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Impacts of anemia and its determinants among 6–59 months age children residing in Dayniile internally displaced person's camps, Banadir region, Somalia

Abdirasak Sharif Ali Mude[1,2], Farhia Abdullahi Ali[2], Sumaya Hassan Ali[2]

Abstract:

BACKGROUND: The prevalence of anemia in children under 5 years of age is a multifaceted issue influenced by various factors, leading to diverse findings across studies. This study aimed to assess the prevalence of anemia and its associated factors among children under 5 years of age living in internally displaced persons camps in the Dayniile district of Somalia.

MATERIALS AND METHODS: This cross-sectional study was conducted between December 2022 and July 2023 in Mogadishu, Somalia. Blood samples from children under 5 years of age were checked for malaria and parasites, as well as for hemoglobin, erythrocytes, hematocrit, mean cell volume, and hematocrit. SPSS version 27.0.1 was used for data analysis, involving descriptive and inferential statistics. Fisher's exact test examined anemia associations due to low expected counts.

RESULTS: The prevalence of anemia among children under 5 years old was 17.6%. Anemia severity varied from mild (8.4%) to moderate (8.7%) to severe (0.5%). No significant correlation was found between a child's primary caregiver and anemia status nor between anemia and sex, age, maternal factors, or family income sources. However, the presence of income from other relatives was statistically significant ($P = 0.046$*), indicating that financial support from extended family members may reduce the incidence of severe anemia in young adults. Children with a history of malaria had notably higher rates of mild and moderate anemia (25.0% and 75.0%, respectively) than those without.

CONCLUSION: Our study, along with previous research, underscores the complexity of the prevalence of childhood anemia and its contributing factors. Addressing anemia in children from lower-income families and urban areas requires tailored intervention. In addition, controlling malaria and promoting breastfeeding are essential strategies for reducing the prevalence of anemia in young children. Overall, a multifaceted approach considering socioeconomic, health, and dietary factors is crucial for the well-being of children under 5 years old.

Keywords:

Anemia, children, feeding practices, health, low income, malaria

[1]Department of Hematology, Faculty of Medicine and Health Sciences, SIMAD University, [2]Department of Microbiology and Laboratory Sciences, SIMAD University, Mogadishu, Somalia

Address for correspondence:
Dr. Abdirasak Sharif Ali Mude,
Faculty of Medicine and Health Sciences, SIMAD University, Mogadishu 252, Somalia.
E-mail: arshamyare@gmail.com

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Introduction

Anemia is a worldwide public health issue that has not been adequately addressed.[1,2] Pediatric anemia continues to be ignored despite the major implications of anemia in children under the age of 5 years on their growth, development, immunity, and future scholastic success.[3,4] Under normal circumstances, erythrocyte production, and removal are in balance. Anemia is caused by an imbalance in the production and elimination ratio, which can be acute and life-threatening or chronic.[5]

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Anemia can be defined as a decrease in hemoglobin (Hb) concentration, hematocrit, or the number of red blood cells per litter that is less than the reference range with a disproportionate impact on children under the age of 5 years.[6] Young children, especially those under the age of 5 years, are at a pivotal point in their cognitive and physical development.[7,8] Low ingestion and absorption of iron-rich foods (e.g. meat and meat products) is the most common cause of anemia in young children, followed by acute blood loss and hereditary or acquired illnesses.[9] Iron deficiency is the most frequent cause of anemia, accounting for roughly 42% of cases in children under the age of 5 years worldwide.[10] While anemia is a problem that spans the lifespan, it is especially pressing for children under the age of 5 years because of its role in contributing to a host of other health problems, many of which result in premature death.[11] In 2019, the global anemia prevalence in children aged 6–59 months was 39.8%, corresponding to 269 million anemic children. The African Region has the highest frequency of anemia among children under the age of 5 years, at 60.2%.[12] Anemia affects nearly 75% of children under the age of 5 years in East Africa, with prevalence ranging between 44% and 76%.[13] A study conducted in Somalia found the prevalence in the pediatric population to anemia 43.4%.[14]

Despite the potential importance of anemia in the Dayniile internally displaced persons (IDP) camps, there is a noticeable gap in research addressing this issue. Generating local data on anemia prevalence and its determinants can fill this gap and provide a foundation for evidence-based policymaking. This study aimed to assess the prevalence of anemia and its associated factors among children under 5 years of age living in IDP camps in the Dayniile district of Somalia.

