Maternal Anemia in Pregnancy and Its Impact on Perinatal Outcomes in Babylon

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***Abstract*:** Anemia during pregnancy remains a major public health problem, particularly in low- and middle-income countries, where it contributes significantly to maternal and perinatal morbidity. This prospective observational study was conducted in Babylon, Iraq, to determine the prevalence, risk factors, and outcomes associated with maternal anemia. A total of 200 pregnant women at 20 weeks of gestation or more were recruited from private clinics and hospitals between January and June 2025 and followed until delivery. Data collection included sociodemographic characteristics, obstetric history, nutritional practices, and lifestyle factors. Laboratory investigations were performed to assess hemoglobin and serum ferritin levels, while pregnancy and neonatal outcomes were recorded at delivery. The prevalence of anemia was 46%, with the majority of cases classified as mild or moderate, while severe anemia was uncommon (5.4%). Anemia was more frequent among rural residents, housewives, and women of low socioeconomic status. A previous miscarriage, a short interpregnancy interval, and a history of iron deficiency anemia were significantly associated with maternal anemia. Nutritional factors played a crucial role, with lower rates of iron supplementation, inadequate intake of iron-rich foods, and higher prevalence of tea consumption during meals observed in the anemic group. Laboratory findings confirmed significantly reduced hemoglobin and serum ferritin concentrations among anemic women compared with their non-anemic counterparts. Maternal anemia was significantly associated with adverse perinatal outcomes, including preterm birth, low birth weight, and reduced Apgar scores at 5 minutes. Although cesarean delivery and perinatal mortality were more frequent among anemic mothers, these differences were not statistically significant. This study underscores the high burden of maternal anemia in Babylon and its multifactorial determinants. Targeted interventions focusing on nutritional counseling, supplementation adherence, and improved antenatal care are essential to mitigate the risks and improve maternal and neonatal outcomes.

***Index Terms*:** Maternal anemia; Iron deficiency; Pregnancy outcomes; Risk factors; Nutritional status; Iraq.

INTRODUCTION

Maternal anemia, most commonly due to iron deficiency, remains one of the most prevalent medical disorders complicating pregnancy. The World Health Organization (WHO) estimates that nearly 40% of pregnant women worldwide are anemic, with the burden disproportionately higher in low- and middle-income countries. Physiological changes in pregnancy, including expanded plasma volume, increase susceptibility to anemia, while nutritional deficiencies, infections, and socioeconomic barriers exacerbate the risk [1].

Recent evidence shows that maternal anemia remains a significant public health issue in Iraq, with prevalence varying across regions and healthcare settings [2]. In Babylon Governorate, 48.6% of women were anemic [3]. Studies in Baghdad show particularly high burdens, with 43–67% of pregnant women diagnosed with anemia, most due to iron deficiency, and a considerable proportion presenting with moderate to severe cases [4].

Anemia in pregnancy can result from iron deficiency, folate or vitamin B12 deficiency, hemoglobinopathies, chronic disease, or acute blood loss. Iron-deficiency anemia accounts for the majority of cases, driven by increased maternal and fetal demands that may not be met by diet alone [5].

Maternal anemia is associated with fatigue, reduced work capacity, impaired immunity, and increased risk of obstetric complications. Severe anemia contributes significantly to maternal morbidity and mortality, increasing the risk of postpartum hemorrhage, infection, preeclampsia, and need for transfusion [6]. Maternal anemia, particularly iron-deficiency anemia, is strongly associated with adverse perinatal outcomes due to impaired oxygen delivery to the placenta and fetus.

Numerous studies and meta-analyses have demonstrated that anemic mothers face higher risks of preterm birth, intrauterine growth restriction, and low birth weight, all of which contribute to neonatal morbidity and mortality. Severe anemia further increases the likelihood of stillbirth, perinatal mortality, and the need for neonatal intensive care admission [7, 8, 9].

The severity and timing of anemia influence outcomes. Moderate to severe anemia early in pregnancy is particularly linked to impaired placental development and adverse fetal growth [10].

Primary prevention through routine iron and folic acid supplementation, dietary interventions, and infection control (e.g., malaria, hookworm) remains crucial. Screening and timely management of anemia improve maternal well-being and significantly reduce risks of preterm birth, low birth weight, and preeclampsia [11]. Evidence also suggests that women who respond to iron therapy experience markedly better outcomes than untreated or refractory cases [12].

This study aimed to estimate the prevalence of anemia among pregnant women attending antenatal clinics in Babylon, to identify risk factors for maternal anemia, including nutritional status, socioeconomic level, infections, and parity, and to evaluate pregnancy and neonatal outcomes associated with maternal anemia (preterm birth, low birth weight, perinatal mortality).

