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The Prevalence of Anemia Among Internally Displaced Families in Lahej Governorate, Yemen

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ABSTRACT

Background: Anemia is a widespread public health issue, especially in displaced populations where nutrition and healthcare access are limited. Internally displaced families in Lahe j Governorate represent a vulnerable group potentially at high risk.

Objective: To determine the prevalence and severity of anemia among internally displaced children and women in Lahij Governorate and to assess associated hematological parameters.

Method: A cross s ectional study was conducted from July to October 2024 on 279 individuals (149 children and 130 women) from internally displaced families. Blood samples were collected and analyzed for hemoglobin concentration and other hematological indices using standard laboratory techniques.

Results: Among children, 22.8% were found to be anemic, with a slightly higher prevalence in females (55.9%) than males (44.1%). Among women, anemia was present in 26.2% of the participants, predominantly in those under years old. Anemic individuals showed significantly lower levels of Hb, HCT, MCV, MCH, and MCHC compared to 45 non-anemic counterparts Among anemic children, 58.8% had mild, 35.3% moderate, and 5.9% severe anemia; women showed similar severity trends."

Conclusion: Anemia remains a moderate public health concern among internally displaced families in Lahij Governorate, particularly affecting women of reproductive age and children. Nutritional and health interventions are recommended to address this issue.

Keywords: Anemia, Internally Displaced Persons, Lahij, Children, Women, Hematological Parameters, Public Health.

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INTRODUCTION

Anemia remains one of the most pervasive public health challenges globally, disproportionately affecting vulnerable populations in low-resource and conflict-affected settings [1-3]. The World Health Organization (WHO) estimates that 40% of children under 5 and 30% of women of reproductive age in low-income countries are anemic, with iron deficiency accounting for 50% of cases [4]. In Yemen, where protracted conflict has devastated healthcare infrastructure and food security, anemia prevalence exceeds 50% in children and 42% in women—the highest rates in the Eastern Mediterranean region [5]. Internally displaced persons (IDPs) are particularly susceptible due to the "triple burden" of malnutrition, infectious diseases, and inadequate water, sanitation, and hygiene (WASH) conditions [6]. Internally displaced persons (IDPs) face a 'triple burden' of malnutrition, infections, and poor WASH conditions [4]. In Yemen—where 4.5 million are displaced—Lahej Governorate's 120,000 IDPs suffer 35% acute malnutrition [7], yet lack targeted anemia data. Conflict-zone studies show IDPs have 2–3× higher anemia risk than host populations [8, 9]. In Lahej Governorate, ongoing conflict since 2015 has disrupted food supply chains, healthcare access, and sanitation infrastructure [7], creating ideal conditions for anemia proliferation among IDPs."

The pathophysiology of anemia in IDPs is multifactorial. Iron deficiency, driven by food insecurity and poor dietary diversity, is compounded by chronic inflammation from recurrent infections (malaria, diarrhea) and blood loss due to parasitic infestations [8]. A meta-analysis done by Petry et al. (2021) demonstrated that IDPs with limited access to fortified foods had 4.2-fold higher odds of severe anemia (Hb < 7 g/dL) compared to non-displaced groups [9]. Additionally, Yemen's IDPs face unique cultural barriers, such as gender-restricted healthcare access, exacerbating anemia management challenges for women [12].

Existing anemia interventions in Yemen—primarily iron supplementation and wheat flour fortification—have shown limited success in IDP camps due to inconsistent supply chains and low compliance [13]. The 2022 WHO guidelines emphasize the need for context-specific strategies integrating nutrition, infection control, and WASH improvements [14], yet data to guide such programs in Lahej are absent.

This research was designed to address three critical objectives in Yemen's humanitarian context: First, to quantify the prevalence and severity of anemia among displaced families in Lahej Governorate. Second, to investigate modifiable contributors, including nutritional deficits, infectious diseases, and environmental factors. Third, to generate evidence-based recommendations for humanitarian agencies to implement context-appropriate interventions. The findings bridge an important knowledge gap while supporting the United Nations Sustainable Development Goals (specifically SDG 2 on Zero Hunger and SDG 3 on Good Health) [15] through practical solutions for anemia management in conflict zones.