Materials and Methods

Study design and time

From December 2022 to July 2023, a community-based cross-sectional study was conducted in IDP camps in Dayniile district, Somalia.

Study area and population

The target population of this study encompassed all children below the age of 5 years who were residents of the IDP camps within the Dayniile district. Dayniile district is the largest district in Somalia's South Eastern Banaadir region. It covers the northern edges of Mogadishu, the national capital.

Inclusion criteria

All children below the age of 5 years residing in the selected IDP camps, whose caretakers provided informed consent for participation, were included in the study.

Exclusion criteria

Children below the age of 5 years residing in the selected IDP camps who were present but did not provide consent for participation were excluded from the study.

Sample technique

The selection of IDP camps within the Benadir region of Somalia was accomplished through convenient nonrandom sampling from those available within the Deyniile district. The chosen camps are itemized in Table 1. The selection of respondents was conducted through systematic sampling, with the initial point selected using a lottery method. In cases where the selected household did not have a child aged below 5 years, the subsequent household was approached.

Sample size determination

The sample size was determined using data from a previous study in Guguftu, South Wollo, Northeast Ethiopia, where the prevalence of anemia among children under the age of 5 years was 41.1%.[7] The sample size was estimated using the single population proportion calculation and assuming a 5% margin of error and a 95% confidence level ($z = Za/2 = 95\% = 1.96$), the sample size was calculated as follows:

$$n = \frac{(Z_{\alpha/2})^2\, p\,(1-p)}{E^2}$$

$$n = \frac{(1.96)^2 \times (0.411) \times (1-0.411)}{(0.05)^2} = 368$$

Data collection

Sociodemographic, medical, feeding practice-related aspects, and other factors were collected using a pretested interviewer-administered questionnaire.

Laboratory investigation and sample collection

Every individual had blood drawn into vacutainer tubes containing ethylenediaminetetraacetic acid, and feces samples were also collected. Hb, red blood cells, hematocrit, and mean cell volume (MCV) are all measured in blood using a fully automated hematology analyzer (Mindray BC-3000). Stool samples were examined for intestinal parasites using a wet-mount light microscope, and some blood samples were used to detect malaria parasites.

Table 1: Selected internally displaced persons camps in Dayniile district

Camp name	Number of participants
Turxiye	96
Sandaroor	82
Garoor	108
Carecade	82

Data analysis

Descriptive statistics were used to summarize and describe the characteristics of the study participants and the prevalence of anemia. Frequencies and percentages were calculated for such categorical variables. To find out the association of anemia with various factors, Fisher's exact test was applied as the expected count in cells was <5. The significance level for all statistical tests was set at $P < 0.05$, indicating a 95% confidence interval (CI). All statistical calculations were performed using IBM SPSS version 27.0.1 (IBM Corp., Armonk, NY).

Results

Table 2 and Figures 1, 2 provide a comprehensive overview of the prevalence and classification of anemia within children under 5 years. The majority of participants (82.3%) were classified as nonanemic, whereas 17.6% of the children were anemic. The anemia severity ranged from mild (8.4%) to moderate (8.7%) to severe (0.5%). The subsequent section categorizes anemia based on MCV. Microcytic hypochromic anemia was observed in 9.3% of participants. A smaller group (3.8%) showed macrocytic normochromic anemia. The majority of participants (86.9%) were classified as having normocytic normochromic anemia.

Table 2: Anemia prevalence among 6–59-month-old children residing in Dayniile internally displaced persons' camps, Banadir region, Somalia

	n (%)
On the basis of Hb	
Nonanemic	303 (82.3)
Mild anemia	31 (8.4)
Moderate anemia	32 (8.7)
Severe anemia	2 (0.5)
On the basis of MCV	
Microcytic hypochromic anemia	34 (9.3)
Macrocytic normochromic anemia	14 (3.8)
Normocytic normochromic anemia	319 (86.9)

