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Determinants of severe acute malnutrition among children aged 6-59 months in the rural health zone of Nundu, in a context of armed conflict and limited resources in eastern DR Congo: A cross-sectional study

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RESEARCH

Determinants of severe acute malnutrition among children aged 6-59 months in the rural health zone of Nundu, in a context of armed conflict and limited resources in eastern DR Congo: A cross-sectional study.

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Abstract

Background: Severe acute malnutrition (SAM) in children aged 6–59 months remains a critical public health crisis, particularly within conflict-affected and low-income regions. In fragile ecosystems, SAM seriously compromises children's physical, cognitive, and social development, while driving high mortality rates. This study aimed to determine the prevalence of severe acute malnutrition and identify its main socio-demographic, dietary, and economic determinants among children aged 6–59 months in the Nundu rural health zone (NRHZ), South Kivu, Democratic Republic of the Congo.

Methods: A community-based cross-sectional and analytical study was conducted on a sample of 384 children aged 6–59 months, selected using a proportional stratified sampling approach across 10 health areas. Anthropometric indicators were evaluated using Mid-Upper Arm Circumference (MUAC), where a MUAC < 115 mm defined severe acute malnutrition. Mobile data collection was executed via KoboToolbox. Statistical analyses, including Pearson's chi-square tests and multivariate logistic regression, were performed using Stata 16 to determine independent risk factors.

Results: The study revealed an alarming SAM prevalence of 30.7% (95% CI: 26.2–35.0%) among the targeted pediatric population. This rate critically exceeds national and regional emergency thresholds. Multivariate logistic regression identified several independent predictors of SAM: child's age between 12–23 months (aOR = 2.73; 95% CI: 1.57–4.74; p < 0.001), a documented history of malnutrition (aOR = 2.03; p = 0.005), hospitalisation within the 12 months prior to the survey (aOR = 2.76; 95% CI: 1.58–4.81; p < 0.001), structural introduction of non-optimal alternative feeding sources (aOR = 1.73; 95% CI: 1.07–2.79; p = 0.023), failure to maintain exclusive breastfeeding until 6 months of age (aOR = 1.73; 95% CI: 1.08–2.79; p = 0.022), lack of geographic or financial access to healthcare infrastructure (aOR = 5.74; 95% CI: 1.61–20.41; p = 0.007), very low household socioeconomic status (aOR = 9.01; 95% CI: 1.11–73.14; p = 0.040), and household self-perception of extreme poverty (aOR = 3.10; p = 0.010).

Conclusion: This investigation highlights a devastating nutritional emergency in the Nundu rural health zone, where pediatric malnutrition has crossed critical humanitarian thresholds. Addressing this crisis requires immediate, multi-sectoral emergency nutritional programming, coupled with sustainable investments in primary healthcare access, community-based screening, and maternal economic empowerment.

Keywords: Prevalence, Severe Acute Malnutrition, Determinants, Children 6–59 months, Nundu, Conflict-affected areas, DR Congo.

Introduction

Malnutrition among children aged between 6 and 59 months remains an unresolved global public health challenge, severely impairing early survival, biological growth, and long-term cognitive architecture. Globally, approximately 149 million children under the age of five suffer from chronic malnutrition (stunting), 45 million present acute malnutrition (wasting), and 37 million are affected by overweight or obesity (WHO, 2023). These figures reflect a multifaceted systemic failure deeply rooted in deep socioeconomic inequalities, chronic household food insecurity, structural poverty, and fragile health delivery systems (UN, 2022).

The initial global nutrition target established to reduce childhood wasting to less than 5% by 2025 has proven unrealistic under contemporary pressures. Consequently, at the 78th World Health Assembly in 2025, Member States adopted a crucial resolution extending the deadline for global nutrition targets to 2030. Progress in eliminating wasting, nutritional oedema, and their associated legalities has decelerated significantly due to the convergence of global hunger crises, protracted armed conflicts, economic shocks, and climate-driven agricultural disruptions.

Childhood acute malnutrition serves as a proxy indicator of a population's developmental and human security baseline. It arises from a complex web of proximal and distal factors, including inadequate dietary intake, suboptimal maternal and child care practices, low immunisation coverage, recurrent exposure to infectious diseases (such as malaria, diarrheal illnesses, and acute respiratory infections), and the overarching socioeconomic vulnerability of the household (Onasaka et al., 2023).

In sub-Saharan Africa, approximately 32% of children under five suffer from various degrees of undernutrition, a trend heavily driven by endemic poverty, geopolitical instability, and recurrent humanitarian emergencies (WHO, 2023; UN, 2022). While regional variations are documented—with wasting prevalences reported at 20.7% in specific conflict-prone pockets of Ethiopia (Dibisa et al., 2025) and similarly high baseline rates in Madagascar (Nassur et al., 2022)—the core risk clusters consistently center on household socioeconomic capital, poor maternal health status, and deficient infant and young child feeding (IYCF) practices.

