Vol.20, No.1, Page 449- 455, 2026 http://dx.doi.org/10.59628/jchm.v20i1.2161 ISSN 2958-7476 JMCH

Sana'a University Journal of Medical and Health Sciences

Prevalence of anemia and associated factors among pregnant women attending Bajil Regional Hospital and public health centers in Bajil City, Yemen

Mohammed Mukbel Ahmed Al-Qubati[1]*, Mohammed Abdulkader Al-Nuzaili[2] and Hassan Abdulwahab Al-Shamahy[3]

[1]**Department of Laboratory, Healthy Laborers Center, Bajil City, Hodeida Governorate, Yemen.,**
[2]**Department of Hematology, Faculty of Medicine and Health Sciences, Sana'a University, Sana'a, Yemen.,**
[3]**Department of Medical Microbiology, Faculty of Medicine and Health Sciences, Sana'a University, Sana'a, Yemen.**

*Corresponding author: malnuzaily@yahoo.com

Abstract

Background: Anemia during pregnancy is a widespread public health concern that can lead to serious complications, including maternal and fetal morbidity and mortality. **Aim:** This study aimed to determine the prevalence of anemia and its associated factors in pregnant women in Bajil City, Yemen. **Materials and methods:** An analytical cross-sectional study was conducted among 382 pregnant women aged 16–47 years who attended Bajil Regional Hospital and public health centers from August 1, 2024, to May 31, 2025. Data were collected using a structured questionnaire, and hemoglobin concentration was estimated using hematology analyzers. The data were analyzed using SPSS version 20. **Results:** The prevalence of anemia among pregnant women was 80.1%. Moderate anemia was the most common (64.05%), followed by mild anemia (29.41%), and severe anemia (6.54%). Univariate analysis revealed significant associations between anemia and young age (p = 0.007), rural residence (p = 0.040), low income (p = 0.038), gravidity (p = 0.001), history of abortion (p =0.024), short pregnancy spacing (p = 0.011), and the second trimester (p = 0.006). After adjustment, only income (p = 0.016) and the second trimester (p = 0.010) remained significant. **Conclusion:** The prevalence of anemia was very high, with moderate anemia being predominant. Low income and being in the second trimester were significantly associated factors. Interventions targeting nutrition, supplementation, health education, and antenatal follow-ups are crucial.

الملخص العربي:

الخلفية: يُعد فقر الدم أثناء الحمل مشكلة صحية عامة واسعة الانتشار يمكن أن تؤدي إلى مضاعفات خطيرة، بما في ذلك الاعتلال والوفيات بين الأمهات والأجنة. **الهدف:** هدف هذه الدراسة إلى تحديد معدل انتشار فقر الدم والعوامل المرتبطة به بين الحوامل في مدينة باجل، اليمن. **المواد والطرق:** أُجريت دراسة مقطعية تحليلية على ٣٨٢ امرأة حامل تتراوح أعمارهن بين ١٦-٤٧ عامًا، واللواتي حضرن إلى مستشفى باجل الإقليمي ومراكز الصحة العامة في الفترة من ١ أغسطس ٢٠٢٤ إلى ٣١ مايو ٢٠٢٥. تم جمع البيانات باستخدام استبيان منظم، جُمعت عينات دم عشوائية واستُخدمت لتقدير تركيز الهيموجلوبين باستخدام أجهزة تحليل الدم. تم تحليل البيانات باستخدام برنامج SPSS الإصدار ٢٠. **النتائج:** بلغ معدل انتشار فقر الدم بين الحوامل ٨٠.١ %. وكان فقر الدم المتوسط هو الأكثر شيوعًا (٦٤.٠٥ %)، يليه فقر الدم الخفيف (٢٩.٤١ %) ثم الشديد (٦.٥٤ %). كشف التحليل أحادي المتغير عن وجود ارتباطات ذات دلالة إحصائية (قيمة الاحتمال < ٠.٠٥) بين فقر الدم وصغر السن (قيمة الاحتمال = ٠.٠٠٧) ، والإقامة في الريف (قيمة الاحتمال = ٠.٠٤٠) ، وانخفاض الدخل (قيمة الاحتمال = ٠.٠٣٨)، وعدد مرات الحمل (قيمة الاحتمال = ٠.٠٠١) ، والتي لديهن تاريخ من الإجهاض (قيمة الاحتمال = ٠.٠٢٤) ، وقصر الفترة بين الحمل والآخر (قيمة الاحتمال = ٠.٠١١) ، وكون الحامل في الثلث الثاني من الحمل (قيمة الاحتمال = ٠.٠٠٦) . وبعد التعديل الإحصائي حدد التحليل متعدد المتغيرات عاملان فقط ذات دلالة إحصائية وهما: انخفاض الدخل (قيمة الاحتمال = ٠.٠١٦) ، وكون الحامل في الثلث الثاني من الحمل (قيمة الاحتمال = ٠.٠١٠) . **الخلاصة:** كان معدل انتشار فقر الدم مرتفعًا جدًا، مع كون فقر الدم المتوسط أكثر فئات الشدة شيوعًا. وكان انخفاض الدخل وكون الحامل في الثلث الثاني من الحمل من العوامل المرتبطة بشكل كبير بفقر الدم. أوصينا بالتدخلات التي تستهدف التغذية، والمكملات الغذائية، والتثقيف الصحي، والمتابعة أثناء الحمل أنها تعتبر بالغة الأهمية للحد من معدلات فقر الدم بين النساء الحوامل. **الكلمات المفتاحية:** الانتشار؛ العوامل المرتبطة؛ فقر الدم؛ النساء الحوامل؛ مدينة باجل؛ اليمن.

