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Prevalence and factors associated with anemia among children aged 2–59 months admitted to Gulu Regional Referral Hospital, Northern Uganda: A hospital-based cross-sectional study

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Abstract

Background

Anemia remains a global public health concern affecting several populations and continues to contribute to significant preventable morbidity and mortality. Unaddressed anemia is associated with long-term effects including poor cognitive and motor development, and behavioral problems. Despite these documented effects, the burden of anemia in Northern Uganda remains underreported. The study therefore aimed to assess the prevalence and factors associated with anemia among children aged 2–59 months admitted to Gulu Regional Referral Hospital (GRRH), in Northern Uganda.

Methods

This was a hospital-based cross-sectional study conducted from May to August 2025. A total of 384 eligible participants were enrolled into the study. Semi-structured questionnaires were used to collect social demographic data and clinical history of participants. Additional medical information was obtained from hospital records and laboratory reports. Data was analysed using STATA version 15.0. Data was summarized using frequencies, percentages, median, and interquartile ranges. Modified Poisson regression, with robust standard errors and a 95% CI were used to assess associated factors. A $p < 0.05$ was considered for statistical significance.

Results

Of the 384 participants, majority 51.3% (n = 197) were aged 24–59 months and 58.1% (n = 223) were male. The median hemoglobin level was 9.20 g/dL (Inter-quartile ranges (IQR): 6.85–10.80). The prevalence of anemia was 79.2% (95% CI:0.75–0.83), [n = 304/384]. Of these, 25% (n = 76) had severe anemia, 39.1%(n = 119) had moderate anemia and 35.9% (n = 109) had mild anemia. Factors significantly associated with anemia were: non-consumption of vegetables (aPR = 1.22, 95% CI: 1.02–1.46, p = 0.032), and children with more than 2 episodes of respiratory tract infection (aPR = 1.18, 95% CI: 1.07–1.31, p = 0.001). Meanwhile, prevalence of anemia was 21% lower among children of caregivers with monthly income above UGX 500,000 (aPR = 0.79, 95% CI: 0.63–0.98, p = 0.031).

Conclusion

About four in five children had anemia in this study. Non-consumption of vegetables and recurrent respiratory tract infections were significantly associated with anemia. Meanwhile, prevalence of anemia was 21% lower among children of caregivers with high monthly income. Empowering families to get out of poverty, parental nutritional advise and prompt seeking of care for childhood illnesses could significantly contribute to addressing anemia in this population.

Introduction

Anemia remains a major global public health concern associated with morbidity and mortality among the affected populations. Anemia is a condition where the number of red blood cells is inadequate to meet metabolic demands. Clinically, anemia is commonly defined using hemoglobin (Hb) levels, which are usually customized for different populations, based on gender and age [1,2]. The populations commonly affected with anemia are: young children, menstruating adolescent girls and women, and pregnant and postpartum women [3]. Low- and lower-middle-income countries (LMIC) remain disproportionately affected by anemia, with the societies that are more at risk being those in rural settings, people with no formal education, and financially constrained populations [3].

Globally, over 40% of all children aged 6–59 months are affected by anemia, with Africa contributing 103 million cases of the total anemia cases [3]. The etiology of anemia in the pediatric population is multifactorial, linked to a shortage of hematopoietic materials, frequent infectious diseases, and inherited haemoglobin diseases [4]. Notably, the highest proportion of pediatric anemia cases reported globally is due to iron deficiency [5]. Children experiencing reduced nutrient intake relative to increased growth requirements are therefore at an increased risk of anemia. Sub-Saharan Africa has the majority of its young children having difficulty accessing the required food nutrients, and therefore an increased risk of anemia [6]. Moreover, anemia has detrimental effects that could affect the child, including poor cognitive and motor development and behavioral problems [7,8]. Addressing anemia is therefore important if we are to counteract the long-term effects that could develop in growing children.