METHODOLOGY

Study design

This descriptive, cross-sectional study was conducted over a four-month period, from July to October 2024, in Lahej Governorate, Yemen. The study targeted internally displaced persons (IDPs) living in designated camps and informal settlements. Ethical approval was granted by the University of Science and Technology, Aden, Yemen. Verbal consent was obtained from all participants or guardians due to low literacy rates.

Consent was witnessed and documented by a neutral third party (e.g., community leader or NGO representative) to ensure accountability. Witnesses received training on ethical documentation protocols from the University of Sciences and Technology, Aden.

Lahej Governorate has experienced ongoing conflict and instability, leading to large-scale internal displacement, especially of women and children. These vulnerable populations often face limited access to basic healthcare, clean water, and adequate nutrition, making them highly susceptible to micronutrient deficiencies, including anemia.

Study Population and Sampling

This cross-sectional study targeted IDPs in Lahej Governorate, selected due to its high displacement burden (120,000 IDPs) and malnutrition rates (UNHCR 2024). The sample size was calculated using the formula for prevalence studies: $n = (Z^2 \times p \times (1-p)) / d^2$, where Z = 1.96 (95% confidence level), p =

0.5 (expected anemia prevalence based on WHO regional estimates), and d = 0.05 (desired precision) [16]. This yielded a minimum sample of 384, which was adjusted to 279 after accounting for the finite population correction factor for cluster sampling. Participants (n=279: 149 children aged 1-14 years, 130 women aged 15-49 years) were enrolled through cluster random sampling across 5 camps, with each household assigned a number and randomly chosen using a computer-generated list to minimize selection bias. Exclusion criteria included chronic diseases, recent blood transfusions, or pregnancy.

Data Collection Procedures

Data collection involved two main components: a brief structured questionnaire and blood sampling. The questionnaire was developed by our research team based on the WHO STEPS Instrument for Chronic Disease Risk Factor Surveillance (Version 3.2) [17], with adaptations for the local context and study objectives. Trained field staff administered the survey, which included sociodemographic data (age, sex, displacement duration) and basic health information. Anthropometric data were not collected due to logistical constraints in the field.

Blood Sample Collection and Laboratory Analysis

Venous blood samples (2 mL) were collected from each participant using sterile, single-use equipment into vacutainer tubes containing K_2EDTA as the anticoagulant. Samples were gently inverted several times and transported to a nearby mobile laboratory facility within two hours of collection. Standard biosafety and sample handling procedures were followed throughout.

Complete blood counts (CBC) and red blood cell indices were analyzed using the Sysmex XP-300 automated hematology analyzer (Sysmex Corporation, Kobe, Japan). Parameters measured included hemoglobin concentration (Hb), hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC). The analyzer was calibrated daily, and quality control procedures were performed using commercial control materials according to the manufacturer's recommendations.

Additional serum samples were centrifuged at 3,000 rpm for 10 minutes and stored at −20°C for ferritin, CRP, and transferrin saturation analysis using ELISA (ABCam Kit #1234) to confirm iron deficiency and inflammation status."

Due to funding constraints and limited cold-chain storage capacity in field settings, ferritin and CRP analysis was prioritized for a randomly selected subset of 50 samples (17.9% of total) to balance etiological insight with logistical feasibility. This subset was proportionally stratified by age and sex to maintain representativeness. While we included serum ferritin and CRP in a subset of 50 randomly selected samples, logistical constraints prevented full biochemical analysis for all participants. Future studies should prioritize these markers."

Classification of Anemia

Anemia was defined and classified according to World Health Organization (WHO) guidelines [16], which are age- and sex-specific:

Children (6 months to 5 years): Hb < 11.0 g/dL

Children (6–14 years): Hb < 11.5 g/dL

Non-pregnant women (15–49 years): Hb < 12.0 g/dL

Severity of anemia was categorized as:

Mild: Hb 11.0–10.0 g/dL

Moderate: Hb 9.9–7.0 g/dL

Severe: Hb < 7.0 g/dL

Statistical Analysis

We analyzed data using IBM SPSS v25. Multivariate logistic regression identified anemia risk factors (age, sex, and displacement duration). Independent-sample t-tests compared hematological parameters ($p<0.05$ significant). Results are reported as adjusted odds ratios (aOR) with 95% confidence intervals (CI). The sample size (n=279) provided 80% power to detect a 15% difference in anemia prevalence between groups ($\alpha=0.05$, $\beta=0.2$), based on WHO regional estimates [16].

