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A catastrophic burden of malnutrition in Sokoto state, Nigeria: A cross-sectional analysis of anthropometric indices in under-five children

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Abstract

Malnutrition remains a critical public health challenge in Northern Nigeria, with Sokoto State bearing a disproportionate burden. This study aimed to determine the prevalence of stunting, wasting, and underweight among children under five years of age in Sokoto State, using a range of anthropometric indicators. A community-based cross-sectional study was conducted among 150 children attending Primary Health Centers. Anthropometric measurements, including weight, height/length, and Mid-Upper Arm Circumference (MUAC), were collected using standardized procedures. Data were analyzed using descriptive statistics, and nutritional status was classified according to WHO child growth standards. The age and sex distribution of the cohort were also examined. The study revealed an exceptionally high burden of malnutrition. The prevalence of underweight (Weight-for-Age Z-score < -2SD) was 83.3%, with 20.0% severely underweight. MUAC classification showed that 68.7% of children suffered from acute malnutrition, including 28.0% with Severe Acute Malnutrition (SAM) and 40.7% with Moderate Acute Malnutrition (MAM). The age distribution confirmed that 64.7% of children were under 36 months, with a mean weight trajectory showing profound and progressive growth faltering compared to WHO standards, particularly during the 13-24 month weaning period. A slight female advantage in mean weight (6.6 kg vs. 6.3 kg) was observed. The findings reveal a catastrophic nutritional crisis of an unprecedented scale, far exceeding WHO emergency thresholds. The convergence of high rates of underweight and acute malnutrition, driven by growth faltering in the first 1000 days, indicates profound systemic failures in diet, healthcare, and sanitation. Urgent, multi-sectoral interventions targeting the critical weaning period are imperative to avert high mortality and long-term developmental consequences.

Keywords: Malnutrition; Stunting; Wasting; Underweight; MUAC; Under-Five Children; Sokoto; Northern Nigeria

1. Introduction

Childhood malnutrition remains one of the most formidable barriers to global health and sustainable development, particularly in low- and middle-income countries (Black et al., 2013). In Nigeria, the burden is disproportionately concentrated in the northern regions, where a confluence of factors including poverty, food insecurity, poor water, sanitation and hygiene (WASH) conditions, and limited healthcare access create a perfect storm for nutritional deprivation (National Population Commission [NPC] & ICF, 2019). The first five years of life represent a critical window for physical and cognitive development, and nutritional insults during this period can lead to irreversible consequences, including stunted growth, impaired intellectual potential, and increased susceptibility to infections (UNICEF, 2021).

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Sokoto State, located in the North-West zone, consistently reports some of the worst nutritional indicators in the country (National Population Commission [NPC] & ICF, 2019; UNICEF, 2022). According to the Nigeria Demographic and Health Survey (NDHS), the prevalence of stunting, wasting, and underweight in the state remains alarmingly high (NPC & ICF, 2019). However, aggregate state-level data can often obscure the true severity of the crisis at the community level. This study was designed to provide a granular, community-based assessment of malnutrition using a comprehensive set of anthropometric indicators.

The primary objective of this study was to determine the prevalence of stunting, wasting, and underweight among children aged 0-59 months attending Primary Health Centres (PHCs) in Sokoto State. Specifically, this paper reports on the anthropometric findings, including weight and height distributions, Mid-Upper Arm Circumference (MUAC) classification, and Weight-for-Age Z-scores, while contextualizing these findings within the age and sex demographics of the cohort (World Health Organization [WHO], 2006). By moving beyond a simple descriptive analysis, this study aims to illuminate the dynamic process of growth faltering and underscore the urgent need for targeted, multi-sectoral interventions (Black et al., 2013; United Nations Children's Fund [UNICEF], 2021).

2. Methodology

2.1. Study Design and Setting

This study employed a community-based, cross-sectional design. It was conducted in selected Primary Health Centres (PHCs) across Local Government Areas (LGAs) in Sokoto State, Northwest Nigeria, between September, 2024 and September, 2025. Sokoto State is characterized by high poverty rates, a predominantly agrarian but food-insecure population, and challenging climatic conditions that exacerbate nutritional vulnerability.

