



(RESEARCH ARTICLE)



PREVALENCE OF UNDERNUTRITION AND ITS SOCIO-DEMOGRAPHIC AND SOCIO-ECONOMIC DETERMINANTS AMONG CHILDREN AGED 6 TO 23 MONTHS IN THE LAMBUSSIE DISTRICT, UPPER WEST REGION, GHANA

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ABSTRACT

Background: Undernutrition in the first two years of life is a leading contributor to child mortality and irreversible growth deficits. Ghana has recorded national declines in stunting and underweight, yet the Upper West Region lags behind and district-level evidence remains scarce. This study determined the prevalence and determinants of undernutrition among children aged 6 to 23 months in the Lambussie District, Ghana.

Methods: An analytical cross-sectional survey of 405 caregiver and child pairs was conducted across 27 communities selected by multistage sampling. Anthropometric z-scores were derived against the WHO Child Growth Standards. Socio-economic position and seven-day child morbidity were recorded by structured interview. Chi-square tests and multivariable logistic regression adjusting for household clustering were applied ($p < 0.05$).

Results: The prevalence of underweight, stunting and wasting was 12.59%, 13.58% and 14.57% respectively. Caregivers were uniformly disadvantaged: 55.80% had no formal education, 80.25% were subsistence farmers and 92.10% of households occupied earthen dwellings. Caregiver education, occupation, income and recent child morbidity were not associated with any outcome. Odds of wasting were lower among children aged 12 to 23 months than among

infants aged 6 to 11 months (aOR 0.53, 95% CI 0.30 to 0.93) and among children in mud-only dwellings than in block dwellings with zinc roofing (aOR 0.10, 95% CI 0.01 to 0.85), the latter estimate resting on a single case.

Conclusions: Undernutrition is of medium to high public health significance, with wasting approaching the very high threshold. Child age, rather than caregiver education, occupation or income, was the robust determinant of wasting, with infants aged 6 to 11 months at greatest risk; age-targeted nutrition-specific interventions beginning at the introduction of complementary foods should take priority over income-based targeting.

Keywords: Stunting; Wasting; Underweight; Socio-economic determinants; Housing; Ghana

1 INTRODUCTION

Undernutrition remains the most important nutritional risk factor for morbidity and mortality among children below five years of age in low-income and middle-income countries. Although global stunting prevalence has declined, progress has been markedly slower in low-income settings, where stunting and wasting continue to coexist at levels carrying substantial excess mortality risk [1]. The burden is concentrated in sub-Saharan Africa, where pooled analyses across 32 countries place stunting at 31.3 percent, underweight at 17.0 percent and wasting at 8.1 percent among children under five years [2,3], and West Africa mirrors this pattern with 32.4 percent of children stunted and 20.1 percent underweight [4].

The window between six and twenty-three months is of particular epidemiological importance. It marks the transition to complementary feeding, when nutrient requirements rise sharply relative to gastric capacity, exposure to enteric pathogens increases and passive maternal immunity wanes. Growth faltering accumulated during this interval is difficult to reverse and translates into deficits in cognitive development, school attainment and adult productivity [1].

Ghana has recorded meaningful national progress, with stunting among children aged 0 to 59 months falling from 32.7 percent in 1993 to 17.3 percent in 2022 and underweight from 24.5 percent to 11.9 percent [5]. These averages conceal persistent subnational inequity, since the 2022 national survey placed stunting at 29.6 percent in the Northern Region and 29.3 percent in the North East Region, almost three times the level recorded in the Eastern Region [6]. The Upper West Region forms part of this savannah belt and is characterised by a single rainfed cropping season, dependence on subsistence agriculture, a pronounced lean season and low household purchasing power, with studies in the region documenting constrained household dietary diversity that responds to nutrition education and home gardening rather than to income alone [7].

1.1 Conceptual framework

The study was guided by the UNICEF Conceptual Framework on the Determinants of Maternal and Child Nutrition, which organises the causes of undernutrition into immediate, underlying and enabling determinants [8]. Diet and care practices act directly on nutritional status at the immediate level, with inadequate intake and disease operating in a reinforcing cycle, while the food, practices and services available to households operate at the underlying level and are shaped by income, housing and environmental conditions and access to health services. The framework justifies the analytical structure adopted here, in which socio-economic position is treated as an underlying determinant acting indirectly through diet, care and exposure to infection, child age and sex modify vulnerability at the immediate level, and recent morbidity is treated as an analytical covariate.

1.2 Prevalence of undernutrition among children aged 6 to 23 months

Prevalence estimates for this age band vary widely across sub-Saharan Africa. A pooled analysis of 48,968 mother and child pairs across 32 countries reported stunting at 28.6 percent, underweight at 16.4 percent and wasting at 9.4 percent [9], while Ghanaian national data place the burden among children aged 6 to 23 months at approximately 16 percent for stunting and 12 percent for wasting [10]. Subnational estimates from northern Ghana are consistently higher, with one survey of 581 mother and child pairs reporting stunting at 33.2 percent, underweight at 27.0 percent and wasting at 14.1 percent [11]. Interpretation requires agreed thresholds, and the WHO and UNICEF Technical Expert Advisory Group classifies wasting of 10 to less than 15 percent as high and 15 percent or above as very high, and stunting of 10 to less than 20 percent as medium [12].

