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Prevalence of Anaemia and Associated Factors among Pregnant Women Attending Antenatal Care at Selected Hospitals in Karbala City, Iraq

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Abstract

Background: Anaemia during pregnancy remains an important maternal health problem and may occur in association with nutritional, socioeconomic, obstetric, and other health-related factors. This study estimated the prevalence of anaemia and examined clinical, haematological, nutritional, socioeconomic, and obstetric characteristics among pregnant women attending antenatal care in Karbala City, Iraq.

Objective: To estimate the prevalence of anaemia using the prespecified study definition and to describe factors associated with anaemia among pregnant women attending antenatal care at the participating hospitals in Karbala City, Iraq. A secondary retrospective analysis applied the WHO 2024 trimester-specific haemoglobin criteria.

Methods: This cross-sectional observational study included 200 pregnant women attending antenatal clinics at the Maternity and Obstetrics Teaching Hospital and Al-Imam Al-Hassan Teaching Hospital in Karbala City, Iraq, from 10 November 2025 to 20 March 2026. Data were collected using a structured questionnaire, clinical examination, and laboratory assessment. The prespecified study definition of anaemia was haemoglobin <11 g/dL in all trimesters. Categorical variables were analysed using chi-square tests, and continuous variables were compared using independent-samples t-tests or Mann–Whitney U tests according to distribution. Multivariable logistic regression was used to examine factors associated with study-defined anaemia.

Results: Among the 200 participants, 68 (34.0%) met the prespecified study definition of anaemia. In a secondary retrospective reclassification using the WHO 2024 trimester-specific criteria, 47 participants (23.5%) were classified as anaemic. Compared with non-anaemic participants, those classified as anaemic had lower mean haemoglobin, ferritin, RBC count, MCV, MCH, and MCHC and higher RDW. Pallor, fatigue, dizziness, headache, and palpitations were significantly more frequent in the anaemia group (all $P < 0.001$). Folic acid use ($P = 0.006$) and red-meat consumption ($P = 0.042$) differed significantly between groups, whereas iron supplementation did not ($P = 0.081$). In the multivariable model, low economic status (AOR 2.69, 95% CI 1.31–5.52; $P = 0.007$) and an iron-poor/irregular nutritional pattern (AOR 2.44, 95% CI 1.17–5.06; $P = 0.017$) were associated with higher odds of study-defined anaemia, while regular menstrual cycles were associated with lower odds (AOR 0.40, 95% CI 0.21–0.76; $P = 0.005$).

Conclusion: Study-defined anaemia was present in 34.0% of participants, whereas retrospective application of the WHO 2024 trimester-specific criteria classified 23.5% as anaemic. Low economic status and the study-specific iron-poor/irregular nutritional pattern were associated with higher odds of anaemia, while regular menstrual cycles were inversely associated. Because the study was facility-based, cross-sectional, and based on convenience sampling, the findings describe associations within the participating study population and should not be interpreted as causal or population-wide estimates.

1. Introduction

Anaemia during pregnancy is an important maternal health problem and has been associated with adverse maternal and fetal outcomes. Its clinical and public health importance is influenced by the severity of anaemia, the timing during pregnancy, and the underlying cause. Iron deficiency is a common contributor, although folate or vitamin B12 deficiency, infection or inflammation, blood loss, and inherited haematological disorders may also be involved [1,2,4–6,16–18].

In the present study, anaemia was defined in the primary analysis according to the prespecified study protocol as haemoglobin (Hb) <11 g/dL for all trimesters. This study definition was retained for the primary analysis. For comparison, a secondary retrospective analysis applied the WHO 2024 trimester-specific criteria, under which the haemoglobin cutoff is <11.0 g/dL in the first and third trimesters and <10.5 g/dL in the second trimester [1]. The two approaches therefore represent different definitions applied to the same participants rather than two competing measurements of the same outcome.

The prevalence and distribution of anaemia may vary according to nutritional intake, socioeconomic circumstances, obstetric history, access to antenatal care, and other health-related factors [4,5,10,13]. Dietary iron intake and adherence to supplementation are particularly relevant during pregnancy because iron requirements increase as maternal red-cell mass expands and the fetus and placenta develop [7,14,15].

Clinical manifestations may include fatigue, weakness, dizziness, headache, pallor, dyspnoea, and palpitations, but these symptoms are not specific to anaemia. Laboratory assessment therefore remains central to diagnosis [8]. Pregnancy itself is accompanied by physiological changes in plasma volume and red-cell mass, which need to be considered when haemoglobin and other haematological indices are interpreted [14,15].

