Nutrition Survey, 47.9% of children under five are stunted (≈ 11 million) and 8.2% are wasted (≈ 1.5 million). In addition, 89.9% of children aged 6–23 months lack a minimum acceptable diet, and 77% have inadequate dietary diversity (Programme National de Nutrition [PRONANUT], 2023).

Despite the implementation of the National Protocol for the Integrated Management of Severe Acute Malnutrition (PCIMA), coverage remains limited. Between 2016 and 2023, annual geographic coverage for treatment ranged from 25 to 40%, constrained by weak logistics, scarce resources, and uneven service delivery. National averages also mask provincial disparities (Enquête Démographique et de Santé [EDS], 2014). In Tshopo Province, the prevalence of severe acute malnutrition (SAM) is 4.3%, while underweight reaches 21.5% (PRONANUT, 2023). However, in Kisangani, the prevalence of SAM is particularly high at 15% (PRONANUT, 2023).

This situation is aggravated by ongoing inter-ethnic conflicts in parts of the city and surrounding areas, which further increase the risk of malnutrition. Although national and provincial data exist, there is limited evidence specific to Kisangani on the determinants of SAM, particularly in the context of conflict-related vulnerabilities. This study therefore aims to assess the nutritional status of children under five in Kisangani and to identify key risk factors to guide strategies that can improve child survival.

METHODS

Study Setting

Figure 1:
Map of Kisangani and target neighbourhoods (numbered in red)

Kisangani is the third-largest city in the Democratic Republic of the Congo (DRC) and the fifth most populous urban area in the country. It covers 1,914 km² with a population density of about 710 inhabitants per km². Geographically, it lies between the Tshopo and Congo Rivers at 0°30′ latitude north and 25°20′ east longitude. Administratively, the city includes six municipalities (Mangobo, Tshopo, Makiso, Kabondo, Lubunga, and Kisangani) as well as the Lubuya Bera sector, and it serves as the capital of Tshopo Province. The climate is equatorial with year-round rainfall, and the terrain is mostly flat with sandy-clay soils and a few plateaus (Boyoma, Médical, Kapalata, Zoo). Vegetation is mainly peri-urban forest crossed by small rivers such as Djubudjubu, Masendula, Avokoko, and Kibiki. The city has five health zones—Makiso–Kisangani (hosting the general referral hospital, university clinics, and the 50th Anniversary Hospital), Tshopo, Kabondo, Mangobo, and Lubunga—each with a general referral hospital.

Type and Period of Study

This study adopted a concurrent mixed-methods cross-sectional design conducted from June 2024 to June 2025. The quantitative component assessed nutritional status and Infant and Young Child Feeding (IYCF) practices through

household surveys, while the qualitative component used focus group discussions (FGDs) to provide contextual insights.

Study Population

The target population consisted of all children under five years of age residing in Kisangani during the study period.

Sampling

Sample size was determined using the WHO cluster-sampling method. Thirty clusters were selected, each comprising 30 households with at least one eligible child, yielding a total of 900 children. An additional 45 participants (5%) were added to account for non-response, giving a final target of 945 children. Within each cluster, households were selected randomly using systematic sampling from updated community household listings. When more than one child under five was present in a household, one child was randomly chosen.

Inclusion and Exclusion Criteria

- **Inclusion:** Children under five years of age whose parents/guardians had resided in Kisangani for at least two years and who provided informed consent.
- **Exclusion:** Children with severe chronic illnesses or congenital malformations affecting growth, and parents/guardians who did not meet inclusion criteria or declined consent.

Qualitative Component

Fifty-eight FGDs were conducted with parents of children under five. Each group included six participants—a size chosen to balance diversity of perspectives with ease of interaction. Recruitment continued until thematic saturation was reached, confirmed at the 33rd FGD (198 participants) and validated by the 58th (348 participants in total).

Data Collection

Quantitative data were collected using structured questionnaires programmed in KoboCollect, and anthropometric data were processed in ENA software. Data were analysed in SPSS version 27 using descriptive statistics, Chi-square tests for bivariate associations, and binary logistic regression for multivariate analysis (including variables with $p < 0.20$ from bivariate analysis). Qualitative data were recorded, transcribed verbatim, and analysed in Atlas.ti 9. Coding was performed independently by two trained researchers to ensure inter-rater reliability, with discrepancies resolved through discussion. Triangulation across themes and sources reinforced analytic rigour.