MCV=Mean cell volume, Hb=Hemoglobin

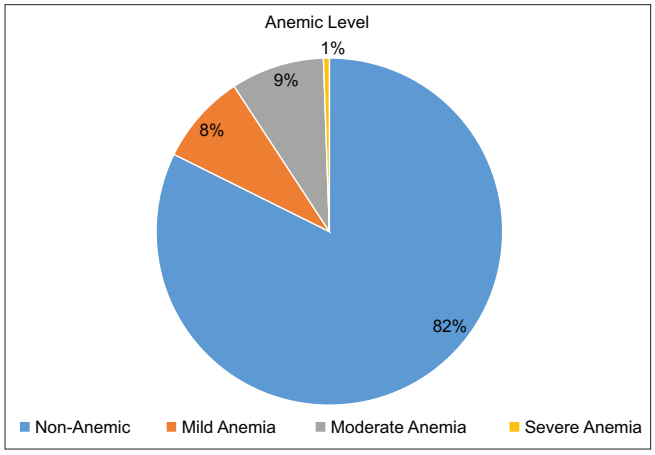

Figure 1: The data illustrate the prevalence of anemia in a community, with 8% classified as having mild anemia, 9% as having moderate anemia, 1% as having severe anemia, and 82% as not being anemic. Hemoglobin levels are used to categorize the severity

Table 3 provides a comprehensive overview of the sociodemographic data collected in the study and presents the distribution of participants' responses using percentages. The table encompasses various factors related to the participants' children, maternal characteristics, paternal characteristics, family livelihood, and income sources from other relatives. The table first explores the primary caretaker for the children, showing that the majority of children have their mothers as their primary caretakers (85.9%), whereas a smaller proportion have fathers in that role (14.1%). Child gender distribution indicates that 51.1% of the children are male, whereas 48.9% are female. The age distribution of the children reveals that 11.4% are <6 months old, 39.1% fall within the 6–24 months range, 20.1% are aged 24–36 months, and 29.3% are above 36 months old. Maternal age groups show that 7.9% of mothers are <19 years old, 38.9% are aged 20–29 years, 35.1% are aged 30–39 years, and 18.2% are above 40 years old. Maternal education highlights that the majority of mothers have no formal education (81.8%), whereas smaller proportions have primary education (17.9%) and even fewer have secondary education (0.3%). Maternal employment status indicates that 42.4% of mothers are employed, whereas 57.6% are not. Father's education reveals that a significant portion of fathers have no formal education (79.6%), whereas 16.0% have primary education and 4.3% have secondary education. Father's occupation distribution shows that a considerable number are unemployed (44.0%), whereas others are self-employed (40.5%), work in the private sector (11.4%), and a few are in the public sector (4.1%). Family livelihood's source indicates that a large majority rely on a family member acting

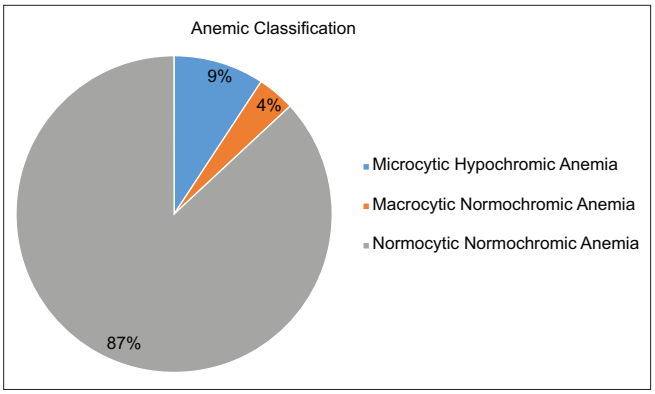

Figure 2: This diagram demonstrates the categorization of anemia based on mean cell volume and mean cell hemoglobin. The study revealed that most patients (87%) had normocytic normochromic anemia, whereas a smaller proportion (9%) had microcytic hypochromic anemia. The least prevalent kind of anemia observed was macrocytic normochromic anemia (4%)

Table 3: Sociodemographic characteristics among 6–59-month-old children residing in Dayniile internally displaced persons' camps, Banadir region, Somalia

	n (%)
Child primary caretaker	
Mother	316 (85.9)
Father	52 (14.1)
Child sex	
Male	188 (51.1)
Female	180 (48.9)
Child age	
Less 6 months	42 (11.4)
6–24	144 (39.1)
24–36	74 (20.1)
Above 36	108 (29.3)
Maternal age (years)	
<19	29 (7.9)
20–29	143 (38.9)
30–39	129 (35.1)
Above 40	67 (18.2)
Maternal education	
No formal education	301 (81.8)
Primary education	66 (17.9)
Secondary education	1 (0.3)
Tertiary education	0
Mother employment	
Employed	156 (42.4)
Unemployed	212 (57.6)
Father education	
No formal education	293 (79.6)
Primary education	59 (16.0)
Secondary education	16 (4.3)
Tertiary education	0
Father occupation	
Unemployment	162 (44.0)
Self-employed	149 (40.5)
Private employee	42 (11.4)
Public employee	15 (4.1)
Others	0
Family livelihood source	
Family members act as a breadwinner	241 (65.5)
Relief programs	77 (20.9)
Begging	37 (10.1)
Others	13 (3.5)
Income sources from other relatives	
Yes	74 (20.1)
No	294 (79.9)

as the breadwinner (65.5%), while smaller portions receive support from relief programs (20.9%), engage in begging (10.1%), or have other sources (3.5%). Finally, income sources from other relatives reveal that 20.1% of participants have income sources from other relatives, whereas the majority (79.9%) do not.