A recent systematic of sub-Saharan African literature has estimated the prevalence of anemia to be 55% [6]. Relatedly, the prevalence in East Africa has also been reported at 53% [9]. The 2016 Uganda Demographic and Health Survey equally estimated an overall prevalence of 53% among children aged 6 to 59 months and Northern Uganda was flagged for having the highest burden [10]. Other earlier Ugandan studies have also found a prevalence of 41.5% and 49.2% in Western Uganda [11,12]. The nutritional status of the children has shown association with the occurrence of anemia. For instance, children who are wasted had more anemia cases than those with normal nutritional status [11]. Among other factors that are associated with anemia includes low birth weight, consumption of cow milk, low socio-economic status of parents, education level of parents, and history of diarrhea [5,11–13]. Understanding these factors is crucial in developing targeted public health interventions to address this problem.

Sustainable Development Goal 3.2 emphasizes reduction of under-five mortality to at least as low as 25 per 1000 live births by 2030 [14]. In an effort to address this, several strategies have been put in place essentially focused on increased governance, accountability for resources and results, community-based approaches, and prioritisation of interventions [15]. Addressing anemia contributes to a reduction in child mortality with estimates suggesting that up to over 1.8 million deaths could be avoided if anemia is addressed in children [16]. Therefore, interventions to reduce anemia prevalence directly aligns with achieving SDG 3.2.

Existing evidence on anemia prevalence in Northern Uganda was reported in 2018 by a study conducted at St Mary's Hospital Lacor [17]. Additionally, the UDHS of 2016 reported a high burden of anemia in Northern Uganda, specifically for the Acholi sub-region [10]. However, there remains a paucity of more recent facility-based generated evidence of the burden of anemia in the region. Given demographic changes and ongoing public health interventions, updated data are essential. Therefore, this study aimed to determine the prevalence and associated factors of anemia among children admitted to GRRH.

Study design and setting

This was a hospital-based cross-sectional study conducted from May to August 2025.

The study was conducted at the pediatric unit of GRRH in Northern Uganda. The pediatric unit admits about 150 and 300 children every month, and the hospital has a functional laboratory that is capable of running Complete Blood Count (CBC) tests for all the children.

Study population and selection criteria

Children aged 2 to 59 months who were present at the pediatric unit during the study period and whose parents provided written informed consent were included in the study. Children with known hemoglobinopathies (such as sickle cell disease) and those who had received a blood transfusion within 3 months before recruitment were excluded from the study.

Sample size estimation and sampling procedure

The sample size was calculated using the Kish-Leisle formula; $n=z^2pq/d^2$. Considering a z-score of 1.96 (at 95% confidence interval), prevalence of 50%, and margin of error at 5%, our sample size was 384 participants. Participants were enrolled in this study using a consecutive sampling technique.

Data collection procedure

Data were collected using a semi-structured questionnaire. The collected data included socio-demographic characteristics such as age, gender, parental education level, and level of income; clinical characteristics such as presenting complaints to the pediatric unit, history of previous illness, and current medication use; laboratory characteristics such as hemoglobin levels, mean corpuscular volume, red blood cell counts; and physical examination findings such as weight and height. informed consent was obtained from the parents, and those who met the eligibility criteria were included in the study. Laboratory data (CBC) were extracted from the patient's records.. A diagnosis of anemia was made using the Hemoglobin levels obtained from the patients CBC reports.

Operational definition

Anemia was defined as Hb < 11 g/dL, classified as mild (10–10.9), moderate (7–9.9), and severe (< 7), per WHO guidelines [18]

Data management and analysis

Completed questionnaires were reviewed for completeness and consistency before being securely stored in waterproof folder files accessible only to authorized study team members. Data were entered into Microsoft Excel, with the electronic database protected using a password to maintain confidentiality and prevent unauthorized access. The dataset was subsequently cleaned, coded, and exported to STATA version 15.0 for statistical analysis.

Descriptive analyses were performed to summarize participants' socio-demographic and clinical characteristics. Categorical variables were presented as frequencies and proportions (percentages). The distribution of continuous variables was assessed using the Shapiro–Wilk test for normality. Normally distributed continuous variables were summarized using means and standard deviations (SD), while non-normally distributed variables were summarized using medians and interquartile ranges (IQR).

Bivariable analysis was conducted to assess the association between potential predictor variables and anemia status. Variables with clinical relevance and those with a p-value < 0.2 at bivariable analysis were considered for inclusion in the multivariable model. Modified Poisson regression was used to estimate prevalence ratios (PRs) and corresponding 95% confidence intervals (CIs) for factors independently associated with anemia.