Haemoglobin is the principal laboratory measure used to identify anaemia. Red-cell indices and serum ferritin may provide additional information when assessing the pattern of anaemia and iron status [1,3,19–21]. Ferritin is useful for assessing iron stores, but its interpretation can be affected by inflammation. Accordingly, a low ferritin value may support iron-restricted erythropoiesis without establishing that iron deficiency is the sole cause of anaemia in every participant [3,19,20,28].

Prevention and management depend on the underlying cause. Iron supplementation can reduce maternal anaemia and iron deficiency during pregnancy, while nutritional measures and appropriate antenatal care remain relevant to prevention [7,9,22–27]. Evidence also indicates that inadequate dietary diversity and low socioeconomic conditions may be associated with maternal anaemia, although the strength and direction of individual associations vary between populations [13,25,26].

The present study was not designed to assess treatment effectiveness or establish causal relationships. It was undertaken to estimate the prevalence of study-defined anaemia and to examine clinical, haematological, nutritional, socioeconomic, and obstetric characteristics associated with anaemia among pregnant women attending antenatal care at the participating facilities in Karbala City, Iraq.

2. Patients and Methods

2.1 Study Design and Setting

This cross-sectional observational study was conducted at the Maternity and Obstetrics Teaching Hospital and Al-Imam Al-Hassan Teaching Hospital in Karbala City, Iraq, from 10 November 2025 to 20 March 2026. The study assessed anaemia and associated clinical, haematological, nutritional, socioeconomic, and obstetric

characteristics among women attending antenatal care. Clinical assessments and anthropometric measurements were performed according to the study procedures, and personal identifiers were not collected.

2.2 Sample Size and Sampling

A total of 200 pregnant women were enrolled using convenience sampling. Eligible women attending the selected antenatal clinics were recruited consecutively until the target sample size was reached. Because the sample was facility-based and selected by convenience sampling, it was not considered representative of all pregnant women in Karbala City.

Sample size was estimated using a single-population-proportion approach with an expected anaemia prevalence of 38%, a 95% confidence level, and an acceptable margin of error of approximately 6.7%. This produced a target sample of approximately 200 participants. The expected prevalence was selected from a previously reported estimate cited in the local literature [12].

2.3 Inclusion and Exclusion Criteria

Pregnant women attending antenatal care at the selected hospitals at any gestational age who provided informed consent were eligible for inclusion. Women with known non-nutritional haematological disorders, including thalassaemia disease or sickle cell disease, active bleeding, chronic renal disease, malignancy, or refusal to participate were excluded.

2.4 Clinical Variables and Data Collection

Trained healthcare personnel collected data using a structured questionnaire and clinical examination. The recorded variables included age, residence, education, occupation, socioeconomic status, gravidity, parity, gestational age, interpregnancy interval, history of miscarriage, previous anaemia, chronic diseases, family history of medical disease, dietary habits, red-meat consumption, tea or coffee consumption with meals, pica, iron and folic acid supplementation and compliance, and symptoms including fatigue, pallor, dizziness, headache, shortness of breath, and palpitations.

Economic status and nutritional pattern were recorded using the categories contained in the study questionnaire. Economic status was classified as low, moderate, or high. Nutritional pattern was classified as iron-poor diet, balanced diet, or irregular meals. Family history of medical disease represented any self-reported family history recorded in the questionnaire. The available study record does not retain the original scoring sheet used to derive the economic and nutritional categories; therefore, these classifications are treated as study-specific rather than as validated external scores.

2.5 Laboratory Assessment and Definition of Anaemia

2.5.1 Primary Study Definition

Venous blood samples were obtained aseptically and analysed using an automated haematology analyser with routine quality-control procedures. Serum ferritin and red-cell indices were used to describe haematological and iron-status patterns. These measurements were not used to assign a single definitive aetiology to every case of anaemia. The primary binary outcome was study-defined anaemia, prespecified as Hb <11 g/dL in all trimesters. Participants with Hb ≥11 g/dL were classified as non-anaemic under the study definition.

2.5.2 Secondary WHO 2024 Reclassification

A secondary retrospective reclassification was performed using each participant's recorded trimester and haemoglobin value according to the WHO 2024 trimester-specific criteria [1]. There were no first-trimester participants in the enrolled sample; therefore, the retrospective reclassification in this dataset concerned second- and third-trimester participants.