METHODS

This study was conducted as a prospective observational study at private clinics and private hospitals in Babylon over a defined period (1st of January–30th of June 2025). The study population consisted of pregnant women at 20 weeks of gestation or more who attended antenatal care services during the study period and were followed up until delivery.

A total of 200 women were recruited. Eligible participants included all consenting pregnant women who met the gestational age criterion, while women with known hematological disorders other than iron deficiency anemia, those with chronic illnesses affecting hematological parameters, or those unwilling to participate were excluded.

Data were collected through an interviewer-administered structured questionnaire that included detailed sociodemographic information (age, residency, education, occupation, socioeconomic status) and obstetric history (gravidity, parity, spacing between pregnancies, history of miscarriage, stillbirth, or preterm birth). Risk factors relevant to maternal anemia were assessed, such as dietary intake and iron supplementation, previous history of anemia, inter-pregnancy interval, frequency of antenatal care visits, and presence of chronic illnesses or infections during pregnancy. Lifestyle-related factors, including smoking and tea or coffee consumption with meals, were also recorded.

Clinical examinations were performed, including anthropometric measurements, blood pressure assessment, and physical evaluation for pallor, fatigue, or other signs of nutritional deficiencies.

Laboratory investigations were carried out to determine hemoglobin concentration and hematocrit for all participants, serum ferritin level was also measured. Peripheral blood smears were performed selectively in a subset of participants, mainly in cases with moderate to severe anemia, to support confirmation of iron deficiency and to rule out other types of anemia (e.g., hemolytic anemia, thalassemia).

Anemia was defined as hemoglobin concentration less than 11 g/dL, and its severity was classified according to World Health Organization (WHO) criteria into mild (10.0–10.9 g/dL), moderate (7.0–9.9 g/dL), and severe (<7.0 g/dL). Pregnancy and neonatal outcomes, including preterm birth, low birth weight, Apgar score at 5 minutes, mode of delivery, and perinatal mortality, were obtained from medical records or through follow-up until delivery.

Data were analyzed using SPSS software, with descriptive statistics (means, standard deviations, and proportions) used to summarize the findings. Chi-square and t-tests were employed to assess associations, and logistic regression was used to identify predictors of adverse perinatal outcomes. A p-value of <0.05 was considered statistically significant.

Informed consent was obtained from all participants. Confidentiality was maintained through coded data, and women diagnosed with anemia were counseled and referred for appropriate management according to national antenatal care guidelines.

RESULTS

Out of the 200 pregnant women enrolled, 92 (46%) were diagnosed with anemia, while 108 (54%) had normal hemoglobin levels. Among the anemic group, the majority had mild anemia (60.9%), followed by moderate anemia (33.7%), whereas severe anemia was observed in only 5.4% of cases. (Table 1).

Table 1. Prevalence and Severity of Anemia Among Pregnant Women (n=200)

Variable		No.	%
Anemia status	Anemic	92	46.0
	Non anemic	108	54.0
Severity of anemia	Mild (10-10.9 g/dL)	56	60.9
	Moderate (7 - 9.9 g/dL)	31	33.7
	Severe (< 7.0 g/dL)	5	5.4

When sociodemographic factors were assessed, the mean age of anemic women (27.8 ± 6.1 years) was slightly lower than that of non-anemic women (28.9 ± 5.3 years), though the difference was not statistically significant. A higher proportion of anemia was found among rural residents (44.6% vs. 26.9%) and housewives (76.1% vs. 63.9%). Socioeconomic status was strongly associated with anemia, as nearly half (42.4%) of anemic women belonged to the low socioeconomic group compared to only 18.5% of their non-anemic counterparts. (Table 2)

Table 2. Sociodemographic Characteristics of Pregnant Women According to Anemia Status

Variable		Normal (n=108)	Anemic (n=92)	p-value
Age	Mean SD	28.9 ± 5.3	27.8 ± 6.1	0.211
Residency	Urban	79 (73.1)	51 (55.4)	0.03
	Rural	29 (26.9)	41 (44.6)	
Occupation	Housewife	69 (63.9)	70 (76.1)	0.07
	Employed	39 (36.1)	22 (23.9)	
Socioeconomic status	Low	20 (18.5)	39 (42.4)	0.01
	Middle	64 (59.3)	43 (46.7)	
	High	24 (22.2)	10 (10.9)	