Quality Control

Data collectors received intensive training on anthropometric measurement techniques, questionnaire administration, and qualitative facilitation. Supervisors conducted daily reviews to detect inconsistencies. For qualitative coding, intercoder agreement was monitored, and consensus meetings were held to standardise themes.

Ethical Considerations

The study was approved by the Bioethics Committee of the Higher Institute of Medical Techniques of Kisangani, Tshopo, Democratic Republic of the Congo (Ref. No. 160/CBE/ISTM/KIN/RDC/PMBBL/2024). Participation was voluntary, with informed consent obtained from parents/guardians. Confidentiality and anonymity were assured, and participants retained the right to withdraw at any stage without consequence.

RESULTS

Socio-demographic and cultural characteristics of respondents and households

Table 1 presents the distribution of respondents and households according to their socio-demographic and cultural characteristics, showing notable differences across the health zones.

Table 1:
Distribution of socio-demographic and cultural characteristics of respondents and households

Characteristic	Kabondo *n (%)*	Lubunga *n (%)*	Makiso Kis *n (%)*	Mangobo *n (%)*	Tshopo *n (%)*	Total *n (%)*
Gender						
Female	100 (52.9%)	56 (44.4%)	153 (60.7%)	140 (55.6%)	60 (63.8%)	509 (55.7%)
Male	89 (47.1%)	70 (55.6%)	99 (39.3%)	112 (44.4%)	34 (36.2%)	404 (44.3%)
Total	**189 (100%)**	**126 (100%)**	**252 (100%)**	**252 (100%)**	**94 (100%)**	**913 (100%)**

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Characteristic	Kabondo *n (%)*	Lubunga *n (%)*	Makiso Kis *n (%)*	Mangobo *n (%)*	Tshopo *n (%)*	Total *n (%)*
Level of Education						
Illiterate	10 (5.3%)	10 (7.9%)	26 (10.3%)	25 (10.0%)	5 (5.3%)	76 (8.3%)
Primary	34 (18.0%)	26 (20.6%)	47 (18.7%)	33 (13.1%)	13 (13.8%)	153 (16.8%)
Secondary	80 (42.3%)	49 (38.9%)	102 (40.5%)	105 (41.7%)	43 (45.7%)	379 (41.5%)
Higher	65 (34.4%)	41 (32.5%)	77 (30.6%)	89 (35.3%)	35 (37.2%)	305 (33.4%)
Total	**189 (100%)**	**126 (100%)**	**252 (100%)**	**252 (100%)**	**94 (100%)**	**913 (100%)**
Household Status						
Displaced (Sites)	5 (2.6%)	58 (46.0%)	154 (61.1%)	45 (17.9%)	16 (17.0%)	278 (30.5%)
Refugees in Foster Care	1 (0.5%)	0 (0.0%)	30 (11.9%)	0 (0.0%)	0 (0.0%)	31 (3.4%)
Natives	183 (96.9%)	68 (54.0%)	68 (27.0%)	207 (82.1%)	78 (83.0%)	604 (66.1%)
Total	**189 (100%)**	**126 (100%)**	**252 (100%)**	**252 (100%)**	**94 (100%)**	**913 (100%)**
Household Size						
≤7 people	58 (30.7%)	34 (27.0%)	69 (27.4%)	68 (27.0%)	24 (25.5%)	253 (27.7%)
8–11 people	49 (25.9%)	32 (25.4%)	67 (26.6%)	49 (19.4%)	31 (33.0%)	228 (25.0%)
>11 people	82 (43.4%)	60 (47.6%)	116 (46.0%)	135 (53.6%)	39 (41.5%)	432 (47.3%)
Total	**189 (100%)**	**126 (100%)**	**252 (100%)**	**252 (100%)**	**94 (100%)**	**913 (100%)**
Age Group						
≤11 months	50 (26.5%)	9 (7.1%)	91 (36.1%)	39 (15.5%)	17 (18.1%)	206 (22.6%)
12–23 months	70 (37.0%)	29 (23.0%)	56 (22.2%)	31 (12.3%)	16 (17.0%)	202 (22.1%)
>23 months	69 (36.5%)	88 (69.8%)	105 (41.7%)	182 (72.2%)	61 (64.9%)	505 (55.3%)
Total	**189 (100%)**	**126 (100%)**	**252 (100%)**	**252 (100%)**	**94 (100%)**	**913 (100%)**

The table indicates that more than half of the children surveyed were girls (55.7%), with the Tshopo health zone showing the highest proportion (63.8%). Parents without formal education accounted for 8.3% overall, exceeding 10% only in Makiso/Kisangani (10.3%), while 41.5% of parents had completed secondary school. The Kabondo health zone was predominantly composed of indigenous populations (96.8%). In contrast, displaced households in camps represented 30.4% of respondents, with Makiso/Kisangani recording the highest proportion—61.1% in camps and 11.9% hosted by other families.

