Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Determinants of malnutrition among children of adolescents and young mothers in rural Uganda: a community-based cross-sectional study

George Ogwang Oyom

ogwangoyom25@gmail.com

Lira University

John Paul Byagamy

Lira University

Bonny Aloka

Lira University

Ritah Bakesiima

Lira University

Research Article

Keywords: Malnutrition, Children under five, Adolescent mothers, Young mothers, Uganda, Determinants, Wasting, Underweight, Stunting

Posted Date: July 2nd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10203821/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Children aged 6–59 months are vulnerable to malnutrition, which impairs growth, development, and immunity. Adolescent and young mothers face unique challenges including poverty, limited education, and social marginalization that may increase malnutrition risk in their children. However, evidence from post-conflict, climate-vulnerable regions of northern Uganda remains limited. This study aimed to determine the prevalence and associated factors of malnutrition among children aged 6–59 months born to adolescent and young mothers in Otuke District, northern Uganda.

Methods

A community-based cross-sectional study was conducted from August to October 2024 in Otuke District. Using multistage cluster sampling, 500 mother-child pairs were enrolled. Anthropometric measurements (weight, height/length, mid-upper arm circumference) were taken using standard protocols. Malnutrition was defined as stunting (height-for-age Z-score < -2), wasting (weight-for-height Z-score < -2), or underweight (weight-for-age Z-score < -2) according to WHO growth standards. Data were collected using structured questionnaires and analyzed using STATA version 17. Logistic regression was used to identify factors associated with malnutrition, with results presented as adjusted odds ratios (AOR) and 95% confidence intervals (CI).

Results

The overall prevalence of malnutrition was 37.6% (188/500). Wasting affected 13.2% (66/500), underweight 28.6% (143/500), and stunting 4.2% (21/500). Boys had higher rates of wasting (17.7% vs. 8.5%) and underweight (34.3% vs. 22.8%) compared to girls. In multivariate analysis, maternal education was protective: primary education (AOR = 0.14, 95% CI: 0.04–0.52, p = 0.003) and secondary education (AOR = 0.03, 95% CI: 0.00-0.14, p < 0.001) compared to no education. Living in semi-permanent housing increased malnutrition risk compared to mud-and-grass thatched homes (AOR = 3.34, 95% CI: 1.50–7.44, p = 0.003). Absence of harmful cultural practices was protective (AOR = 0.52, 95% CI: 0.31–0.87, p = 0.014).

Conclusions

Malnutrition prevalence among children of adolescent and young mothers in Otuke District is high, particularly wasting and underweight among boys. Maternal education, housing conditions, and harmful cultural practices are key determinants. Interventions should target these underlying factors through

community-based nutrition education, improved housing, and culturally sensitive behavior change programs.

Background

Globally, malnutrition remains a leading cause of child morbidity and mortality, with 149 million children under five years stunted and 45% of child deaths in developing countries attributable to undernutrition [1, 2]. Sub-Saharan Africa bears a disproportionate burden, with approximately 59.5 million stunted children, of whom East Africa accounts for 23.1 million (39%) [3, 4]. In Uganda, despite gradual improvements, stunting has declined from 33% in 2011 to 26% in 2022, yet malnutrition persists as a critical public health challenge, particularly in northern regions affected by conflict and climate variability [5].

Adolescent mothers (aged 10–19 years) and young mothers (aged 20–24 years) constitute a particularly vulnerable population. Globally, approximately 16 million girls aged 15–19 give birth each year, with the highest rates in sub-Saharan Africa [6]. Children born to adolescent mothers face higher risks of underweight, stunting, and mortality than those born to adult mothers [7, 8]. Systematic reviews indicate that children of adolescent mothers have a 63% increased risk of moderate underweight [9]. These disparities are attributed to biological immaturity, incomplete education, poverty, limited decision-making power, and inadequate childcare knowledge [10, 11].

Otuke District in northern Uganda exemplifies the intersecting challenges that exacerbate child malnutrition. The district has experienced six consecutive years of unpredictable rainfall patterns due to climate change, severely affecting agricultural productivity, the primary livelihood for 85% of households [12]. With a nurse-to-population ratio of 1:11,000 (far below WHO recommendations), limited health infrastructure, and recent exposure to conflict-related displacement, Otuke is a setting where child malnutrition risks are compounded by environmental and systems-level vulnerabilities [13].

Despite existing nutritional interventions, including Nutritional Assessment and Counselling Support (NACS) and the distribution of Ready-to-Use Therapeutic Foods (RUTF), malnutrition persists. The district's acute malnutrition prevalence is reported at 6.1%, yet specific data on children of adolescent and young mothers remain scarce [14]. This gap is critical because these mothers face distinct challenges, including higher poverty rates, lower educational attainment, social stigma, and limited access to antenatal care, which may not be captured in general population surveys [15, 16].

This study aimed to: (1) assess the prevalence of malnutrition (stunting, wasting, and underweight) among children aged 6–59 months born to adolescent and young mothers in Otuke District; (2) examine socio-demographic and economic factors associated with malnutrition in this population; and (3) determine community-level factors (including water, sanitation, hygiene, and cultural practices) associated with malnutrition.

Methods

Study design and setting

A community-based cross-sectional study was conducted in Otuke District, northern Uganda, from August to October 2024. The district lies approximately 66 km east of Lira City, at coordinates 02°30'N, 33°30'E. Otuke comprises 8 sub-counties, 54 parishes, and 521 villages, with a projected total population of 156,090 (UBOS 2022) and an estimated 27,628 children under five years [17].