1.3 Determinants of child undernutrition

Child age is among the most consistently reported correlates. Pooled Demographic and Health Survey data show that children above one year carry higher odds of undernutrition than infants below one year, a pattern driven by the cumulative nature of growth faltering [13]. A systematic review of thirty-seven studies concluded that the most

consistent correlates of child malnutrition across settings are maternal education, household income, maternal nutritional status, child age, sanitation, family size, birth order and birth weight [14].

Socio-economic position is the most extensively documented underlying determinant. Analysis of thirteen West African countries found that undernutrition prevalence declined monotonically with rising maternal education and household wealth, and that attainment of a minimum acceptable diet mediated between 35.9 percent and 44.5 percent of that association [15]. Ghanaian national data confirm that low household socio-economic status is independently associated with stunting and wasting among children aged 6 to 23 months [10], and that household wealth predicts attainment of minimum dietary diversity [16]. Housing quality has attracted growing attention as a determinant that is both measurable and modifiable, and an analysis of 824,694 children across 33 sub-Saharan African countries found improved housing to be associated with 17 percent lower odds of stunting, 10 percent lower odds of wasting and 15 percent lower odds of underweight [17]. Housing construction is interpreted both as a proxy for accumulated wealth and as a direct exposure operating through vector entry, contamination of the domestic environment and thermal stress.

The bidirectional relationship between infection and undernutrition is a further premise of the framework, since infection suppresses appetite and impairs absorption while undernutrition compromises immune competence. Diarrhoea has been associated with increased odds of undernutrition in Benin [18] and in pooled sub-Saharan African data [13], although short recall windows are a poor proxy for cumulative infectious burden. Three gaps follow. The Ghanaian evidence base is dominated by secondary analyses of national datasets that cannot yield district level estimates for programme use, the primary studies that exist underrepresent the Upper West Region, and the transferability of socio-economic determinants from pooled datasets to homogeneously deprived rural districts has not been tested directly.

1.4 Study rationale and objectives

Within the region, the Lambussie District has repeatedly been identified in routine health information as a poor performer, contributing a disproportionate share of the regional underweight caseload and ranking among the districts with the highest number of severe acute malnutrition admissions. Routine child welfare clinic data are facility based and capture only children brought for weighing, so they cannot estimate population prevalence, they exclude households furthest from services and they carry no information on the household characteristics that would allow programmes to target scarce resources. This study therefore addressed these gaps by determining the nutritional status of children aged 6 to 23 months in the district, described the socio-economic status of their caregivers and identified the socio-demographic and socio-economic factors independently associated with undernutrition, with recent child morbidity retained as a covariate.

2 MATERIALS AND METHODS

2.1 Study design and setting

An analytical cross-sectional design was employed, selected because the objectives were to estimate the prevalence of three anthropometric outcomes at a defined point in time and to quantify their association with caregiver and household characteristics. The study was conducted in the Lambussie District of the Upper West Region, which lies in the north-western corner of the region, shares an international boundary with Burkina Faso and covers approximately 1,078 square kilometres. The projected population was 56,751, of whom approximately 3,405 were children aged 6 to 23 months. The district is predominantly rural with a sparse settlement pattern and an economy dominated by rainfed subsistence agriculture. Health services are delivered through five health centres, one polyclinic, nineteen functional Community-based Health Planning and Services zones and eighty-nine outreach points, supported by community-based surveillance volunteers and agents. There is no district hospital.

2.2 Study population, sample size and sampling

The study population comprised children aged 6 to 23 months living with a caregiver in a household within the district, together with their primary caregivers, who were eligible if they had resided in the household for at least three months preceding the survey. The sample size was calculated using the single population proportion formula, n equals z squared multiplied by p multiplied by q divided by d squared, with z set at 1.96, p at 0.5 to yield the maximum required sample in the absence of a district specific prior, and d at 0.05. The calculation returned 384, which was inflated by 5 percent for household design effect and instrument loss to give 403, rounded to 405 to permit equal allocation across clusters.

A multistage procedure was applied. Each of the 78 communities was designated a cluster and 27 clusters were selected by simple random sampling using numbered paper strips drawn from an agitated container. Within each selected cluster, households containing an eligible child were enumerated from existing community registers, the sampling

interval was computed by dividing the number of eligible households by 15, a random start was drawn within the first interval, and every subsequent household at the fixed interval was approached until 15 questionnaires had been administered, yielding 405 respondents.

2.3 Data collection, measurement and variables

Data were collected using a structured interviewer-administered questionnaire covering caregiver socio-demographic characteristics, household socio-economic status, feeding and household practices, child health status and child anthropometry. The instrument was pre-tested in the Die community of the neighbouring Jirapa District, which shares the agro-ecological and cultural profile of the study area and was excluded from the sampling frame, establishing a mean administration time of 33 minutes and identifying several items requiring minor revision. The field team comprised five nutrition officers from the District Health Directorate and two students on attachment, trained on the instrument, on standardised anthropometric technique and on ethical conduct, and supervised throughout by the principal investigator.

