



Pregnancy-Related Anemia and Platelet Deficiency Prevalence in the Al-Khums, Libya

Wafa R. Griba^{1*}, Ahmed A. Algadar², Najla M. Worayet³

¹ Chemistry Department, Faculty of Science, Elmergib University, Al-Khums, Libya

² Medical Laboratory Department, Faculty of Health Science, Al-Asmarya Islamic University, Zliten, Libya

³ Chemistry Department, Faculty of Science, Misurata university, Misurata, Libya

انتشار فقر الدم المرتبط بالحمل ونقص الصفائح الدموية في الخمس، ليبيا

وفاء غريبة^{1*}، أحمد القدار²، نجلاء وريث³

¹ قسم الكيمياء، كلية العلوم، جامعة المرقب، الخمس، ليبيا

² قسم مختبرات طبية، كلية العلوم الصحية، الجامعة الإسلامية الاسمرية، زليتين، ليبيا

³ قسم الكيمياء، كلية العلوم، جامعة مصراتة، مصراتة، ليبيا

*Corresponding author: wrgarib@elmergib.edu.ly

Received: July 12, 2025

Accepted: September 20, 2025

Published: September 26, 2025

Abstract:

According to the World Health Organization (WHO), anemia in pregnancy is defined as a hemoglobin concentration below 11 g/dL and is categorized into three levels of severity: mild (10–10.9 g/dL), moderate (9–9.9 g/dL), and severe (below 7 g/dL). Anemia represents one of the most prevalent medical conditions affecting pregnant women worldwide. In Libya, it remains a significant health concern and one of the primary causes of hospital admission among expectant mothers in obstetrics and gynecology departments. This study aimed to determine the prevalence of anemia among pregnant women and its association with platelet deficiency in patients attending the Obstetrics Department at Al-Khums/Souq Al-Khamis Hospital. A total of 50 participants aged 17–46 years were included, and blood samples were collected between February and May 2023 for complete blood count analysis. The results revealed a 60% prevalence of anemia, with the highest rate (63.64%) observed during the third trimester. Thus, 25% of pregnant women exhibited platelet deficiency in the first trimester, while 21.43% had mild thrombocytopenia and 7.14% showed moderate thrombocytopenia.

Keywords Hemoglobin, Anemia, Platelet, Pregnancy, Age.

المخلص

وفقاً لمنظمة الصحة العالمية (WHO)، يُعرّف فقر الدم أثناء الحمل بأنه انخفاض تركيز الهيموغلوبين عن 11 غ/دل، ويُصنّف إلى ثلاث درجات من الشدة: خفيف (10.9–10 غ/دل)، متوسط (9.9–9 غ/دل)، وشديد (أقل من 7 غ/دل). ويُعد فقر الدم من أكثر الاضطرابات الطبية شيوعاً بين النساء الحوامل في جميع أنحاء العالم. وفي ليبيا، لا يزال يمثل مشكلة صحية خطيرة وأحد الأسباب الرئيسية لدخول النساء الحوامل إلى أقسام أمراض النساء والتوليد. هدفت هذه الدراسة إلى تحديد معدل انتشار فقر الدم بين النساء الحوامل وعلاقته بنقص الصفائح الدموية لدى المراجعات لقسم التوليد في مستشفى الخمس/سوق الخميس. شملت الدراسة 50 مشاركة تراوحت أعمارهن بين 17 و46 عاماً، وتم جمع عينات الدم خلال الفترة من فبراير إلى مايو 2023 لإجراء تحليل صورة دم كاملة. أظهرت النتائج أن نسبة انتشار فقر الدم بلغت 60٪، مع تسجيل أعلى معدل في الثلث الثالث من الحمل (63.64٪). كما تبين أن 25٪ من النساء الحوامل يعانين من

نقص في الصفائح الدموية في الثلث الأول من الحمل، في حين كانت 21.43٪ منهن مصابات بنقص صفائح دموية خفيف، و7.14٪ بنقص متوسط.