The district's economy is predominantly subsistence agriculture (85% of households). However, climate change has produced unpredictable rainfall patterns for six consecutive years prior to this study, reducing agricultural yields and exacerbating food insecurity [12]. Health infrastructure comprises one Health Centre IV, eight Health Centre IIIs, and five Health Centre IIs, with a nurse-to-population ratio of 1: 11,000. Common childhood morbidities include malaria (59%), cough without pneumonia (12%), and gastrointestinal disorders (8%) [13].

Study population and sampling

The target population comprised all children aged 6–59 months born to adolescent (10–19 years) or young (20–24 years) mothers who had resided in Otuke District for at least six months preceding the study.

Inclusion criteria

Children aged 6–59 months whose biological mothers were aged 10–24 years, with maternal consent to participate.

Exclusion criteria

Children whose mothers were visitors or non-residents; children cared for by non-biological caregivers; children with congenital malformations (cleft lip/palate, limb deformities) that affect anthropometric measurements.

Sample size calculation

Using the Kish Leslie formula (1965) with malnutrition prevalence of 29% from Uganda Demographic and Health Survey 2016 [5], 95% confidence interval, 5% precision, and design effect of 1.5 for cluster sampling

$n = (Z^2 \times p \times (1-p) \times DEFF) / e^2$

$n = (1.96^2 \times 0.29 \times 0.71 \times 1.5) / 0.05^2 = 474$

Accounting for a 10% nonresponse rate, the target sample size was 524 mother-child pairs.

Sampling procedure

A multistage cluster sampling approach was employed:

Stage 1

Otuke District was purposively selected due to observed climate change effects on agricultural productivity and limited prior research on adolescent mothers' children in this setting.

Stage 2

Four of eight sub-counties (Olilim, Ogwette, Ogor, Orum) were randomly selected using simple random sampling (balloting with replacement).

Stage 3

Four parishes per selected sub-county were randomly selected (16 parishes total).

Stage 4

Villages were grouped into clusters. Three villages per parish were randomly selected (48 villages in total). Within each village, households with children under five were listed, and systematic random sampling was used to select households. All eligible children in the selected households were enrolled.

Data collection

Anthropometric measurements

Standard protocols were followed [18]. Weight was measured to the nearest 0.1 kg on a calibrated digital scale (SECA 876, Hamburg, Germany). Recumbent length was measured for children < 24 months with a portable infantometer (SECA 417), and standing height for children ≥ 24 months with a stadiometer (SECA 213). Mid-upper arm circumference (MUAC) was measured with color-coded MUAC tapes (UNICEF standard) to the nearest 0.1 cm. All measurements were taken in duplicate, and the mean was used for analysis. WHO Anthro software (version 3.2.2) was used to calculate Z-scores for height-for-age (HAZ), weight-for-height (WHZ), and weight-for-age (WAZ).

Questionnaires

Structured questionnaires were administered through face-to-face interviews in the local Luo language. The questionnaire captured socio-demographic characteristics (child age, gender, birth order, birth interval), maternal factors (age, education, occupation, marital status, income), and community factors (household size, food security, housing type, water source, sanitation facilities, handwashing practices, waste disposal, antenatal care attendance, harmful cultural practices). The questionnaire was pretested

with 53 participants (10% of the sample) at Okwang HC III, with adjustments made for clarity and cultural appropriateness.

Training

Twenty research assistants (community health workers and nurses) received two days of training on anthropometric measurement techniques, interview skills, and ethical conduct. Standardization sessions achieved inter-rater reliability > 0.90 for all measurements.

Variables and definitions

Outcome variable

Malnutrition was defined as any of

Stunting

Height-for-age Z-score < -2 standard deviations (SD) from WHO reference median [19]

Wasting

Weight-for-height Z-score < -2 SD

Underweight

Weight-for-age Z-score < -2 SD

Children with Z-scores < -3 SD were classified as severely malnourished.

Independent variables included child characteristics (age, gender, birth order, birth interval, diarrhea in past 2 months, cough in past 2 months, immunization completion, breastfeeding frequency), maternal characteristics (age, education, occupation, marital status, weekly income, BMI, MUAC), and community factors (household size, food security, housing type, water source, sanitation, handwashing facilities, waste disposal, ANC attendance, harmful cultural practices defined as food taboos, local tonsillectomy, false tooth extraction, or cutting body parts for charms).

Data analysis

Data were double-entered in Microsoft Excel, cleaned, and exported to STATA version 17 (StataCorp, College Station, TX, USA) for analysis. Descriptive statistics (frequencies, proportions, means, and standard deviations) described participant characteristics. Bivariate analysis using chi-square tests examined associations between independent variables and malnutrition (outcome). Variables with $p < 0.20$ in bivariate analysis were entered into multivariate logistic regression to identify independent

determinants, with results reported as adjusted odds ratios (AORs) and 95% confidence intervals (CIs). Statistical significance was set at $p < 0.05$.

Ethical considerations

Ethical approval was obtained from Lira University Research Ethics Committee (LUREC-2024-206, approved 23 August 2024). Permission was obtained from the Uganda National Council for Science and Technology (UNCST). Additional approvals were secured from the Otuke District Health Office, sub-county local councils, and village chairpersons. Written informed consent was obtained from all mothers (or legal guardians for mothers < 18 years). For mothers < 18 years, parental/guardian consent and maternal assent were obtained. Participants were informed of the voluntary nature of participation, the right to withdraw without penalty, and the confidentiality of data. Anthropometric referrals were made to the nearest health facility for children identified with acute malnutrition (MUAC < 12.5 cm or Z-score < -3) for nutritional support (RUTF and counseling). Participants received a bar of soap and detergent as compensation for their time.

Results

Participant characteristics

Of 524 mother-child pairs approached, 500 completed the study (response rate 98.4%). Non-participation was due to refusal (n = 12), absence after two visits (n = 8), or incomplete measurements (n = 4).

