



Assessment of Anthropometric Indicators of Maternal Malnutrition among Pregnant Women in Nongowa Chiefdom, Kenema District, Sierra Leone

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Abstract

Maternal malnutrition remains a major public-health concern in Sierra Leone, yet community-level evidence based on objective anthropometric measurement is scarce. This study assessed anthropometric indicators of maternal malnutrition among pregnant women attending antenatal care (ANC) clinics in Nongowa Chiefdom, Kenema District. A cross-sectional, descriptive design was used, and data were collected from 63 pregnant women using a structured, interviewer-administered questionnaire and standardized measurements of body mass index (BMI) and mid-upper arm circumference (MUAC). Data were analyzed in SPSS using frequencies, percentages, and charts. The findings revealed a clear double burden of malnutrition: by BMI, 14.3% of respondents were underweight, 49.2% were of normal weight, 25.4% were overweight, and 11.1% were obese; by MUAC, 19.0% were malnourished (below 23 cm). Overall, just over half (50.8%) fell outside the normal BMI range, and MUAC detected more acute undernutrition than BMI. The population was highly economically vulnerable, with 65.1% reporting no income and 50.8% unemployed, and more than half experienced household food insecurity. Respondents identified poverty and food shortages, rather than cultural beliefs, as the main factors affecting their nutrition. Although ANC coverage, supplementation, and nutrition education were high (all above 87%), most women (79.4%) attended only one or two ANC visits, far below the WHO-recommended minimum. Maternal malnutrition in the study area is therefore driven principally by poverty and food insecurity, and the routine integration of MUAC screening into ANC, alongside economic and food-security interventions, is recommended.

Keywords: maternal malnutrition; anthropometric indicators; mid-upper arm circumference; body mass index; food insecurity; antenatal care

1. Introduction

Maternal nutrition is a fundamental determinant of pregnancy outcomes, maternal survival, and child development. Adequate nutrition during pregnancy supports fetal growth, maintains maternal health, and helps prevent complications such as anaemia, preterm birth, and low birth weight. The World Health Organization defines malnutrition as an imbalance between nutrient intake and the body's requirements for growth and physiological function, a condition that is particularly critical during pregnancy [1].

Maternal malnutrition remains a major global health challenge, especially in low- and middle-income countries. Anaemia alone affects an estimated 37% of pregnant women worldwide, with the highest burden in sub-Saharan Africa owing to persistent poverty, food insecurity, and limited access to diversified diets [2], [3]. These conditions sustain a cycle of poor maternal outcomes, including elevated maternal mortality and adverse neonatal outcomes such as low birth weight and impaired cognitive development.



Anthropometric indicators, particularly body mass index (BMI) and mid-upper arm circumference (MUAC), are widely used to assess maternal nutritional status. BMI indexes body fat from weight and height, whereas MUAC is a practical, reliable measure of maternal nutritional reserves in low-resource settings. A MUAC below 23 cm and a BMI below 18.5 kg/m² are strongly associated with maternal undernutrition and poor pregnancy outcomes [4]. Both are especially valuable in antenatal care (ANC), where rapid, low-cost assessment is required.

In Sierra Leone, maternal malnutrition persists amid poverty, food insecurity, and limited healthcare infrastructure. National data indicate that a considerable proportion of women of reproductive age experience undernutrition while others face overweight and obesity, reflecting a growing double burden of malnutrition [5], [6]. Recent district-level evidence from Kenema reports that maternal malnutrition is strongly associated with socioeconomic deprivation and food insecurity: 63.8% of pregnant women earned less than Le5, 000 per month, 75.6% skipped meals for financial reasons, and 66.1% experienced hunger during pregnancy [7]. Diets were predominantly carbohydrate-based (90.6%) and adolescent pregnancy was highly prevalent (43.4%), while cultural and religious restrictions played a comparatively minor role [7].

Nongowa Chiefdom shares the socioeconomic and health-system characteristics of the wider district, yet localized data on anthropometric indicators such as BMI and MUAC among its pregnant women are lacking; most existing studies address broader district-level determinants without detailed anthropometric assessment [7]. This gap limits the ability of providers and policymakers to design targeted interventions. Accordingly, this study assessed anthropometric indicators of maternal malnutrition among pregnant women attending ANC clinics in Nongowa Chiefdom. The specific objectives were: (i) to assess nutritional status using MUAC and BMI; (ii) to determine the prevalence of maternal malnutrition; and (iii) to examine associations between socio-demographic factors and maternal nutritional status.