Article Info

Keywords:
prevalence, associated factors, anemia, pregnant women, Bajil City, Yemen.

Article History:
Received: 1-September-2025,
Revised: 4-January-2026,
Accepted: 10-January-2026,
Available online: 28-February-2026

Introduction

Anemia during pregnancy is a widespread public health concern, particularly in developing countries, and can lead to serious maternal and fetal complications [1]. The World Health Organization (WHO) defines anemia during pregnancy as hemoglobin (Hb) concentration below 11.0 g/dL [2], categorized as mild (10.0–10.9 g/dL), moderate (7.0–9.9 g/dL), and severe (<7.0 g/dL) [3, 4]. Globally, the WHO Health Organization has recently estimated a prevalence of 35.5% among pregnant women [5], with the highest rates in Africa and South Asia [6–8]. In Yemen, prevalence ranges from 25% to 81% across different regions [9–16].

The major causes of anemia include nutritional deficiencies, parasitic infections, and chronic diseases. Approximately 50% of anemia cases are caused by iron deficiency [17–19]. Maternal anemia is linked to an increased risk of hemorrhage, sepsis, maternal and perinatal mortality, low birth weight, and poor work capacity [20]. However, maternal mortality is twice as high as that in patients with severe anemia [21]. Understanding local epidemiology is essential for designing targeted interventions; thus, this study assessed the prevalence and associated factors of anemia among pregnant women in Bajil City, Hodeida Governorate, and Yemen.

Materials and Methods

Study design and populations

This analytical cross-sectional study included 382 pregnant women aged 16–47 years attending Bajil Regional Hospital and public health centers, Bajil City, Hodeida Governorate, Yemen, from August 1, 2024, to May 31, 2025. Participants were selected using non-probability convenience sampling from antenatal care clinic visitors.

Data and sample collection

Data were collected using a structured questionnaire covering sociodemographic, obstetric, health, and dietary variables through face-to-face interviews with the participants. As well as two milliliters of venous blood were collected by venipuncture using sterile disposable syringes and needles from each participant in ethylenediaminetetraacetic acid (EDTA) tubes for hemoglobin (Hb) estimation using ADVIA 360 and ABX Micron ES hematology analyzers.

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) version 25 was used to analyze the data. A Chi-square test was performed to analyze the differences in the prevalence of anemia between the risk factor groups using univariate analysis. The risk factor category with a higher prevalence of anemia was coded as 1 and the other category was coded as 0 (reference group). Variables that showed a difference with a P-value $\leq$ 0.05 were used to develop a multiple analysis. Prevalence ratios (PR) for risk factor analysis were calculated using the Poisson model incorporating robust sandwich variance (RSV). Statistical significance was set at P <0.05.