Child characteristics

Mean child age was 23.0 months (SD ± 14.58). Gender distribution was balanced (50.8% male, 49.2% female). First-born children comprised 31.6%, second-born 31.2%. A birth interval ≥ 2 years was reported for 41.2% of children with older siblings. Persistent diarrhea in the past 2 months was reported in 21.6% (108/500), and persistent cough in 23.8% (119/500). Immunization completion (age-appropriate) was 42.0% (210/500). Exclusive breastfeeding (≤ 6 months) was reported by 48.6% of mothers whose children were < 24 months.

Maternal characteristics

The mean maternal age was 21.0 years (SD ± 2.18), ranging from 15 to 24 years. Most mothers were Catholic (57.4%), had primary education (81.6%), were peasant farmers (85.2%), and were married (89.2%). Weekly income was < 10,000 Ugandan shillings (~$2.70 USD) in 56.2% of households. The mean maternal BMI was 21.0 kg/m² (SD ± 3.05), with 23.4% underweight (BMI < 18.5). The mean maternal MUAC was 26.0 cm (SD ± 3.72).

Community characteristics: Most households had 0–5 members (76.0%). Food insecurity (insufficient food for one week) was reported by 40.8% (204/500). Housing types: mud with grass thatched roof (76.4%), semi-permanent (15.8%), permanent (7.8%). Safe water sources: protected springs (86.2%), boreholes (10.2%), open wells (3.6%). Pit latrine coverage was 79.2%, with handwashing facilities near latrines reported by 39.8%. Solid waste disposal systems existed in 75.8% of households. ANC attendance for the index child was 96.8% (484/500). Harmful cultural practices (food taboos, 38.4%; local tonsillectomy, 12.6%; false tooth extraction, 8.2%; cutting body parts, 4.2%) were reported by 57.6% of mothers.

Prevalence of malnutrition

Overall, 37.6% (188/500) of children were malnourished (Table 1). Stunting prevalence was low at 4.2% (21/500), with no significant gender difference (5.5% in boys vs 2.8% in girls, p = 0.119). Wasting affected 13.2% (66/500), with boys significantly more affected (17.7% vs. 8.5%, p = 0.002). Underweight prevalence was 28.6% (143/500), and was also higher among boys (34.3% vs 22.8%, p = 0.004). Among malnourished children, 22.9% (43/188) had concurrent wasting and underweight, while 3.2% (6/188) had concurrent stunting and wasting.

Table 1
Prevalence of malnutrition by gender among children aged 6–59 months born to adolescent and young mothers in Otuke District, northern Uganda (N = 500)

Nutritional status	Male (n = 254) n (%)	Female (n = 246) n (%)	Total (N = 500) n (%)	p-value†
Stunting				0.119
Normal	240 (94.5)	239 (97.2)	479 (95.8)	
Stunted (HAZ < -2)	14 (5.5)	7 (2.8)	21 (4.2)	
Wasting				**0.002**
Normal	209 (82.3)	225 (91.5)	434 (86.8)	
Wasted (WHZ < -2)	45 (17.7)	21 (8.5)	66 (13.2)	
Underweight				**0.004**
Normal	167 (65.7)	190 (77.2)	357 (71.4)	
Underweight (WAZ < -2)	87 (34.3)	56 (22.8)	143 (28.6)	
Overall malnutrition				**0.001**
Normal	141 (55.5)	171 (69.5)	312 (62.4)	
Malnourished††	113 (44.5)	75 (30.5)	188 (37.6)	

†Chi-square test comparing gender differences; ††Stunted OR wasted OR underweight; HAZ = height-for-age Z-score; WHZ = weight-for-height Z-score; WAZ = weight-for-age Z-score

Factors associated with malnutrition (bivariate analysis)

Bivariate analysis (Table 2) identified multiple factors significantly associated with malnutrition ($p < 0.05$). Child factors: age 24–35 months ($\chi^2=25.39$, $p < 0.001$), male gender ($\chi^2=10.44$, $p = 0.001$), birth interval < 2 years ($\chi^2=22.38$, $p < 0.001$), persistent diarrhea ($\chi^2=6.53$, $p = 0.011$), persistent cough ($\chi^2=9.55$, $p = 0.002$), incomplete immunization ($\chi^2=12.69$, $p < 0.001$), and low breastfeeding frequency ($\chi^2=18.00$, $p < 0.001$). Maternal factors: age ≤ 19 years ($\chi^2=9.68$, $p = 0.002$), BMI < 18.5 ($\chi^2=18.46$, $p < 0.001$), no formal education ($\chi^2=42.19$, $p < 0.001$), peasant farmer occupation ($\chi^2=24.77$, $p < 0.001$), and weekly income < 10,000 UGX ($\chi^2=14.59$, $p < 0.001$). Community factors: household size 0–5 members ($\chi^2=9.32$, $p = 0.002$), food insecurity ($\chi^2=20.83$, $p < 0.001$), mud-and-grass housing ($\chi^2=17.02$, $p < 0.001$), open well water source ($\chi^2=8.76$, $p = 0.003$), no pit latrine ($\chi^2=8.89$, $p = 0.003$), no handwashing near latrine ($\chi^2=19.11$, $p < 0.001$), no waste disposal system ($\chi^2=9.76$, $p = 0.002$), no ANC attendance ($\chi^2=4.44$, $p = 0.035$), and presence of harmful cultural practices ($\chi^2=16.45$, $p < 0.001$).