الكلمات المفتاحية: الهيموجلوبين، فقر الدم، الصفائح الدموية، الحمل، العمر.

Introduction

Pregnancy is accompanied by numerous physiological and biochemical changes that affect multiple organ systems to support fetal growth and maternal adaptation. These alterations begin as early as conception and persist through delivery and the postpartum period to accommodate the metabolic and nutritional needs of both the mother and the developing fetus [1]. Such changes, encompassing both structural and hormonal modifications, represent essential physiological adaptations that ensure the maintenance of pregnancy and the successful delivery of a healthy newborn capable of independent survival [2].

Among the most significant hematological adaptations during pregnancy are fluctuations in the components of the complete blood count (CBC), including hemoglobin concentration, white blood cell count, and red blood cell count, which often decline below normal reference ranges. This physiological reduction can predispose pregnant women to various forms of anemia, which serves as a critical indicator of maternal health and systemic stress [3].

According to the World Health Organization (WHO), anemia in pregnancy is defined as a hemoglobin concentration of less than 11 g/dL and is categorized by severity as follows: mild anemia (10–10.9 g/dL), moderate anemia (9–9.9 g/dL), and severe anemia (<7 g/dL) [4]. The average hemoglobin level at term is approximately 12.5 g/dL, and values below 7 g/dL demand urgent medical intervention due to the risk of cardiac complications such as congestive heart failure [4]. Globally, it is estimated that 20% of pregnant women are affected by anemia, with the highest prevalence observed in Africa and Southeast Asia, where nutritional deficiencies and limited healthcare access exacerbate maternal vulnerability [5].

Anemia during pregnancy is associated with a range of adverse maternal and fetal outcomes, including low birth weight, preterm delivery, intrauterine growth restriction, perinatal mortality, and fetal anemia [6]. Early detection and effective management are therefore crucial to restoring hemoglobin concentration, treating underlying etiologies, and preventing complications. Physiologically, plasma volume begins to expand between 6 and 12 weeks of gestation, increasing by approximately 10–15% initially and continuing rapidly until 30–34 weeks, leading to a relative dilutional decrease in hemoglobin concentration [7,8]. Insufficient plasma volume expansion has been linked to lower birth weight, reduced placental mass, and an elevated risk of small-for-gestational-age (SGA) infants, even among otherwise healthy women [8–10].

Globally, anemia remains one of the most pervasive public health challenges, influenced by diverse etiological factors such as iron deficiency, micronutrient insufficiency, parasitic infections, and chronic inflammatory conditions [11,12]. The severity and prevalence of anemia vary across populations, depending on socioeconomic conditions, healthcare access, and dietary practices.

This study makes an important contribution to the understanding of maternal health by quantifying the prevalence of anemia and platelet deficiency among pregnant women within a defined sample population. By analyzing hematological data from 50 participants aged 17–46 years, the research provides empirical evidence that anemia affects a significant proportion (60%) of the cohort, particularly during the third trimester (63.64%). Furthermore, the identification of platelet deficiencies, 25% in the first trimester and 21.43% with mild thrombocytopenia, adds valuable insight into hematologic alterations associated with pregnancy. The absence of statistically significant correlations between maternal age, platelet count, and hemoglobin levels suggests that factors other than age may play dominant roles in anemia development during pregnancy. Overall, this study contributes to the field by establishing a localized prevalence baseline, highlighting trimester-specific hematologic variations, and underscoring the need for comprehensive prenatal screening and early interventions to mitigate anemia-related risks in maternal and fetal health.

Material and methods

The present study was conducted between February and May 2023 in the Al-Khums region of Libya, specifically within the Obstetrics Department of Al-Khums/Souq Al-Khamis Hospital. Data were obtained from patients attending this department during the study period. The research encompassed a total sample of 50 participants, aged between 17 and 46 years, comprising 40 pregnant women and 10 non-pregnant women serving as a control group. Venous blood samples were collected from all participants, and a complete blood count (CBC) analysis was performed to evaluate hematological parameters. According to the World Health Organization (WHO) criteria, participants exhibiting hemoglobin concentrations below 11 g/dL were classified as anemic. The collected data were

systematically analyzed using the Statistical Package for the Social Sciences (SPSS), version 20, to determine the prevalence of anemia and its relationship with platelet levels and other relevant variables.