2.2. Study Population and Sampling

The study population comprised children aged 0 to 59 months who presented at the selected PHCs during the study period. A total of 150 mother-child pairs were enrolled. A multi-stage sampling technique was employed to select LGAs, PHCs, and subsequently, the study participants. Children with obvious physical deformities that could impede accurate anthropometric measurement or those who were critically ill and requiring immediate emergency care were excluded from the study.

2.3. Data Collection

Data were collected through face-to-face interviews with mothers or caregivers using a semi-structured, pre-tested questionnaire adapted from the validated WHO STEPwise approach to surveillance (STEPS) instrument, which captured demographic and socioeconomic information. In addition, detailed anthropometric measurements were taken, including weight, height or length, and mid-upper arm circumference (MUAC). Weight was measured to the nearest 0.1 kg using a Seca electronic scale that was calibrated daily, with children wearing minimal clothing. Recumbent length was measured for children under 24 months using a calibrated infantometer, while standing height was measured for those aged 24 months and above using a portable stadiometer, with both recorded to the nearest 0.1 cm. MUAC was measured at the midpoint of the left upper arm using a non-stretchable tape and recorded to the nearest 0.1 cm.

2.4. Data Analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) and Excel, employing descriptive statistics such as frequencies, percentages, means, and standard deviations to summarize the demographic and anthropometric characteristics of the children. Nutritional status was classified by calculating Weight-for-Age Z-scores (WAZ) based on the 2006 WHO Child Growth Standards (WHO, 2006), with children categorized as normal weight (WAZ ≥ -2SD), mildly underweight (-3SD < WAZ < -2SD), moderately underweight (-4SD < WAZ ≤ -3SD), or severely underweight (WAZ ≤ -4SD). Additionally, Mid-Upper Arm Circumference (MUAC) was assessed using standard cut-offs for children aged 6-59 months, classifying them as having Severe Acute Malnutrition (SAM) with MUAC < 11.5 cm (Red), Moderate Acute Malnutrition (MAM) with MUAC between 11.5 and 12.5 cm (Yellow), or normal nutritional status with MUAC > 12.5 cm (Green).

3. Results

3.1. Demographic Profile of the Cohort

The study cohort consisted of 150 children under five years. The age distribution, as shown in Table 1, revealed that nearly two-thirds (64.7%) of the children were under 36 months of age. The largest age group was 13-24 months, accounting for 30.0% (n=45) of the sample. The sex distribution was near-equitable, with 53.3% (n=80) females and 46.7% (n=70) males (Table 2).

Table 1 Distribution of Children by Age Group (Months) (N=150)

Age Group (Months)	Frequency	Percentage (%)
0 – 12	22	14.7
13 – 24	45	30.0
25 – 36	30	20.0
37 – 48	28	18.7
49 – 59	25	16.6
Total	150	100

Source: SPSS

Table 2 Distribution of Children by Sex (N=150)

Sex	Frequency	Percentage (%)
Male	70	46.7
Female	80	53.3
Total	150	100

Source: SPSS

3.2. Weight Distribution and Growth Faltering

The overall weight distribution showed that 78% of children weighed less than 7.0 kg (Table 3). A cross-analysis of mean weight by age group against WHO standards (Table 4) revealed profound growth faltering. Infants aged 0-12 months had a mean weight of 4.8 kg, which is approximately the WHO 50th percentile for a healthy 2-month-old (WHO, 2006). The weight deficit widened dramatically in the 13 to 24-month age group, whose mean weight of 6.2 kg corresponds to that of a well-nourished 5 to 6-month-old, representing a developmental lag of 12-18 months. By the 49 to 59-month age group, the mean weight deficit exceeded 7 kg.