2.6 Anthropometric Assessment and Outcome Variables

BMI was calculated using measured height and pre-pregnancy measured weight or first-trimester measured weight (kg/m²). BMI was classified as <18.5 kg/m² (underweight), 18.5–24.9 kg/m² (normal), and ≥25 kg/m² (overweight/obese). Current gestational weight was recorded separately and was not included in the primary regression model.

The primary outcome was the proportion of participants meeting the study definition of anaemia. Secondary outcomes included clinical findings, haematological measures, nutritional characteristics, sociodemographic characteristics, and obstetric characteristics.

2.7 Ethical Approval and Consent

The study received approval from the Ethics Committee of the College of Medicine, University of Kerbala (approval No. UoK/COM/EC/2025/117), dated 28 October 2025. Participants who could read and write provided written, signed informed consent. Participants who could not sign or write provided verbal consent in the presence of a witness. The study was observational and low risk, had no effect on routine antenatal care, and all data were handled confidentially.

2.8 Statistical Analysis

2.8.1 Statistical Procedures

Data were analysed using SPSS version 26 and Microsoft Excel 2013. Categorical variables were summarised as frequencies and percentages, while continuous variables were summarised as mean ± standard deviation. The Shapiro–Wilk test was used to assess normality. Normally distributed continuous variables were compared using independent-samples t-tests, while skewed variables were compared using Mann–Whitney U tests. Categorical associations were assessed using chi-square tests. Statistical significance was defined as a two-sided $P < 0.05$.

2.8.2 Multivariable Analysis

For bivariate analyses, the number of available observations was used for each variable, and missing observations were reflected in the corresponding denominator. Five prespecified study variables—age group, economic status, nutritional pattern, menstrual cycle, and family history—were included in the final multivariable logistic regression model based on the study objectives and the variables available in the study. The reported odds ratios were adjusted odds ratios (AORs) with 95% confidence intervals (CIs).

The retrospective WHO reclassification was performed separately from the primary regression analysis and was used only to provide a secondary estimate based on the updated trimester-specific haemoglobin criteria [1].

2.9 Potential Bias and Limitations

Facility-based convenience sampling may limit the applicability of the findings to other antenatal clinics and to the wider population. Information on dietary intake, menstrual characteristics, and compliance with supplementation was self-reported and may therefore be affected by recall or reporting bias. Standardised questionnaires and clinical procedures were used to minimise measurement variation.

The cross-sectional design does not establish temporal sequence or cause and effect. External validity is limited by convenience sampling, and some variables were self-reported. The primary study definition of Hb <11 g/dL for all trimesters differs from the WHO 2024 trimester-specific criteria, so the two prevalence estimates should not be interpreted as interchangeable. The study was also not designed to determine the definitive aetiology of each anaemia case; haemoglobin and ferritin findings should therefore not be interpreted as proof that all observed anaemia was caused by iron deficiency.

No first-trimester participants were included, which limits interpretation of the retrospective WHO classification across all pregnancy stages. The original scoring criteria for economic status and nutritional pattern were not retained in the available study record, so these categories remain study-specific. In addition, iron-supplementation information was missing for 55 participants; the corresponding comparison was based on 145 complete

observations. The reason for the missing responses was not documented in the available study record and should be considered when interpreting that association.

3. Results

Among the 200 participants, 56.0% were aged 20–30 years, 25.0% were >30 years, and 19.0% were <20 years. Moderate socioeconomic status was reported by 59.0%, low socioeconomic status by 23.0%, and high socioeconomic status by 18.0%. Father occupation was reported as employed in 66.0%, unemployed in 14.0%, and retired in 20.0%. Among participants, 73.0% were housewives and 27.0% were employed.

Table 1. Sociodemographic characteristics of study participants

Characteristic	Category	n (%)
Age	<20 years	38 (19.0%)
Age	20–30 years	112 (56.0%)
Age	>30 years	50 (25.0%)
Economic status	Low	46 (23.0%)
Economic status	Moderate	118 (59.0%)
Economic status	High	36 (18.0%)
Father occupation	Employed	132 (66.0%)
Father occupation	Unemployed	28 (14.0%)
Father occupation	Retired	40 (20.0%)
Participant occupation	Housewife	146 (73.0%)
Participant occupation	Employed	54 (27.0%)

Based on pre-pregnancy or first-trimester weight, 73 participants (36.5%) were underweight, 102 (51.0%) had normal BMI, and 25 (12.5%) were overweight/obese. Nutritional patterns included an iron-poor diet in 44.0%, a balanced diet in 31.0%, and irregular meal consumption in 25.0%. For regression analysis, the iron-poor and irregular-meal categories were combined into an iron-poor/irregular nutritional-pattern category, with balanced diet as the reference.