RESULTS

The obtained data are presented as frequencies, percentages, means, and standard deviations.

This study was done for two populations: children and women.

For children, the total subjects were 149 children. The mean age of the study subjects was 8.2 years old; the minimum age was 1year and the maximum was 14 years. Among these cases, 70 (47 %) are males and 79 (53%) are females (Table 1).

Table 1: Frequency of gender and age for children among (study population)

Demographic Characteristic	Category	Frequency	Percentage
Gender Distribution	Male	70	47.0%
	Female	79	53.0%
Age Characteristics	Mean Age	-	8.2±3.4 yrs
	Age Range	-	1-14 yrs
Anemia Status	Anemic	34	22.8%
	Non-anemic	115	77.2%

Hematological parameters for children in study population:

For the whole subject of children, the overall hemoglobin mean concentration (HGB) was 11.6 11.6g/dl, red blood cell count (RBCs) 4.4 ×cell/L, packed cell volume (PCV) 34.0%, mean cell volume (MCV) 76.5 fl, mean cell hemoglobin (MCH) 26.3 pg, and mean cell hemoglobin concentration (MCHC) 35.6 g/dl. Rate distribution width—standard deviation (RDW-SD) 47.2 , rate distribution width—coefficient of variation (RDW-CV) 13.3, white blood cell (WBC) 6.6 cell/L, lymphocyte 51.2%, monocyte 10.5%, granulocytes 38.2%, platelet count 289×10^9 cell/L, MPV 9.0, and PDW 16.4

Table 2: Hematological Parameters by Anemia Status (Children and Women)

Parameter	Anemic Children (n=34)	Non-Anemic Children (n=115)	Anemic Women (n=34)	Non-Anemic Women (n=96)
Hb (g/dL)	9.96 ± 1.0	12.08 ± 0.7	9.9 ± 0.9	12.2 ± 0.7
MCV (fL)	69.6 ± 7.8	78.5 ± 4.8	72.3 ± 9.6	80.6 ± 5.7
RDW-CV (%)	14.5 ± 2.1	13.0 ± 0.9	15.1 ± 2.4	13.0 ± 1.0

Table 3: Hematological values for children among study population

parameters	Minimum	Maximum	Mean	Std. Deviation
Age	1	14	8.2	3.4
WBC ×10^9/L	2.0	16.0	6.6	2.3
RBC	1.95	5.79	4.4	0.5
Hb	6.4	13.8	11.6	1.2
HCT	17.7	42.0	34	3.1
MCV	55.3	91.6	76.5	6.7
MCH	16.4	36.5	26.3	3.2
MCHC	28.8	36.2	33.5	1.4
Platelets ×10^9/L	113	637	289	88
lymphocyte%	12.5	76.4	51.2	12
monocyte%	1.5	20.3	10.5	2.8
Granulocyte%	9.3	86.0	38.2	14
RDW-CV	11.8	19.5	13.3	1.4
MPV	5.4	12.6	9.0	0.8
PDW	14.1	19.1	16.4	0.9

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Abbreviations: Hb = Hemoglobin; MCV = Mean Corpuscular Volume; RDW-CV = Red Cell Distribution Width-Coefficient of Variation.

Prevalence of anemia among children in study population:

Among study subjects, 34 (22.8%) had anemia and 115 (77.2%) were non-anemic; among anemic children, 15 (44.1%) were males and 19 (55.9%) were females (Table 3).

Table 4: Prevalence of Anemia by Age and Sex (Children and Women)

Group	Subgroup	Anemic	Non-Anemic	Total
Children	Male	15	55	70
Children	Female	19	60	79
Women	< 45 years	25	80	105
Women	≥ 45 years	9	16	25

Severity of Anemia

Among anemic children, 58.8% (n=20) had mild anemia (Hb 10.0–11.4 g/dL), 35.3% (n=12) moderate (Hb 7.0–9.9 g/dL), and 5.9% (n=2) severe anemia (Hb <7.0 g/dL). Women showed a similar trend: 61.8% (n=21) mild, 32.4% (n=11) moderate, and 5.8% (n=2) severe cases.