Results

Prevalence and Severity of Anemia Among Pregnant Women

As shown in Table (1), the overall prevalence of anemia among pregnant women was 80.1% (306 of 382) Table (3.1). Among the women with anemia, the majority (64.05%) had moderate anemia, followed by mild anemia (29.41%). A smaller proportion (6.54%) of the patients were diagnosed with severe anemia.

Sociodemographic Characteristics of Participants

The sociodemographic profiles of the study participants are summarized in Table (2). The majority of women were young, with 45.5% aged 16-24 years and 44.5% aged 25-34 years. Most participants resided in rural areas (70.2%) and were housewives (89.3%). Regarding income, 42.4% had an average monthly income of 50,000-200,000 YR, whereas 31.7% earned less than 50,000 YR. Education levels varied, with 33.2% having secondary education and 27.7% holding graduate or postgraduate degrees. These findings reflect a predominantly young, low-to-middle-income population with varying levels of educational exposure and factors that may influence anemia susceptibility.

Obstetric and Health Characteristics of Participants

As shown in Table (3), the obstetric and health-related characteristics of the participants revealed that most women were primigravidas (70.7%). A history of abortion was reported by 40.3% of participants. The spacing between the last and current pregnancy was $\geq$5 years in 42.4% of multigravid women. The participants were fairly distributed across trimesters, with the highest proportion in their third trimester (44%). Furthermore, 39.3% of the women had 1-2 living children, and 31.4% reported having health problems during their current pregnancy.

Dietary Characteristics of Participants

As shown in Table (4), dietary and supplementation practices showed that slightly more than half of the participants (52.6%) took folic acid supplements, whereas a smaller proportion (26.4%) took iron supplements. The consumption of vegetables and fruits was universal (100%), and nearly all the women (99.5%) reported consuming meat, chicken, or fish. Notably, 49.7% of participants reported chewing khat.

Factors Associated with Anemia in Pregnant Women

To identify the factors associated with anemia among pregnant women, both univariate and multivariate analyses were performed Table (3.5). In univariate analysis, the following factors were significantly associated with anemia: age (p=0.007), residence (p=0.040), monthly income (p=0.038), gravidity (p=0.001), history of abortion (p=0.024), spacing between pregnancies (p=0.011), current trimester (p=0.006), and number of living children (p=0.006). Variables such as occupation, education, health problems during pregnancy, folic acid supplementation, iron supplementation, and khat chewing were not significantly associated with anemia in the univariate

Table[1]: Prevalence and severity of anemia among pregnant women (n=382)

Characteristic	No.	%
Anemic status (n = 382)		
Yes	306	80.1
No	76	19.9
Total	382	100
Severity of anemia (n = 306)		
Mild anemia (Hb 10–10.9 g/dl)	90	29.41
Moderate anemia (Hb 7.0–9.9 g/dl)	196	64.05
Severe anemia (Hb $<$ 7.0 g/dl)	20	6.54
Total	306	100

Table[2]: Sociodemographic characteristics of the study participants (n=382)

Characteristic		No.	%
Age (years)	**16–24**	174	45.5
	25–34	170	44.5
	$\geq$35	38	9.9
Residence	**Rural**	268	70.2
	Urban	114	29.8
Occupation	**Housewife**	341	89.3
	No-housewife	41	10.7
Income average monthly (YR)	**$<$50,000**	121	31.7
	50,000–200,000	162	42.4
	$>$200,000	99	25.9
Education	**No**	42	11
	Primary	107	28
	Secondary	127	33.2
	Graduate/Postgraduate	106	27.7

Table[3]: The obstetric and health characteristics of the study participants (n=382)

Characteristic		No.	%
Gravidity	**Nulligravida**	30	7.9
	Primigravida	270	70.7
	Multigravida	83	21.5
History of abortion	**Yes**	154	40.3
	No	228	59.7
Spacing between last and current pregnancy	**Primigravida**	64	16.8
	1–2 years	40	10.5
	3–4 years	116	30.4
	$\geq$ 5 years	162	42.4
Current trimester	**First**	73	19.1
	Second	141	36.9
	Third	168	44.0
Number of living children	**0**	76	19.9
	1–2	150	39.3
	3–4	109	28.5
	$\geq$ 5	47	12.3
Health problems during the current pregnancy	**Yes**	120	31.4
	No	262	68.6