Table 2. Anthropometric and nutritional characteristics of study participants

Characteristic	Category	n (%)
BMI	Underweight	73 (36.5%)
BMI	Normal	102 (51.0%)
BMI	Overweight/obese	25 (12.5%)
Nutritional pattern	Iron-poor diet	88 (44.0%)
Nutritional pattern	Balanced diet	62 (31.0%)
Nutritional pattern	Irregular meals	50 (25.0%)

A regular menstrual cycle was reported by 64.0% of participants and an irregular cycle by 36.0%. A positive family history of medical disease, defined as any self-reported family history recorded in the questionnaire, was reported by 29.0%, while 71.0% reported no such history.

Table 3. Menstrual-cycle and family-history characteristics of study participants

Characteristic	Category	n (%)
Menstrual cycle	Regular	128 (64.0%)
Menstrual cycle	Irregular	72 (36.0%)
Family history of medical disease	Yes	58 (29.0%)
Family history of medical disease	No	142 (71.0%)

Gestational age was <20 weeks in 30 participants, 20–27 weeks in 75, and ≥28 weeks in 95. Gestational-age group was not significantly associated with study-defined anaemia (P = 0.978). There were no first-trimester participants. Among participants in the second trimester, 35 were anaemic and 70 were non-anaemic; in the third trimester, 33 were anaemic and 62 were non-anaemic (P = 0.834). Gravidity (P = 0.213), parity (P = 0.306),

miscarriage history (P = 0.223), interpregnancy interval (P = 0.486), and recurrent bleeding (P = 0.229) were not significantly associated with study-defined anaemia.

Information on chronic disease was available for 55 participants and was not significantly associated with anaemia (P = 0.727). Parasitic infection showed a statistically significant three-category association when the Unknown category was retained (P = 0.036); however, when Unknown responses were excluded, the Yes-versus-No comparison was not statistically significant (P = 0.104). Age-group distributions did not differ significantly between anaemic and non-anaemic participants (P = 0.151), and age group was not independently associated with anaemia in the multivariable model. For regression, age was dichotomised as ≤30 years versus >30 years.

Table 4. Prevalence of study-defined anaemia among participants

Anaemia status	n	%
Anaemic	68	34.0
Non-anaemic	132	66.0
Total	200	100.0

Pallor was observed in 70.6% of anaemic participants compared with 10.6% of non-anaemic participants (P < 0.001). Fatigue was reported by 82.4% versus 16.7%, respectively (P < 0.001). Dizziness occurred in 61.8% versus 9.1%, headache in 67.6% versus 15.2%, and palpitations in 35.3% versus 3.0%; all differences were statistically significant (P < 0.001).

Table 5. Clinical manifestations according to anaemia status

Clinical feature	Anaemic n (%)	Non-anaemic n (%)	P value
Pallor	48 (70.6%)	14 (10.6%)	<0.001
Fatigue	56 (82.4%)	22 (16.7%)	<0.001
Dizziness	42 (61.8%)	12 (9.1%)	<0.001
Headache	46 (67.6%)	20 (15.2%)	<0.001
Palpitations	24 (35.3%)	4 (3.0%)	<0.001

Folic acid use differed significantly between groups, with 66.2% of anaemic participants and 83.3% of non-anaemic participants reporting use (P = 0.006). Red-meat consumption also differed significantly (P = 0.042). Iron supplementation was not significantly associated with anaemia (P = 0.081), based on 145 complete observations; 55 responses were missing. Daily meal frequency did not differ between groups (P = 0.987). Previous anaemia was reported by 44.1% of anaemic women compared with 15.2% of non-anaemic women (P < 0.001).