2. Literature Review

2.1. Theoretical and Conceptual Framework

This study is grounded in the UNICEF conceptual framework on the determinants of maternal and child nutrition, which explains malnutrition as the product of interacting immediate, underlying, and basic determinants operating at individual, household, and societal levels [8]. At the immediate level, diet and care shape nutritional status; inadequate intake, compounded by infections such as malaria and gastrointestinal disease, contributes to undernutrition reflected in low MUAC and reduced BMI. At the underlying and basic levels, food access, maternal and household practices, and access to healthcare services, sanitation, education, and social protection determine outcomes [9]. Within this framework, socioeconomic factors such as income, education, occupation, and household size shape food security and dietary intake and access to health services, which together determine maternal nutritional status as captured by anthropometric indicators and, ultimately, pregnancy outcomes [8], [10].

2.2. Empirical Evidence

Globally, the burden of maternal malnutrition remains substantial: the number of undernourished women in vulnerable countries rose by roughly 25% between 2020 and 2023 [11]. MUAC has gained recognition as a simple, effective tool for identifying acute malnutrition among pregnant women in low-resource settings [12]. In sub-Saharan Africa, maternal undernutrition prevalence ranges between about 15% and 30% depending on country and criteria, with low dietary diversity and heavy reliance on staples contributing to poor

outcomes [13]. At the national level, a documented double burden sees undernutrition coexist with overweight and obesity among Sierra Leonean women of reproductive age [14].

Maternal malnutrition is consistently associated with poverty, low education, food insecurity, and limited healthcare access, with adolescent mothers and high-parity women at elevated risk [2], [9], and [10]. Although food taboos contribute in some settings, economic constraints dominate: in the Kenema study, financial constraints (78.7%) far outweighed cultural restrictions (4.7%) and knowledge gaps (6.3%) as barriers to adequate nutrition [7]. Undernutrition (BMI below 18.5 kg/m² or MUAC below 23 cm) increases the risk of low birth weight, preterm birth, and maternal morbidity and mortality [6], [15]; MUAC often outperforms BMI as a predictor in low-resource settings because it is relatively stable across pregnancy [16], [17]. Overnutrition (BMI of 25 kg/m² or above) is an emerging concern linked to gestational diabetes and hypertensive disorders [6]. Despite this evidence, community-level data using standardized anthropometric indicators remain scarce in Sierra Leone, and few studies link socio-demographic factors directly to measured MUAC and BMI at the chiefdom level the gap the present study addresses.

3. Methodology

A cross-sectional, descriptive design was used to assess anthropometric indicators of maternal malnutrition among pregnant women attending ANC clinics in Nongowa Chiefdom, Kenema District, in Sierra Leone's Eastern Province. Nongowa, which includes Kenema City and surrounding peri-urban communities, is the most urbanized and densely populated chiefdom in the district, with an estimated population exceeding 250,000 [18], [20]. The study population comprised all pregnant women attending ANC at selected facilities; the accessible population comprised those present during the data-collection period who consented. Women who were seriously ill or who declined to participate were excluded.

The sample size was estimated using the Cochran formula for prevalence studies [20], with $Z = 1.96$, an assumed prevalence $p = 0.5$, and a margin of error $e = 0.05$, giving 384; after finite-population correction (assuming $N \approx 1,000$) and a 10% non-response allowance, the calculated minimum was approximately 306. In practice, the number of eligible, consenting women during the limited data-collection window determined the achievable sample, and 63 pregnant women were enrolled and analyzed. This realized sample is adequate for descriptive estimation but limits statistical power and generalizability. A multi-stage procedure was used: facilities were purposively selected based on high ANC attendance and accessibility, and respondents were then selected within facilities using simple random or systematic sampling.

Data were collected using a structured, interviewer-administered questionnaire covering socio-demographic characteristics, dietary habits, and access to health services, together with standardized anthropometric measurements: body weight (scale), height (height board), and MUAC (tape). Content and face validity were established through expert and supervisor review, and a pilot study conducted outside the study area was used to refine the instrument. Data were coded and analyzed in the Statistical Package for the Social Sciences (SPSS) using frequencies, percentages, means, and standard deviations; the chi-square test was planned to examine associations between socio-demographic variables and nutritional status. BMI was classified using standard WHO cut-offs, and MUAC using the widely applied 23 cm threshold for maternal undernutrition. Ethical approval was obtained from the relevant authorities; informed consent was secured from all participants; and confidentiality and anonymity were maintained throughout.

4. Results

4.1. Respondent Characteristics

All 63 women approached consented, yielding a 100% response rate. Respondents were predominantly young, with 58.7% aged 15–24 years, and most were single (58.7%). The educational profile was relatively favorable: 63.5% had secondary education and 15.9% had tertiary education, yet 20.6% had little or no formal schooling. Economic vulnerability was pronounced: half were unemployed (50.8%), and almost two-thirds reported no income (65.1%), with only 1.6% reporting a medium income and none a high income (Table 1).