Regarding obstetric and reproductive history, parity did not show a significant association with anemia. However, a previous miscarriage was significantly more common among anemic women (23.9% vs. 11.1%). A history of stillbirth was higher among anemic women, though not statistically significant. A short interpregnancy interval of less than 2 years was strongly associated with anemia (51.1% vs. 25.9%), and a prior history of iron deficiency anemia was more frequent in the anemic group (31.5% vs. 9.3%). (Table 3)

Table 3. Obstetric and Reproductive History by Anemia Status

Variable		Normal (n=108)	Anemic (n=92)	p-value
Parity	Nullipara	34 (31.5)	20 (21.7)	0.12
	1-4	59 (54.6)	56 (60.9)	
	>5	15 (13.9)	16 (17.4)	
Previous miscarriage		12 (11.1)	22 (23.9)	0.01
History of stillbirth		3 (2.8)	6 (6.5)	0.18
Interpregnancy interval < 2 years		28 (25.9)	47 (51.1)	0.001
History of IDA Before Pregnancy		10 (9.3)	29 (31.5)	0.001

Nutritional and supplementation patterns revealed strong associations. Only 57.6% of anemic women reported iron supplement use compared to 86.1% of the non-anemic group. Similarly, adequate dietary intake of iron-rich foods was significantly lower among anemic women (38.0% vs. 73.1%). Conversely, tea consumption with meals, a known inhibitor of iron absorption, was markedly higher in the anemic group (68.5% vs. 40.7%). (Table 4)

Table 4. Nutritional and Supplementation Factors by Anemia Status

Variable	Normal (n=108)	Anemic (n=92)	p-value
Iron supplement use	93 (86.1)	53 (57.6)	0.001
Adequate Dietary Intake of Iron-rich Foods	79 (73.1)	35 (38.0)	0.001
Tea with meals	44 (40.7)	63 (68.5)	0.001

Laboratory investigations further confirmed these findings. Mean hemoglobin levels were significantly lower in anemic women (9.5 ± 1.1 g/dL) compared to non-anemic women (12.5 ± 0.8 g/dL). Serum ferritin concentrations were also markedly reduced in the anemic group (12.3 ± 6.2 µg/L vs. 35.2 ± 12.3 µg/L). (Table 5).

Table 5. Laboratory Findings Among Pregnant Women by Anemia Status

Variable	Normal (n=108)	Anemic (n=92)	p-value
Hb (g/dL)	12.5± 0.8	9.5 ± 1.1	0.001
S. ferritin (µg/L)	35.2± 12.3	12.3 ± 6.2	0.001

In terms of perinatal outcomes, maternal anemia was significantly associated with an increased risk of preterm birth (19.6% vs. 6.5%), low birth weight infants (17.4% vs. 5.6%), and low Apgar scores at 5 minutes (9.8% vs. 2.8%). Cesarean section rates were higher among anemic women (38.0% vs. 27.8%), though the difference did not reach statistical significance. Perinatal mortality was also more frequent in the anemic group (4.3% vs. 0.9%), but the association was not statistically significant. (Table 6)

Table 6. Perinatal Outcomes in Relation to Maternal Anemia

Variables	Normal (n=108)	Anemic (n=92)	p-value
Preterm birth <37 weeks	7 (6.5)	18 (19.6)	0.004
Cesarean section	30 (27.8)	35 (38.0)	0.11
Low birth weight <2500 g	6 (5.6)	16 (17.4)	0.006
5 min. APGAR score < 7	3 (2.8)	9 (9.8)	0.03
Perinatal mortality	1 (0.9)	4 (4.3)	0.09

DISCUSSION

Anemia in pregnancy remains one of the most significant public health challenges worldwide, particularly in low- and middle-income countries, where nutritional deficiencies, limited access to health care, and socio-economic disparities contribute substantially to maternal morbidity and adverse perinatal outcomes. Iron deficiency anemia, in particular, is recognized as a leading cause of preventable complications during pregnancy, affecting maternal well-being, fetal growth, and neonatal survival [13]. Conducting research on the prevalence, risk factors, and outcomes of maternal anemia is crucial to inform targeted interventions, improve antenatal care practices, and reduce maternal and perinatal health burdens.

In the present study, nearly half of the pregnant women (46%) were diagnosed with anemia, with the majority presenting with mild (60.9%) or moderate anemia (33.7%), while severe anemia was relatively uncommon (5.4%). This prevalence is consistent with national and regional data from Iraq and other Middle Eastern countries, where reported rates of anemia in pregnancy range between 35–55% [14,15]. However, it is higher than prevalence rates documented in some high-income countries, such as the United States (15–20%) and parts of Europe (10–15%), reflecting differences in socioeconomic status, nutritional patterns, and the strength of antenatal care systems [16].