Weight was measured using an electronic SECA uni-scale placed on a firm horizontal surface and calibrated each morning against a known 5 kilogram weight, with heavy clothing removed. For infants unable to stand, the tared weighing function was used, whereby the caregiver was weighed alone, the scale was zeroed and the child was passed to the caregiver so that the weight of the child was read directly. Recumbent length was measured using a wooden infantometer, with the crown of the head against the fixed headboard, the head aligned in the Frankfort plane, the knees held gently extended and the feet flat against the movable footboard, each measurement being taken by a two-person team of measurer and recorder. Indices were converted to z-scores against the WHO Child Growth Standards, with underweight, stunting and wasting defined as weight-for-age, height-for-age and weight-for-height below minus two standard deviations respectively.

The dependent variables were the three binary anthropometric outcomes. Independent variables comprised a socio-demographic domain of caregiver age, sex, marital status, religion and number of children, together with child age and sex, and a socio-economic domain of caregiver education, occupation, monthly household income, housing type and travel time to the nearest health facility. Housing type was recorded in four categories reflecting wall and roof construction, ordered from the most to the least durable. Caregiver-reported malaria, diarrhoea, pneumonia and any other illness in the seven days preceding interview were treated as covariates.

2.4 Statistical analysis

Data were analysed using Stata version 14 (StataCorp LP, College Station, Texas, United States of America). Categorical variables were summarised as frequencies and percentages, and unadjusted associations were assessed using the Pearson chi-square test. Variables significant at p less than 0.05 in unadjusted analysis, together with variables specified a priori, namely child sex, caregiver educational level, monthly household income and recent child morbidity, were entered into multivariable binary logistic regression models, with clustering specified at household level and adjusted odds ratios and 95 percent confidence intervals reported.

3 RESULTS AND DISCUSSION

3.1 Characteristics of caregivers, households and children

All 405 sampled caregivers participated, giving a response rate of 100 percent. Caregivers were overwhelmingly female (95.31 percent) and married (93.83 percent), with a modal age group of 20 to 24 years (31.36 percent) and an approximate mean age of 28.5 years (Table 1). Christianity was the dominant affiliation at 67.16 percent and most households contained one child (70.37 percent). Among the children, 52.84 percent were female and 68.89 percent were aged 12 to 23 months.

Socio-economic position was uniformly low. More than half of caregivers (55.80 percent) had received no formal education and only 0.99 percent, corresponding to four respondents, had attained tertiary education, while farming occupied 80.25 percent. More than two thirds of households (68.40 percent) reported monthly income below GHS 100 and only 2.47 percent more than GHS 500. Only 7.90 percent occupied block dwellings with zinc roofing, while 81.48 percent lived in mud dwellings with zinc roofing, 8.15 percent in mud dwellings without a durable roof and 2.47 percent in mud dwellings with thatch roofing, so that 92.10 percent occupied earthen dwellings. Access to services was comparatively favourable, with 56.79 percent of households within 30 minutes walking distance of a health facility.

Table 1: Characteristics of caregivers, households and children (n = 405)

Characteristic	Category	n	%
Age of caregiver (years)	15 to 19	15	3.70
	20 to 24	127	31.36
	25 to 29	91	22.47
	30 to 34	89	21.98
	35 to 39	62	15.31
	40 to 44	15	3.70
	45 and above	6	1.48
Sex of caregiver	Male	19	4.69
	Female	386	95.31
Marital status	Married	380	93.83
	Single	19	4.69
	Separated or divorced	6	1.48
Religion	Traditional	55	13.58
	Christianity	272	67.16
	Islam	78	19.26
Number of children	One	285	70.37
	Two	98	24.20
	Three or more	22	5.43
Educational level of caregiver	None	226	55.80
	Primary	88	21.73
	Junior high school	65	16.05
	Senior high or vocational	22	5.43
	Tertiary	4	0.99
Occupation of caregiver	Farming	325	80.25
	Petty trading	59	14.57
	Government worker	14	3.46
	Other	7	1.73
Monthly household income	Less than GHS 100	277	68.40
	GHS 100 to 500	118	29.14
	More than GHS 500	10	2.47
Housing type	Block with zinc roof	32	7.90
	Mud with zinc roof	330	81.48
	Mud with thatch roof	10	2.47
	Mud only	33	8.15
Travel time to health facility	Less than 30 minutes	230	56.79
	30 to 60 minutes	159	39.26
	More than 60 minutes	16	3.95

Age of child (months)	6 to 11	126	31.11
	12 to 23	279	68.89
Sex of child	Male	191	47.16
	Female	214	52.84

GHS, Ghana cedi. Source: field survey.