A two-sided p-value of < 0.05 was considered statistically significant. Model assumptions were assessed, and results were presented using adjusted prevalence ratios (aPRs) with 95% confidence intervals.

Ethical considerations

Ethical approval was obtained from the Gulu University Research Ethics Committee (GUREC-2024-1056). Administrative clearance was obtained from Gulu Regional Referral Hospital (GRRH). Participants were assigned unique identification numbers to ensure confidentiality, and all ethical guidelines stated in the Declaration of Helsinki were respected during the study. Written informed consent was obtained from the parents/guardians. Participation was voluntary, and appropriate measures were taken to uphold participants' rights, safety, and confidentiality throughout the study.

Results

3.1 Socio-demographic characteristics of children aged 2–59 months admitted to Gulu Regional Referral Hospital, Northern Uganda

A total of 384 children aged 2–59 months were enrolled in the study. Of these, 51.3%(n-197) were aged 24–59 months, and 58.1%(n = 223) were male. The majority of the care givers were mothers (81.3%, n = 312). Most caregivers were married (69.3%, n = 266) and the largest proportion had attained secondary education (39.1%, n = 150).

More than half of the households (54.7%, n = 210) had more than four members. Regarding household income, 51.3% (n = 197) of caregivers reported a monthly income ranging between UGX 200,001 and 500,000.

With regard to feeding practices, only 6.5% (n = 25) of children had been exclusively breastfed, while the majority (52.1%, n = 200) were reported to receive other feeds only. Most children were fed three to four times per day (60.9%, n = 234). Dietary diversity was generally limited, with infrequent consumption of fruits, vegetables, and animal-source foods. Meat was rarely or never consumed by 68.0% (n = 261) of children. Detailed socio-demographic and feeding characteristics of the study participants are presented in Table 1.

Table 1
shows socio-demographic characteristics of children aged 2–59 months admitted to Gulu Regional Referral Hospital, Northern Uganda

Variable	Frequency	Percentage
Age		
2–5 months	25	6.5
6–11 months	61	15.9
12–23 months	101	26.3
24–59 months	197	51.3
Gender		
Male	223	58.1
Female	161	41.9
Presenting symptoms		
Febrile illness symptoms	200	52.1
Respiratory symptoms	70	18.2
Gastrointestinal symptoms	96	25.0
Others	18	4.7
Malaria status		
Positive	163	42.4
Negative	221	57.6
Caregiver relationship		
Mother	312	81.3
Father	51	13.3
Guardian	21	5.5
Caregiver education level		
Primary	138	35.9
Secondary	150	39.1
Tertiary	74	19.3
No formal education	22	5.7
Marital status		

Variable	Frequency	Percentage
Married	266	69.3
Unmarried	118	30.7
Family size		
≤ 4 members	174	45.3
> 4 members	210	54.7
Employment status		
Formal	80	20.8
Informal	161	41.9
Unemployed	143	37.2
Monthly income (UGX)		
< 200,000	93	24.2
200,001–500,000	197	51.3
> 500,000	94	24.5
Water source		
Borehole	251	65.4
Tap water	109	28.4
Natural water sources	24	6.3
Child feeding		
Exclusive breastfeeding	25	6.5
Breast milk + other feeds	142	37.0
Cow's milk/Formula	17	4.4
Other feeds only	200	52.1
Feeding frequency per day		
< 3 times	31	8.1
3–4 times	234	60.9
5–7 times	90	23.4
≥ 8 times	29	7.6
Fruit consumption		

Variable	Frequency	Percentage
Daily	41	10.7
Weekly	135	35.2
Rarely	171	44.5
Never	37	9.6
Vegetable consumption		
Daily	93	24.2
Weekly	174	45.3
Rarely	69	18.0
Never	48	12.5
Meat consumption		
Daily	21	5.5
Weekly	102	26.6
Rarely	198	51.6
Never	63	16.4
Previous illness		
Yes	200	52.1
No	184	47.9
Respiratory tract infection frequency		
<=2 episodes	225	58.6
> 2 episodes	55	14.3
Current medication		
Yes	282	73.4
No	102	26.6
Immunization status		
Up to date	365	95.1
Not up to date	19	4.9