Results and discussion

Prevalence of anemia

Out of the total 50 women included in this study at the Al-Khums/Souq Al-Khamis Hospital, 30 participants (60%) were found to be anemic, while the remaining 20 participants (40%) exhibited normal hemoglobin levels and were considered non-anemic. This indicates a notably high prevalence of anemia among the study population, emphasizing its clinical significance in maternal health within the region. Figure 1 presents distribution of anemic pregnant women and non-anemic pregnant women.

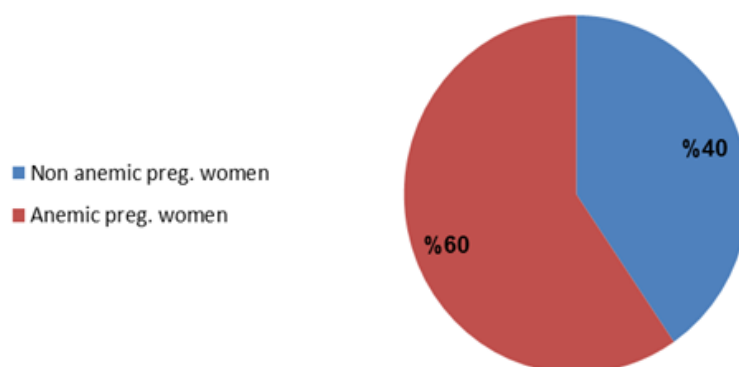


Figure (1): Disturbition of anemic pregnant women and non-anemic pregnant women.

As illustrated in Figure 1, the predominance of anemia among the participants underscores the persistent burden of hematological deficiencies during pregnancy, which may be attributed to nutritional inadequacies, increased physiological demands, or limited access to antenatal healthcare services. These findings align with global trends reported in developing countries, where maternal anemia remains a major public health concern affecting both maternal and fetal outcomes.

Table 1 presents the distribution of anemia cases among study participants according to pregnancy periods and physiological status. The overall prevalence of anemia among pregnant women was 59.57%, indicating that more than half of the expectant participants were affected. This high incidence emphasizes the continuing public health challenge of maternal anemia in the Al-Khums region.

Table 1 Distribution of the study cases according to pregnancy periods.

Classification	anemia%	% of total
Pregnant	59.57	54.90
First trimester	50.00	7.84
Second trimester	50.00	5.88
Third trimester	63.64	41.18
Non-pregnant	75.00	5.88

When stratified by trimester, the prevalence of anemia was 50% during both the first and second trimesters, increasing to 63.64% in the third trimester. This progressive trend is consistent with physiological and nutritional demands that intensify as pregnancy advances. The third trimester is typically characterized by plasma volume expansion and heightened fetal iron requirements, which may exacerbate hemodilution and iron depletion, leading to a higher frequency of anemia. The data therefore suggest that anemia screening and nutritional supplementation programs should be particularly emphasized during the late stages of pregnancy.

Interestingly, non-pregnant women in the control group exhibited an even higher anemia rate (75%), despite representing only 5.88% of the total sample. This finding indicates that anemia is not solely pregnancy-related but may also reflect broader nutritional deficiencies, dietary inadequacies, or socioeconomic constraints within the study population. In summary, the results reveal a substantial burden of anemia among women of reproductive age, with severity peaking during the third trimester. These findings highlight the urgent need for targeted antenatal interventions, including routine hematological monitoring, dietary counseling, and iron-folate supplementation, to mitigate maternal and fetal health risks associated with anemia.

Figure 2 illustrates the distribution of anemia prevalence across different age groups among the study participants. The incidence of anemia was recorded as 46% in the 17–26 age group, 50% in the 27–36 age group, and 4% in the 37–46 age group. When considered as percentages of the overall study population, these values correspond to 45%, 50%, and 5%, respectively.