3.2 Nutritional status of children

The prevalence of underweight, stunting and wasting among children aged 6 to 23 months was 12.59 percent, 13.58 percent and 14.57 percent respectively, wasting being the most prevalent of the three indicators (Table 2). Underweight was recorded in 15.87 percent of infants aged 6 to 11 months and 11.11 percent of children aged 12 to 23 months, wasting in 20.63 percent and 11.83 percent of the two groups respectively, while stunting rose from 12.70 percent to 13.98 percent. Applying the WHO and UNICEF classification, stunting and underweight fall within the medium category of public health significance while wasting falls within the high category and lies close to the 15 percent threshold above which prevalence is classified as very high [12].

Table 2: Nutritional status of children aged 6 to 23 months by age group, n (%)

Nutritional indicator	6 to 11 months (n = 126)	12 to 23 months (n = 279)	All children (n = 405)
Underweight (WAZ < -2 SD)	20 (15.87)	31 (11.11)	51 (12.59)
Stunting (HAZ < -2 SD)	16 (12.70)	39 (13.98)	55 (13.58)
Wasting (WHZ < -2 SD)	26 (20.63)	33 (11.83)	59 (14.57)

WAZ, weight-for-age z-score; HAZ, height-for-age z-score; WHZ, weight-for-height z-score; SD, standard deviation. Source: field survey.

3.3 Socio-demographic and socio-economic characteristics and undernutrition

Unadjusted associations are presented in Table 3. Child age was significantly associated with wasting ($\chi^2 = 5.41$, $p = 0.020$) but not with underweight ($p = 0.181$) or stunting ($p = 0.728$). Housing type was significantly associated with wasting ($\chi^2 = 8.27$, $p = 0.041$) but not with underweight ($p = 0.392$) or stunting ($p = 0.573$). No other characteristic was associated with any outcome at the 5 percent level. Caregiver educational level, occupation and monthly household income showed no statistically significant association with any of the three indicators, although the associations between educational level and wasting ($\chi^2 = 7.80$, $p = 0.099$) and between household income and stunting ($\chi^2 = 4.81$, $p = 0.091$) approached conventional significance without following a socio-economic gradient.

Table 3: Socio-demographic and socio-economic characteristics and undernutrition among children aged 6 to 23 months

Characteristic	n	Underweight n (%)	Wasting n (%)	Stunting n (%)
Age of caregiver (years)		$\chi^2 = 5.41$, $p = 0.492$	$\chi^2 = 4.84$, $p = 0.565$	$\chi^2 = 4.45$, $p = 0.616$
15 to 19	15	2 (13.3)	2 (13.3)	2 (13.3)
20 to 24	127	17 (13.4)	21 (16.5)	18 (14.2)
25 to 29	91	11 (12.1)	9 (9.9)	14 (15.4)
30 to 34	89	13 (14.6)	15 (16.9)	15 (16.9)
35 to 39	62	6 (9.7)	9 (14.5)	4 (6.5)
40 to 44	15	0 (0.0)	1 (6.7)	1 (6.7)
45 and above	6	2 (33.3)	2 (33.3)	1 (16.7)
Sex of caregiver		$\chi^2 = 1.30$, $p = 0.255$	$\chi^2 = 1.39$, $p = 0.239$	$\chi^2 = 0.95$, $p = 0.330$
Male	19	4 (21.1)	1 (5.3)	4 (21.1)
Female	386	47 (12.2)	58 (15.0)	51 (13.2)
Marital status		$\chi^2 = 1.41$, $p = 0.495$	$\chi^2 = 3.17$, $p = 0.205$	$\chi^2 = 0.20$, $p = 0.903$
Married	380	46 (12.1)	54 (14.2)	52 (13.7)