Table[4]: Dietary characteristics of the study participants (n=382)

Characteristic		No.	%
Folic acid supplementation	Yes	201	52.6
	No	181	47.4
Iron supplementation	Yes	101	26.4
	No	281	73.6
Vegetables	Yes	382	100
	No	0	0
Fruits	Yes	382	100
	No	0	0
Meat / Chicken / Fish	Yes	380	99.5
	No	2	0.5
Khat chewing	Yes	190	49.7
	No	192	50.3

analysis. These significant variables were included in a multivariate Poisson regression model to control for potential confounders. After adjustment, only two factors (income and trimester of pregnancy) retained a statistically significant independent association with anemia. Women with a middle income (50,000-200,000 YR) had a 13% lower prevalence of anemia than those in the highest income group (>200,000 YR) (PR=0.87, 95% CI: 0.77-0.97, p=0.016). Conversely, Women in their second trimester had a 25% higher prevalence of anemia than those in their first trimester (PR=1.25, 95% CI: 1.05-1.48, p=0.010).

Discussion

This study revealed an alarmingly high prevalence of anemia (80.1%) among pregnant women in Bajil City, Yemen. The severity of anemia was predominantly moderate (64.05%), followed by mild (29.41%), and severe (6.54%). This finding is consistent with the substantial body of evidence from recent studies conducted across Yemen, including Hodeida City, Sana'a City, and other governorates, which reported prevalence rates ranging from 25.0% to 81% [10–16]. For instance, studies in Sana'a, the capital, have documented rates between 25% and 44% [12–15], whereas a 2021 study in Hodeida City reported a prevalence of 55% [16]. The rate identified in our investigation falls in the upper extreme of this range and aligns with the high rates observed in many developing countries, typically varying from 18.1% to 75% [22]. The exceptionally high prevalence in our study population is likely multifactorial and attributable to a confluence of socioeconomic and cultural challenges. These include widespread poverty, low educational attainment, limited health awareness, suboptimal dietary practices, high burden of parasitic infestations, and local food-related cultural norms. The geographic context of Bajil, particularly its low altitude, may also be a contributing factor.

Univariate analysis identified several factors that were significantly associated with anemia ($p < 0.05$). Sociodemographically, anemia was more prevalent among younger women ($p = 0.007$), those from rural residences ($p = 0.040$), and those with lower household incomes ($p = 0.038$). Significant obstetric factors included gravidity ($p = 0.001$) and a history of abortion ($p = 0.024$). Furthermore, shorter pregnancy spacing (1-2 years, $p = 0.011$) and second trimester were also associated with a higher prevalence of anemia. It is noteworthy that other variables such as maternal occupation, educational level, and concurrent health problems during pregnancy did not demonstrate a statistically significant association in the univariate analysis. This non-significance does not necessarily imply that these factors are biologically or clinically irrelevant; rather, their effects within the specific context of our study population may have been obscured. The overwhelming homogeneity of the population in terms of profound socioeconomic disadvantage and high-risk environmental exposures may have created a "ceiling effect," where the pervasive impact of poverty and malnutrition was so dominant that it masked the subtler contributions of other variables. Contrary to expectations, factors such as iron and folic acid supplementation and khat chewing were not statistically significant. The non-significance of iron and folic acid supplementation could be due to several reasons: the cross-sectional design limits our ability to assess adherence, duration, and timing of supplementation; the dosage might have been insufficient; or the primary cause of anemia in this population may extend beyond simple iron and folate deficiency to include other micronutrient deficiencies (e.g., Vitamin B12) [23], hemoglobinopathies, or chronic inflammation [24, 25]. Furthermore, the potential for measurement errors, particularly in self-reported data concerning supplementation adherence and dietary habits, could have diluted the observable associations. The high prevalence of khat chewing (49.7%) was not significantly associated with anemia. Although khat is known to suppress appetite, its direct pathophysiological