Table 3 Weight Distribution by Range (kg) (N=150)

Weight Range (kg)	Frequency	Percentage (%)
≤ 3.0	12	8.0
3.1 – 5.0	40	26.7
5.1 – 7.0	65	43.3
7.1 – 9.0	28	18.7
≥ 9.1	5	3.3
Total	150	100

Source: SPSS

Table 4 Mean Weight by Age Group and Comparison with WHO Standards

Age Group (Months)	Mean Weight (kg)	WHO 50th Percentile Weight (kg)	Weight Deficit (kg)
0 – 12	4.8	7.5 - 9.6	2.7 - 4.8
13 – 24	6.2	9.6 - 11.1	3.4 - 4.9
25 – 36	6.9	11.1 - 12.7	4.2 - 5.8
37 – 48	7.4	12.7 - 14.2	5.3 - 6.8
49 – 59	7.8	14.2 - 15.7	6.4 - 7.9
Total	6.6	-	2.7 – 7.9

Source: WHO Child Growth Standards, 2006

Table 4: A sex-based comparison showed that females had a slightly higher mean weight (6.6 kg) compared to males (6.3 kg), as shown in Table 5.

Table 5 Mean Weight by Sex

Sex	Mean Weight (kg)
Male	6.3
Female	6.6

Source: SPSS

3.3. Prevalence of Underweight and Acute Malnutrition

The classification based on Weight-for-Age Z-scores (Table 6) showed that 83.3% (n=125) of the children were underweight (WAZ < -2SD). Of these, 20.0% (n=30) were classified as severely underweight (WAZ ≤ -4SD).

Table 6 Nutritional Status Based on WHO Weight-for-Age Z-scores (N=150)

Nutritional Category	Frequency	Percentage (%)
Normal weight (WAZ ≥ -2SD)	25	16.7
Mildly underweight (-3SD < WAZ < -2SD)	50	33.3
Moderately underweight (-4SD < WAZ ≤ -3SD)	45	30.0
Severely underweight (WAZ ≤ -4SD)	30	20.0
Total	150	100

Source: SPSS

Table 7: The MUAC classification, presented revealed a catastrophic level of acute malnutrition. A total of 68.7% (n=103) of children were malnourished based on MUAC, with 28.0% (n=42) suffering from Severe Acute Malnutrition (SAM) (MUAC < 11.5 cm) and 40.7% (n=61) from Moderate Acute Malnutrition (MAM) (MUAC 11.5–12.5 cm).

Table 7 Nutritional Classification (Mid-Upper Arm Circumference MUAC) (N=150)

MUAC Category	Frequency	Percentage (%)
Red (<11.5 cm) -- Severe Acute Malnutrition	42	28.0
Yellow (11.5–12.5 cm) -- Moderate Malnutrition	61	40.7
Green (>12.5 cm) – Normal	47	31.3
Total	150	100

Source: SPSS

4. Discussion

The results of this study paint an unambiguous and alarming picture of a severe nutritional crisis among children under five in Sokoto State. The findings, which show that 83.3% of children are underweight and 68.7% suffer from acute malnutrition, indicate a public health emergency of catastrophic proportions that demands an immediate and multi-sectoral response.

The prevalence of underweight (83.3%) is exceptionally high, far exceeding the national average of approximately 36.8% for underweight children in Nigeria (NPC & ICF, 2019). As Weight-for-Age is a composite indicator reflecting both acute and chronic malnutrition, this high prevalence signals a population experiencing prolonged and severe growth failure (WHO, 2006). The trajectory of mean weight by age confirms this, demonstrating that growth faltering begins in early infancy and worsens dramatically during the weaning period (13-24 months). The mean weight of children in this age group (6.2 kg) is equivalent to that of a healthy 5-month-old, a finding consistent with the "weaning dilemma" described in the UNICEF Conceptual Framework, where nutritionally inadequate and contaminated complementary foods fail to meet the high demands of rapid growth, leading to a rapid decline in nutritional status (UNICEF, 2021; Dewey & Mayers, 2011).