Table 4 provides an in-depth exploration of the association between anemia levels and various sociodemographic factors. The child's primary caretaker did not exhibit a significant association with anemia levels ($P = 0.249$). Similarly, the child's gender, age, maternal age group, maternal education, maternal employment, father's education, father's occupation, and the source of family livelihood income were not significantly associated with anemia levels. However, the presence of income sources from other relatives displayed significance ($P = 0.046$*). Children whose parents had income sources from other relatives had lower percentages of anemia (86.5%) compared to those without such income sources (81.3%). This suggests a potential role of additional income sources from relatives in reducing the prevalence of severe anemia in children.

Table 5 presents an insightful analysis of the association between medical/health-related factors and anemia prevalence. The table examines whether the child experienced sickness within the last 6 months and its relation to anemia levels. Results indicate no significant association ($P = 0.878$). A majority of children who fell sick (82.4%) or did not (82.1%) were nonanemic. Investigating whether the child was vaccinated, the analysis reveals no significant associations with anemia levels ($P = 0.725$). Vaccinated children and nonvaccinated children exhibited similar anemia prevalence patterns. The presence of a history of malarial infection and its association with anemia levels are explored. The analysis indicates a significant association ($P < 0.001$). Children with a history of malarial infection had notably higher rates of mild and moderate anemia (25.0% and 75.0%, respectively), compared to nonmalarial cases (8.2% and 8.0%, respectively). Examining the history of intestinal parasite infection, no significant associations with anemia levels are found ($P = 0.553$). The presence of a history of blood transfusion and its association with anemia also did not reveal significant results ($P = 1.000$).

Table 6 delves into the relationship between feeding practices and anemia prevalence, utilizing Fisher's exact test for significance and presenting frequencies and percentages. The table explores the impact of feeding practices during the first 5 months of life on anemia levels. A significant association is observed ($P = 0.047$*). Exclusive breastfeeding (83.1%) and feeding other than breast milk (83.9%) exhibit lower anemia rates compared to fixed feeding (81.1%). The initiation of supplementary feeding and its connection to anemia levels is investigated, and no significant association is found ($P = 0.790$).

Discussion

The prevalence of anemia in children under 5 years of age is a complex issue influenced by various factors, as evidenced by the diverse findings in different studies. We compare our findings with those published in the past.

Table 4: Association of sociodemographic characteristics and anemia among 6–59-month-old children residing in Dayniile internally displaced persons' camps, Banadir region, Somalia