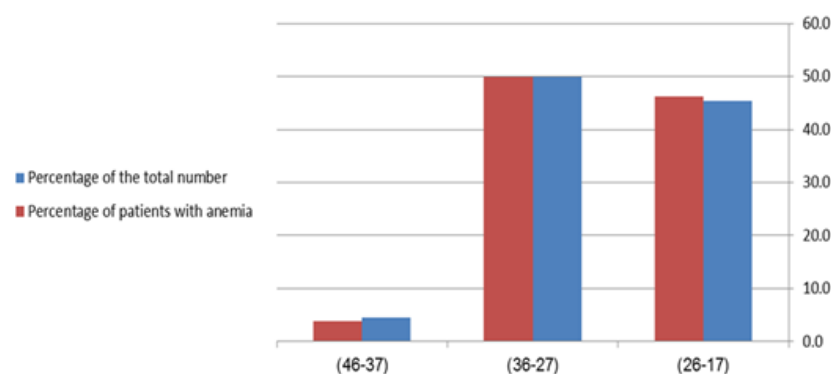


Figure (2): Prevalence of Anemia according to age.

Overall, the results indicate that anemia was most prevalent among women aged 27–36 years, representing the age bracket with the highest reproductive activity and nutritional demands. This trend suggests that physiological stress associated with pregnancy, coupled with possible nutritional deficiencies during peak childbearing years, may contribute significantly to the observed pattern. The comparatively lower incidence in older women (37–46 years) could be attributed to reduced fertility rates and fewer pregnancies within this group. These findings are consistent with previous studies reporting a higher vulnerability to anemia among women in their late twenties to mid-thirties, reflecting the interplay between physiological, nutritional, and socioeconomic determinants of maternal health.

Anemia and Platelet Correlation

The analysis of platelet levels among pregnant women revealed a variable pattern of platelet deficiency across the different stages of pregnancy. As illustrated in Figure 3, approximately 25% of women in the first trimester exhibited platelet deficiency, representing the highest occurrence among all trimesters. This early decline in platelet count may be attributed to hemodilution effects and physiological adjustments occurring during the initial phase of gestation, when plasma volume expansion begins.

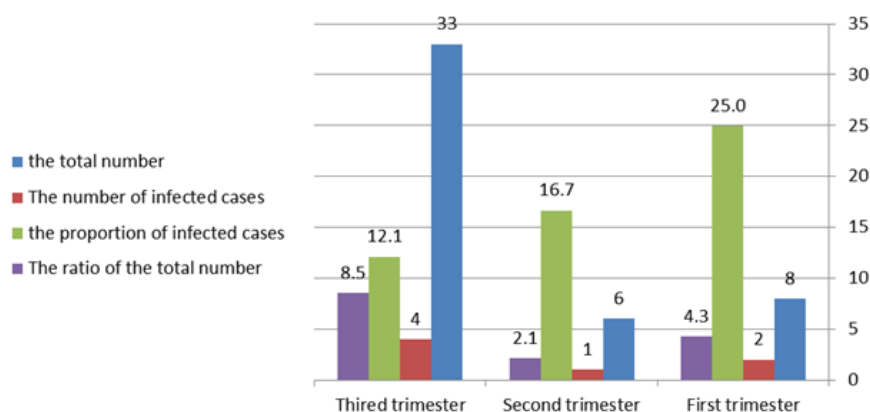


Figure (3): Distribution of the platelet according to pregnancy periods.

During the second trimester, the prevalence of platelet deficiency decreased to 16.7%, suggesting partial hematological adaptation as pregnancy progresses. In the third trimester, the deficiency rate further declined to 12.1%, which could indicate compensatory mechanisms or effective clinical interventions such as nutritional supplementation and improved maternal care during the later stages of pregnancy. Despite these variations, the study's statistical analysis found no significant correlation

between platelet levels and hemoglobin concentration, indicating that thrombocytopenia and anemia may arise from distinct physiological or nutritional mechanisms rather than a shared causal pathway.