In the Democratic Republic of the Congo (DRC), the nutritional landscape is exceptionally severe. The 2023–2024 Demographic and Health Survey (EDS-RDC, 2024) indicated that 8.2% of children aged 6–59 months nationwide suffer from global acute malnutrition (GAM), with 2.6% exhibiting severe forms, while chronic malnutrition affects 47.9% of children, peaking prominently within rural jurisdictions. In eastern DRC, decades of asymmetric warfare, forced mass displacements, and localized asset destruction have systematically dismantled agrarian livelihoods and healthcare delivery systems, driving extreme local disparities in nutritional vulnerability (Bavurhe et al., 2024; Mwene-Batu et al., 2021).

Evidence confirms that mitigating this burden requires scalable, evidence-based strategies, including the enforcement of exclusive breastfeeding, timely and high-quality dietary diversification, early community-based screening, and the seamless integration of therapeutic programs into primary healthcare networks (ENN, 2023; WHO, 2023; Dibisa et al., 2025). Programs like the Community-Based Management of Acute Malnutrition (CMAM/PCIMA) have reduced infant mortality when adequately supported by resilient supply chains and comprehensive household food security interventions (FAO & WHO, 2022).

However, operationalizing these frameworks is highly challenging in isolated and conflict-affected zones like the Nundu Rural Health Zone (NRHZ) in South Kivu, where local indicators suggest that acute malnutrition rates far exceed national averages (Nundu Rural Health Zone, 2025). Households in this area face recurring food insecurity, frequent healthcare supply stockouts, and persistent insecurity.

Despite the evident severity of this situation, there remains a critical gap in localized, empirical data regarding the exact prevalence and independent predictors of severe acute malnutrition in conflict-impacted rural settings in eastern DRC. Most public health strategies rely on aggregated provincial estimates that obscure sub-district crises. Therefore, this study aimed to determine the prevalence of severe acute malnutrition among children aged 6–59 months and identify its main sociodemographic, dietary, and healthcare-related determinants within the Nundu Rural Health Zone. Identifying these specific local drivers is essential for shifting interventions from generalized humanitarian aid toward targeted, context-specific public health responses.

Materials and Methods

Study Setting and Contextual

This study was conducted within the Nundu Rural Health Zone (NRHZ), situated in the Fizi Territory, South Kivu Province, in the eastern region of the Democratic Republic of the Congo. The zone is characterized by an complex geopolitical environment marked by recurrent armed conflict, institutional fragility, and severely constrained resources. Topographically, the NRHZ stretches along the western shore of Lake Tanganyika, flanked by high-altitude hills and plain corridors. This terrain complicates internal transport, isolates remote communities, and limits physical access to secondary referral health facilities and regional food markets.

Although the local tropical climate supports subsistence agriculture, contemporary weather shifts and erratic rainfall patterns have compromised seasonal crop yields, increasing food insecurity. The local economy relies primarily on informal small-scale commerce, traditional fishing, and subsistence farming. However, household income remains low, and market access to diverse food groups is highly restricted. Furthermore, deeply embedded socio-cultural practices often influence intra-household food allocation, prioritizing protein-dense items for adult males over young children.

Study Design and Timeline

A community-based, analytical cross-sectional study design was utilized. Field epidemiological data collection was executed over a six-month period, spanning from February to July 2025.

Population and Sampling

The reference study population comprised the entire demographic baseline of children aged 6–59 months residing within the NRHZ, estimated at 23,303 children out of a total population of 137,887 inhabitants. This population is distributed across 10 distinct health areas (*Aires de Santé*), which were categorized into four operational axes: the Northern Axis (Swima), the Middle-North Axis (Ake, Abeka, Kabumbe), the Central Axis (Mboko, Nundu, Kaboke II, Kenya), and the Southern Axis (Lweba, Bitobolo). The minimum required sample size (n) was determined using the classical Cochran/Schwartz formulation:

$$n = \frac{Z^2\alpha.\ P\ (1-P)}{(d)^2}$$

$$= \frac{1{,}96^2.0{,}5(1-0{,}5)}{(0{,}5)^2}$$

$$= \frac{3{,}8416.0{,}5.0{,}5}{0{,}0025}$$

= 384 children aged 6-59 months was established.

p: expected prevalence of malnutrition in the Nundu health zone was 0.50 (50%),

Z^2: coefficient corresponding to 1.96

d: degree of precision or margin of error (5%)

n: sample

To ensure representative geographical distribution, a proportional stratified sampling method was implemented, treating each of the 10 health areas as an independent stratum. The number of parent-child pairs allocated to each stratum was directly proportional to the pediatric population density of that specific health area (Table 1).

Distribution of the target population and calculated sample sizes across the health areas of the Nundu Rural Health Zone

At the community level, systematic household selection was applied within each health area. Because rural villages lack standardized municipal numbering or addresses, field teams established a central reference point (such as a local market or church) or utilized the village entrance. From this point, the "spinning pen" method (a modified EPI cluster sampling tool) was employed to randomly select the initial walking direction. Households along the designated path were sequentially approached and evaluated for eligibility. In households with multiple eligible children within the 6–59 months range, a single child was selected using a random number table to prevent intra-cluster correlation bias (Tab1).

Figure 1. Flow chart on the selection of the study population.

Selection Criteria

- **Inclusion Criteria:** Children aged 6–59 months at the date of the survey, whose mother, father, or primary legal guardian provided free, informed, and written consent, and who were physically present and available for anthropometric assessment.
- **Exclusion Criteria:** Children presenting with overt, severe congenital malformations or pre-existing chronic systemic illnesses (such as advanced renal pathology or known cardiac defects) that independently alter physical development, and children whose guardians actively declined participation.