3.2 Laboratory findings of children aged 2–59 months admitted to Gulu Regional Referral Hospital, Northern Uganda

The median hemoglobin level among the children was 9.20 g/dL (Inter-quartile ranges (IQR): 6.85–10.80), reflecting the high burden of anemia in this population. The median RBC count was 4.10 $\times 10^{12}$/L (IQR: 2.80–5.17) and median MCV was 80.05 fL (IQR: 72.35–90.00). Anthropometric findings showed a median weight of 14.05 kg (IQR: 11.00–17.15), height of 89.20 cm (IQR: 74.10–97.75), and MUAC of 13.90 cm (IQR: 13.10–14.50). Full findings are shown in Table 2.

Table 2
shows laboratory findings of children aged 2–59 months admitted to Gulu Regional Referral Hospital, Northern Uganda

Variable	Median (IQR)
Weight (kg)	14.05 (11.00–17.15)
Height (cm)	89.20 (74.10–97.75)
MUAC (cm)	13.90 (13.10–14.50)
RBC count (×1012/L)	4.10 (2.80–5.17)
Hemoglobin (g/dL)	9.20 (6.85–10.80)
Mean corpuscular volume (MCV, fL)	80.05 (72.35–90.00)

3.3 Prevalence of anemia among children aged 2–59 months admitted to Gulu Regional Referral Hospital, Northern Uganda

The prevalence of anemia was 79.2% (95% CI:0.75–0.83), [n = 304/389]. Of these, 25% (n = 76) had severe anemia 39.1%(n = 119) had moderate anemia and 35.9% (n = 109) had mild anemia. Figure 1.

3.4 Bivariate analysis of factors associated with anemia among children aged 2–59 months admitted to Gulu Regional Referral Hospital, Northern Uganda.

In the bivariate analysis, several factors were statistically associated with anemia among children aged 2–59 months. These included the child's nutritional status ($p = 0.005$), caregiver education level ($p = 0.041$), caregiver income level ($p = 0.001$), feeding patterns ($p = 0.032$), frequency of meat consumption ($p < 0.001$), dietary diversity ($p = 0.013$), history of previous illness ($p = 0.021$), and frequency of respiratory tract infections ($p = 0.041$).

Variables associated with anemia at bivariate analysis, alongside other clinically relevant factors, were considered for inclusion in the multivariable analysis. Detailed comparisons of factors associated with anemia are presented in Table 3.

Table 3
shows bivariate analysis of factors associated with anemia among children aged 2–59 months admitted to Gulu Regional Referral Hospital, Northern Uganda.

Variable	Total (N = 384)	Anemia 1 (N = 305)	Anemia 0 (N = 79)	p-value
Age				0.487
2–5 months	25 (6.5%)	18 (5.9%)	7 (8.9%)	
6–11 months	61 (15.9%)	48 (15.7%)	13 (16.5%)	
12–23 months	101 (26.3%)	85 (27.9%)	16 (20.3%)	
24–59 months	197 (51.3%)	154 (50.5%)	43 (54.4%)	
Gender				0.631
Male	223 (58.1%)	179 (58.7%)	44 (55.7%)	
Female	161 (41.9%)	126 (41.3%)	35 (44.3%)	
Presenting complaints				0.661
Febrile illness symptoms	200 (52.1%)	163 (53.4%)	37 (46.8%)	
Respiratory symptoms	70 (18.2%)	54 (17.7%)	16 (20.3%)	
GI symptoms	96 (25.0%)	73 (23.9%)	23 (29.1%)	
Others	18 (4.7%)	15 (4.9%)	3 (3.8%)	
Nutrition status				**0.005**
Normal	326 (84.9%)	256 (83.9%)	70 (88.6%)	
Moderate Acute Malnutrition	34 (8.9%)	33 (10.8%)	1 (1.3%)	
Severe Acute Malnutrition	24 (6.3%)	16 (5.2%)	8 (10.1%)	
Malaria infection				0.247
Positive	163 (42.4%)	134 (43.9%)	29 (36.7%)	
Negative	221 (57.6%)	171 (56.1%)	50 (63.3%)	
Caregiver relationship				**0.166**
Mother	312 (81.3%)	242 (79.3%)	70 (88.6%)	
Father	51 (13.3%)	45 (14.8%)	6 (7.6%)	
Guardian	21 (5.5%)	18 (5.9%)	3 (3.8%)	
Education level of caregiver				**0.041**