As presented in Table 2, the distribution of platelet levels across different anemia classifications reveals that 21.43% of pregnant women exhibited reduced platelet counts associated with mild anemia, while 7.14% demonstrated moderate anemia. Notably, no cases of severe anemia were identified among the study participants.

Table (2): The distribution of the platelet according to the types of anemia

Type	per of infected	per of total
Mild anemia	21.43	50
Moderate anemia	7.14	50
Severe anemia	0	0

These results suggest that thrombocytopenia was predominantly observed among individuals with mild to moderate anemia, indicating that platelet deficiency may develop concurrently with early or moderate reductions in hemoglobin concentration rather than at more severe stages. This pattern implies a potential physiological adaptation during pregnancy where mild hematologic imbalances emerge before progressing to critical levels. The absence of severe anemia cases may also reflect early clinical intervention or limited exposure duration to aggravating factors such as nutritional deficiency or infection. Overall, the findings underscore the importance of regular hematological screening during pregnancy to detect early signs of both anemia and platelet decline, enabling timely management to prevent adverse maternal and fetal outcomes.

Age and platelet count correlation:

As presented in Figure 4, the analysis revealed no statistically significant relationship between the age of pregnant women and their platelet count, with a calculated correlation coefficient of $r = 0.0538$. This very weak positive correlation indicates that variations in maternal age have negligible influence on platelet levels among the studied participants.

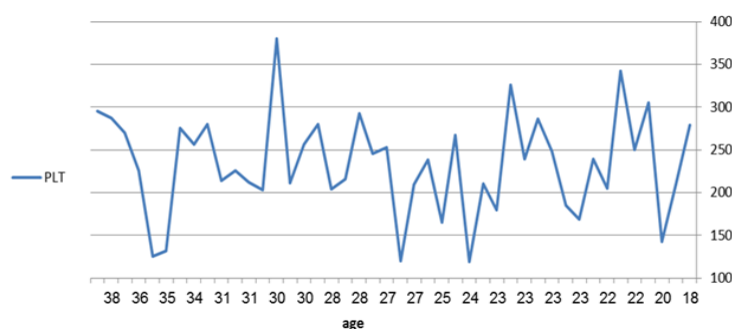


Figure (4): Correlation between age and platelet level

The graphical trend line demonstrates random fluctuations in platelet counts across different age groups, with no discernible upward or downward pattern. Such variability suggests that physiological platelet changes during pregnancy are primarily governed by gestational and hematological factors rather than maternal age. These findings align with previous studies reporting that gestational thrombocytopenia, often observed in the later stages of pregnancy, is largely independent of maternal age and instead influenced by plasma volume expansion, hormonal changes, and increased platelet turnover. Consequently, age alone does not serve as a predictive determinant of platelet count during pregnancy, emphasizing the need for individualized clinical assessment based on hematological parameters rather than demographic characteristics.

Age and hemoglobin level correlation:

As illustrated in Figure 5, the computed correlation coefficient between maternal age and hemoglobin concentration was $r = 0.264$, signifying a weak and statistically insignificant relationship between the two variables. This finding indicates that age does not appear to exert a measurable influence on hemoglobin levels among the pregnant women included in this study.

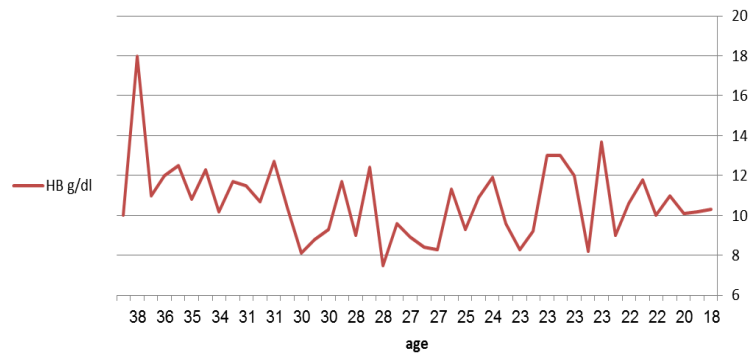


Figure (5) Correlation between age and Hemoglobin level.