Study Variables and Measurement Procedures

The primary dependent variable was the nutritional status of the child, specifically categorized as the presence or absence of *Severe Acute Malnutrition (SAM)*. This was determined via Mid-Upper Arm Circumference (MUAC) metrics, adhering strictly to WHO and UNICEF diagnostic protocols. MUAC measurements were executed on the left arm, precisely at the midpoint between the acromion process of the shoulder and the olecranon process of the elbow. High-precision, color-coded, non-stretchable UNICEF pediatric MUAC measuring tapes were utilized. Severe acute malnutrition was defined by a MUAC value strictly below 115 mm (< 115 mm), or the presence of bilateral pitting nutritional oedema. Children with MUAC values >=115 mm were classified as having a good or non-SAM nutritional status. Maternal nutritional status was similarly screened using adult-specific white MUAC bands, with undernutrition defined as a MUAC < 218.

The independent variables included: Socio-demographic Factors: Child's age (stratified into 6–11, 12–23, and 24–59 months), verified through official preschool health records (*Fiche de Consultation Préscolaire/CPS*), civil birth certificates, or maternal recall; child's physiological sex; health area of residence; maternal age; maternal education level (none, primary, secondary, university); maternal marital status; and overall household size (categorized as ≤4, 5–7, or >=8 individuals).

Clinical and Healthcare Utilization Factors: Child's birth weight; current weight measured using calibrated SALTER/UNICEF hanging spring scales (0–100 kg range, tared to zero prior to each assessment with the child minimally clothed); official routine immunisation status (fully vaccinated, partially vaccinated, unvaccinated based on BCG, polio, and measles records); history of hospitalisation within the preceding 12 months; primary clinical reason for admission; history of childhood malnutrition episodes; access to a functional primary healthcare facility within the health zone; and history of routine clinical follow-ups or nutritional consultations. Dietary and Infant Feeding Practices (IYCF): Adherence to exclusive breastfeeding during the first 6 months of life; primary alternative or introductory feeding sources (such as formula, infant feeding bottles, or premature solid food introduction); precise age of weaning; daily meal frequency; specific food groups consumed regularly (grains, vegetables, fruits, animal proteins, dairy products); and documented history of receiving therapeutic or prophylactic micronutrient/medicinal supplementation (Vitamin A, Amoxicillin, or Albendazole) within the 3 months prior to the survey.
Economic Dynamics: Household residential security status (landowner/host family versus tenant/displaced non-host family); structural household socioeconomic tier based on basic need fulfillment capabilities (very low, low, medium/high); and subjective maternal self-perception of household poverty.

Data Collection Procedures

Data collection was performed by a dedicated team of six community health workers (*Relais Communautaires/RECOs*) recruited locally within the NRHZ. These data collectors underwent an intensive three-day training seminar covering technical anthropometric techniques, ethical standard maintenance, and mobile data entry. Questionnaires were administered face-to-face, with questions translated into local languages (Kibembe and Swahili) to ensure clear communication and data validity.

Data Management and Statistical Analysis

Field data entry was conducted on mobile smartphones using the KoboCollect application, which had built-in validation rules to minimize input errors. Completed electronic forms were uploaded daily to a secured KoboToolbox cloud server. The consolidated data matrix was exported into Microsoft Excel 2021 for data cleaning and subsequently imported into Stata SE version 16.0 for formal statistical processing. Descriptive statistics are presented as absolute frequencies and relative percentages for categorical variables. Continuous variables were evaluated for normality; normally distributed variables are described via arithmetic means and standard deviations (SD), while non-normally distributed data are expressed as medians and interquartile ranges (IQR). Bivariate analyses to assess associations between categorical independent variables and childhood nutritional status were performed using Pearson's Chi-square test or Fisher's exact test when expected cell counts fell below five.

To determine the independent predictors of severe acute malnutrition, a robust logistic regression framework was constructed. Independent variables demonstrating a biological plausibility or showing a liberal association level of $p < 0.20$ in the crude univariate analysis (Crude Odds Ratios [COR]) were selected for inclusion in the final multivariate logistic regression model. This purposeful selection approach controls for potential confounding factors. In the final multivariate model, Adjusted Odds Ratios (aOR) and their corresponding 95% Confidence Intervals (CI) were calculated. Multi-collinearity among predictors was assessed using Variance Inflation Factors (VIF), ensuring no severe variance inflation was present. All statistical tests were two-tailed, and a p-value strictly below 0.05 ($p < 0.05$) was used to define statistically significant independent associations.

Ethical Considerations

This study was approved by the Provincial Health Ethics Committee of South Kivu under reference number CNES001/DPSK/178/2025. Administrative clearances were obtained from the NRHZ Chief Medical Officer and local community leaders. Participation was strictly voluntary, and written or thumbprint informed consent was secured from the parent or guardian of every child before any data collection or anthropometric measurement. Complete confidentiality and anonymity were maintained throughout the process; names, precise geographic coordinates, and identifiers were omitted from all analytical databases. Children diagnosed with severe acute malnutrition during field screening were immediately provided with referral slips and transferred to the nearest therapeutic nutritional unit (*Unité Nutritionnelle Thérapeutique/UNT*) for subsidized medical and nutritional management.