Table[5]: Factors associated with anemia in pregnant women using univariate and multivariate Poisson regression model with robust variance analysis

Variable	Univariate analysis		Multivariate analysis	
	Anemia n (%)	*P* value	PR (95% CI)	*P* value
Age				
16–24	128 (41.8)	0.007*	1	
25–34	148 (48.4)		1.11 (0.98–1.26)	0.976
≥35	30 (9.8)		0.99 (0.79–1.26)	0.095
Residence				
Rural	222 (72.5)	0.040*	1.10 (0.97–1.25)	0.128
Urban	84 (27.5)		1	
Occupation				
Housewife	273 (89.2)	0.948		
No-housewife	33 (10.8)			
Income average monthly				
<50,000	94 (30.7)	0.038*	0.89 (0.79–1.01)	0.064
50,000–200,000	124 (40.5)		0.87 (0.77–0.97)	0.016*
>200,000	88 (28.8)		1	
Education				
No	34 (11.1)	0.056		
Primary	83 (27.1)			
Secondary	95 (31)			
Graduate and postgraduate	94 (30.7)			
Gravidity				
Nulligravida	26 (8.5)	0.001*	1	
Primigravida	226 (73.9)		0.95 (0.79–1.13)	0.537
Multigravida	54 (17.6)		0.82 (0.49–1.39)	0.466
History of abortion				
Yes	132 (43.1)	0.024*	1.10 (0.99–1.22)	0.075
No	174 (56.9)		1	
Spacing between last and current pregnancy				
Primigravida	42 (13.7)	0.011*	1.02 (0.65–1.58)	0.948
1–2 years	32 (10.5)		0.94 (0.79–1.11)	0.463
3–4 years	94 (30.7)		0.93 (0.84–1.04)	0.216
≥ 5 years	138 (45.1)		1	
Current trimester				
First	50 (16.3)	0.006*	1	
Second	145 (47.4)		1.25 (1.05–1.48)	0.010*
Third	111 (36.3)		1.13 (0.95–1.34)	0.159
Number of living children				
0	50 (16.3)	0.006*	1	
1–2	124 (40.5)		1.05 (0.56–1.97)	0.891
3–4	93 (30.4)		1.04 (0.55–1.96)	0.899
≥ 5	39 (12.8)		1.01 (0.54–1.89)	0.984
Health problems during the current pregnancy				
Yes	94 (30.7)	0.557		
No	212 (69.3)			
Folic acid supplementation				
Yes	165 (53.9)	0.306		
No	141 (46.1)			
Iron supplementation				
Yes	83 (27.1)	0.543		
No	223 (72.9)			
Khat chewing				
Yes	151 (49.3)	0.759		
No	155 (50.7)			

PR, prevalence ratio; CI: Confidence interval; * $p < 0.05$, considered statistically significant.

link to anemia may be weak or confounded by other socioeconomic or dietary variables. This lack of association underscores the complexity of anemia etiology in this setting and highlights the need for more detailed biochemical and dietary assessments in future studies to identify the primary causative factors.

Subsequent multivariate analysis refined these findings by identifying lower income (p = 0.016) as an independent and significant factor of anemia and found that women in the mid-income bracket (50,000–200,000 YR) had a significantly lower prevalence of anemia than those in the highest income group (>200,000 YR). This counterintuitive result may be attributed to confounding factors. For instance, women in the highest-income group might have different dietary patterns, potentially relying more on processed foods low in bioavailable iron, or they might have a higher prevalence of conditions such as gestational diabetes. In addition, multivariate analysis identified second-trimester pregnancy (p = 0.010) as an independent and significant factor for anemia compared to the first trimester. This is biologically plausible, as the second trimester is characterized by plasma volume expansion, leading to hemodilution and a consequent fall in hemoglobin concentration, a well-known physiological adaptation in pregnancy [26, 27]. Another explanation is that there is an increase in hemodilution as a result of an increase in estrogen levels towards the end of gestational age [28]. Our findings are in agreement with other recent studies conducted in Hodeida City, Sana'a City, and other governorates in Yemen, which revealed that the problem is driven by socioeconomic, nutritional, and healthcare factors, highlighting the need for improved maternal nutrition, supplementation, and antenatal care for women [10–16].