The fluctuating trend observed in the graphical representation further supports this conclusion, as hemoglobin values demonstrate considerable variability across different age groups without a consistent upward or downward pattern. These results suggest that factors other than age, such as nutritional status, parity, socioeconomic conditions, or access to prenatal care, can play more decisive roles in determining hemoglobin levels during pregnancy. Hence, interventions aimed at reducing anemia prevalence should prioritize nutritional and clinical management strategies rather than focusing solely on maternal age.

Discussion

The findings of this study revealed that 60% of pregnant women in the Al-Khums region were affected by anemia, a rate higher than that reported in several other Libyan studies. For instance, the prevalence of anemia among pregnant women was 55% in Al-Zawiya, 54.6% in Derna, and 49.7% in Brack Al-Shati [13]. Moreover, the observed prevalence was also higher than the 44% reported in a similar study conducted in Saudi Arabia [14]. The variation in these results could be attributed to differences in socioeconomic conditions, sample selection, methodological design, and the extent of iron supplementation among the studied populations. Differences in healthcare access, dietary habits, and awareness of prenatal nutrition may further explain the higher prevalence observed in the present study.

A trimester-wise analysis indicated that anemia was most prevalent during the third trimester (63.64%), exceeding figures reported in previous Libyan studies, 34.9% in Al-Zawiya, 59.6% in Derna, and 53% in Brack Al-Shati [13]. This increased prevalence during late pregnancy can be explained by hemodilution resulting from expanded plasma volume, iron depletion, and hormonal and metabolic adjustments associated with fetal growth demands [14]. Additionally, delayed initiation of antenatal care may have contributed to inadequate iron supplementation and late detection of anemia, further compounding the problem in the final stages of gestation.

The study also identified the highest prevalence of anemia among women aged 27–36 years, which is consistent with findings from Saudi Arabia, where the highest rates were recorded among women aged 36–40 years [14]. Nevertheless, no statistically significant correlation was found between maternal age and hemoglobin concentration, corroborating the outcomes of earlier Libyan studies that also reported no age-related association with anemia prevalence [15].

Furthermore, 25% of pregnant women were observed to have platelet deficiencies during the first trimester. Although no significant relationship was established between platelet count and maternal age, this hematological alteration could be attributed to physiological hemodilution and increased plasma volume during pregnancy. The elevated demand for nutrients and the expansion of blood volume to support fetal development can result in relative thrombocytopenia and reduced hemoglobin synthesis. This phenomenon has been recognized as a common gestational adaptation, where platelet counts tend to decline progressively with advancing pregnancy, reflecting the growing metabolic and hematopoietic requirements of both the mother and the developing fetus [13].

Overall, these findings emphasize the necessity for early and continuous prenatal screening, nutritional interventions, and public health programs targeting maternal anemia in Libya. Enhancing awareness about the importance of early antenatal visits and consistent iron supplementation could substantially reduce anemia-related risks and improve both maternal and neonatal outcomes.

Conclusion

Anemia during pregnancy remains a critical global health concern with significant implications for maternal and fetal well-being. The present study identified a 60% prevalence of anemia among pregnant women, a rate exceeding those reported in previous Libyan studies. The condition was found

to be most prevalent among women aged 27–36 years, and 25% of the participants exhibited platelet deficiencies during the first trimester, while 21% experienced mild thrombocytopenia. Importantly, the study detected no statistically significant correlation between maternal age, hemoglobin concentration, and platelet count, suggesting that other physiological and nutritional factors may play a more dominant role in the development of anemia during pregnancy. These findings highlight the urgent need for early screening, nutritional supplementation, and preventive healthcare interventions aimed at reducing the incidence of anemia among pregnant women. Strengthening antenatal care programs, promoting awareness about iron and micronutrient intake, and encouraging timely medical follow-up can collectively enhance maternal and neonatal health outcomes, contributing to a reduction in anemia-related complications and improving the overall quality of maternal care.