Table 6. Nutritional and selected clinical-history variables

Variable	Category	Anaemic n (%)	Non-anaemic n (%)	P value
Folic acid use	Yes	45 (66.2%)	110 (83.3%)	0.006
Folic acid use	No	23 (33.8%)	22 (16.7%)	
Red-meat consumption	Rarely	30 (44.1%)	35 (26.5%)	0.042
Red-meat consumption	1–2 times/week	25 (36.8%)	65 (49.2%)	
Red-meat consumption	≥3 times/week	13 (19.1%)	32 (24.2%)	
Iron supplementation	Regular	20 (29.4%)	60 (45.5%)	0.081
Iron supplementation	Irregular	25 (36.8%)	40 (30.3%)	
Iron supplementation	Missing	23 (33.8%)	32 (24.2%)	
Daily meal frequency	1 meal	8 (11.8%)	15 (11.4%)	0.987
Daily meal frequency	2 meals	25 (36.8%)	50 (37.9%)	
Daily meal frequency	3 meals	35 (51.5%)	67 (50.8%)	
Previous anaemia	Yes	30 (44.1%)	20 (15.2%)	<0.001
Previous anaemia	No	38 (55.9%)	112 (84.8%)	

Note: The iron-supplementation P value is based on 145 complete observations; 55 responses were missing.

Table 7. Comparison of haematological parameters according to anaemia status

Parameter	Anaemic mean ± SD	Non-anaemic mean ± SD	P value
Haemoglobin (g/dL)	10.2 ± 0.9	12.8 ± 0.8	<0.001
Ferritin (ng/mL)	11.4 ± 5.6	24.6 ± 8.2	<0.001
RBC (×10⁶/µL)	3.6 ± 0.4	4.4 ± 0.5	<0.001
MCV (fL)	72.1 ± 7.8	82.6 ± 6.9	<0.001
MCH (pg)	23.4 ± 2.9	27.1 ± 3.1	<0.001
MCHC (g/dL)	30.6 ± 1.9	32.4 ± 2.1	0.002
RDW (%)	17.2 ± 2.4	14.9 ± 1.8	<0.001

Anaemic participants had lower mean haemoglobin, ferritin, RBC count, MCV, MCH, and MCHC and higher RDW than non-anaemic participants. All differences were statistically significant, including the difference in MCHC (P = 0.002).

Table 8. Multivariable logistic regression analysis of factors associated with anaemia

Predictor	Comparison vs reference	AOR	95% CI	P value
Age group	>30 vs ≤30 years	0.83	0.40–1.71	0.608
Economic status	Low vs moderate/high	2.69	1.31–5.52	0.007
Nutritional pattern	Iron-poor/irregular vs balanced	2.44	1.17–5.06	0.017
Menstrual cycle	Regular vs irregular	0.40	0.21–0.76	0.005
Family history of medical disease	Yes vs no	1.47	0.75–2.86	0.259

The multivariable model included 200 participants and 68 anaemia events. The omnibus model test was significant ($\chi^2(5) = 20.36$, P = 0.001). The Hosmer–Lemeshow test was non-significant ($\chi^2(8) = 11.90$, P = 0.156), Nagelkerke R^2 was 0.134, and overall classification accuracy was 67.5%. Reference categories were ≤30 years, moderate/high economic status, balanced diet, irregular menstrual cycle, and no family history of medical disease. Reference categories were coded as 0, comparison categories as 1, anaemia as 1, and non-anaemia as 0.

Using the prespecified study definition, 68 participants (34.0%) were classified as anaemic. When the WHO 2024 trimester-specific criteria were applied retrospectively, 47 participants (23.5%) were classified as anaemic. The difference between these estimates reflects the different haemoglobin thresholds used in the primary study definition and the updated trimester-specific criteria [1].

4. Discussion

The present study found that 34.0% of participants met the prespecified study definition of anaemia. A separate retrospective analysis using the WHO 2024 trimester-specific criteria classified 23.5% as anaemic. These figures should be understood as estimates produced by two predefined approaches within the same study population. The first represents the outcome used for the primary analysis, whereas the second provides a contemporary reference-based reclassification [1].

The difference between the two estimates is particularly relevant because haemoglobin thresholds can vary according to pregnancy trimester and guideline. The WHO 2024 guideline specifies a lower threshold in the second trimester than in the first and third trimesters [1]. Because no first-trimester participants were enrolled in the present study, the retrospective comparison was limited to second- and third-trimester participants. The two estimates therefore should not be treated as interchangeable measures of prevalence.

Low economic status was independently associated with study-defined anaemia. Participants in the low-economic-status group had approximately 2.7-fold higher adjusted odds of anaemia than those in the moderate/high group. Socioeconomic circumstances may influence food access, dietary quality, preventive supplementation, and access to health services, although the present cross-sectional design cannot identify which pathway accounted for the observed association [10,13,24,26].