Variable	Total (N = 384)	Anemia 1 (N = 305)	Anemia 0 (N = 79)	p-value
Primary	138 (35.9%)	118 (38.7%)	20 (25.3%)	
Secondary	150 (39.1%)	111 (36.4%)	39 (49.4%)	
Tertiary	74 (19.3%)	56 (18.4%)	18 (22.8%)	
No formal education	22 (5.7%)	20 (6.6%)	2 (2.5%)	
Family size				0.649
< 4 members	174 (45.3)	140 (45.9)	34 (43.0)	
> 4 members	210 (54.7)	165 (54.1)	45 (57.0)	
Caregiver Income (UGX)				**0.001**
< 200,000	93 (24.2%)	82 (26.9%)	11 (13.9%)	
200,001–500,000	197 (51.3%)	160 (52.5%)	37 (46.8%)	
> 500,000	94 (24.5%)	63 (20.7%)	31 (39.2%)	
Water source				0.576
Borehole	251 (65.4%)	197 (64.6%)	54 (68.4%)	
Tap water	109 (28.4%)	87 (28.5%)	22 (27.8%)	
Natural water sources	24 (6.3%)	21 (6.9%)	3 (3.8%)	
Child's feeding patterns				**0.032**
Exclusive breastfeeding	25 (6.5%)	18 (5.9%)	7 (8.9%)	
Breast milk + other feeds	142 (37.0%)	118 (38.7%)	24 (30.4%)	
Cow's milk/Formula	17 (4.4%)	17 (5.6%)	0 (0.0%)	
Other feeds only	200 (52.1%)	152 (49.8%)	48 (60.8%)	
Feeding frequency/day				0.923
< 3	31 (8.1%)	26 (8.5%)	5 (6.3%)	
3–4	234 (60.9%)	184 (60.3%)	50 (63.3%)	
5–7	90 (23.4%)	72 (23.6%)	18 (22.8%)	
≥ 8	29 (7.6%)	23 (7.5%)	6 (7.6%)	
Fruit consumption				**0.177**
Daily	41 (10.7%)	35 (11.5%)	6 (7.6%)	

Variable	Total (N = 384)	Anemia 1 (N = 305)	Anemia 0 (N = 79)	p-value
Weekly	135 (35.2%)	101 (33.1%)	34 (43.0%)	
Rarely	171 (44.5%)	142 (46.6%)	29 (36.7%)	
Never	37 (9.6%)	27 (8.9%)	10 (12.7%)	
Vegetable consumption				0.661
Daily	93 (24.2%)	73 (23.9%)	20 (25.3%)	
Weekly	174 (45.3%)	135 (44.3%)	39 (49.4%)	
Rarely	69 (18.0%)	56 (18.4%)	13 (16.5%)	
Never	48 (12.5%)	41 (13.4%)	7 (8.9%)	
Meat consumption				**< 0.001**
Daily	21 (5.5%)	17 (5.6%)	4 (5.1%)	
Weekly	102 (26.6%)	64 (21.0%)	38 (48.1%)	
Rarely	198 (51.6%)	172 (56.4%)	26 (32.9%)	
Never	63 (16.4%)	52 (17.0%)	11 (13.9%)	
Diet diversity				**0.013**
Very diverse	46 (12.0%)	30 (9.8%)	16 (20.3%)	
Moderately diverse	163 (42.4%)	127 (41.6%)	36 (45.6%)	
Not diverse	175 (45.6%)	148 (48.5%)	27 (34.2%)	
Previous illness				**0.021**
Yes	200 (52.1%)	168 (55.1%)	32 (40.5%)	
No	184 (47.9%)	137 (44.9%)	47 (59.5%)	
Diarrhea frequency				0.410
1–2 episodes	223 (58.1%)	175 (57.4%)	48 (60.8%)	
≥ 3 episodes	40 (10.4%)	35 (11.5%)	5 (6.3%)	
None	121 (31.5%)	95 (31.1%)	26 (32.9%)	
RTI frequency				**0.041**
<=2 episodes	225 (58.6%)	169 (55.4%)	56 (70.9%)	
> 2 episodes	55 (14.3%)	48 (15.7%)	7 (8.9%)	