Household sizes were generally large, with 47.3% of participants living in households with more than 11 members and 25.0% in those with 8–11 members. Regarding age distribution, children older than 23 months were the most represented group (55.3%), peaking at 72.2% in Mangobo. Those aged ≤11 months and 12–23 months constituted similar proportions.

Table 2 shows the distribution of household response rates across the different health zones.

Table 2:
Distribution of response rates for the sample of households by health zone

Health Zone	Households			Children 0–59 months		
	Number planned households	Number surveyed households	Response rate (%)	Number of planned children	Number of children surveyed	Response rate (%)
Kabondo	72	72	100.0%	189	189	100.0%
Lubunga	48	48	100.0%	126	126	100.0%
Makiso/Kis	96	96	100.0%	252	252	100.0%
Tshopo	36	36	100.0%	94	94	100.0%
Mangobo	108	97	89.8%	284	252	88.7%
Total	**360**	**349**	**96.9%**	**945**	**913**	**96.6%**

The overall response rate was complete in most health zones, except in Mangobo, where it declined to 89.8% for households and 88.7% for children under five. This shortfall resulted from inaccessibility and insecurity in some neighbourhoods, where disturbances by violent youth groups hindered data collection.

The study also found that most mothers initiated breastfeeding shortly after birth, with 75.7% (278 out of 367) starting immediately. A small proportion (6.6%) began 2–3 days later, mainly due to caesarean delivery, lack of awareness about early initiation, or infant illness. Exclusive breastfeeding during the first six months was rare, reported in only 7% of children, while 93% received additional foods or liquids. Breastfeeding often continued beyond one year—typically until 18 months—though some mothers weaned their children at two years or earlier when pregnant again. The low rate of exclusive breastfeeding and early weaning practices are major risk factors for malnutrition in young children.

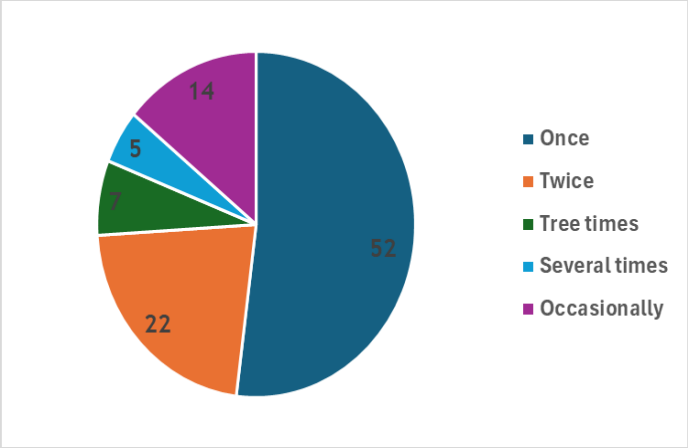
Qualitative findings on infant feeding practices

Qualitative findings indicated that most mothers weaned their children between 20 months and two years, often waiting until the child became strong or until the mother became pregnant again. Complementary feeding usually began at six months; however, due to financial constraints, some families introduced other foods as early as three months, while others delayed until the child's first birthday. The choice of supplementary foods depended largely on household resources. Semi-solid foods such as meat, fresh fish, or eggplant were typically introduced first, followed by solid foods such as cassava semolina, rice, beans, and vegetables when available. These results suggest that socio-economic factors strongly influence both the timing and type of complementary feeding, which in turn affects child nutrition and growth.

Frequency of meals in households

As shown in **Figure 2**, 52% of survey respondents reported eating only once per day, while only 5% consumed meals more than once per day.