Results

Sociodemographic Profiles and Pediatric Nutritional Status

The overall prevalence of severe acute malnutrition within the study sample was 30.7% (95% CI: 26.2% – 35.0%), representing 118 out of the 384 surveyed children. Bivariate evaluation demonstrated a statistically significant association between the child's age group and their nutritional status ($p < 0.001$), with the highest proportion of malnourished cases clustered within the 12–23 months cohort (42.3%). Conversely, no statistically significant differences in SAM rates were found regarding the child's sex ($p = 0.474$), routine vaccination status ($p = 0.216$), or specific health area of origin ($p = 0.170$) (Table 2).

Dietary Habits, Feeding Practices, and Clinical Factors

Analysis of child feeding and therapeutic history revealed that failure to maintain exclusive breastfeeding up to 6 months of age was significantly associated with a higher rate of SAM (37.7% vs 24.9%, $p = 0.007$). Similarly, the introductory use of non-optimal feeding sources (such as infant formula or bottle feeding) was associated with an increased proportion of acute malnutrition (36.6% vs 23.4%, $p = 0.005$). Early weaning before 6 months ($p = 0.020$) and a low daily meal frequency of only 1 meal per day ($p = 0.014$) were also significantly associated with poorer nutritional outcomes. Regarding prophylactic medical interventions, a history of amoxicillin therapeutic treatment during prior illnesses was significantly associated with nutritional status variations ($p < 0.001$). However, no direct descriptive differences were observed regarding macro-dietary item categories or routine Vitamin A and Albendazole distributions (Table 3).

Healthcare Access and Institutional Utilization Profiles

While participation in routine preschool consultations (CPS) and receiving general nutritional counseling showed no significant baseline variations in SAM rates ($p > 0.05$), geographic and structural access to an operational healthcare center or hospital within the zone was significantly associated with nutritional status ($p = 0.006$). Among children whose families lacked access to primary health structures, 64.3% were diagnosed with severe acute malnutrition. Completing routine immunisations also demonstrated a strong protective trend approaching statistical significance ($p = 0.051$) (Table 4).

Household Socioeconomic Configurations

Socioeconomic variables were strongly associated with pediatric acute malnutrition. The structural socioeconomic tier of the family was highly significant ($p < 0.001$), with a SAM rate of 39.0% observed among children from households with a "very low" capacity to meet basic needs. Maternal self-perception of extreme poverty ($p = 0.002$) and housing security status ($p = 0.017$$) were also significantly associated with malnutrition, indicating higher risk among internally displaced families or tenants. Conversely, maternal educational background ($p = 0.191$), age ($p = 0.192$), nutritional status ($p = 0.578$), and overall household size ($p = 0.622$) did not show statistically significant associations with SAM in this sample (Table 5).

Multi-Variable Logistic Regression Analysis

Multivariate logistic regression identified several independent predictors of severe acute malnutrition. Children aged 12–23 months had a significantly higher risk of SAM compared to older cohorts (aOR = 2.73; 95% CI: 1.57–4.74; $p < 0.001$). A history of hospitalisation within the past 12 months (OR = 2.76; 95% CI: 1.58–4.81; $p< 0.001$) and a history of previous malnutrition episodes (aOR = 2.03; 95% CI: 1.21–3.42; $p = 0.005$) were also strong clinical predictors. Among dietary practices, the introduction of non-optimal alternative feeding sources (aOR = 1.73; 95% CI: 1.07–2.79; $p = 0.023$) and the absence of exclusive breastfeeding for the first six months (aOR= 1.73; 95% CI: 1.08–2.79; $p = 0.022$) significantly increased the risk of SAM. Finally, structural and economic barriers were strong independent predictors: a lack of physical access to healthcare structures increased the odds of malnutrition more than five-fold (aOR = 5.74; 95% CI: 1.61–20.41; $p = 0.007$), while living in a household with a very low socioeconomic status increased the risk nine-fold (aOR = 9.01; 95% CI: 1.11–73.14; $p = 0.040$) (Table 6).

Discussion

This cross-sectional investigation within the Nundu Rural Health Zone (NRHZ) revealed an exceptionally high severe acute malnutrition (SAM) prevalence of 30.7% (95% CI: 26.2–35.0%) among children aged 6–59 months. This rate critically exceeds national baseline estimates for the Democratic Republic of the Congo, which average between 8.0% and 8.2% for global acute malnutrition according to recent multi-indicator cluster surveys and PRONANUT documentation (PRONANUT, 2023; EDS-RDC, 2024). It also substantially surpasses broader sub-Saharan African regional emergency thresholds, typically ranging between 10% and 22% (UNICEF, 2022; IPC, 2023).

This high prevalence confirms that the Fizi/Nundu territory represents an intense locus of nutritional vulnerability. This finding aligns with localized research in eastern DRC, which shows that aggregated national metrics often obscure severe sub-district humanitarian crises driven by structural instability (Bavurhe et al., 2024; Mwene-Batu et al., 2021).