The MUAC findings are perhaps the most alarming, revealing an acute malnutrition burden that is more than ten times higher than the WHO emergency threshold of 2% (WHO, 2000). A SAM prevalence of 28.0% represents an imminent risk of death for a significant portion of the cohort, as children with SAM have a mortality risk up to nine times higher than their well-nourished peers (Briend et al., 2021). The even larger proportion of children with MAM (40.7%) constitutes a "pre-famine" cohort on the verge of slipping into severe wasting, highlighting the critical need for preventive interventions. These figures are a stark reflection of systemic failures, likely driven by chronic food insecurity, poor dietary diversity, high rates of infection (e.g., diarrhea), and a weak health system with limited coverage of Community-based Management of Acute Malnutrition (CMAM) programs (Black et al., 2013).

The age distribution, with a concentration of children under 36 months, underscores the critical importance of the "first 1000 days" window of opportunity (from conception to a child's second birthday). This is the period when nutritional interventions have the greatest potential to prevent lifelong deficits in cognitive and physical development (Victora et al., 2010). The peak in the 13 to 24-month group highlights the transition to complementary feeding as a point of extreme vulnerability, suggesting that interventions must focus not only on breastfeeding promotion but also on ensuring access to safe, diverse, and nutrient-dense complementary foods.

Interestingly, the study found a slight female advantage in mean weight, contrary to patterns of son preference reported in other contexts (Dancer et al., 2008). This finding may be explained by a "floor effect" in this context of extreme poverty, where deprivation is so severe that it overrides gender-based discrimination. Alternatively, it could point to specific maternal buffering behaviors or biological vulnerabilities that disadvantage male infants in conditions of severe stress (Pongou, 2013). This nuance underscores the importance of context-specific analysis rather than applying generalized assumptions about gender dynamics.

This study has several limitations. Its cross-sectional design captures a snapshot in time and cannot establish causality. The sample was drawn from PHC attendees, which may introduce a selection bias, as these children may be more vulnerable than the general population. However, this targeted approach also illuminates the true extent of the crisis in a high-burden, facility-based setting, which may be obscured in broader, population-level surveys.

5. Conclusion and Recommendations

This study provides compelling evidence of a catastrophic malnutrition crisis among under-five children in Sokoto State. The unprecedented prevalence of underweight and acute malnutrition, driven by profound growth faltering in the first 1000 days, indicates a systemic failure to protect the most vulnerable members of society. The findings move beyond a simple description of prevalence to demonstrate the dynamic, cumulative process of nutritional deprivation that begins in early infancy and accelerates during the weaning period.

Based on these findings, the following recommendations are made:

- Declare a Public Health Emergency: The scale of the crisis, particularly the 28% SAM prevalence, warrants an immediate declaration of a public health emergency to mobilize resources and fast-track humanitarian response.

- Scale-Up CMAM Services: There is an urgent need to expand community-based management of acute malnutrition, ensuring a consistent supply of Ready-to-Use Therapeutic Food (RUTF) and RUTF for the MAM cohort, and training community health workers to actively screen for and treat uncomplicated cases.
- Target the First 1000 Days: Preventive strategies must focus intensively on the first 1000 days. This includes promoting early and exclusive breastfeeding, and critically, implementing interventions to improve complementary feeding through the provision of culturally appropriate, nutrient-dense food supplements and social safety nets for vulnerable households.
- Strengthen Multi-Sectoral Integration: Addressing the root causes of malnutrition requires a "nutrition-sensitive" approach. This involves integrating nutrition interventions with programs that improve food security (agriculture, social protection), access to clean water and sanitation (WASH), and quality healthcare.
- Further Research: Longitudinal studies are needed to track the long-term outcomes for these children and to evaluate the effectiveness of any interventions implemented. Qualitative research should also explore the social, cultural, and gender dynamics influencing infant and young child feeding (IYCF) practices.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

The study adhered to the ethical principles of the Declaration of Helsinki. Ethical approval was obtained from the Health Research Ethics Committee of the Sokoto State Ministry of Health (Ref: SKHREC/059/2022). Permission was also secured from the SSPHCDA and local government authorities.

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