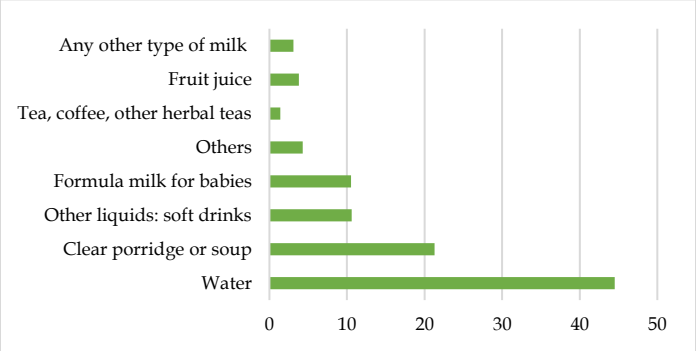
Figure 2:
Number of meals per day



Fluids consumed during the previous day or night

Figure 3 shows that 44.9% of respondents reported their children drank water during the previous day or night. Tea, coffee, and other herbal teas were the least consumed beverages, reported by only 1.4% of respondents.

Figure 3:
Distribution of liquids drunk yesterday during the day or at night



Food consumption

More than half of respondents reported that their children ate solid foods the previous day, while 47.2% consumed semi-solid foods. The prevalence of severe acute malnutrition (SAM) was assessed using weight-for-height z-scores based on the WHO 2006 standards for children under five years of age.

Prevalence of severe acute malnutrition by parents' socio-demographic and cultural variables

Table 3 presents the distribution of parents' socio-demographic and cultural characteristics according to the nutritional status of their children.

Table 3:
Distribution of parents' sociodemographic and cultural characteristics according to the child's nutritional status

Socio-demographic characteristics	MAS				Total		p
	MAS +		MAS -				
	N	%	N	%	n	%	
Health zone							
Kabondo	22	12.4	155	87.6	177	100.0	0.001
Lubunga	23	18.4	102	81.6	125	100.0	
Makiso Kisangani	62	27.4	164	72.6	226	100.0	
Mangobo	24	9.5	234	90.5	252	100.0	
Tshopo	7	7.4	87	92.6	94	100.0	
Total	**132**	**15.1**	**742**	**84.9**	**874**	**100.0**	
Age group							
Under 11 years old	34	17.8	157	82.2	191	100.0	< 0.001
12 to 23 years old	25	12.8	170	87.2	195	100.0	
Over 23 years old	73	15.0	415	85.0	488	100.0	
Total	**132**	**15.1**	**742**	**84.9**	**874**	**100.0**	
Gender							
Male	79	20.1	310	79.9	388	100.0	< 0.001
Female	53	10.9	432	89.1	485	100.0	
Total	**132**	**15.1**	**742**	**84.9**	**873**	**100.0**	
Household status							
Displaced persons (sites)	72	27.2	193	72.8	265	100.0	0.029
Refugees in host families	10	32.3	21	67.7	31	100.0	
Indigenous people	50	8.7	528	91.3	578	100.0	
Total	**132**	**15.1**	**742**	**84.9**	**874**	**100.0**	
Household size							
Less than 7 people	40	17.2	192	82.8	232	100.0	0.030
8-11 people	23	9.8	212	90.2	235	100.0	
More than 11 people	69	17.0	338	83.0	407	100.0	
Total	**132**	**15.1**	**742**	**84.9**	**874**	**100.0**	
Level of education							
No education	10	13.5	64	86.5	74	100.0	0.367
Primary	26	18.2	117	81.8	143	100.0	
Secondary	47	12.9	317	87.1	364	100.0	
Higher	49	16.7	244	83.3	293	100.0	
Total	**132**	**15.1**	**742**	**84.9**	**874**	**100.0**	

The overall prevalence of SAM among children under five was 15.1% (132/874). Prevalence varied across health zones, being highest in Makiso-Kisangani (27.4%) and Lubunga (18.4%), and lowest in Mangobo (9.5%) and Tshopo (7.4%) (p = 0.001). Children under 11 months were more affected (17.8%) than those aged 12–23 months (12.8%) and over 23 months (15.0%) (p < 0.001).

Male children had a higher prevalence than females (20.1% vs. 10.9%, p < 0.001). Household status was significantly associated with SAM: displaced children in camps had a prevalence of 27.2%, those hosted by other families 32.3%, and indigenous children 8.7% (p = 0.029). Household size also influenced the risk, with children from households of more than 11 members showing a prevalence of 17.0% (p = 0.030). Parental education showed no significant association (p = 0.367), although the highest prevalence (16.7%) occurred among parents with higher education.