The determinants of this crisis are multifactorial and systemic. Decades of asymmetric armed conflict in South Kivu have forced mass displacements, disrupted agricultural supply chains, and systematically weakened primary healthcare delivery systems. These structural factors are supported by the DRC Nutrition Cluster reports (2023), which identify isolated rural conflict zones as highly prone to severe acute malnutrition peaks.

Furthermore, research by Daures et al. (2024) regarding simplified nutritional protocols in fragile DRC environments confirms that areas with intermittent health service delivery experience pediatric malnutrition rates far exceeding national baseline statistics.

The clinical distribution observed in this sample aligns with trends seen in acute food security crises, where protein-energy deficiencies are worsened by rapid dietary disruptions and low dietary diversity (Golden, 2021; WHO, 2023).

Multivariate analysis identified several independent socio-demographic, clinical, and economic predictors of SAM. The significant risk found among the 12–23 months age group (OR = 2.73, $p < 0.001$) aligns with developmental and nutritional transitions observed across sub-Saharan Africa (Alemu et al., 2022; Alflah et al., 2023). This period represents the critical weaning window, where children transition away from breast milk. In resource-limited settings, they are frequently transitioned onto nutrient-poor, bulky carbohydrate staples, increasing their vulnerability to growth failure and acute wasting (Ayana et al., 2016).

The strong independent associations between SAM and a history of previous malnutrition (aOR=2.03) or recent hospitalisation (aOR= 2.76, $p < 0.001$) underscore a well-documented bi-directional relationship between infection and undernutrition. Acute episodes of infectious diseases, such as malaria, diarrheal illnesses, and respiratory tract infections—including recent regional outbreaks of measles and monkeypox—cause severe nutrient malabsorption, metabolic stress, and anorexia (Bedha et al., 2024). This accelerates the progression toward severe wasting.

Conversely, severe acute malnutrition impairs cell-mediated immunity, rendering the child highly susceptible to recurrent, severe infections (Black et al., 2013; WHO, 2022). This cycle is aggravated by frequent stockouts of essential therapeutic medicines and routine vaccines within the NRHZ, undermining childhood survival and preventive healthcare efforts.

Infant and young child feeding (IYCF) practices were also identified as strong independent predictors of SAM. Suboptimal practices, including a lack of exclusive breastfeeding during the first six months of life (aOR= 1.73, $p = 0.022$) and the early introduction of non-optimal alternative foods or bottle-feeding (aOR = 1.73, $p = 0.023$), significantly increased the odds of malnutrition. Descriptively, 45.1% of the sampled children received solid food formulations before reaching the six-month threshold, contrary to WHO and UNICEF guidelines.

Furthermore, dietary diversity scores were low: 93.8% of the children relied almost entirely on a monotone carbohydrate base of rice, maize, and cassava, with minimal access to animal proteins, dairy items, or essential micronutrients. This nutritional deficit is compounded by low meal frequency, with 45.3% of the pediatric sample receiving only a single meal per day.

These patterns align with findings from other rural conflict-impacted zones in sub-Saharan Africa, where a combination of household poverty, limited maternal nutritional literacy, and restrictive cultural traditions regarding intra-household food allocation negatively influence infant feeding habits (FAO, 2022; UNICEF RDC, 2023). Fortunately, contemporary intervention trials demonstrate that these behavioral patterns can be modified through community-based nutritional education combined with targeted social safety nets, such as kitchen gardening and direct cash transfers (Vaivada T et al., 2017; GTAM, 2022).

The strongest independent risk factors identified in this study were structural and economic. Living in a household with a very low socioeconomic status increased the risk of SAM nine-fold (aOR= 9.01, $p = 0.040$). This strong correlation underscores that severe economic deprivation directly restricts a household's capacity to purchase diverse, nutrient-dense foods, secure clean water, or afford primary healthcare services **(**Black et al., 2013; UNICEF, 2022).

Similarly, a lack of physical or geographic access to operational healthcare infrastructure increased the odds of SAM more than five-fold (aOR = 5.74, $p = 0.007$). In the NRHZ, families must navigate long distances across insecure, mountainous terrain to reach

functional clinics. This geographic isolation delays the early detection and treatment of childhood illnesses and mild wasting, allowing cases to progress into severe acute malnutrition before receiving medical attention. These findings align with IPC and ENN diagnostic reports from the DRC, which highlight how forced displacements, structural poverty, and geographical barriers intersect to drive acute child survival crises (IPC RDC, 2023; ENN, 2023).

Methodological Limitations

Several limitations should be considered when interpreting these results. First, the cross-sectional study design captures data at a single point in time, preventing the establishment of direct causal relationships between the identified risk factors and SAM. Second, the reliance on maternal recall for dietary histories, weaning timelines, and historical birth weights introduces potential recall or social desirability biases. Third, utilizing Mid-Upper Arm Circumference (MUAC) as the primary anthropometric tool, while highly effective for community-based screening in humanitarian settings, may capture a different subset of malnourished children compared to weight-for-height Z-scores (WHZ), which can introduce selection variations. Finally, because data collection occurred during a period of active conflict and displacement, the findings may reflect an acute nutritional peak rather than a stable structural trend.