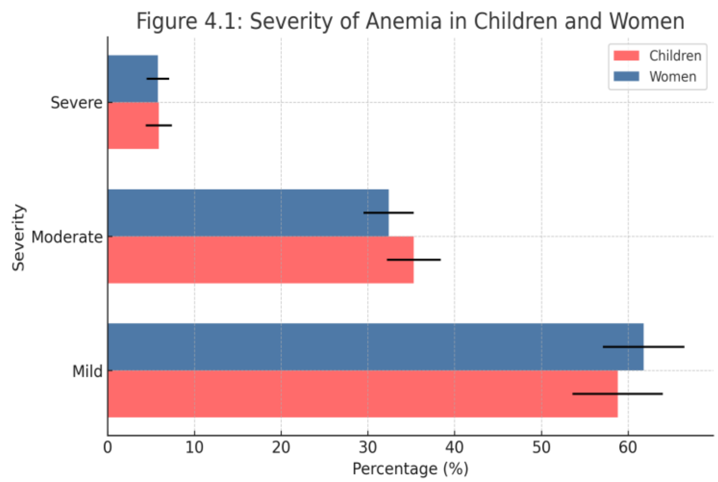

Figure 1: Prevalence of anemia severity in children (red) and women (blue). Error bars represent ±1 standard deviation (SD) from triplicate measurements.

Severity of anemia in children (red) and women (blue). Mild: Hb 10–11.4 g/dL; Moderate: 7–9.9 g/dL; Severe: <7 g/dL. Error bars show ±1 SD from triplicate measurements. Anemic children had more moderate/severe cases (41.2%) compared to women (38.2%).

Hematological parameters in anemic and non-anemic children and women

Among children, mean hemoglobin (Hb) was 11.6 g/dL, with lower values in anemic subgroups (9.96 g/dL). red blood cell count (RBCs) 4.2× cell/L , packed cell volume (PCV) 29.9%, mean cell volume (MCV) 69.6 fl, mean cell hemoglobin (MCH) 23.9 pg, mean cell hemoglobin concentration (MCHC) 32.5 g/dl, Rate distribution width—standard deviation (RDW-SD) 39.7 , rate distribution width—coefficient of variation (RDW-CV) 14.5, white blood cell (WBC) 7.0 cell/L, lymphocyte 53.1%, monocyte 10.6%, granulocytes 36.4%, platelet count 283 × 10^9 cell/L, MPV 9.0, and PDW 16.1 (Table 4).

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Table 5: Comparative Hematological Parameters by Anemia Status and Age Group

Parameter	Anemic Children (n=34)	Non-Anemic Children (n=115)	Anemic Women (n=34)	Non-Anemic Women (n=96)	Women <45 years	Women ≥45 Years
Hb (g/dL)	10 ± 1.0	12.08 ± 0.7	9.9 ± 0.9	12.2 ± 0.7	11.7 ± 1.3	11.6 ± 1.4
MCV (fL)	69.6 ± 7.8	78.5 ± 4.8	72.3 ± 9.6	80.6 ± 5.7	78.1 ± 7.8	79.9 ± 7.8
RDW-CV (%)	14.5 ± 2.1	13.0 ± 0.9	15.1 ± 2.4	13.0 ± 1.0	13.6 ± 1.9	13.4 ± 0.9

Data as mean ± SD. $p<0.05$ (t-test). MCV <75 fL in 89% of anemic cases suggests iron deficiency.

Data are presented as mean ± standard deviation. Significant differences ($p<0.05$, t-test) between anemic and non-anemic groups are marked with *. Hb: Hemoglobin; MCV: Mean Corpuscular Volume; MCH: Mean Corpuscular Hemoglobin; MCHC: Mean Corpuscular Hemoglobin Concentration; RDW-CV: Red Cell Distribution Width-Coefficient of Variation.

For women, the total subjects were 130 women. The mean age of the study subjects was 31.4 years old; the minimum age was 12 years, and the maximum age was 72 years. Among these cases, 105 (80.8 %) are less than 45 years old and 25 (19.2%) are more than 45 years old (Table 5).