Table 1. Socio-demographic characteristics of respondents (N = 63).

Characteristic	Category	N	%
Age (years)	15–19	8	12.7
	20–24	29	46
	25–29	16	25.4
	30 and above	10	15.9
Marital status	Single	37	58.7
	Married	25	39.7
	Divorced	1	1.6
Education	No formal	9	14.3
	Primary	4	6.3
	Secondary	40	63.5
	Tertiary	10	15.9
Occupation	Unemployed	32	50.8
	Trader	15	23.8
	Other	8	12.7
	Farmer	5	7.9
	Civil servant	3	4.8
Monthly income	No income	41	65.1
	Low	21	33.3
	Medium	1	1.6

4.2. Maternal, Health, and Food-Security Profile

Almost half of the respondents (49.2%) were in the first trimester, and most (58.7%) were primigravid. Although drawn entirely from ANC attendees, 79.4% had made only one or two visits, far below the WHO-

recommended minimum of eight contacts [1], even though 90.5% had received iron/folic-acid supplements and 87.3% nutrition education a coverage paradox in which high service coverage does not translate into adequate contact frequency [21] (Table 2). Dietary and food-security data reinforced the picture of economic strain: 41.3% skipped meals, chiefly for financial reasons; vegetables were consumed daily by only 20.6% of women; and experience-based indicators showed that 55.6% worried about having enough food, 52.4% reduced meal size, 36.5% skipped meals for lack of food, and 17.5% went a whole day without eating.

Table 2. Maternal, health-service, and food-security characteristics (N = 63).

Variable	Category	N	%
Gestational age	1st trimester	31	49.2
	2nd trimester	25	39.7
	3rd trimester	7	11.1
ANC visits	1–2	50	79.4
	3–4	12	19
	5 and above	1	1.6
Iron/folic acid received	Yes	57	90.5
Nutrition education received	Yes	55	87.3
Skips meals	Yes	26	41.3
Worried about enough food	Yes	35	55.6
Went a whole day without eating	Yes	11	17.5

4.3. Nutritional Status and Prevalence of Malnutrition

By BMI, 14.3% of respondents were underweight, 49.2% were of normal weight, 25.4% were overweight, and 11.1% were obese, so 36.5% carried excess weight—the hallmark of a double burden within a single population [14]. By MUAC, 19.0% were malnourished (below 23 cm), and 81.0% were normal. The proportion identified as acutely undernourished by MUAC (19.0%) exceeded that identified as underweight by BMI (14.3%), consistent with MUAC being less influenced by pregnancy-related fluid retention and weight gain and therefore able to detect undernutrition that BMI may mask [16]. Taken together, 50.8% of respondents fell outside the normal BMI range, meaning that one in every two women assessed exhibited some form of malnutrition (Table 3, Fig. 1).

Table 3. Summary of maternal malnutrition prevalence by indicator (N = 63).

Indicator of malnutrition	N	Prevalence (%)
Undernutrition by BMI (< 18.5)	9	14.3
Acute malnutrition by MUAC (< 23 cm)	12	19
Over-nutrition by BMI ($\geq$ 25.0)	23	36.5
Any form of malnutrition (BMI abnormal)	32	50.8

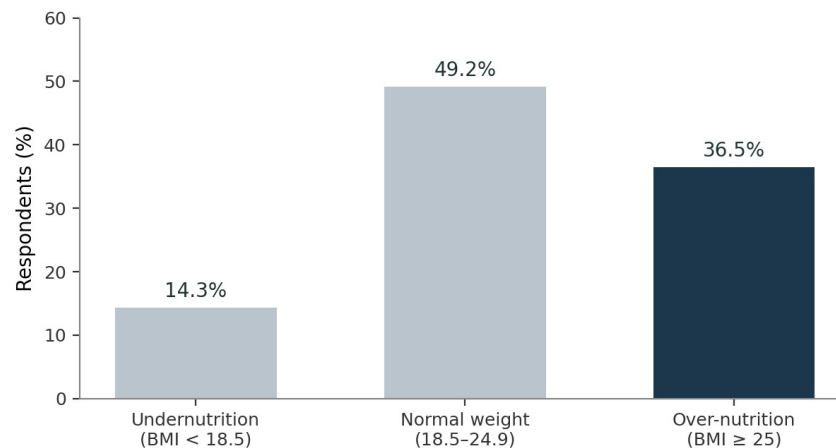


Fig. 1. The double burden of maternal malnutrition based on body mass index (BMI). Bars show the percentage of respondents who were undernourished, of normal weight, and overnourished.