Conclusion

This study documents a critical nutritional emergency within the Nundu Rural Health Zone, where the prevalence of severe acute malnutrition among children aged 6–59 months has reached an alarming 30.7%. This crisis is driven by an interaction of young age (12–23 months), suboptimal infant feeding practices, recurrent infectious illnesses, geographic isolation from healthcare structures, and extreme household poverty. Addressing this high burden requires a shift from short-term humanitarian food aid toward integrated, multi-sectoral public health strategies. Immediate priorities must include strengthening community-based screening networks through local health workers (*Relais Communautaires*), ensuring consistent supply chains for Ready-to-Use Therapeutic Foods (RUTF), and improving access to routine childhood immunisations. In the long term, sustainable interventions should focus on maternal economic empowerment, localized agricultural support, and expanding primary healthcare infrastructure. These steps are essential to break the cycle of poverty and malnutrition, protecting childhood survival and developmental potential in eastern DR Congo.

Footnotes

Clinical Trial: Not applicable

Consent for publication: Not applicable

Availability of data and material: The datasets generated and/or analysed as part of this study are not accessible to the public owing to the sensitivity of the subject and to guarantee the confidentiality of the information.

Competing interests: All the authors declare that they have no competing interests.

Funding: No financing was received for this research.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the South Kivu Health Ethics Committee. Written informed consent was obtained from all mothers of children aged 6–59 months, and all participants were informed of the objectives and use of the study and gave their consent freely and without coercion. Confidentiality was strictly respected throughout the research process. All procedures were

carried out in accordance with current guidelines and regulations, and the study complied with the principles of the Declaration of Helsinki.

Author contributions:

Study design and implementation: AAA, LOM, DBA, and HMM designed and carried out the study.

Methodology: AAA, LOM, DBA, MKM, CBB, JDLB, HMM

Data collection and entry: AAA, MKM

Data analysis and interpretation: AAA, LOM

Validation and addition of data: AAA, LOM, DBA, MKM, CBB, JDMB, FAE, TW, HMM

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Abbreviations

AOR Adjusted odds ratio,

HA= Health area

ATPE= Aliments thérapeutiques prêts à l'emploi

BCG= Calmette and Guérin bacillus

CI=Confidence interval

COR= Crude odds ratio

CPS=Consulting préscolaire

EDS=Enquête démographique et santé

FAO= Food and Agriculture Organisation of the United Nations

GAVI= *Global Alliance for Vaccines and Immunisation*

ICART International Center for Advanced Research and Training

IQR= Interquartile range

ARI= Acute respiratory infection

MICS= Multiple indicator cluster survey

MUAC= Mid-Upper Arm Circumference

UNO=United Nations

BP= Brachial perimeter

PCIMA= Community programme for the management of acute malnutrition

PRONANUT=Programme national de la nutrition

DRC= Democratic Republic of Congo

RECO=Relais Communautaire

SD= Standard deviation

UNICEF= United Nations Children's Fund

WHO=World Health Organisation

NRHZ= Nundu rural health zone

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List of figures and tables

Figure 1. Flow chart on the selection of the study population.

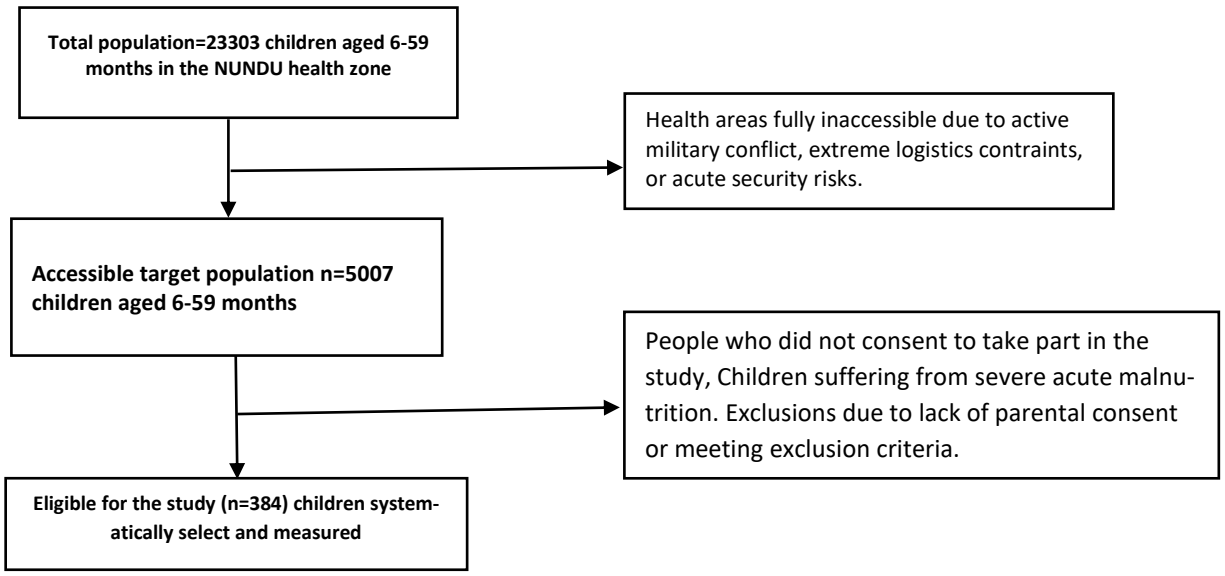


Table 1: Distribution of the target population and calculated sample sizes across the health areas of the Nundu Rural Health Zone