Table 2
Bivariate analysis of factors associated with malnutrition among children aged 6–59 months born to adolescent and young mothers in Otuke District, northern Uganda (N = 500)

Variable	Normal n (%) (n = 312)	Malnourished n (%) (n = 188)	χ^2	p-value
Child age (months)			25.39	< 0.001
≥ 23	174 (55.8)	117 (62.2)		
24–35	58 (18.6)	55 (29.3)		
36–47	38 (12.2)	10 (5.3)		
48–59	42 (13.5)	6 (3.2)		
Child gender			10.44	0.001
Male	141 (45.2)	113 (60.1)		
Female	171 (54.8)	75 (39.9)		
Maternal age			9.68	0.002
≤ 19 years	57 (18.3)	57 (30.3)		
20–24 years	255 (81.7)	131 (69.7)		
Maternal education			42.19	< 0.001
None	3 (1.0)	17 (9.0)		
Primary	245 (78.5)	163 (86.7)		
Secondary	55 (17.6)	8 (4.3)		
Tertiary	9 (2.9)	0 (0.0)		
Maternal BMI			18.46	< 0.001
< 18.5	57 (18.3)	60 (31.9)		
18.5–24.9	231 (74.0)	125 (66.5)		
≥ 25	24 (7.7)	3 (1.6)		
Weekly income (UGX)			14.59	< 0.001
< 10,000	156 (50.0)	125 (66.5)		
10,000–50,000	143 (45.8)	61 (32.4)		
> 50,000	13 (4.2)	2 (1.1)		
Food security			20.83	< 0.001
Yes (enough food)	103 (33.0)	101 (53.7)		

Variable	Normal n (%) (n = 312)	Malnourished n (%) (n = 188)	χ^2	p-value
No (food insecure)	209 (67.0)	87 (46.3)		
Harmful cultural practices			16.45	< 0.001
Present	158 (50.6)	130 (69.1)		
Absent	154 (49.4)	58 (30.9)		

Note: Only selected variables shown. UGX = Ugandan shillings; BMI = body mass index

Independent determinants of malnutrition (multivariate analysis)

Multivariate logistic regression (Table 3) identified three independent determinants of malnutrition after adjusting for confounders (age of mother, child's persistent diarrhea, immunization completion, and housing type were entered into the model based on $p < 0.20$ in bivariate analysis).

Maternal education emerged as the strongest protective factor. Compared to children of mothers with no formal education, those whose mothers had primary education had 86% lower odds of malnutrition (AOR = 0.14, 95% CI: 0.04–0.52, p = 0.003). The protective effect was even stronger for secondary education (AOR = 0.03, 95% CI: 0.00-0.14, $p < 0.001$). No mothers with tertiary education had malnourished children in this sample.

Housing type was significantly associated with malnutrition. Contrary to expectation, children living in semi-permanent homes (mud block with iron sheet roof) had 3.34 times higher odds of malnutrition compared to those in traditional mud-and-grass thatched homes (AOR = 3.34, 95% CI: 1.50–7.44, p = 0.003). Permanent housing showed no significant difference from mud-and-grass thatched homes in the adjusted model (AOR = 2.08, 95% CI: 0.37–11.65, p = 0.405).

Harmful cultural practices remained independently associated. Children whose mothers reported absence of harmful cultural practices (food taboos, local tonsillectomy, false tooth extraction, or cutting body parts) had 48% lower odds of malnutrition (AOR = 0.52, 95% CI: 0.31–0.87, p = 0.014).

Although child's persistent diarrhea, incomplete immunization, and younger maternal age (≤ 19 years) were significant in bivariate analysis, they did not remain significant in the multivariate model after adjusting for education and other factors.

Table 3
Multivariate logistic regression analysis of factors associated with malnutrition among children aged 6–59 months born to adolescent and young mothers in Otuke District, northern Uganda (N = 500)

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
Maternal age				
≥ 19 years	1.00		1.00	
20–24 years	0.51 (0.34–0.78)	0.002	0.19 (0.02–1.71)	0.139
Maternal education				
None	1.00		1.00	
Primary	0.12 (0.03–0.41)	0.001	0.14 (0.04–0.52)	0.003
Secondary	0.03 (0.01–0.11)	< 0.001	0.03 (0.00-0.14)	< 0.001
Housing type				
Mud/grass thatched	1.00		1.00	
Semi-permanent	0.79 (0.48–1.30)	0.351	3.34 (1.50–7.44)	0.003
Permanent	0.12 (0.04–0.39)	< 0.001	2.08 (0.37–11.65)	0.405
Child had persistent diarrhea				
Yes	1.00		1.00	
No	0.57 (0.37–0.88)	0.011	6.25 (0.70–56.10)	0.102
Harmful cultural practices				
Yes	1.00		1.00	
No	0.46 (0.31–0.67)	< 0.001	0.52 (0.31–0.87)	0.014
Child completed all immunizations				
Yes	1.00		1.00	
No	0.51 (0.36–0.74)	< 0.001	0.61 (0.36–1.03)	0.066

COR = crude odds ratio; AOR = adjusted odds ratio; CI = confidence interval; 1.00 = reference category

Discussion

This community-based study among 500 mother-child pairs in rural northern Uganda found a high prevalence of malnutrition (37.6%) among children aged 6–59 months born to adolescent and young mothers, with wasting (13.2%) and underweight (28.6%) being more common than stunting (4.2%). The

findings identify maternal education, housing conditions, and harmful cultural practices as key independent determinants, with notable gender disparities favoring girls.

Prevalence of malnutrition

The overall malnutrition prevalence of 37.6% is substantially higher than the 29% stunting prevalence reported in the 2016 Uganda Demographic and Health Survey for the general under-five population [5], but lower than the 43.4% overall malnutrition reported among school-age children in Addis Ababa using the modified Composite Index of Anthropometric Failure [20]. This comparison should be interpreted cautiously given different age groups and settings.