Single	19	4 (21.1)	5 (26.3)	2 (10.5)
Separated or divorced	6	1 (16.7)	0 (0.0)	1 (16.7)
Religion		$\chi^2 = 2.64, p = 0.267$	$\chi^2 = 2.21, p = 0.331$	$\chi^2 = 1.20, p = 0.550$
Traditional	55	7 (12.7)	11 (20.0)	5 (9.1)
Christianity	272	30 (11.0)	35 (12.9)	38 (14.0)
Islam	78	14 (17.9)	13 (16.7)	12 (15.4)
Number of children		$\chi^2 = 1.80, p = 0.406$	$\chi^2 = 0.25, p = 0.885$	$\chi^2 = 0.53, p = 0.769$
One	285	38 (13.3)	41 (14.4)	37 (13.0)
Two	98	9 (9.2)	14 (14.3)	14 (14.3)
Three or more	22	4 (18.2)	4 (18.2)	4 (18.2)
Age of child		$\chi^2 = 1.79, p = 0.181$	$\chi^2 = 5.41, p = 0.020$	$\chi^2 = 0.12, p = 0.728$
6 to 11 months	126	20 (15.9)	26 (20.6)	16 (12.7)
12 to 23 months	279	31 (11.1)	33 (11.8)	39 (14.0)
Sex of child		$\chi^2 = 0.08, p = 0.776$	$\chi^2 = 0.27, p = 0.607$	$\chi^2 = 0.00, p = 0.986$
Male	191	25 (13.1)	26 (13.6)	26 (13.6)
Female	214	26 (12.1)	33 (15.4)	29 (13.6)
Educational level		$\chi^2 = 0.82, p = 0.936$	$\chi^2 = 7.80, p = 0.099$	$\chi^2 = 3.12, p = 0.539$
None	226	29 (12.8)	35 (15.5)	34 (15.0)
Primary	88	11 (12.5)	7 (8.0)	13 (14.8)
Junior high school	65	8 (12.3)	11 (16.9)	7 (10.8)
Senior high or vocational	22	2 (9.1)	4 (18.2)	1 (4.5)
Tertiary	4	1 (25.0)	2 (50.0)	0 (0.0)
Occupation		$\chi^2 = 1.57, p = 0.666$	$\chi^2 = 1.16, p = 0.764$	$\chi^2 = 4.51, p = 0.212$
Farming	325	44 (13.5)	47 (14.5)	49 (15.1)
Petty trading	59	5 (8.5)	8 (13.6)	6 (10.2)
Government worker	14	1 (7.1)	2 (14.3)	0 (0.0)
Other	7	1 (14.3)	2 (28.6)	0 (0.0)
Monthly household income		$\chi^2 = 0.06, p = 0.969$	$\chi^2 = 1.82, p = 0.403$	$\chi^2 = 4.81, p = 0.091$
Less than GHS 100	277	35 (12.6)	44 (15.9)	33 (11.9)
GHS 100 to 500	118	15 (12.7)	13 (11.0)	22 (18.6)
More than GHS 500	10	1 (10.0)	2 (20.0)	0 (0.0)
Housing type		$\chi^2 = 3.00, p = 0.392$	$\chi^2 = 8.27, p = 0.041$	$\chi^2 = 2.00, p = 0.573$
Block with zinc roof	32	7 (21.9)	8 (25.0)	2 (6.3)
Mud with zinc roof	330	40 (12.1)	47 (14.2)	47 (14.2)
Mud with thatch roof	10	1 (10.0)	3 (30.0)	2 (20.0)
Mud only	33	3 (9.1)	1 (3.0)	4 (12.1)

χ^2 , Pearson chi-square statistic; GHS, Ghana cedi. Percentages are row prevalences within each category. Source: field survey.

3.4 Recent child morbidity and undernutrition

Caregiver-reported morbidity in the seven days preceding the survey was common, with malaria reported for 26.91 percent of children, diarrhoea for 21.98 percent, pneumonia for 8.64 percent and any other illness for 11.85 percent.

None of these indicators was significantly associated with underweight, wasting or stunting (Table 4). The observed differences were small and inconsistent in direction, and underweight prevalence was in fact lower among children reported to have had malaria (9.2 percent) than among those who had not (13.9 percent).

Table 4: Recent child morbidity and undernutrition among children aged 6 to 23 months

Characteristic	n	Underweight n (%)	Wasting n (%)	Stunting n (%)
Malaria		$\chi^2 = 1.58, p = 0.208$	$\chi^2 = 0.84, p = 0.361$	$\chi^2 = 0.84, p = 0.359$
Yes	109	10 (9.2)	13 (11.9)	12 (11.0)
No	296	41 (13.9)	46 (15.5)	43 (14.5)
Diarrhoea		$\chi^2 = 0.08, p = 0.774$	$\chi^2 = 0.11, p = 0.743$	$\chi^2 = 0.10, p = 0.749$
Yes	89	12 (13.5)	12 (13.5)	13 (14.6)
No	316	39 (12.3)	47 (14.9)	42 (13.3)
Pneumonia		$\chi^2 = 0.10, p = 0.752$	$\chi^2 = 0.00, p = 0.961$	$\chi^2 = 0.02, p = 0.899$
Yes	35	5 (14.3)	5 (14.3)	5 (14.3)
No	370	46 (12.4)	54 (14.6)	50 (13.5)
Any other illness		$\chi^2 = 1.99, p = 0.158$	$\chi^2 = 0.00, p = 0.997$	$\chi^2 = 1.28, p = 0.258$
Yes	48	3 (6.3)	7 (14.6)	4 (8.3)
No	357	48 (13.4)	52 (14.6)	51 (14.3)

χ^2 , Pearson chi-square statistic. Morbidity refers to caregiver report over the seven days preceding interview. Source: field survey.

3.5 Independent determinants of undernutrition

Variables significant in unadjusted analysis, together with the a priori covariates, were entered into multivariable logistic regression models fitted for each outcome with adjustment for clustering at household level. Two variables were independently associated with wasting, and no variable was independently associated with underweight or stunting. None of the retained morbidity covariates attained significance in any model.

Table 5: Unadjusted and adjusted logistic regression of factors associated with wasting among children aged 6 to 23 months

Variable	cOR (95% CI)	p	aOR (95% CI)	p
Age of child				
6 to 11 months (ref)	1.00		1.00	
12 to 23 months	0.52 (0.29, 0.91)	0.020	0.53 (0.30, 0.93)	0.030
Housing type				
Block with zinc roof (ref)	1.00		1.00	
Mud with zinc roof	0.50 (0.21, 1.18)	0.110	0.54 (0.23, 1.30)	0.170
Mud with thatch roof	1.28 (0.27, 6.25)	0.750	1.32 (0.27, 6.67)	0.730
Mud only	0.09 (0.01, 0.80)	0.030	0.10 (0.01, 0.85)	0.030

cOR, crude odds ratio; aOR, adjusted odds ratio; CI, confidence interval; ref, reference category. Models adjusted for child sex, caregiver educational level, monthly household income and recent child morbidity, with clustering specified at household level. Source: field survey.