Health area	**Total Population**	**Population of children aged 6-59 months**	**Sample**
Abeka	10509	1776	29
Ake	14892	2517	41
Bitobolo	6693	1131	19
Kaboke 2	20851	3524	58
Kabumbe	11086	1874	31
Kenya	6393	1080	18
Lweba	16073	2716	45
Mboko	26628	4500	74
Nundu	10244	1731	29
Swima	14518	2454	40
Total	137887	23303	384

Table 2: Sociodemographic characteristics and nutritional status of the children (N=384)

Variables	Total sample=384 (n,%)	Nutritional status		p Value
		SAM n=118 (%)	normal n=266 (%)	
Overall SAM Prevalence	30,7 % (IC à 95%: 26,2-35,0%)			
Child age group (months)				<0,001
6-11	76 (19,8)	26 (34,2)	50 (65,8)	
12-23	123(32,0)	52 (42,3)	71 (57,7)	
24-59	185(48,2)	40 (21,6)	145(78,4)	
Child sex				0,474
Male	183 (47,7)	53 (29,0)	130 (71,0)	
Female	201 (52,3)	65 (32,3)	136 (67,7)	
Vaccination schedule status				0,216
Fully vaccinated	99 (25,8)	25(25,3)	74 (74,7)	
Vaccinated	125(32,6)	45(36,0)	80 (64,0)	
Unvaccinated	160(41,7)	48(30,0)	112 (70,0)	
Health area of origin				0,170
Abeka	29 (7,6)	8 (27,6)	21(72,4)	
Ake	41 (10,7)	18(43,9)	23(56,1)	
Bitobolo	19 (4,9)	7 (36,8)	12(63,2)	
Kaboke 2	58 (15,1)	15(25,9)	43(74,1)	
Kabumbe	31 (8,1)	5 (16,1)	26(83,9)	
Kenya	18 (4,7)	8 (44,4)	10(55,6)	
Lweba	45 (11,7)	13(28,9)	32(71,1)	
Mboko	74 (19,3)	19(25,7)	55(74,3)	
Nundu	29 (7,6)	8 (27,6)	21(72,4)	
Swima	40 (10,4)	17(42,5)	23(57,5)	

Table 3 : Dietary practices, young child feeding habits, and therapeutic history vs. nutritional status ($N = 384)

Variables	Total sample=384 (n,%)	Nutritional status		p Value
		SAM n=118 (%)	Normal n=266 (%)	
Mainly breastfed and survey date				0,085
Yes	151(39,3)	54(35,8)	97(64,2)	
No	233(60,7)	64(27,5)	169(72,5)	
Fed via alternative				0,005
Yes (bottle, formula, early solids)	213(55,5)	78(36,6)	135(63,4)	
No	171(44,5)	40(23,4)	131(76,6)	
Exclusive breastfeeding (<6 months)				0,007
Yes	209(54,4)	52(24,9)	157(75,1)	
No	175(45,6)	66(37,7)	109(62,3)	
Weaning Age Threshold				0,020
Less than 6 months	173(45,1)	65(37,6)	108(62,4)	
Between 6 and 12 months	1(0,3%)	0(0,0)	1(100,0)	
More than 12 months	1(0,3%)	1(100,0)	0(0,0)	
Daily meal frequency				0,014
1 meal per day	174(45,3)	67(38,5)	107(61,5)	
2 meals per day	165(43,0)	43(26,1)	122(73,9)	
3 meals per day	42(10,9)	7(16,7)	35(83,3)	
More than 3 meals per day	3(0,8)	1(33,3)	2(66,7)	
Regular dietary items consumed				
Staples (Rice, maize, cassava, beans)	360(93,8)	112(31,1)	248(68,9)	0,530
Leafy Vegetables/spinach	273(71,1)	78 (28,6)	195(71,4)	0,151
Fruits (banana, mango, papaya)	11(2,9)	4(36,4)	7(63,6)	0,681
Meat/fish products	25(6,5)	7(28,0)	18(72,0)	0,760
Milk or dairy items	10(2,6)	1(10,0)	9(90,0)	0,150
Processed foods/commercial porridges	59(15,4)	18(30,5)	41(69,5)	0,968
Eggs	1(0,3)	0(0,0)	1(100,0)	0,505
Supplements Received (<3 Months)				
Vitamin A				
Amoxicillin (Therapeutic)	355(99,7)	105(29,6)	250(70,4)	0,517
Albendazol (Deworming)	126(35,4)	66(52,4)	60(47,6)	0,001
Mainly breastfed	238(66,9)	68(28,6)	170(71,4)	0,588

Table 4: Healthcare structural access and utilization characteristics (N = 384)