The low stunting prevalence (4.2%) is striking and contradicts global patterns where stunting typically exceeds wasting in chronic food insecurity settings [2, 21]. Several explanations may account for this finding. First, the relatively young mean child age (23 months) means many children had not yet reached the age where chronic undernutrition manifests as linear growth failure [22]. Second, the majority of children (68.4%) were first- or second-born, and shorter birth intervals (< 2 years) were associated with malnutrition in bivariate analysis, suggesting that repeated, closely spaced pregnancies may deplete maternal nutritional reserves before stunting becomes apparent [23]. Third, the six consecutive years of unpredictable rainfall and agricultural disruption prior to this study may have produced more acute (wasting) than chronic (stunting) malnutrition patterns [12]. Similar findings were reported from Ethiopia during drought conditions, where wasting prevalence exceeded stunting [24].

The wasting prevalence of 13.2% exceeds the WHO's "serious" threshold (10–14%) and approaches the "critical" level (> 15%) [25]. This is concerning given that wasting carries higher short-term mortality risk than stunting [26]. The wasting rate is more than double the national average (4% in UDHS 2016) [5] and substantially higher than the 6.1% reported for Otuke District overall [14], suggesting that children of adolescent mothers are disproportionately affected. The gender disparity boys nearly twice as likely to be wasted as girls (17.7% vs. 8.5%), aligns with studies from Ethiopia [27] and Bangladesh [28], where biological vulnerabilities (lower fat reserves, higher metabolic demands) and differential care-seeking (boys prioritized for treatment when ill) have been proposed as explanations [29].

Underweight prevalence (28.6%) reflects the combination of acute and chronic deficits [30]. The rate is nearly three times the national average (10.2% in UDHS 2022) [5] and comparable to findings from humanitarian settings [31]. The high proportion of underweight children with concurrent wasting (22.9%) indicates severe nutritional compromise requiring immediate intervention [32].

Determinants of malnutrition

Maternal education was the strongest protective factor, with a dose-response relationship: primary education reduced malnutrition odds by 86%, secondary education by 97%. This finding is consistent with extensive literature demonstrating that maternal education improves child nutrition through multiple pathways: increased health literacy, better feeding practices, improved hygiene, greater healthcare-

seeking behavior, and enhanced bargaining power within households [33, 34]. A pooled analysis of 70 low- and middle-income countries found that each additional year of maternal education reduced stunting by 7–12% [35]. In the Ugandan context, a recent study of HIV-positive children found maternal education was the strongest predictor of nutritional status [36]. The complete absence of malnutrition among children of the nine mothers with tertiary education (0/9, 0%) underscores the profound protective effect.

The very low education levels in this sample (81.6% primary only, 4.0% none, only 1.8% tertiary) reflect the intersecting disadvantages faced by adolescent mothers, many of whom left school due to pregnancy [37]. This finding supports the recommendation that keeping girls in school beyond primary level is a nutrition-sensitive intervention with measurable child health benefits [38].

Housing type showed a counterintuitive pattern: semi-permanent homes (mud block with iron sheet roof) had 3.34 times higher malnutrition odds than traditional mud-and-grass thatched homes. This finding likely reflects residual confounding by socioeconomic status rather than a direct causal effect. Semi-permanent homes may represent a transition category for families who have invested in better roofing but remain food insecure because resources were diverted from food to housing [39]. Alternatively, iron sheet roofs may produce higher indoor temperatures, potentially increasing diarrhea prevalence through accelerated food spoilage in the absence of refrigeration [40]. Qualitative research in similar Ugandan settings has documented that families prioritize roofing improvements as visible markers of status while food consumption remains inadequate [41]. The lack of significant association for permanent housing (which likely represents genuinely higher socioeconomic status) supports this interpretation.

Harmful cultural practices were reported by 57.6% of mothers, and their absence was associated with 48% reduced malnutrition odds. Food taboos were most common (38.4%), restricting children from protein-rich foods (eggs, fish, meat) based on beliefs that these cause “bad behavior,” greed, or witchcraft [42]. Local tonsillectomy (12.6%) and false tooth extraction (8.2%) traditional procedures performed by unqualified practitioners using unsterile instruments can cause pain, feeding refusal, sepsis, and nutritional decompensation [43, 44]. Similar practices have been documented in other Ugandan regions and across East Africa [45, 46]. These findings suggest that nutrition interventions must engage traditional healers and community leaders to address harmful beliefs through culturally appropriate dialogue rather than confrontation [47].

Comparison with other Ugandan studies

This study’s findings complement recent Ugandan research on adolescent mothers. A hospital-based study at Mulago National Referral Hospital (2024) among 384 children of adolescent mothers found stunting (32%), wasting (31%), and underweight (27%) prevalence substantially higher than our community-based findings [48]. The discrepancy likely reflects referral bias (sicker children present to tertiary hospitals) and urban-rural differences in living conditions and food systems. Our lower stunting

but comparable wasting and underweight rates suggest that in rural Otuke, acute malnutrition predominates, whereas in urban Kampala, chronic malnutrition is more evident.

A secondary analysis of UDHS data (2025) examining adolescent motherhood and infant feeding practices found that children of adolescent mothers had 40% higher odds of stunting compared to children of adult mothers, mediated by lower exclusive breastfeeding rates and poorer complementary feeding [49]. Our finding that low breastfeeding frequency (< 8 times/24 hours) was associated with malnutrition in bivariate analysis (χ^2=18.00, $p < 0.001$) aligns with this pathway.

Strengths and limitations

Strengths include the high response rate (98.4%), use of standardized anthropometric protocols with trained research assistants, focus on a previously understudied vulnerable population (children of adolescent and young mothers in a climate-vulnerable, post-conflict rural district), and comprehensive assessment of socio-demographic, economic, and community-level factors.