Children aged 12 to 23 months had lower odds of wasting than infants aged 6 to 11 months (aOR 0.53, 95% CI 0.30 to 0.93, $p = 0.030$), an estimate closely comparable to the unadjusted odds ratio of 0.52 (95% CI 0.29 to 0.91, $p = 0.020$) and therefore showing little evidence of confounding by the other variables in the model. Housing type was also independently associated with wasting. Relative to children living in block dwellings with zinc roofing, children living in mud dwellings without a durable roof had lower odds of wasting (aOR 0.10, 95% CI 0.01 to 0.85, $p = 0.030$). This estimate rests on a single wasted child in that category, and the width of the confidence interval reflects the sparseness of the underlying cells. Neither mud dwellings with zinc roofing (aOR 0.54, 95% CI 0.23 to 1.30, $p = 0.170$) nor mud

dwellings with thatch roofing (aOR 1.32, 95% CI 0.27 to 6.67, $p = 0.730$) differed significantly from the reference category (Table 5).

3.6 Magnitude and public health significance

This study established that 12.59 percent of children aged 6 to 23 months in the Lambussie District were underweight, 13.58 percent stunted and 14.57 percent wasted. Stunting and underweight fall within the medium category of public health significance while wasting falls within the high category and approaches the very high threshold [12]. The ordering of the indicators is itself informative, since in most sub-Saharan African populations stunting substantially exceeds wasting, with pooled regional estimates of 28.6 percent and 9.4 percent respectively [9], whereas in this district the ordering was inverted. This profile is characteristic of acute nutritional stress superimposed on a chronic burden that is moderate by regional standards, and it is consistent with data collection during the rainy season, which coincides with the agricultural lean period and with peak transmission of malaria and diarrhoeal disease.

The stunting estimate compares favourably with those reported elsewhere in northern Ghana [11] and is well below the 29.6 percent recorded for the Northern Region in the most recent national survey [6]. The wasting estimate, by contrast, exceeds both the national figure and the pooled sub-Saharan African estimate. A district appearing unremarkable on the indicator most commonly used for national monitoring therefore carries a substantial and largely unrecognised burden of acute undernutrition, and reliance on stunting alone as the headline district indicator would obscure the problem most requiring attention.

3.7 Child age as an independent determinant

Infants aged 6 to 11 months carried the highest burden of wasting, and children in their second year of life had approximately half their adjusted odds of wasting, with nearly identical unadjusted and adjusted estimates indicating that the association was not materially confounded. Underweight followed the same direction descriptively, falling from 15.87 percent to 11.11 percent between the two age groups, whereas stunting rose slightly from 12.70 percent to 13.98 percent. This pattern contrasts with pooled evidence that children above one year carry higher odds of undernutrition than younger infants [13], and indicates that acute risk in this district is concentrated in the first months of complementary feeding, when nutrient requirements rise sharply relative to gastric capacity, exposure to enteric pathogens increases and passive maternal immunity wanes. The modest rise in stunting with age is consistent with the cumulative character of linear growth faltering, since deficits acquired during the complementary feeding transition accumulate rather than resolve.

The programmatic implication is direct. Where nutrition resources are finite and socio-economic variables offer no discriminating basis for targeting, child age provides a simple and administratively feasible targeting criterion. Growth monitoring and promotion contacts, responsive feeding counselling and complementary feeding demonstrations should be intensified from the introduction of complementary foods at six months, when the risk of wasting is greatest, and sustained through the second year, which aligns with evidence that regular utilisation of growth monitoring and promotion services is significantly related to underweight, stunting and wasting in northern Ghana [19].

3.8 Housing quality and wasting

Housing type was the only socio-economic variable independently associated with an anthropometric outcome, but in an unexpected direction, with children in mud dwellings without a durable roof having lower adjusted odds of wasting than children in block dwellings with zinc roofing. This runs counter to evidence that improved housing is protective, since the analysis of 824,694 children across 33 sub-Saharan African countries found improved housing to be associated with 10 percent lower odds of wasting alongside reductions in malaria infection, diarrhoea and anaemia [17]. Durable construction reduces vector entry and rodent access, limits contamination of the domestic environment, provides thermal protection and permits safer food storage, so there is no plausible mechanism by which the least durable housing would protect against acute undernutrition.

Two qualifications apply. The estimate was imprecise, with a confidence interval spanning 0.01 to 0.85, because only one of the 33 children in mud-only dwellings was wasted, against eight of the 32 children in block dwellings, and estimates from such sparse cells are unstable. In addition, mud dwellings with zinc roofing, which housed 81.48 percent of the sample, did not differ significantly from the reference category, so the gradient across housing categories was not monotonic. The finding should therefore not be interpreted as evidence that poorer housing protects against wasting, and the relationship between housing quality and acute undernutrition warrants examination in an adequately powered study.