References

- [1] I. Murray and J. Hendley, *Change and Adaptation in Pregnancy*, in *Myles' Textbook for Midwives*, 17th ed. Elsevier, 2020, p. 197.
- [2] G. R. Gangakhedkar and A. P. Kulkarni, "Physiological changes in pregnancy," *Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine*, vol. 25, no. Suppl 3, pp. S189–S193, 2021.
- [3] G. R. Lee, J. Foerster, J. Lukens, F. Paraskevas, J. P. Greer, and G. Rodgers, *Clinical Hematology*, 10th ed., vol. 1. Williams & Wilkins, Canada, 1999, p. 1484.
- [4] O. Akinlaja, "Hematological changes in pregnancy: The preparation for intrapartum blood loss," *Obstetrics and Gynecology International Journal*, vol. 4, no. 3, pp. 00109–00112, 2016.
- [5] T. O. Scholl, "Iron status during pregnancy: Setting the stage for mother and infant," *American Journal of Clinical Nutrition*, vol. 81, no. 5, pp. 1218S–1222S, 2005.
- [6] World Health Organization, *Hemoglobin Concentrations for the Diagnosis of Anemia and Assessment of Severity*. Geneva: WHO, 2011. [Online]. Available: <http://www.who.int/entity/vmnis/indicators/haemoglobin>
- [7] World Health Organization (WHO), *Iron Deficiency Anemia: Assessment, Prevalence and Control*, WHO/NHD/01.3. Geneva: WHO, 2001.
- [8] P. G. Whittaker, S. Macphail, and T. Lind, "Serial hematologic changes and pregnancy outcome," *Obstetrics and Gynecology*, vol. 88, no. 1, pp. 33–39, 1996.
- [9] S. P. Salas, P. Rosso, R. Espinoza, J. A. Robert, G. Valdés, and E. Donoso, "Maternal plasma volume expansion and hormonal changes in women with idiopathic fetal growth retardation," *Obstetrics & Gynecology*, vol. 81, no. 6, pp. 1029–1033, 1993.
- [10] P. Hays, D. Cruikshank, and L. Dunn, "Plasma volume determination in normal and preeclamptic pregnancies," *Survey of Anesthesiology*, vol. 30, no. 1, p. 22, 1986.
- [11] E. I. Ugwuja, E. I. Akubugwo, U. A. Ibiam, and O. Onyechi, "Impact of maternal iron deficiency and anaemia on pregnancy and its outcomes in a Nigerian population," *The Internet Journal of Nutrition and Wellness*, vol. 10, no. 1, pp. 1–11, 2010.
- [12] Y. Balarajan, U. Ramakrishnan, E. Özaltın, A. H. Shankar, and S. V. Subramanian, "Anaemia in low-income and middle-income countries," *The Lancet*, vol. 378, no. 9809, pp. 2123–2135, 2011.
- [13] A. MohyAldeen, *Prevalence of Anemia and Platelet Deficiency Among Pregnant Women in Brack Al-Shati District in Southern Libya*, 2022.
- [14] A. A. El-Kholy, E. A. El-Kholy, A. H. Abdou, H. A. D. Karar, M. A. Bushara, K. Abdelaal, and R. Sayed, "Prevalence and associated factors of anemia among pregnant women and the impact of clinical pharmacist counseling on their awareness level: A cross-sectional study," *Saudi Pharmaceutical Journal*, vol. 31, no. 8, p. 101699, 2023.
- [15] N. Majed, A. Alkaseh, K. Ahmed, E. Albrane, and A. Suliman, "Prevalence of anemia and associated risk factors among pregnant women in Al Bayda City, Libya," *AlQalam Journal of Medical and Applied Sciences*, pp. 305–312, 2023.