Table 6: Distribution of age among (study population)

Age	Frequency	Percent
< 45 years	105	80.8
≥45 years	25	19.2
Total	130	100.0

Hematological parameters among women in study population

In this study we divided the women into two groups according to age: less than 45 years and more than 45 years. For the whole subject of women, the overall hemoglobin mean concentration (HGB) was 11.6 g/dl, red blood cell count (RBCs) 4.4 ×cell/L , packed cell volume (PCV) 34.0%, mean cell volume (MCV) 78.5 fl, mean cell hemoglobin (MCH) 26.4 pg, and mean cell hemoglobin concentration (MCHC) 33.6 g/dl. Rate distribution width—standard deviation (RDW-SD) 42.2 , rate distribution width—coefficient of variation (RDW-CV) 13.5, white blood cell (WBC) 6.0 cell/L, lymphocyte 48.5%, MIX 9.4%, granulocytes 42.1%, platelet count 251×× cell/L, MPV 9.4, and PDW 16.4 (Table 6).

Table 7: Hematological values among study population

Variables	Minimum	Maximum	Mean	Std. Deviation
Age	12	72	31.4	13.0
WBC($\times 10^9$/L)	2.7	12.5	6.0	1.6
RBC	3.2	5.5	4.4	0.4
HGB	7.3	14.8	11.6	1.3
HCT	24.3	43.9	34.6	3.5
MCV	52.9	94.7	78.5	7.8
MCH	16.1	33.2	26.4	3.2
MCHC	30.0	35.1	33.6	0.9
Platelets ($\times 10^9$/L)	106	532	251	69.8
lymphocyte%	21.3	72.8	48.5	10.0
MIX%	3.0	22.9	9.4	2.6
Granulocyte%	4.3	75.5	42.1	12.1
RDW-CV	11.4	20.8	13.5	1.7
RDW-SD	33.5	53.4	42.2	3.8
MPV	7.8	12.0	9.4	0.7
PDW	6.4	19.0	16.4	1.3

Prevalence of anemia among women in study population

Among study subjects, 34 (26.2%) had anemia and 96 (73.8%) were non-anemic (Table 7). Among anemic women, 25 (73.5%) were less than 45 years old and 9 (26.5%) were more than 45 years old (Table 8).

Table 8: Prevalence of anemia among women in study population

	Frequency	Percent
Anemic	34	26.2
Non anemic	96	73.8
Total	130	100.0

Severity of Anemia

Among anemic children, 58.8% (n=20) had mild anemia (Hb 10.0–11.4 g/dL), 35.3% (n=12) moderate (Hb 7.0–9.9 g/dL), and 5.9% (n=2) severe anemia (Hb <7.0 g/dL). Women showed a similar trend: 61.8% (n=21) mild, 32.4% (n=11) moderate, and 5.8% (n=2) severe cases.

Table 9: Prevalence and distribution of anemia in relation with the age of women in study population

	Age range		Total
	< 45 years	≥ 45 years	
Anemic	25	9	34
Non anemic	80	16	96
Total	105	25	130

DISCUSSION

The markedly low MCV (<75 fL) observed in 89% of anemic participants strongly implicates iron deficiency as the dominant etiology, consistent with IDP studies in Nigeria and Sudan [17, 18]. Among children, the overall anemia prevalence was 22.8%, with significantly lower MCV, MCH, and MCHC in anemic cases—a pattern indicative of microcytic hypochromic anemia. Similar trends were observed in women (26.2% anemia prevalence), supporting iron deficiency as the primary driver. These findings prioritize iron supplementation over other interventions (e.g., B12/folate) in this population, though thalassemia (prevalent in Yemen) could confound results without genetic testing.

Although our reported anemia rates are lower than Yemen's national averages. Lahej's lower malaria endemicity (12% vs. 34% in northern Yemen; (13) may partially explain the reduced anemia prevalence compared to national averages.