4.4. Perceived Factors Affecting Nutrition

When asked what affected their nutrition during pregnancy, respondents most frequently identified poverty (19.0%), lack of knowledge (15.9%), and food shortage (12.7%), while cultural beliefs (3.2%) and poor healthcare access (1.6%) were mentioned least often. A large free-text “other” category (41.3%) overwhelmingly reflected economic hardship, stress, and lack of food. In the women’s own perception, therefore, maternal malnutrition in the study area is driven principally by poverty and food insecurity rather than by cultural restrictions or ignorance [7].

5. Discussion

The findings provide a detailed, community-level picture of maternal nutritional status in Nongowa Chiefdom and, taken together, address all three objectives. The anthropometric assessment revealed that maternal malnutrition is a significant problem, with 19.0% of respondents acutely malnourished by MUAC and 14.3% underweight by BMI, alongside a considerable burden of over-nutrition (36.5%). This confirms a double burden of malnutrition within a single, relatively small population, a pattern increasingly reported across Sierra Leone and sub-Saharan Africa [13], [14]. The undernutrition prevalence recorded here falls within, and towards the upper part of, the 15–30% range reported regionally [13].

The study also demonstrates the analytical value of combining MUAC and BMI. The higher prevalence detected by MUAC (19.0%) than by BMI-defined underweight (14.3%) supports the argument that MUAC is a more sensitive and stable indicator of maternal undernutrition in low-resource settings, where it is less affected by gestational weight change [16]. This has a direct practical implication: MUAC should be integrated into routine ANC to avoid underestimating acute undernutrition. At the same time, the substantial over-nutrition observed means that interventions addressing only undernutrition would overlook a large segment of women facing overweight- and obesity-related complications such as gestational diabetes and hypertensive disorders [6], underscoring the need for a dual-focused strategy.

The socio-demographic and household data situate these outcomes within pronounced economic vulnerability: most respondents had no income (65.1%) or were unemployed (50.8%), and more than half experienced household food insecurity. These conditions, together with the women’s own perceptions, point to poverty and food insecurity as the principal drivers of maternal malnutrition, consistent with district evidence [7] and with the broader finding that economic access to food outweighs cultural factors in low-

income settings [23]. Finally, the study exposes a health-system paradox: although coverage of ANC, supplementation, and nutrition education was high (all above 87%), the number of ANC contacts was very low, with 79.4% of women attending only once or twice. Coverage alone is therefore insufficient; the quality, frequency, and effective utilization of services must also improve, and cost-effective, evidence-based nutrition interventions delivered through ANC could yield substantial benefit [21], [22].

These findings should be interpreted in light of the study's limitations. The cross-sectional design precludes causal inference; some information was self-reported and subject to recall bias; the sample was restricted to ANC attendees, potentially excluding more vulnerable non-attenders; and the realized sample of 63, smaller than the calculated target, limits statistical power and generalizability. The assessment was also confined to anthropometry and did not capture biochemical "hidden hunger."

6. Conclusion

Maternal malnutrition is a significant public-health concern in Nongowa Chiefdom, characterized by a double burden in which undernutrition (19.0% by MUAC; 14.3% underweight by BMI) coexists with substantial overnutrition (36.5%). MUAC proved more sensitive than BMI for detecting acute undernutrition, underscoring its usefulness for antenatal screening in low-resource settings. The burden is driven primarily by poverty, unemployment, lack of income, and household food insecurity rather than by cultural practices, and the effectiveness of otherwise well-covered ANC services is undermined by very low contact frequency. Improving maternal nutrition will require an integrated response that simultaneously addresses economic deprivation and food insecurity, integrates routine MUAC screening into ANC, and strengthens the quality and intensity of antenatal nutrition support. Larger multi-facility studies, completion of inferential analyses, and the addition of biochemical assessment are recommended to extend these findings.

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Conflict of Interest

The authors declare no conflict of interest.

Data Availability Statement

The de-identified dataset supporting the findings of this study is available from the corresponding author on reasonable request.

AI Usage Disclosure

The authors used a generative AI assistant for language editing and formatting of the manuscript to the journal template; all content was reviewed and verified by the authors. AI tools are not listed as authors.

Author Contributions

Conceptualization, [MMK, LTK]; methodology, [MMK, MAK]; data collection and analysis, [JK]; writing—original draft, [JK]; writing—review and editing, all authors. All authors have read and agreed to the published version of the manuscript.

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Appendix A. Supplementary Material

The structured questionnaire instrument, the full food-frequency and household food-insecurity item tables, and the planned chi-square association analysis are available as supplementary material (items labelled A.1, A.2, and so on).