	Anemic level; frequency (%)				*P*
	Nonanemic	Mild anemia	Moderate anemia	Severe anemia	
Child primary caretaker					
Mother	259 (82.0)	29 (9.2)	27 (8.5)	1 (0.3)	0.249
Father	44 (84.6)	2 (3.8)	5 (9.6)	1 (1.9)	
Child sex					
Male	156 (83.0)	15 (8.0)	16 (8.5)	1 (0.5)	0.979
Female	147 (81.7)	16 (8.9)	16 (8.9)	1 (0.6)	
Child age					
Less 6 months	36 (85.7)	4 (9.5)	2 (4.8)	0	0.575
6–24	116 (80.6)	16 (11.1)	12 (8.3)	0	
24–36	61 (82.4)	6 (8.1)	6 (8.1)	1 (1.4)	
Above 36	90 (83.3)	5 (4.6)	12 (11.1)	1 (0.9)	
Maternal age (years)					
<19	23 (79.3)	3 (10.3)	3 (10.3)	0	0.844
20–29	117 (81.8)	14 (9.8)	12 (8.4)	0	
30–39	105 (81.4)	11 (8.5)	12 (9.3)	1 (0.8)	
Above 40	58 (86.6)	3 (4.5)	5 (7.5)	1 (1.5)	
Maternal education					
No formal education	247 (82.1)	26 (8.6)	26 (8.6)	2 (0.7)	1.000
Primary education	55 (83.3)	5 (7.6)	6 (9.1)	0	
Secondary education	1 (100.0)	0	0	0	
Tertiary education	0	0	0	0	
Maternal employment					
Employed	125 (80.1)	17 (10.9)	13 (8.3)	1 (0.6)	0.506
Unemployed	178 (84.0)	14 (6.6)	19 (9.0)	1 (0.5)	
Father education					
No formal education	241 (82.3)	22 (7.5)	28 (9.6)	2 (0.7)	0.656
Primary education	48 (81.4)	8 (13.6)	3 (5.1)	0	
Secondary education	14 (87.5)	1 (6.3)	1 (6.3)	0	
Tertiary education	0	0	0	0	
Father occupation					
Unemployment	137 (84.6)	12 (7.4)	11 (6.8)	2 (1.2)	0.675
Self-employed	117 (78.5)	15 (10.1)	17 (11.4)	0	
Private employee	35 (83.3)	3 (7.1)	4 (9.5)	0	
Public employee	14 (93.3)	1 (6.7)	0	0	
Others	0	0	0	0	
Family livelihood source					
Family members act as a breadwinner	187 (77.6)	25 (10.4)	28 (11.6)	1 (0.4)	0.107
Relief programs	69 (89.6)	4 (5.2)	3 (3.9)	1 (1.3)	
Begging	35 (94.6)	1 (2.7)	1 (2.7)	0	
Others	12 (92.3)	1 (7.7)	0	0	
Income sources from other relatives					
Yes	64 (86.5)	4 (5.4)	4 (5.4)	2 (2.7)	0.046*
No	239 (81.3)	27 (9.2)	28 (9.5)	0	

*P<0.05; Significant, Fisher's exact test

In our study, the prevalence of anemia among children under 5 years old was 17.6%. Anemia severity varied from mild (8.4%) to moderate (8.7%) to severe (0.5%) in children under the age of 5 years. Compared to our study, a previous study conducted using children under 5 years of age and on the same topic found prevalence of anemia at 61.4%.[15] Another study conducted in Mexico showed that children younger than 2 years old had the highest prevalence of anemia (28.96 vs. children aged 3–4 years old: 14%); no variations were identified between sexes.[16] In another study overall, 41.1% of children under 5 years of age were anemic. The anemia severity among children under the age of 5 years ranged from mild (67.5%) to moderate (31.3%) to severe (1.2%).[7] Similarly, a meta-analysis showed the global pooled prevalence of iron deficiency anemia among under-5 children was 16.42%.[17] Anemia (Hb = 11 g/dL) was present in approximately 85% of the population in

Table 5: Association of medical history and anemia among 6–59-month-old children residing in Dayniile internally displaced persons' camps, Banadir region, Somalia

	Anemic level; frequency (%)				*P*
	Nonanemic	Mild anemia	Moderate anemia	Severe anemia	
Have you ever had your child got sick in the last 6 months?					
Yes	280 (82.4)	28 (8.2)	30 (8.8)	2 (0.6)	0.878
No	23 (82.1)	3 (10.7)	2 (7.1)	0	
Is your child vaccinated?					
Yes	152 (81.3)	16 (8.6)	17 (9.1)	2 (1.1)	0.725
No	151 (83.4)	15 (8.3)	15 (8.3)	0	
Have you ever your child got malarial infection?					
Yes	0	1 (25.0)	3 (75.0)	0	<0.001*
No	303 (83.2)	30 (8.2)	29 (8.0)	2 (0.5)	
History of intestinal parasite of child?					
Yes	51 (81.0)	5 (7.9)	6 (9.5)	1 (1.6)	0.553
No	252 (82.6)	26 (8.5)	26 (8.5)	1 (0.3)	
History of blood transfusion?					
Yes	34 (85.0)	3 (7.5)	3 (7.5)	0	1.000
No	269 (82.0)	28 (8.5)	29 (8.8)	2 (0.6)	

*P<0.05; Significant, Fisher's exact test

Table 6: Association of feeding practices and anemia among 6–59-month-old children residing in Dayniile internally displaced persons' camps, Banadir region, Somalia

	Anemic level; frequency (%)				*P*
	Nonanemic	Mild anemia	Moderate anemia	Severe anemia	
Feeding practice during the first 5 months					
Exclusive breastfeeding	118 (83.1)	14 (9.9)	10 (7.0)	0	0.047*
Fixed feeding	133 (81.1)	11 (6.7)	20 (12.2)	0	
Feeding other than breast milk	52 (83.9)	6 (9.7)	2 (3.2)	2 (3.2)	
Supplementary feeding					
Yes	272 (82.2)	29 (8.8)	28 (8.5)	2 (0.6)	0.790
No	31 (83.8)	2 (5.4)	4 (10.8)	0	