Our findings demonstrate that anemia was more common among rural residents, housewives, and women of lower socioeconomic status. These associations align with the well-documented link between social determinants of health and nutritional deficiencies in pregnancy. Similar studies in South Asia and sub-Saharan Africa report higher anemia prevalence among rural and socioeconomically disadvantaged populations, largely due to reduced dietary diversity, limited access to antenatal care, and lower awareness of nutritional requirements during pregnancy [17,18]. While age did not show a significant association in our cohort, younger maternal age has been reported as a risk factor in some studies, possibly reflecting nutritional vulnerability and shorter reproductive spacing among adolescents [19].

A history of miscarriage and short interpregnancy interval were strongly associated with anemia in our study. Women with recurrent pregnancies in close succession may have inadequate time to replenish iron stores, predisposing them to iron deficiency during subsequent pregnancies. This is consistent with findings from Ethiopia and India, where short interpregnancy intervals (<24 months) were independent predictors of maternal anemia [20,21]. Likewise, the association between prior iron deficiency anemia and current anemia reflects the chronic and recurrent nature of nutritional deficiencies in settings with limited preventive measures. Interestingly, parity did not significantly influence anemia in our cohort, although multiparity has been identified as a risk factor in several studies [22]. This discrepancy may reflect variations in population characteristics and healthcare access.

The nutritional assessment highlighted the importance of diet and supplementation. Only 57.6% of anemic women reported taking iron supplements, compared to 86.1% in the non-anemic group, while adequate dietary intake of iron-rich foods was substantially lower among the anemic women (38.0%). In addition, tea consumption with meals—an inhibitor of non-heme iron absorption—was significantly more frequent in anemic women. These findings are strongly supported by literature from South Asia and the Middle East, where cultural practices such as tea and coffee consumption with meals exacerbate dietary iron deficiency, particularly in populations relying predominantly on plant-based diets [23,24]. WHO recommends universal iron supplementation during pregnancy, but adherence remains a challenge due to gastrointestinal side effects, inadequate counseling, and irregular antenatal follow-up [25]. Our findings reinforce the need for intensified nutrition education and counseling within antenatal programs.

The laboratory data confirm the clinical and nutritional findings, with significantly lower mean hemoglobin and serum ferritin levels in the anemic group. The mean ferritin concentration (12.3 µg/L) is consistent with depleted iron stores, further confirming iron deficiency as the predominant etiology. Comparable values have been reported in studies from Jordan and Egypt, highlighting the widespread burden of iron deficiency anemia across the region [14,26].

The adverse perinatal outcomes observed in this study—namely increased risk of preterm birth, low birth weight, and lower Apgar scores—underscore the clinical significance of maternal anemia. The associations are biologically plausible, as maternal iron deficiency compromises oxygen delivery to the placenta and fetus, impairing intrauterine growth and fetal development [27]. Similar associations between anemia and adverse perinatal outcomes have been consistently reported in large cohort studies and meta-analyses [28,29]. Although cesarean delivery and perinatal mortality were more common among anemic women, these associations did not reach statistical significance in our study, possibly due to limited sample size or improvements in obstetric care mitigating the risks.

CONCLUSIONS AND RECOMMENDATIONS

This study highlights that anemia remains a prevalent condition among pregnant women in Babylon, affecting nearly half of the study population, with iron deficiency as the primary underlying cause. The findings emphasize that anemia is influenced by sociodemographic factors such as low socioeconomic status and rural residency, reproductive factors including short interpregnancy interval and prior history of anemia, as well as nutritional and lifestyle practices like inadequate dietary intake and poor adherence to supplementation. Importantly, maternal anemia was significantly associated with adverse perinatal outcomes, including preterm birth, low birth weight, and low Apgar scores. These results underscore the urgent need for strengthening antenatal care services to include routine screening, timely diagnosis, and management of anemia. Public health interventions should focus on improving awareness, ensuring universal access to and compliance with iron supplementation, promoting dietary diversification, and addressing cultural

practices that hinder iron absorption. At the policy level, programs targeting high-risk groups, particularly women of lower socioeconomic background and those in rural areas, are recommended. Implementing these strategies could contribute substantially to reducing the burden of maternal anemia and improving both maternal and neonatal outcomes in Iraq and similar settings.

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DATA CONFIDENTIALITY AND STORAGE

The data will be processed with a higher degree of confidentiality and privacy.

CONFLICTS OF INTEREST

The researchers did not report any conflicts of interest.

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