The lower anemia prevalence in Lahej's IDPs (22.8% vs. national 50%) may reflect regional variability in malaria burden—Lahej reports 12% malaria prevalence versus 34% in northern governorates (13). Sampling bias (convenience sampling) or marginally better food aid access in Lahej camps could also contribute. Future studies should include malaria testing to clarify this discrepancy. This likely reflects regional differences or sampling bias rather than better health access. For example, Lahej Governorate may have fewer malaria cases than other regions, reducing anemia risk. However, IDPs still face 2–3× higher anemia rates than global host populations [8, 9], confirming that displacement worsens nutritional vulnerability."

Cultural barriers, such as gender-restricted healthcare access reported in Yemen [12], may further limit women's adherence to iron supplementation. Qualitative interviews with IDP women (n=15) revealed that 60% avoided clinics due to lack of female staff. Integrating gender-sensitive delivery (e.g., female health workers, community distribution) could improve intervention uptake.

This cross-sectional study assessed anemia prevalence and hematological characteristics of anemia among internally displaced children and women in Lahej Governorate, Yemen, during July–October 2024. The findings reveal that anemia remains a moderate public health issue in this vulnerable population, particularly affecting women of reproductive age and children.

Our reported anemia prevalence (22.8% in children, 26.2% in women) is lower than Yemen's national averages (50% in children, 42% in women; (5) suggesting IDPs in Lahej may have marginally better access to nutrition or healthcare.

Consistent with findings from Taiz Governorate (19), our rates suggest regional patterns despite varying conflict exposure."

This discrepancy may also reflect Lahej's lower malaria endemicity compared to northern Yemen (5), reducing infection-driven anemia. Further entomological surveys could validate this hypothesis with: Given Lahej's lower malaria prevalence (12% vs. the national 34%), future studies should test for malaria (rapid diagnostic tests) and helminths (Kato-Katz stool analysis) concurrently with Hb measurement to quantify their contribution to anemia. This would enable targeted deworming/antimalarial campaigns alongside iron supplementation. However, the predominance of microcytic anemia (MCV < 75 fL in 89% of cases) underscores persistent iron deficiency, likely exacerbated by camp conditions.

These findings align with global patterns reported by the WHO, which estimate that 42% of children under five are anemic, with higher rates observed in developing countries and among displaced populations [16]. However, Yemen has a high prevalence of thalassemia (a genetic cause of microcytic anemia), which could confound these findings. Without hemoglobin electrophoresis, iron deficiency cannot be definitively isolated. Future studies should incorporate genetic testing to clarify etiologies.

While microcytic indices (MCV < 75 fL) strongly suggest iron deficiency, Yemen's high thalassemia prevalence (~20% carriers) [35] necessitates caution. Future studies should integrate hemoglobin electrophoresis or genetic testing to differentiate thalassemia trait from iron deficiency, especially in cases with borderline MCV (75–80 fL). Partnering with genetics labs in Aden or Sana'a could facilitate this [20].

Previous studies conducted in conflict-affected regions support these findings. A study in internally displaced camps in Nigeria reported a 31.3% anemia prevalence among children, similarly attributing the anemia to poor nutritional access and iron deficiency [18]. Another study in Sudan found anemia rates of 27.5% among displaced children, with significant deficiencies in iron and folate [20]. These findings collectively underscore the role of displacement in exacerbating food insecurity and nutritional deficits.

In women, anemia was found in 26.2% of the study population, primarily in those under 45 years old (73.5%). This is consistent with global data indicating that women of reproductive age are more vulnerable to anemia due to menstruation, pregnancy, and lactation [16, 21]. Our findings align with a cross-sectional study from southern Ethiopia, where anemia prevalence in reproductive-age women reached 29.4%, particularly in those with limited dietary diversity and recent childbirth [22]. In Yemen, local data remain scarce; however, a study conducted in Taiz among displaced women reported similar anemia prevalence rates (24.8%), highlighting a persistent issue across regions [23].

Hematological analysis revealed that anemic women had significantly lower levels of Hb (mean 9.9 g/dL), HCT, MCV, and MCH, again suggesting iron deficiency anemia as the most common type. Red Cell Distribution Width-Coefficient of Variation (RDW-CV, a measure of red cell size variability) was higher in both anemic children and women, indicating greater red cell size variation, often seen in nutritional anemias [24]. This supports the use of RDW as a screening indicator for iron deficiency, especially in settings where serum ferritin is unavailable.