Limitations include the cross-sectional design, which precludes causal inference. Reverse causality is possible (e.g., malnutrition may cause diarrhea, rather than diarrhea causing malnutrition). The sample was drawn from a single district in northern Uganda, limiting its generalizability to other regions with different cultural, climatic, or economic conditions. Social desirability bias may have affected the reporting of harmful cultural practices and breastfeeding behaviors. The study did not assess dietary diversity or micronutrient status, which would provide deeper insight into nutritional deficiencies. Finally, the lack of a comparison group of children born to adult mothers (≥ 25 years) limits attribution of findings specifically to adolescent/young maternal age rather than other confounding factors.

Conclusions

This study demonstrates a high burden of malnutrition particularly wasting and underweight among children aged 6–59 months born to adolescent and young mothers in rural northern Uganda. Maternal education, housing conditions, and harmful cultural practices are independent determinants. The low stunting but high wasting prevalence suggests acute nutritional crises in this population, likely exacerbated by climate change-induced agricultural disruption.

Implications for policy and practice

First, keeping girls in school beyond primary level should be prioritized as a nutrition-sensitive intervention. Uganda's Universal Secondary Education policy should be strengthened with enforcement of re-entry policies for girls who become pregnant [50].

Second, community-based nutrition education should be delivered through existing platforms (Village Health Teams, antenatal care, immunization clinics) focusing on: (a) appropriate complementary feeding practices, (b) exclusive breastfeeding, (c) recognition of malnutrition signs, and (d) addressing harmful food taboos and traditional procedures through dialogue with community leaders and traditional healers.

Third, integrated WASH-nutrition programs are needed given the associations between poor sanitation (lack of latrines, handwashing facilities, waste disposal) and malnutrition. The nutrition-sensitive WASH approach should address both direct (diarrhea prevention) and indirect (time poverty, economic constraints) pathways [51].

Fourth, targeted nutritional support for boys may be warranted given their consistently worse outcomes across all indicators. Research on gender-differential care-seeking and feeding practices in this context is needed to inform interventions.

Recommendations for future research

Longitudinal studies are needed to establish temporal relationships and identify critical windows for intervention. Research should examine the mechanisms linking semi-permanent housing to malnutrition, including household expenditure trade-offs and indoor environmental quality. Intervention studies evaluating culturally adapted behavior change communication to reduce harmful traditional practices are a priority. Finally, the impact of climate change on child nutrition in this region warrants further investigation given the six-year pattern of unpredictable rainfall.

Abbreviations

ANC Antenatal care

AOR Adjusted odds ratio

BMI Body mass index

CI Confidence interval

COR Crude odds ratio

HAZ Height-for-age Z-score

LMIC Low- and middle-income country

MUAC Mid-upper arm circumference

NACS Nutritional Assessment and Counseling Support

RUTF Ready-to-use therapeutic food

UBOS Uganda Bureau of Statistics

UDHS Uganda Demographic and Health Survey

UGX Ugandan shillings

UNCST Uganda National Council for Science and Technology

UNICEF United Nations Children's Fund

WASH Water, sanitation, and hygiene

WAZ Weight-for-age Z-score

WHO World Health Organization

WHZ Weight-for-height Z-score

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from Lira University Research Ethics Committee (LUREC-2024-206, approved 23 August 2024). Permission was obtained from the Uganda National Council for Science and Technology (UNCST). Written informed consent was obtained from all mothers or legal guardians. For mothers under 18 years, parental/guardian consent was obtained in addition to maternal assent. All procedures complied with the Declaration of Helsinki.

Consent for publication
Not applicable (no individual person's data are presented).

Availability of data and materials
The dataset supporting the conclusions of this article is available from the corresponding author upon reasonable request.

Competing interests
The authors declare that they have no competing interests.

Funding
This study was self-funded by the principal investigator (G.O.O.). No external funding was received.

Authors' contributions
G.O.O. conceived the study, designed the protocol, supervised data collection, performed data analysis, and drafted the manuscript. J.P.B. performed data analysis, and drafted the manuscript. B.A. contributed to study design, supervised data collection, and critically revised the manuscript. R.B. contributed to study design, provided clinical expertise on child malnutrition, and critically revised the manuscript. All authors read and approved the final manuscript.

Acknowledgements
The authors thank the mothers and children who participated in this study. We acknowledge the Otuke District Health Office, sub-county local councils, village chairpersons, and Village Health Teams for

facilitating community entry. We thank the research assistants for their dedication during data collection. We are grateful to Lira University Faculty of Public Health for administrative support.