These findings indicate that health zone, age, gender, household status, and household size were key determinants of SAM in Kisangani.

Prevalence of severe acute malnutrition according to feeding practices among infants (0–11 months) and young children (12–23 months)

Table 4 summarises the distribution of feeding practices according to the nutritional status of infants and young children aged 0–23 months.

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Table 4:
Distribution of feeding practices according to the nutritional status of infants and young children (0 to 23 months)

Eating habits	MAS				Total		P
	MAS +		MAS -				
	N	%	N	%	N	%	
Exclusive breastfeeding							
Yes	54	15.8	288	84.2	342	100.0	0.155
No	1	4.0	24	96.0	25	100.0	
Total	**55**	**15.0**	**312**	**85.0**	**367**	**100.0**	
Time to breastfeed after birth							
Immediately	42	15.1	236	84.9	278	100.0	0.598
1 hour to 24 hours	11	16.9	54	83.1	65	100.0	
2 to 3 days	2	8.3	22	91.7	24	100.0	
Total	**55**	**15.1**	**312**	**85.0**	**367**	**100.0**	
Food group consumed							
Cereals, tubers, porridge, bread, biscuits, doughnuts, sweet potatoes, rice, yams, potatoes	34	17.1	165	82.9	199	100.0	0.011
Milk and dairy products; curdled milk, cheese	9	9.1	90	90.9	99	100.0	
Fish and meat	11	12.0	81	88.0	92	100.0	
Eggs	4	12.1	29	87.9	33	100.0	
ATPE: Plumpy Nut	14	25.9	40	74.1	54	100.0	
Type of food consumed							
Solid	26	13.3	170	86.7	196	100.0	0.327
Liquid	10	9.4	96	90.6	106	100.0	
Total	**36**	**11.9**	**266**	**88.1**	**302**	**100.0**	
Liquids drunk							
Water	50	15.5	272	84.5	322	100.0	0.029
Formula milk for babies	13	17.6	61	82.4	74	100.0	
Any other type of milk	5	23.8	16	76.2	21	100.0	
Fruit juice	2	7.4	25	92.6	27	100.0	
Tea, coffee, other herbal teas	3	27.3	8	72.7	11	100.0	
Other liquids, such as sweetened soft drinks	9	11.5	69	88.5	78	100.0	
Clear broth or soup	27	17.3	129	82.7	156	100.0	
Other	6	20.7	23	79.3	29	100.0	

Overall, 15.0% of children were affected by SAM, with no significant association found for exclusive breastfeeding (p = 0.155) or the timing of breastfeeding initiation (p = 0.598). Significant differences were observed across certain food groups: SAM prevalence was 17.1% among children consuming cereals, tubers, porridge, bread, or rice (p = 0.011) and 25.9% among those consuming ATPE (Plumpy Nut). Consumption of solid versus liquid foods showed no significant difference (p = 0.327).

Regarding liquids, children who drank water had a 15.5% SAM prevalence, while those consuming formula milk, other milk types, clear broth, or tea/herbal drinks showed higher rates (p = 0.029). These findings highlight that the type of food and liquids consumed can influence nutritional status, underscoring the need for improved dietary practices.

Factors associated with severe acute malnutrition

Table 5 presents the socio-demographic factors associated with SAM among children under five.

Table 5:
Sociodemographic factors associated with severe acute malnutrition

Equation variables		β	s.d	Wald	ddl	Sig.	OR	IC95% for OR	
								Lower	Higher
Step 1[a]	Tshopo			12.403	4	0.015			
	Kabondo	0.467	0.398	1.376	1	0.241	1.595	0.731	3.477
	Lubunga	0.637	0.271	5.533	1	0.019	1.891	1.112	3.214
	Makiso Kisangani	0.927	0.207	16.530	1	0.004	2.527	1.547	3.486
	Mangobo	0.095	0.475	0.040	1	0.841	1.100	0.434	2.789
	Age (Under 11 months)			22,277	2	0.000			

	Age (12 to 23 months)	0.478	0.238	4.054	1	0.044	1.613	1.013	2.569
	Age (Over 23 months)	0.024	0.288	0.007	1	0.934	1.024	0.583	1.800
	Child's gender/M	0.829	0.203	16.648	1	0.000	2.291	1.539	3.412
	Indigenous people			53.977	2	0.000			
	Refugees in foster care	0.842	0.207	16.530	1	0.000	2.322	1.547	3.486
	Displaced persons (sites)	0.095	0.475	0.040	1	0.841	1.100	0.434	2.789
	Less than 7 people			6.912	2	0.032			
	8 to 11 people	0.020	0.218	0.009	1	0.926	1.021	0.665	1.565
	More than 11 people	0.652	0.280	5.430	1	0.020	1.920	1.109	3.324
	Constant	1.337	0.624	4.596	1	0.032	3.809		