3.9 Absence of socio-economic gradients and of morbidity associations

Neither caregiver educational level, nor occupation, nor monthly household income was associated with any anthropometric outcome. This stands in apparent contrast to analyses showing that undernutrition declines

monotonically with rising maternal education and household wealth in West Africa [15], to Ghanaian national data identifying low socio-economic status as an independent predictor [10], and to a systematic review concluding that maternal education and household income are among the most consistent correlates worldwide [14]. The most plausible reconciliation lies in the compressed variance of the study population, since more than half of caregivers had no formal education, 80.25 percent were subsistence farmers, 68.40 percent of households earned below GHS 100 monthly and 92.10 percent occupied earthen dwellings. Where almost the entire population occupies the lowest stratum of a distribution, there is no gradient within the sample for an analysis to detect, whereas multi-country analyses derive their power precisely from the variance that a single deprived district does not contain. The isolated and counter-intuitive housing association does not alter this reading.

Reported morbidity was common, with 26.91 percent of children having had malaria and 21.98 percent diarrhoea in the preceding seven days, yet none was associated with any anthropometric outcome, which diverges from studies identifying diarrhoea as a determinant of undernutrition in Benin [18] and in pooled sub-Saharan African data [13]. A seven-day recall window captures a single point on a highly dynamic exposure whose nutritional consequence is cumulative, caregiver report is susceptible to recall error, and where treatment seeking is prompt episodes may be truncated before they exert a measurable anthropometric effect. The absence of association should therefore be read as a limitation of the morbidity measure rather than as evidence that infection is unimportant to nutritional status.

3.10 Strengths and limitations

The strengths of the study are its population basis, its complete response rate, its probability sampling across 27 of the 78 communities in the district and its standardised anthropometric protocol with daily instrument calibration. It provides the first population-based nutritional profile of a district previously characterised only through facility-based routine data. Several limitations qualify the findings. The cross-sectional design precludes causal inference. Data were collected during the rainy season, so the wasting estimate may overstate the annual average. Several analyses involved sparse cells, most notably the housing and education categories, producing imprecise estimates, and morbidity was ascertained by seven-day caregiver recall. Birth weight, maternal anthropometry, water and sanitation conditions and household food insecurity were not measured, and each is an established determinant of child undernutrition [4,10], so residual confounding cannot be excluded. Finally, the sample size was calculated to estimate prevalence rather than to detect associations of specified magnitude.

4 CONCLUSION

Undernutrition among children aged 6 to 23 months in the Lambussie District is of medium to high public health significance, with wasting at 14.57 percent approaching the threshold above which prevalence is classified as very high, stunting at 13.58 percent and underweight at 12.59 percent. Child age was the robust independent determinant of wasting, with infants aged 6 to 11 months at greatest risk and children in their second year of life carrying approximately half their adjusted odds of wasting; the lower odds of wasting observed in the least durable dwellings rested on a single case and is best regarded as a chance finding. Within a caregiver population that was uniformly and severely disadvantaged, no measure of education, occupation or income discriminated nutritional risk, and recent child morbidity was likewise unassociated.

District nutrition programming should therefore prioritise age-targeted, universally delivered nutrition-specific interventions beginning at the introduction of complementary foods at six months and sustained through the second year of life, strengthen growth monitoring and promotion and responsive feeding counselling through child welfare clinics, outreach points and community-based agents, and treat the quality of the household living environment as a nutrition-sensitive entry point alongside food-based interventions. Routine district monitoring should report acute alongside chronic indicators. Future research should incorporate longitudinal follow-up, seasonal repetition of measurement and the inclusion of birth weight, maternal anthropometry, household food insecurity and water and sanitation conditions.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare that they have no financial or non-financial conflicts of interest in relation to this work.

Statement of ethical approval

Ethical clearance was obtained from the Committee on Human Research, Publications and Ethics of the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, with administrative permission from the Upper West Regional Health Directorate and the Lambussie District Health Administration.

Statement of informed consent

Community entry protocols were observed, and written or witnessed thumbprint informed consent was obtained from every caregiver after oral explanation of the study in the local dialect. Children identified as acutely malnourished were referred for management.