References

1. Chirgwin H, Cairncross S, Zehra D, Waddington H. Interventions promoting uptake of water, sanitation and hygiene (WASH) technologies in low- and middle-income countries: An evidence and gap map of effectiveness studies. Campbell Syst Rev. 2021;17(4):e1194. 10.1002/CL2.1194.
2. Menghwar B, Laghari ZA, Memon SF, Warsi J, Shaikh SA, Baig NM. Prevalence of malnutrition in children under five years' age in District Tharparkar Sindh, Pakistan. J Pak Med Assoc. 2022;72(4):764–9. 10.47391/JPMA.20-540.
3. Gaiser ML, Winkler A, Klug S, Nkurunziza S, Stelzle D. Determinants of stunting among children under age five in Burundi: Evidence from the 2016–2017 Burundi Demographic and Health Survey (BDHS 2016–17). Food Sci Nutr. 2023;11(8):4479–93. 10.1002/FSN3.3400.
4. Susarla SM, Trimble M, Sokal-Gutierrez K. Cross-Sectional Analysis of Oral Healthcare vs. General Healthcare Utilization in Five Low- and Middle-Income Countries. Front Oral Health. 2022;3:911110. 10.3389/FROH.2022.911110.
5. Uganda Bureau of Statistics (UBOS) and ICF. Uganda Demographic and Health Survey 2016. Maryland, USA: UBOS and ICF;: Kampala, Uganda and Rockville; 2018.
6. Chandra-Mouli V, Akwara E. Improving access to and use of contraception by adolescents: What progress has been made, what lessons have been learnt, and what are the implications for action? Best Pract Res Clin Obstet Gynaecol. 2020;66:107–18. 10.1016/j.bpobgyn.2020.04.003.
7. Agho KE, Ahmed T, Fleming C, Dhami MV, Miner CA, Torome R, Ogbo FA. Breastfeeding Practices among Adolescent Mothers and Associated Factors in Bangladesh (2004–2014). Nutrients. 2021;13(2):557. 10.3390/NU13020557.
8. Alemayehu GM, Cherie KT, Chernet AG. Severity of malnutrition among underweight children and family-related factors: A cross-sectional analysis of data from the 2019 Ethiopian Demographic and Health Survey (EDHS). Health Sci Rep. 2022;5(6):e860. 10.1002/hsr2.860.
9. Merga BT, Balis B, Fekadu G, Birhanu A, Alemu A, Turi E. Determinants of pre-lacteal feeding practices among mothers having children aged less than 36 months in Ethiopia: Evidence from 2016 Ethiopian demographic and health survey. SAGE Open Med. 2021;9:20503121211019235. 10.1177/20503121211019235.
10. Bayih WA, Mekonen DK, Kebede SD. Prevalence and associated factors of prelacteal feeding among neonates admitted to neonatal intensive care units, North central Ethiopia, 2019. BMC Public Health. 2020;20(1):1502. 10.1186/S12889-020-09578-5.
11. Sorrie MB, Yesuf ME, Mekonnen MG. Determinants of stunting among children aged 6–59 months in rural Ethiopia: A community-based cross-sectional study. BMC Nutr. 2020;6:33. 10.1186/s40795-020-00361-8.

12. Okwir D, Aloka B, Oryema C. Climate variability and household food security in Otuke District, northern Uganda. J Agric Food Secur. 2023;12(1):45–58.
13. Ajari EE, Ojilong D. Assessment of the preparedness of the Ugandan health care system to tackle more COVID-19 cases. J Glob Health. 2020;10(2):020305. 10.7189/jogh.10.020305.
14. Debela SA, Sisay D, Negassa M, Daba C, Mesfin Tefera Y, Debela EA, et al. Determinants of undernutrition among children aged 6–59 months during the COVID-19 pandemic: A hospital-based cross-sectional study in Ethiopia. J Public Health Res. 2023;12(2):22799036231181174. 10.1177/22799036231181174.
15. Nguyen P, Kim SS, Tran L, Menon P, Frongillo E. Early breastfeeding practices contribute to exclusive breastfeeding in Bangladesh, Vietnam and Ethiopia. Matern Child Nutr. 2020;16(4):e13012. 10.1111/MCN.13012.
16. 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. 10.1371/JOURNAL.PONE.0269279.
17. Uganda Bureau of Statistics. National Population and Housing Census 2022: District Profiles. Kampala: UBOS; 2022.
18. World Health Organization. Training Course on Child Growth Assessment. Geneva: *WHO*; 2008.
19. World Health Organization. WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. Geneva: *WHO*; 2006.
20. Fite MT, Challa Y, Tiruneh M, Zemenfeskidus S, Destaw Z, Ashenafi M, et al. Use of modified composite index of anthropometric failure and MUAC-for-age to assess prevalence of malnutrition among school-age children and adolescents involved in the school feeding program in Addis Ababa, Ethiopia. BMC Nutr. 2021;7(1):48. 10.1186/s40795-021-00471-x.
21. Nabwera HM, Moore SE, Mwangome M, Molyneux S, Darboe MK, Camara-Trawally N, et al. The influence of maternal psychosocial circumstances and physical environment on the risk of severe wasting in rural Gambian infants: A mixed methods approach. BMC Public Health. 2018;18(1):109. 10.1186/S12889-017-4984-2.
22. Orellana J, Gatica-Domínguez G, Vaz JS, Neves PA, Vasconcellos ACD, Hacon S, Basta PC. Intergenerational Association of Short Maternal Stature with Stunting in Yanomami Indigenous Children from the Brazilian Amazon. Int J Environ Res Public Health. 2021;18(17):9130. 10.3390/IJERPH18179130.
23. Kozuki N, Walker N. Exploring the association between short/long preceding birth intervals and child mortality: using reference birth interval children of the same mother as comparison. BMC Public Health. 2013;13(Suppl 3):S6.
24. Gebrie M, Benti A. Stunting, feeding practice and its associated factors among children age from 6–59 months in Ziway Dugda Woreda, Arsi Zone, Oromia Region, Ethiopia. Int J Nutr Metab. 2021;13(1):1–10. 10.5897/IJNAM2020.0279.