Conclusion

This study revealed a high prevalence of anemia among pregnant women, with moderate anemia being the most common severity category. Lower income and second trimester pregnancy were significantly associated with anemia.

Recommendations

The recommendations derived from this study encompass several practical measures and future research directions to improve the status of anemia among pregnant women in the region. First, it is recommended that intensive and culturally appropriate health education programs be implemented that emphasize the importance of iron and folic acid supplementation, address the detrimental health effects of khat chewing during pregnancy, and teach methods to enhance dietary iron absorption (e.g., consuming vitamin C-rich foods with meals). Second, it is necessary to explore programs to improve the affordability and accessibility of micronutrient supplements in low-income pregnant women. Third, antenatal care should be strengthened to include routine screening and counseling on nutrition and substance use (such as khat) from the first trimester onwards. Fourth, a longitudinal cohort study is warranted to understand the incidence of anemia during pregnancy in Bajil City, the progression of anemia, and the causal relationships between the identified factors and anemia outcomes. Finally, future studies should include biochemical markers (e.g., serum ferritin, transferrin saturation, serum folate, and vitamin B12) to accurately diagnose specific types of anemia and guide more targeted and effective nutritional interventions.

Abbreviations

ANC: Antenatal care; APR: Adjusted Prevalence Ratio; CBC: Complete blood count; CI: Confidence interval; EDTA: ethylenediaminetetraacetic acid; Hb: Hemoglobin; ID: Iron deficiency; IDA: Iron deficiency anemia; LBW: Low birth weight; LMICs: Low- and middle-income countries; PR: Prevalence ratios; RFs: Risk factors; RSV: Robust sandwich variance; SPSS: Statistical Package for the Social Sciences; WHO: World Health Organization.

REFERENCES

[1] Means RT, "Iron Deficiency and Iron Deficiency Anemia: Implications and Impact in Pregnancy, Fetal Development, and Early Childhood Parameters," *Nutrients*, vol. 12, no. 2, p. 447, 2020.

[2] World Health Organization, *Guideline on haemoglobin cutoffs to define anaemia in individuals and populations*. Geneva: World Health Organization, 2024.

[3] World Health Organization, "Hemoglobin concentrations for the diagnosis of anemia and assessment of severity," World Health Organization, Geneva, 2011.

[4] World Health Organization, *Nutritional anaemias: Tools for effective prevention and control*. Geneva: World Health Organization, 2022.

[5] World Health Organization, "WHO Global Anaemia estimates, 2025 Edition," World Health Organization, Geneva, 2025.

[6] Azhar SB and Islam MS and Karim MR, "Prevalence of anemia and associated risk factors among pregnant women attending antenatal care in Bangladesh: a cross-sectional study," *Prim Health Care Res Dev*, vol. 22, e61, 2021.

[7] Ahmed RH and Yussuf AA and Ali AA and Iyow SN and Abdulahi M and Mohamed LM et al., "Anemia among pregnant women in internally displaced camps in Mogadishu, Somalia: a cross-sectional study on prevalence, severity and associated risk factors," *BMC Pregnancy Childbirth*, vol. 21, no. 1, p. 832, 2021.

[8] Garanet F and Sampabe G and Tinta AA, "Persistence of a high prevalence of anemia in rural areas among pregnant women in Burkina Faso. A cross-sectional study," *J Public Health Afr*, vol. 14, no. 12, p. 2734, 2024.

[9] World Health Organization, "The Global Prevalence of Anaemia in 2011," World Health Organization, Geneva, 2015.

[10] Abu Salem ME and Mahrous OA and El Shazly HM and Ibrahem RA and Al-oshari SH, "Epidemiology of irondeficiency anemia among pregnant women in menoufa governorate, Egypt and Taiz Governorate, Yemen: A comparative study," *Menoufia Med J*, vol. 29, pp. 1005–1011, 2016.

[11] Akabat MY and Al-Shammakh AA and Mehrass AA and Al-Adhroey AH and Ali AD, "Prevalence and associated factors of anemia among pregnant women residing at high altitude in Yemen," *Am J Health Res*, vol. 5, pp. 93–98, 2017.