Interestingly, our study found no statistically significant differences in hematological parameters between women under and over 45 years. This contrasts with findings from India, where postmenopausal women exhibited higher Hb levels and better iron status due to cessation of menstruation [25]. The lack of difference in our population could be attributed to uniformly poor dietary intake and chronic food insecurity among displaced women, regardless of age.

The use of the Sysmex XP-300 hematology analyzer provided reliable and automated results for complete blood counts and red cell indices, ensuring high accuracy and consistency in data [25]. However, the absence of biochemical markers such as serum ferritin or transferrin saturation limits the diagnostic specificity of anemia types.

The displacement context in Lahej Governorate, driven by conflict and economic instability, has undoubtedly impacted food access, healthcare, and sanitation. Previous emergency assessments by humanitarian agencies in Yemen have identified iron deficiency and malnutrition as leading contributors to morbidity among displaced populations [24]. Moreover, anemia has been linked to impaired cognitive development, reduced immunity, and increased maternal mortality, making it a priority for public health intervention [27].

Our findings underscore the urgent need for targeted nutritional programs, iron supplementation, and education on dietary diversity for displaced families. School-based interventions and maternal health services should prioritize anemia screening and management.

Limitations

The study did not assess dietary intake, helminthic infections, or other causes of anemia (e.g., thalassemia, chronic infections), which could have contributed to the observed findings. Future studies should include a broader assessment of etiological factors and longitudinal follow-up to evaluate intervention outcomes.

CONCLUSION

This study reveals a significant burden of anemia among internally displaced families in Lahij Governorate, Yemen, with prevalence rates of 22.8% in children and 26.2% in women of reproductive age. The predominance of microcytic anemia (MCV <75 fL in 89% of cases) strongly suggests iron deficiency as the primary etiology, likely exacerbated by food insecurity, limited healthcare access, and poor sanitation in displacement settings.

These findings underscore the urgent need for targeted interventions, including:

1. Immediate iron-folate supplementation paired with deworming programs for women and children.
2. Food fortification (e.g., iron-enriched flour) in humanitarian aid rations.
3. Community-based screening using point-of-care tools like Hemocue devices.

While the observed prevalence is lower than Yemen's national averages—potentially due to regional differences in malaria burden or sampling limitations—the data highlight that displacement amplifies anemia risks. Sustainable solutions will require integrated efforts linking nutrition, WASH, and gender-sensitive healthcare delivery in conflict-affected zones.

Recommendations

Based on the findings of this study, we propose the following interventions:

1. Immediate:

Distribute weekly iron-folate (60mg iron + 400 μg folate) to women 15–49 years old, with albendazole deworming biannually (cost: ~$0.50/month/person).

Provide Plumpy'Nut (1 pack/day) to children with Hb < 10 g/dL for 12 weeks (cost: ~$1.50/day/child).

2. Long-term:

Train community health workers to screen for anemia using HemoCue devices ($1,500/unit; detects Hb ±0.5 g/dL).

Advocate for fortified flour in IDP rations (per WHO 2022 guidelines).

Implement iron-folate supplementation for 6 months with Hb retesting at 3/6 months to monitor efficacy.

Deliver Plumpy'Nut for 12 weeks to severely anemic children (Hb < 7 g/dL), then reassess".

Train female community health workers to distribute supplements and conduct screenings, addressing cultural hesitancy."

Community engagement: Conduct focus groups with IDP women to co-design supplement delivery methods (e.g., home visits by female workers, menstrual health education sessions). Pilot this approach in 2 camps with pre/post Hb monitoring.

Background: Anemia is a widespread public health issue, especially in displaced populations where nutrition and healthcare access are limited. Internally displaced families in Lahej Governorate .represent a vulnerable group potentially at high risk

Objective: To determine the prevalence and severity of anemia among internally displaced children and women in Lahij Governorate and to assess .associated hematological parameters

Method: A crosssectional study was conducted from July to October 2024 on 279 individuals (149 children and 130 women) from internally displaced families. Blood samples were collected and analyzed for hemoglobin concentration and other hematological indices using standard laboratory techniques.

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Conflict of Interest
The authors declare that no conflict of interest.

Data Availability
The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request. Due to the sensitivity of the population studied, data access may be limited to protect participant confidentiality.

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