Variables	Total sample=384 (n,%)	Nutritional status		P Value
		SAM n=118 (%)	Normal n=266 (%)	
Regular medical check-ups (CPS, vaccinations)				0,266
Yes	228(59,4)	75(32,9)	153(67,1)	
No	156(40,6)	43(27,6)	113(72,4)	
Total number of CPS visits since birth				0,326
1 time	176(45,9)	50(28,4)	126(71,6)	
2 times	18(4,6)	9(50,0)	9(50,0)	
3 times	57(14,9)	21(36,8)	36(63,2)	
4 times	106(27,6)	33(27,9)	73(72,1)	
>=5 times	27(7,0)	5(18,5)	22(81,5)	
Received standard nutritional advice				0,259
Yes	208(54,2)	69(33,2)	139(66,8)	
No	176(45,8)	49(27,8)	127(72,2)	
Physical access to health center/hospital				0,006
Yes	370 (96,4)	109 (29,5)	261 (70,5)	
No	14 (3,6)	9 (64,3)	5(35,7)	
Completed Routine childhood vaccines				0,051
Yes	314(81,8)	90(28,7)	224(71,3)	
No	70(18,2)	30(42,9)	40(57,1)	

***PSC=Preschool consultation*

Tableau 5 : Household socioeconomic factors and childhood acute malnutrition (N = 384)

Variables	Total sample=384 (n,%)	Nutritional status		p Value
		SAM n=118 (%)	Normal n=266 (%)	
Maternal Education Level				0,191
None	120(31,3)	38(31,7)	82(68,3)	
Primary school	195(50,8)	65(33,3)	130(66,7)	
Secondary school	64(16,4)	15(23,8)	48(76,2)	
Higher/university	6(1,6)	0(0,0)	6(100,0)	
Maternal age group (years)				0,192
≤ 18	31(8,1)	10(32,2)	21(67,8)	
19-25	131(34,1)	36(27,5)	95(72,5)	
26-31	122(31,8)	44(36,1)	78(63,9)	
≥ 32	100(26,0)	28(28,0)	72(72,0)	
Maternal anthropometric status (MUAC)				0,578
≤ 218 mm	25(6,5)	10(40,0	15(60,0)	
219-229n mm	356(92,7)	107(30,1)	249(69,9)	
≥ 230 mm	3(0,8)	1(66,7)	2(33,3)	
Maternal marital status				0,187
Married	329 (85,7)	91(27,7)	238(72,3)	
Divorced/separated	42(11)	21(50)	21(50)	
Unrelated/widowed	13(3,3)	6(46,2)	7(53,8)	
Household housing security status				0,017
Landowner/host family	262(68,2	72(27,5)	190(72,5)	
Tenant/Intrenally displaced family	122(31,8)	46(37,0)	76(62,3)	
Structural socioeconomic status				0,001
Very low (cannot meet basic needs)	205(53,4)	80(39,0)	125(61,0)	
Low (few resources, meets basic needs)	156(40,6)	37(23,7)	119(76,3)	
Medium/high	23(6,0)	1(4,5)	22 (95,5)	
Self-perception of poverty				0,002
Yes	326(84,9)	111(34,0)	215(66,0)	
No	48(12,5)	4(8,3)	44(91,7)	
Do not know	10(2,6)	3(30,0)	7 (70,0)	
Total Household size (individuals)				0,622
≤ 4	74 (19,3)	21 (28,4)	53 (71,6)	
5-7	183 (47,7)	57 (31,1)	126 (68,9)	
≥ 8	106(27,6)	31(29,2)	75(70,8)	

Table 6: Univariate and Multivariate Logistic Regression of Independent Determinants of Severe Acute Malnutrition

Variables	Crudes Odds Ratios (95% CI)	p Value	Adjusted Odds Ratios (95% CI)	p Value
Child age category (months)				
6-11	1,88 (1,04-3,39)	0,035	2,02 (0,84-4,82)	0,112
12-23	2,65 (1,60-4,37)	<0,001	2,73 (1,57-4,74)	<0,001
24-59	Reference	-	Reference	-
History of malnutrition episode in the last 12 months				
Yes	2,24 (1,41-3,56)	<0,001	2,03 (1,21-3,32)	<0,001
No	Reference	-	Reference	-
Hospitalised in the last 12 months				
Yes	3,19 (1,86-5,48)	<0,001	2,76 (1,58-4,81)	<0,001
No	Reference	-	Reference	-
Alternative feeding sources				
Yes	1,80 (1,14-2,84)	0,010	1,73 (1,07-2,79)	0,023
No	Reference	-	Reference	-
Exclusive breastfeeding (>6 months)				
Yes	Reference	-	Reference	-
No	1,82 (1,17-2,83)	0,007	1,73 (1,08-2,79)	0,022
Access to Healthcare facility				
Yes	Reference	-	Reference	-
No	4,31 (1,41-13,15)	0,010	5,74 (1,61-20,41)	0,007
Structural socioeconomic status				
Very low	14,10 (1,86-106,5)	0,010	9,01 (1,11-73,14)	0,040
Low	6,84 (0,89-52,4)	0,001	5,54 (1,67-45,28)	0,021
Medium/High	Reference	-	Reference	-
Maternal Self-Perceived Poverty				
Yes	3,65 (1,52-8,76)	0,004	3,10 (1,30-7,32)	0,032
No	Reference	-	Reference	-
Maternal education level				
None	1,48 (0,73-2,97)	0,267	1,22 (0,57-2,59)	0,605
Primary school	1,60 (0,83-3,07)	0,158	1,41 (0,69-2,88)	0,335
Secondary school	Reference	-	Reference	-

Supplementary Files

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