*P<0.05; Significant, Fisher's exact test

another study that assessed anemia in children under 5 years of age.[18]

In our study, there was no statistically significant correlation between the child's primary caregiver and their anemia status (P = 0.249). Similarly, there was no statistically significant relationship between anemia and the child's gender, age, maternal age group, maternal education, maternal employment, father's education, father's occupation, or family source of money. The presence of income from other relatives, however, was statistically significant (P = 0.046*). Anemia was less common among children whose families received financial support from extended family (86.5% vs. 81.3%). These data point to the possibility that financial support from family members can help reduce the incidence of severe anemia in youngsters. Compared to our study research revealed that anemia is more common in children aged 6–11 months and 12–24 months, with a 4.5 times higher risk in children aged 6–11 months and 2.8 times higher in children aged 12–24 months.[7] Younger children (under 2 years) were more likely to be anemic compared to their older peers.[18]

Children in urban areas have a 1.83-fold increased risk of anemia compared to their rural counterparts. Children of mothers with only a high school education or less are seven times more likely to be anemic than those with a college degree or higher. Anemia is more common in children from families with monthly incomes of 750 ETB or less and 750–1500 ETB or less than those from families with monthly incomes of >1500 ETB.[7]

In our study, children with a history of malarial infection had notably higher rates of mild and moderate anemia (25.0% and 75.0%, respectively), compared to nonmalarial cases (8.2% and 8.0%, respectively). Compared to our study a study discovered that among children aged 5 years exposed to between 1 and 2 years of malaria control, the mean relative risk for a hemoglobin concentration of 11 g/dL was 0.73 (95% CI = 0.64–0.81) and for a hemoglobin concentration of 8 g/dL was 0.40 compared to the control groups.[19,20]

In difference to our study, another study found children who were malnourished at the time of the baseline survey were no more likely to be parasitemic than children who were not malnourished, with approximately 5% of children parasitemic regardless of malnutrition status. Although stunted and underweight children had a higher risk of anemia, stunting did not appear to be related to clinical malaria in this sample,[21,22] whereas other studies reported malaria as a risk factor for malnutrition and subsequently anemia.[23]

In our study, exclusive breastfeeding (83.1%) and feeding other than breast milk (83.9%) exhibit lower anemia rates compared to fixed feeding (81.1%). The initiation of supplementary feeding and its connection to anemia levels is investigated and no significant association is found. Compared to our study a study found children who were breastfed had a significantly reduced prevalence of malaria parasites (16.2%) compared to children who were not breastfed (61.3%). The prevalence of anemia was highest (80.5% in children who received breastfeeding), whereas it was most common in those who did not have any breastfeeding (6.6% and 67.1%, respectively, $P = 0.029$). Studies conducted Asoba *et al*. and Kassim *et al*. found that the prevalence of the malaria parasite was much lower in children who were exclusively breastfed, suggesting that infant feeding practices are strongly linked to the spread of the disease.[24,25]

Hence, understanding these factors and their impact on childhood anemia is essential for developing effective prevention and intervention strategies.

The study's limitations include potential sample size constraints that could affect the generalizability of findings, a cross-sectional design limiting the establishment of causal relationships, reliance on self-reported data subject to recall and reporting biases, and context-specific findings applicable primarily to IDP camps in the Benadir region, Somalia. The study comprehensively examines anemia prevalence and its associations among children under 5 years in this specific setting but acknowledges the possibility of unmeasured confounding variables.

Conclusion

Our study, along with previous research, underscores the complexity of the prevalence of childhood anemia and its contributing factors. Addressing anemia in children from lower-income families and urban areas requires tailored intervention. In addition, controlling malaria and promoting breastfeeding are essential strategies for reducing the prevalence of anemia in young children. Overall, a multifaceted approach considering socioeconomic, health, and dietary factors is crucial for the well-being of children under 5 years old.

Data availability

Data are available from the author (Abdirasak Sharif Ali) on request.

Ethics approval and consent to participate

The study was approved by the Research Ethics Sub Committee of the University of SIMAD'S School of Medicine and Health Sciences. The legal guardians of the participants provided informed consent.

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Conflicts of interest

There are no conflicts of interest.

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