Note:
a. Variables entered in Step 1: *Health zone, Age in months, Child's gender (M), Individual status (°), Household size.*

Multivariate logistic regression analysis identified several significant determinants. Living in Makiso-Kisangani (OR = 2.53; 95% CI: 1.55–3.49; p = 0.004) or Lubunga (OR = 1.89; 95% CI: 1.11–3.21; p = 0.019) increased the odds of SAM compared with Tshopo. Children aged 12–23 months were more likely to be malnourished than those under 11 months (OR = 1.61; 95% CI: 1.01–2.57; p = 0.044), and male children were more vulnerable than females (OR = 2.29; 95% CI: 1.54–3.41; p < 0.001). Refugees in foster care also faced an elevated risk (OR = 2.32; 95% CI: 1.55–3.49; p < 0.001). Larger households (>11 members) were linked to higher odds of SAM (OR = 1.92; 95% CI: 1.11–3.32; p = 0.020).

Table 6 examines feeding practices associated with SAM.

Table 6:
Feeding practices associated with severe acute malnutrition

Equation variables									
Eating habits		**β**	**s.d**	**Wald**	**ddl**	**Sig.**	**OR**	**IC95% for OR**	
								Lower	Higher
Step 1a	Exclusive breastfeeding	-0.753	1.136	0.440	1	0.507	0.471	0.051	4.365
	Water(1)	-0.067	0.825	0.007	1	0.935	0.935	0.185	4.714
	Formula milk for babies(1)	-0.434	0.693	0.393	1	0.531	0.648	0.166	2.520
	Any other type of milk(1)	0.036	1.103	0.001	1	0.974	1.037	0.119	9.002
	Fruit juice(1)	1.138	1.093	1.085	1	0.298	3,121	0.367	26.569
	Tea, coffee, other herbal teas(1)	-1.341	0.805	2.773	1	0.096	0.262	0.054	1.268
	Other liquids, such as sweetened carbonated drinks(1)	-0.339	0.624	0.295	1	0.587	0.712	0.210	2.420
	Clear porridge or soup(1)	-1.083	0.553	3.839	1	0.050	0.339	0.115	1.000
	Others	-1.224	0.694	3.107	1	0.078	0.294	,075	1,147
	Cereals, tubers, porridge, bread, biscuits, doughnuts, sweet potatoes, rice, yams, apples (1)	0.739	0.659	1.257	1	0.262	2.093	0.575	7.615
	Legumes, nuts, beans, coconut, peanuts(1)	-0.998	0.541	3.407	1	0.065	0.369	0.128	1.064
	milk and milk products; curdled milk, cheese,(1)	1.206	0.710	2.888	1	0.089	3.341	0.831	13.434
	Fish, meat(1)	0.247	0.623	0.157	1	0.692	1.280	0.378	4.338
	Egg(1)	1.050	0.949	1.226	1	0.268	2.858	0.445	18.346
	ATPE: Plumpy-nut(1)	-0.642	0.641	1.005	1	0.316	0.526	0.150	1.847
	Constan	3.111	1.389	5.021	1	0.025	22.448		

Note:
a. Variables entered in Step 1: Exclusive breastfeeding, food groups consumed, and fluids drunk.

Logistic regression results showed that exclusive breastfeeding had a non-significant protective effect (OR = 0.47; p = 0.507). Most dietary variables were not statistically significant. However, clear porridge or soup showed a borderline protective association (OR = 0.34; p = 0.050), and legumes and nuts displayed a near-significant trend (OR = 0.37; p = 0.065). Collectively, eating habits alone did not fully account for the risk of SAM in this population.

DISCUSSION

This study found a prevalence of severe acute malnutrition (SAM) of 15.1% among children under five in Kisangani, which exceeds the World Health Organization's (WHO) emergency threshold of 2% and represents a critical public health concern. Boys were more affected than girls (20.1% vs. 10.9%, p = 0.001), consistent with the findings of Bassibila et al. (2019), who reported that male children were

disproportionately affected—likely due to gender-based childcare practices. Comparable prevalence levels were also reported by Dikoke (2019) in Sankuru Province, reflecting similar socioeconomic conditions, while Dama et al. (2023) observed a lower prevalence of 3.6% in Cameroon, likely reflecting stronger national nutrition and child health policies.