25. World Health Organization. Global Nutrition Targets 2025: Wasting Policy Brief. Geneva: WHO; 2014.
26. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet. 2013;382(9890):427–51.
27. Bekele T, Rahman B, Rawstorne P. The effect of access to water, sanitation and handwashing facilities on child growth indicators: Evidence from the Ethiopia Demographic and Health Survey 2016. PLoS ONE. 2020;15(9):e0239313. 10.1371/JOURNAL.PONE.0239313.
28. Gandra NR, Masillamoni KJ. Assessment of nutritional status of children aged 34–92 months using various nutritional status indices and validity of age independent indices. Int J Contemp Pediatr. 2019;6(6):2432–8. 10.18203/2349-3291.IJCP20194740.
29. Thurstans S, Opondo C, Seal A, Wells JC, Khara T, Dolan C, et al. Boys are more likely to be undernourished than girls: a systematic review and meta-analysis of sex differences in undernutrition. BMJ Glob Health. 2020;5(12):e004030.
30. Siswati T, Paramashanti B, Pramestuti N, Waris L. A pooled data analysis to determine risk factors of childhood stunting in Indonesia. J Nutr Coll. 2023;12(1):20–30. 10.14710/JNC.V12I1.35413.
31. Tickell KD, Atlas HE, Watson JL. Environmental enteric dysfunction: A review of potential mechanisms, consequences and management strategies. BMC Med. 2019;17(1):181. 10.1186/S12916-019-1417-3.
32. Nsiah-Asamoah C, Adjei G, Agblorti SKM, Doku DT. Association of maternal characteristics with child feeding indicators and nutritional status of children under-two years in Rural Ghana. BMC Pediatr. 2022;22(1):597. 10.1186/S12887-022-03651-1.
33. Ahmad D, Afzal M, Imtiaz A. Effect of socioeconomic factors on malnutrition among children in Pakistan. Future Bus J. 2020;6(1):30. 10.1186/S43093-020-00032-X.
34. Zaidi SRH, Iqbal J, Mahmud T, Raheel N, Fatima A. Maternal literacy and malnutrition in children: A comparative study. Pak J Med Med Sci. 2021;31(1):42–8. 10.51642/PPMJ.V31I01.128.
35. Makoka D, Masibo PK. Is there a threshold level of maternal education sufficient to reduce child undernutrition? Evidence from Malawi, Tanzania and Zimbabwe. BMC Public Health. 2019;19(1):276.
36. Ahmed AM, Nduwimana M, Nankunda J, Walyeldin E, Mohamoud AH, Hussein MH, et al. Prevalence and factors associated with undernutrition among HIV-positive children aged 6 months to 12 years attending antiretroviral treatment clinics in Bushenyi District, Uganda: a cross-sectional study. BMC Nutr. 2026;12(1):15. 10.1186/s40795-025-01001-9.
37. Kagawa M, Byron C. The impact of teenage pregnancy on school dropout in Uganda. Int J Educ Dev. 2021;86:102471.
38. Gatica-Domínguez G, Mesenburg MA, Barros AJD, Victora CG. Ethnic inequalities in child stunting and feeding practices: Results from surveys in thirteen countries from Latin America. Int J Equity Health. 2020;19(1):64. 10.1186/S12939-020-01165-9.

39. Onagbiye S, Ricci H, Bester P, Ricci C. Sedentariness and overweight in relation to mortality in sub-Saharan Africa. J Public Health Afr. 2023;14(3):2155. 10.4081/jphia.2023.2155.
40. Azhar GS, Mavalankar D, Nori-Sarma A, Rajiva A, Dutta P, Jaiswal A, et al. Heat-related mortality in India: excess all-cause mortality associated with the 2010 Ahmedabad heat wave. PLoS ONE. 2014;9(3):e91831.
41. Kempton JW, Périssé A, Hofer C, Vasconcellos ACD, Viana PVS, Lima MO, et al. An Assessment of Health Outcomes and Methylmercury Exposure in Munduruku Indigenous Women of Childbearing Age and Their Children under 2 Years Old. Int J Environ Res Public Health. 2021;18(19):10091. 10.3390/IJERPH181910091.
42. Tekaly G, Kassa M, Belete T, Tasew H, Mariye T, Teshale T. Pre-lacteal feeding practice and associated factors among mothers having children less than two years of age in Aksum town, Tigray, Ethiopia, 2017: A cross-sectional study. BMC Pediatr. 2018;18(1):341. 10.1186/S12887-018-1284-7.
43. G/slassie M, Mulugeta K, Berhe AT. Prelacteal Feeding and Associated Factors Among Northwestern Ethiopian Women Having Children Less than Six Months Age: A Community Based Cross-Sectional Study. Res Sq. 2020. 10.21203/RS.3.RS-37785/V1.
44. Temesgen H, Negesse A, Woyraw W, Getaneh T, Yigizaw M. Prelacteal feeding and associated factors in Ethiopia: Systematic review and meta-analysis. Int Breastfeed J. 2018;13:49. 10.1186/S13006-018-0193-6.
45. Muhumuza S, Ssematimba A, Nanteza C, Nabatanzi M, Nankabirwa JI. Traditional tooth extraction among children in Uganda: a cross-sectional study. BMC Oral Health. 2020;20(1):199.
46. Moges A, Wondimu M, Mamo A, Tsegaye D. Traditional uvulectomy among children in Ethiopia: a systematic review and meta-analysis. BMC Pediatr. 2021;21(1):457.
47. Orellana J, Marrero L, Alves CLM, Ruiz CMV, Hacon S, Oliveira MW, Basta PC. Association of severe stunting in indigenous Yanomami children with maternal short stature: Clues about the intergenerational transmission. Ciênc Saúde Coletiva. 2019;24(12):4575–86. 10.1590/1413-81232018245.17062017.
48. Nakamanya S, Nalwadda C, Atuyambe L. Malnutrition and associated factors among children of adolescent mothers attending a tertiary hospital in Uganda. Afr Health Sci. 2024;24(4):408–19.
49. Namugumya B, Nankumbi J, Kiboneka A. Reflections of adolescent motherhood on infant and young child feeding practices: the case of Uganda. BMC Public Health. 2025;25(1):892.
50. Ministry of Education and Sports Uganda. National Re-entry Policy for Girls who Drop Out of School Due to Pregnancy. Kampala: *MoES*; 2020.
51. Abbas F, Kumar R, Mahmood T, Somrongthong R. Impact of children born with low birth weight on stunting and wasting in Sindh province of Pakistan: A propensity score matching approach. Sci Rep. 2021;11(1):19940. 10.1038/S41598-021-98924-7.