An iron-poor/irregular nutritional pattern was also independently associated with anaemia, with approximately 2.4-fold higher adjusted odds compared with a balanced diet. This result is consistent with the observed difference

in red-meat consumption and with previous evidence linking dietary factors and inadequate dietary diversity with maternal anaemia [13,25,26]. However, the nutritional categories used in this study were derived from the study questionnaire and were not a validated nutritional score. The finding should therefore be interpreted as an association with the recorded study-specific category rather than as evidence of a causal dietary effect.

Regular menstrual cycles were inversely associated with study-defined anaemia after adjustment (AOR 0.40). This association should be interpreted cautiously because menstrual characteristics were self-reported and the cross-sectional design does not establish temporal sequence [11]. Age and family history were not independently associated with anaemia after adjustment.

Most participants had normal BMI (51.0%), while 36.5% were underweight and 12.5% were overweight/obese. BMI and haematological status represent different aspects of maternal health and should not be treated as interchangeable indicators. Dietary quality and laboratory measures provide additional information when describing characteristics associated with anaemia [13].

Clinical manifestations were substantially more frequent among anaemic participants. Fatigue, pallor, dizziness, headache, and palpitations were all significantly more common in the anaemia group. These findings are compatible with the clinical presentation described in the literature, but such symptoms are not specific to anaemia and should not replace laboratory assessment [8].

Anaemic participants had lower ferritin, RBC count, MCV, MCH, and MCHC and higher RDW. The combination of lower ferritin with microcytic and hypochromic red-cell indices is compatible with iron-restricted erythropoiesis [3,19,20,28]. Nevertheless, ferritin may be influenced by inflammation, and the study did not include sufficient information to establish the definitive aetiology of every anaemia case. The laboratory findings should therefore be interpreted as an observed haematological and iron-status pattern rather than proof that all anaemia was caused by iron deficiency.

Folic acid use was more frequent among non-anaemic participants, and red-meat consumption differed significantly between groups. Iron supplementation itself was not statistically significant ($P = 0.081$), and 55 responses were missing. The observed association should therefore be interpreted cautiously. Previous evidence indicates that iron supplementation can reduce maternal anaemia and iron deficiency during pregnancy, but the effect of supplementation in an individual observational sample can be influenced by adherence, timing, baseline iron status, and other factors [7,9,22,23,27].

The wider literature has also linked maternal anaemia with adverse pregnancy outcomes, including low birth weight and preterm birth [16–18]. Those outcomes were not assessed in the present study and therefore should not be inferred from the current findings. The contribution of this study is instead its description of anaemia and associated clinical, nutritional, socioeconomic, obstetric, and haematological characteristics in the participating antenatal-care population.

The 34.0% estimate should not be interpreted as the prevalence of anaemia among all pregnant women in Karbala City. Participants were recruited from selected antenatal clinics using convenience sampling, which limits external validity. The results are most appropriately interpreted as associations observed among women attending the participating facilities.

The study also has limitations related to missing information and study-specific classifications. Iron-supplementation data were incomplete for 55 participants, and the original scoring criteria for economic status and nutritional pattern were not retained in the available study record. These issues should be considered when interpreting the corresponding associations. The absence of first-trimester participants further limits the scope of the retrospective WHO comparison.

Overall, the findings are consistent with the broader clinical literature indicating that anaemia in pregnancy is influenced by multiple nutritional, socioeconomic, physiological, and clinical factors. Recent guidance and reviews also emphasise that haemoglobin should be interpreted within the clinical context and that iron status may require additional assessment when iron deficiency is suspected [1,21,28].

5. Conclusion

Using the prespecified study definition of Hb <11 g/dL across all trimesters, anaemia was identified in 34.0% of pregnant women attending the participating antenatal clinics. Retrospective application of the WHO 2024 trimester-specific haemoglobin criteria classified 23.5% as anaemic. These are two estimates generated from different definitions and should not be treated as interchangeable.

Low economic status and the study-specific iron-poor/irregular nutritional pattern were independently associated with higher odds of study-defined anaemia, whereas regular menstrual cycles were associated with lower odds. Anaemic participants also had lower haemoglobin, ferritin, RBC count, MCV, MCH, and MCHC and higher RDW, together with more frequent clinical manifestations.

The findings support continued attention to antenatal screening and to nutritional and socioeconomic characteristics that may accompany anaemia. However, because the study was cross-sectional, facility-based, and based on convenience sampling, the results describe associations within the participating study population and should not be interpreted as causal or population-wide estimates.

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