[12] Alflah YM and Wahdan IH and Hasab AA and Tayel DI, "Prevalence and Determinants of Anemia in Pregnancy, Sana'a, Yemen," *Int J Public Health Sci (IJPHS)*, vol. 6, no. 3, pp. 213–220, 2017.

[13] Al-Aini S and Senan CP and Azzani M, "Prevalence and associated factors of anemia among pregnant women in Sana'a, Yemen," *Indian J Med Sci*, 2020.

[14] Al-Nuzaili MA and Hajar MA and Allow AK, "Prevalence of anemia and associated risk factors among pregnant women in Sana'a, Yemen," *Sana'a Univ J Med Health Sci*, vol. 2, no. 1, pp. 48–55, 2023.

[15] S. A. A. Al-Jarrmozi et al., "Prevalence and risk factors for anemia during pregnancy in sana'a city," *Sana'a Univ. J. Med. Health Sci.*, vol. 18, no. 5, pp. 107–113, 2024.

[16] Gonaid NMH and El-Sanousi S and Kadi H, "Prevalence and Determinants of Anemia during Pregnancy at Hodeida City, (Yemen) during the Year 2021," *Int J Health Sci Res*, vol. 12, no. 3, pp. 23–31, 2022.

[17] Stevens GA and Paciorek CJ and Flores-Urrutia MC and Borghi E and Namaste S and Wirth JP et al., "National, regional, and global estimates of anaemia by severity in women and children for 2000–19," *Lancet Glob Health*, vol. 10, no. 5, e627–e639, 2022.

[18] World Health Organization, "Global nutrition targets 2025: stunting policy brief," World Health Organization, Geneva, 2018.

[19] Abd Rahman R and Idris IB and Isa ZM and Rahman RA and Mahdy ZA, "The Prevalence and Risk Factors of Iron Deficiency Anemia Among Pregnant Women in Malaysia: A Systematic Review," *Front Nutr*, vol. 9, p. 847 693, 2022.

[20] Taner CE and Ekin A and Solmaz U and Gezer C and Çetin B and Keleşoğlu M et al., "Prevalence and risk factors of anemia among pregnant women attending a high-volume tertiary care center for delivery," *J Turk Ger Gynecol Assoc*, vol. 16, no. 4, pp. 231–236, 2015.

[21] Beckert RH and Baer RJ and Anderson JG and Jelliffe-Pawlowski LL and Rogers EE, "Maternal anemia and pregnancy outcomes: a population-based study," *J Perinatol*, vol. 39, no. 7, pp. 911–919, 2019.

[22] Ali SA and Khan U and Feroz A, "Prevalence and Determinants of Anemia among Women of Reproductive Age in Developing Countries," *JCPSP*, vol. 30, no. 2, pp. 177–186, 2020.

[23] Milman N and Byg KE and Bergholt T and Eriksen L and Hvas AM, "Cobalamin status during normal pregnancy and postpartum," *Eur J Haematol*, vol. 76, pp. 512–515, 2006.

[24] van den Broek NR and Letsky EA, "Etiology of anemia in pregnancy in south Malawi," *Am J Clin Nutr*, vol. 72, no. 1, 247S–256S, 2000.

[25] Alflah YM, Wahdan IH, Hasab AA, Tayel DI, "Prevalence and Determinants of Anemia in Pregnancy, Sana'a, Yemen," *Int J Public Health Sci (IJPHS)*, vol. 6, no. 3, p. 213, 2017.

[26] Kaur M and Chauhan A and Manzar MD and Rajput MM, "Maternal anemia and neonatal outcome: A Prospective study on Urban Pregnant Women," *J Clin Diagn Res*, vol. 9, QC04–QC08, 2015.

[27] Thomsen JK and Prien-Larsen JC and Devantier A and Fogh-Andersen N, "Low dose iron supplementation does not cover the need for iron during pregnancy," *Acta Obstet Gynecol Scand*, vol. 72, pp. 93–98, 1993.

[28] Susan T and Blackburn DO, *Maternal, Fetal, & Neonatal Physiology: A Clinical Perspective*. 2007, vol. 11, pp. 780–794.