3.5 Multivariable analysis of factors associated with anemia among children aged 24–59 months at GRRH

After adjusting for potential confounding factors, three variables remained independently associated with anemia among children aged 2–59 months. Children who did not consume vegetables had a higher prevalence of anemia compared with those who consumed vegetables (adjusted prevalence ratio [aPR] = 1.22, 95% CI: 1.02–1.46, p = 0.032). Similarly, children who experienced more than two episodes of respiratory tract infection had a significantly higher prevalence of anemia (aPR = 1.18, 95% CI: 1.07–1.31, p = 0.001).

Conversely, children from households where caregivers reported a monthly income above UGX 500,000 had a lower prevalence of anemia by 21% compared with those from lower-income households (aPR = 0.79, 95% CI: 0.63–0.98, p = 0.031). The adjusted associations between the identified factors and anemia are presented in Table 4.

Table 4
shows the multivariable analysis of factors associated with anemia among children aged 24–59 months at GRRH

Variable	aPR (95% CI)	p-value
Age		
2–5 months	1.00	
6–11 months	1.16 (0.89–1.52)	0.275
12–23 months	1.24 (0.93–1.64)	0.147
24–59 months	1.24 (0.92–1.66)	0.151
Caregiver relationship		
Mother	1.00	
Father	1.16 (0.99–1.35)	0.062
Guardian	1.11 (0.89–1.40)	0.361
Family size		
≤ 4 members	1.00	
> 4 members	1.06 (0.95–1.18)	0.326
Caregiver education level		
No formal education	1.00	
Primary	1.04 (0.88–1.23)	0.654
Secondary	0.87 (0.72–1.04)	0.130
Tertiary	0.82 (0.65–1.05)	0.110
Marital status		
Married	1.00	
Unmarried	0.98 (0.87–1.11)	0.785
Monthly income		
< 200,000 UGX	1.00	
200,001–500,000 UGX	1.01 (0.90–1.13)	0.918
> 500,000 UGX	0.79 (0.63–0.98)	**0.031**
Fruit consumption		
Daily	1.00	

Variable	aPR (95% CI)	p-value
Weekly	0.97 (0.83–1.14)	0.748
Monthly	0.93 (0.77–1.11)	0.410
Never	0.72 (0.52–1.01)	0.055
Vegetable consumption		
Daily	1.00	
Weekly	1.01 (0.89–1.15)	0.846
Monthly	0.99 (0.84–1.15)	0.853
Never	1.22 (1.02–1.46)	**0.032**
Child feeding practice		
Exclusive breastfeeding	1.00	
Breast milk + other feeds	0.95 (0.73–1.23)	0.687
Cow's milk/Formula	0.99 (0.75–1.32)	0.956
Other feeds only	0.87 (0.64–1.20)	0.407
Diet diversity		
Very diverse	1.00	
Moderately diverse	1.12 (0.89–1.42)	0.341
Not diverse	1.19 (0.93–1.52)	0.166
Previous illness		
Yes	1.00	
No	0.98 (0.88–1.10)	0.737
Respiratory tract infection (RTI)		
<=2 episodes	1.00	
> 2 episodes	1.18 (1.07–1.31)	**0.001**

Discussion

This study assessed the prevalence and factors associated with anaemia among children aged 2–59 months admitted to Gulu Regional Referral Hospital (GRRH), Northern Uganda. The prevalence of anaemia was very high, with nearly four in five children (79.2%) affected. Majority of the children had mild or moderate anaemia, while severe anaemia accounted for the smallest proportion of cases. After

adjustment for potential confounders, non-consumption of vegetables and experiencing more than two episodes of respiratory tract infection (RTI) were independently associated with a higher prevalence of anaemia. Additionally, children from households with caregivers earning more than UGX 500,000 per month had a significantly lower prevalence of anaemia.