Feeding practices showed that 75.7% of children were introduced to breastfeeding early, yet only 7% were exclusively breastfed during the first six months—considerably below national and regional averages (UNICEF, 2022). Dietary diversity was extremely limited: only 5% of children consumed more than five food groups per day, and 52% consumed a single meal daily. These results reveal precarious living conditions, widespread food insecurity, and the burden of displacement in affected communities. Similar findings were noted in the nutritional surveys conducted in Moba Territory (PRONANUT, 2021), suggesting a persistent challenge across regions of the Democratic Republic of the Congo (DRC).

Multivariate analysis identified several key risk factors for SAM. Children residing in Makiso-Kisangani (OR = 2.53; 95% CI [1.55, 3.49]) and Lubunga (OR = 1.89; 95% CI [1.11, 3.21]) health zones faced greater risk than those in Tshopo, likely due to concentrations of displaced and conflict-affected populations. Children aged 12–23 months were particularly vulnerable (OR = 1.61; 95% CI [1.01, 2.57]), as were male children (OR = 2.29; 95% CI [1.54, 3.41]). Refugee children in foster care exhibited significantly higher risk (OR = 2.32; 95% CI [1.55, 3.49]), and those from households with more than 11 members also faced elevated risk (OR = 1.92; 95% CI [1.11, 3.32]). Interestingly, no specific dietary practice showed a statistically significant association with SAM in multivariate analysis.

These findings reveal an alarming level of nutritional vulnerability in Kisangani, driven largely by socioeconomic deprivation, household overcrowding, and displacement. This pattern mirrors the broader situation in the DRC, where stunting and acute malnutrition rates remain among the highest globally (Global Nutrition Report, 2024). Provinces such as Kasai continue to exhibit even higher rates, underscoring the influence of local economic conditions and healthcare access on child nutritional outcomes (Dikoke, 2019). Comparatively, the lower prevalence reported in Cameroon (Dama et al., 2023) suggests that effective social protection policies and targeted nutrition interventions can substantially reduce child malnutrition.

Overall, while early breastfeeding initiation is common in Kisangani, it is insufficient to counteract the effects of poverty, displacement, and ongoing inter-ethnic conflicts. Therefore, interventions must go beyond promoting feeding practices to include comprehensive social and economic support systems for vulnerable families.

Limitations

This study had several limitations. The use of caregiver self-reports may have introduced recall bias or inaccuracies. Furthermore, data from insecure or inaccessible areas were excluded, which may affect the representativeness of the sample. Finally, the cross-sectional design precludes causal inference. Future longitudinal studies are needed to establish causal pathways and assess the long-term effects of interventions on SAM reduction.

CONCLUSION

The study demonstrates a notably high prevalence of severe acute malnutrition among children under five in Kisangani, with pronounced vulnerability among male children, those aged 12–23 months, and those living in large or displaced households. Although early breastfeeding was common, neither exclusive breastfeeding nor specific dietary practices showed significant independent associations with SAM after adjustment.

Socioeconomic adversity, household overcrowding, displacement, and localised conflict were key drivers of malnutrition rather than feeding behaviours alone. Recognising the study's limitations—self-reported data, exclusion of inaccessible zones, and its cross-sectional design—further investigations should adopt longitudinal and interventional designs.

Future research should explore cultural feeding practices, assess the effectiveness of targeted nutrition interventions, and monitor the long-term nutritional outcomes of children in conflict-affected settings. Policy-makers and humanitarian partners should prioritise nutrition programmes in high-risk health zones, provide support to

displaced and refugee families, promote age-appropriate feeding, ensure access to nutrient-rich and fortified foods, and strengthen community-level self-sufficiency. Regular screening and early medical interventions are essential to mitigate malnutrition-related morbidity and mortality among children in Kisangani.

Ethical Approval: The study was approved by the Bioethics Committee of the Higher Institute of Medical Techniques of Kisangani, Tshopo, Democratic Republic of the Congo (Ref. No. 160/CBE/ISTM/KIN/RDC/PMBBL/2024).

Conflicts of Interest: None declared.

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