REFERENCES

- [1] Victora CG, Christian P, Vidaletti LP, Gatica-Domínguez G, Menon P, Black RE. Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda. *Lancet*. 2021;397(10282):1388-99. [https://doi.org/10.1016/S0140-6736\(21\)00394-9](https://doi.org/10.1016/S0140-6736(21)00394-9)
- [2] Aboagye RG, Ahinkorah BO, Seidu AA, Frimpong JB, Archer AG, Adu C, et al. Birth weight and nutritional status of children under five in sub-Saharan Africa. *PLoS One*. 2022;17(6):e0269279. <https://doi.org/10.1371/journal.pone.0269279>
- [3] Seidu AA, Hagan JE, Budu E, Aboagye RG, Okyere J, Sakyi B, et al. High-risk fertility behaviour and undernutrition among children under-five in sub-Saharan Africa: a cross-sectional study. *BMJ Open*. 2023;13(6):e066543. <https://doi.org/10.1136/bmjopen-2022-066543>
- [4] Amegah AK, Ayinemi R, Sewor C, Fenta HM, Yeboah K, Mohammed SA, et al. Birth weight mediates the association of maternal undernutrition with child undernutrition prevalence in West Africa. *Eur J Clin Nutr*. 2024;78(9):772-81. <https://doi.org/10.1038/s41430-024-01453-5>
- [5] Osborne A, Bangura C, Sesay U, Ahinkorah BO. Trends and inequalities in stunting and underweight among children aged 0 to 59 months in Ghana, 1993 to 2022. *Int J Equity Health*. 2025;24(1):168. <https://doi.org/10.1186/s12939-025-02519-x>
- [6] Ghana Statistical Service (GSS), ICF. Ghana Demographic and Health Survey 2022. Accra, Ghana, and Rockville, Maryland, USA: GSS and ICF; 2024. Available from: <https://dhsprogram.com/pubs/pdf/FR387/FR387.pdf>
- [7] Pienaa CKA, Saaka SA, Yengnone HZ, Molle MN, Luginaah I. Does government food demonstration intervention influence household dietary diversity in the Upper West Region of Ghana? *PLoS One*. 2024;19(5):e0302869. <https://doi.org/10.1371/journal.pone.0302869>
- [8] United Nations Children's Fund (UNICEF). UNICEF conceptual framework on maternal and child nutrition. New York: UNICEF; 2021. Available from: <https://www.unicef.org/documents/conceptual-framework-nutrition>
- [9] Aboagye RG, Seidu AA, Ahinkorah BO, Arthur-Holmes F, Cadri A, Dadzie LK, et al. Dietary diversity and undernutrition in children aged 6 to 23 months in sub-Saharan Africa. *Nutrients*. 2021;13(10):3431. <https://doi.org/10.3390/nu13103431>
- [10] Addae HY, Sulemana M, Yakubu T, Atosona A, Tahiru R, Azupogo F. Low birth weight, household socio-economic status, water and sanitation are associated with stunting and wasting among children aged 6 to 23 months: results from a national survey in Ghana. *PLoS One*. 2024;19(3):e0297698. <https://doi.org/10.1371/journal.pone.0297698>
- [11] Anin SK, Saaka M, Fischer F, Kraemer A. Association between infant and young child feeding (IYCF) indicators and the nutritional status of children (6 to 23 months) in northern Ghana. *Nutrients*. 2020;12(9):2565. <https://doi.org/10.3390/nu12092565>
- [12] de Onis M, Borghi E, Arimond M, Webb P, Croft T, Saha K, et al. Prevalence thresholds for wasting, overweight and stunting in children under 5 years. *Public Health Nutr*. 2019;22(1):175-9. <https://doi.org/10.1017/S1368980018002434>
- [13] Okyere J, Donkoh IE, Seidu AA, Ahinkorah BO, Aboagye RG, Yaya S. Mother-child dyads of overnutrition and undernutrition in sub-Saharan Africa. *J Health Popul Nutr*. 2024;43(1):1. <https://doi.org/10.1186/s41043-023-00479-y>

- [14] Katoch OR. Determinants of malnutrition among children: a systematic review. *Nutrition*. 2022;96:111565. <https://doi.org/10.1016/j.nut.2021.111565>
- [15] Dwomoh D, Sewor C, Annim SK, Stranges S, Kandala NB, Amegah AK. Do dietary practices and household environmental quality mediate socio-economic inequalities in child undernutrition risk in West Africa? *Public Health Nutr*. 2023;26(5):1022-33. <https://doi.org/10.1017/S1368980022002269>
- [16] Akanbonga S, Hasan T, Chowdhury U, Kaiser A, Akter Bonny F, Lim IE, et al. Infant and young child feeding practices and associated socioeconomic and demographic factors among children aged 6 to 23 months in Ghana: findings from Ghana Multiple Indicator Cluster Survey, 2017 to 2018. *PLoS One*. 2023;18(6):e0286055. <https://doi.org/10.1371/journal.pone.0286055>
- [17] Tusting LS, Gething PW, Gibson HS, Greenwood B, Knudsen J, Lindsay SW, et al. Housing and child health in sub-Saharan Africa: a cross-sectional analysis. *PLoS Med*. 2020;17(3):e1003055. <https://doi.org/10.1371/journal.pmed.1003055>
- [18] Addo IY, Boadu EF, Osei Bonsu E, Boadi C, Dadzie FA. Prevalence and factors associated with undernutrition among children under the age of five years in Benin. *PLoS One*. 2023;18(8):e0289933. <https://doi.org/10.1371/journal.pone.0289933>
- [19] Baguune B, Aminu DM, Bekyieriya E, Adokiya MN. Utilization of growth monitoring and promotion services and undernutrition of children less than two years of age in northern Ghana. *BMC Nutr*. 2023;9(1):70. <https://doi.org/10.1186/s40795-023-00729-6>