The high prevalence of anaemia observed in this study is consistent with findings from other hospital-based studies in the region. Studies conducted in Tanzania reported anaemia prevalence of 83.2% and 77.2%, respectively [18,19]. The similarity in prevalence is partly explained by comparable study settings, since all were conducted among children admitted in healthcare facilities. Hospital-based populations are more likely to include children with acute and chronic conditions that increase the risk of anaemia, including malaria, malnutrition, infections, and gastrointestinal illnesses. In the current study, more than half of the children presented with febrile illnesses, while approximately one-quarter had gastrointestinal symptoms. Given that Northern Uganda remains a malaria-endemic region [20], malaria-related haemolysis may have contributed substantially to the anaemia burden among febrile children. In addition, gastrointestinal illnesses, particularly diarrhoeal diseases, may contribute to anaemia through reduced nutrient absorption and poor dietary intake, consistent with findings from previous studies [21].

In contrast, community-based studies in Uganda and elsewhere have generally reported lower prevalence estimates. For example, studies from Namutumba District and the Busoga sub-region reported anaemia prevalence of 58.8% and 67.4%, respectively[22,23], while a community-based study in Tanzania reported a prevalence of 37.9% [24]. The difference between facility-based and community-based estimates is expected, as children admitted to hospitals represent a higher-risk group with a greater burden of acute illness, severe infections, malnutrition, and other conditions that can either cause or exacerbate anaemia. Therefore, the high prevalence observed in this study likely reflects the vulnerability of hospitalized children rather than the prevalence in the general child population.

Household income was independently associated with anaemia in this study. Children whose caregivers reported a monthly income above UGX 500,000 had a lower prevalence of anaemia compared with those from lower-income households. This finding is consistent with previous studies demonstrating a higher burden of anaemia among children from economically disadvantaged households [25–27]. Higher household income may reduce the risk of anaemia through multiple pathways, including improved access to diverse diets rich in iron and other micronutrients, increased ability to seek timely healthcare, improved household hygiene, and reduced exposure to infections that contribute to anaemia. These findings highlight the importance of addressing socioeconomic determinants as part of comprehensive strategies to reduce childhood anaemia.

Dietary practices were also important determinants of anaemia. Children who did not consume vegetables had a significantly higher prevalence of anaemia compared with those who consumed vegetables. This association is biologically plausible because vegetables provide non-haem iron, folate, and vitamin C, which enhances intestinal absorption of iron. Similar findings have been reported in Tanzania, where inadequate vegetable consumption was associated with increased risk of anaemia

among children [28]. Although fruit consumption showed an association with anaemia at bivariate analysis, it was not retained in the multivariable model, suggesting that overall dietary quality and diversity may be more important than consumption of individual food groups. This finding supports nutrition interventions that promote diverse complementary feeding practices, including regular consumption of iron-rich animal-source foods, legumes, vegetables, and vitamin C-rich foods.

Recurrent respiratory tract infections were another factor independently associated with anaemia. Children who experienced more than two episodes of RTI had a higher prevalence of anaemia compared with those with fewer episodes. The relationship between anaemia and infection is complex and likely bidirectional. Iron deficiency may impair immune function by affecting lymphocyte proliferation and other components of host defence, thereby increasing susceptibility to infections. Supporting this mechanism, a case-control study in Egypt found that children with iron-deficiency anaemia had a substantially increased risk of acute lower respiratory tract infections compared with non-anaemic children [29]. Conversely, recurrent infections may contribute to anaemia through inflammation-mediated disturbances in iron metabolism, including reduced iron availability for erythropoiesis despite adequate iron stores, a process commonly described as anaemia of inflammation [30]. Given the cross-sectional design of this study, causality cannot be established; however, the observed association likely reflects the interaction between nutritional deficiencies, immune function, and recurrent infections in this population.

Strengths and Limitations

Our study used the WHO recommended cut offs for anemia diagnosis and severity classification. This enhances comparability with other regional and global studies, and offers direct clinical and public health relevance, since these same thresholds inform clinical decision-making and intervention development.

Our study however has some limitations. The hospital-based nature prevents our findings from being generalizable to the wider community of children in Northern Uganda. Additionally, the cross-sectional design hinders establishment of causal inferences between the identified factors and anaemia status. Finally, most variables were based on caregiver recall which may be subject to recall and social desirability bias.

Conclusion

The findings demonstrate that anaemia among hospitalized children in Northern Uganda is driven by a combination of nutritional, socioeconomic, and infectious factors. Interventions to reduce the burden of childhood anaemia should therefore extend beyond iron supplementation alone and incorporate strategies that improve household economic security, promote dietary diversity, strengthen infection prevention and control, and enhance early identification and management of illnesses associated with anaemia.

Declarations

Data Availability

All data is available upon request from the corresponding author.

Competing interests

The authors declare no conflicting interests

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Author contributions.

All authors contributed substantially, to the development and preparation of this manuscript for publication.

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Clinical Trial Number: Not applicable

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Figures

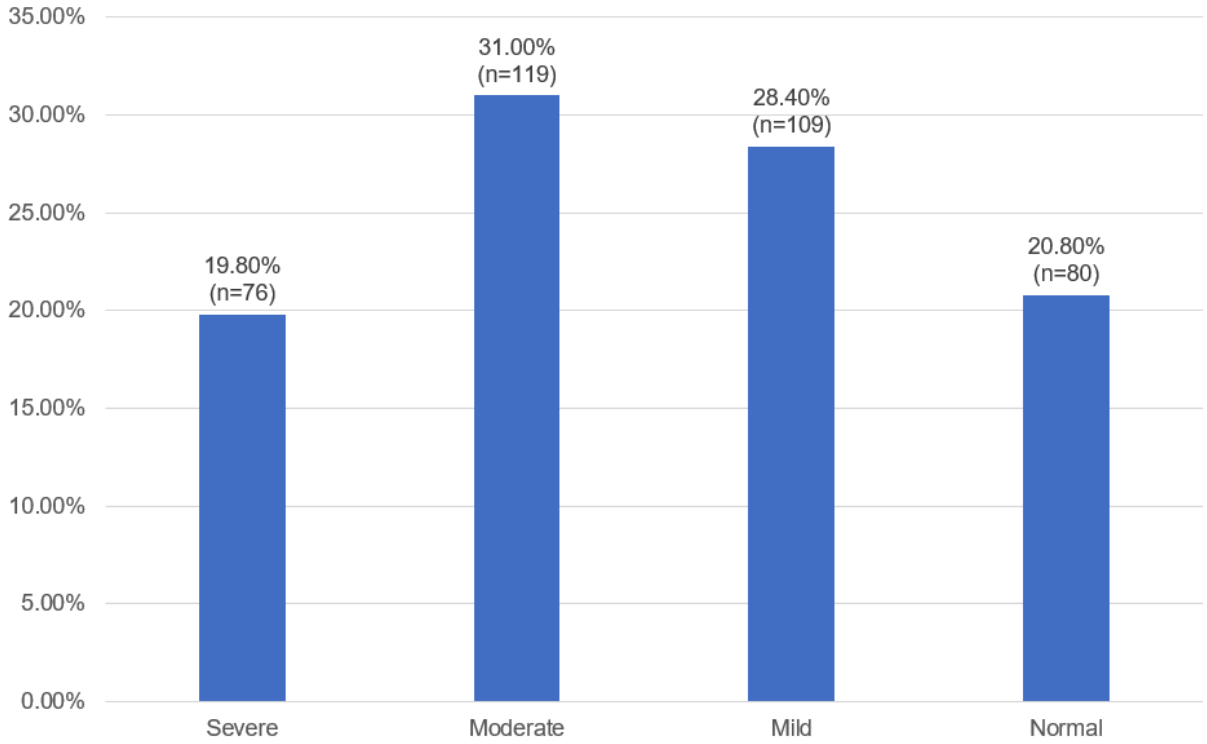


Figure 1 shows the classes of anemia among children aged 2–59 months admitted to Gulu Regional Referral Hospital, Northern Uganda

Figure 1

See image above for figure legend.