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Preeclampsia development and neonatal outcomes in pregnant women who were anemic in the first trimester

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Ethics Committee Approval
Ethical approval was obtained from Gazi University Ethics Committee (Decision no: 2022-1237, 8 November 2022).
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Anemia is a disease that can be easily treated, but it is still widespread worldwide. Anemia can affect nearly 40% of women. Anemia has been extensively studied and related to a variety of pregnancy complications. The primary purpose of our study was to discover the relationship between preeclampsia and anemia in the first trimester, and the secondary goal was to analyze the outcomes of newborns born to these mothers.

Methods: This study was compiled as a retrospective cohort study. Age, gravida, parity, and thyroid stimulating hormone (TSH) levels were recorded in a patient's first visit file. Hemoglobin counts in the first trimester were analyzed as hemogram values. Those with a hemoglobin value <11 g/dl during pregnancy were classified as anemic. The patients' file records were reviewed to determine mode of delivery, birth weight, and Appearance, Pulse, Grimace, Activity, and Respiration (APGAR) scores. To confirm a diagnosis of preeclampsia, the American Congress of Obstetricians and Gynecologists (ACOG) criteria were used.

Results: After the exclusion of 186 women due to comorbidities and multiple pregnancies, 364 women were evaluated. The number of anemic pregnant women in the first trimester was 87 (23.9%), and 277 non-anemic women were matched with the anemic group. No statistical difference between the groups in terms of demographic characteristics, such as age, gravida, body mass index (BMI), and TSH were found. No statistical difference between the groups in terms of delivery type, infant birth weight, and APGAR scores were found ($P > 0.05$). Preeclampsia frequency was statistically higher in pregnant women who were anemic in the first trimester ($P = 0.032$).

Conclusion: Preeclampsia was found to be more common in pregnant women who were anemic in the first trimester. Although it would seem that neonatal outcomes are unaffected, we believe that the unaffected outcomes are due to iron replacement. To avoid pregnancy complications, it is crucial for women not to be anemic prior to becoming pregnant.

Keywords: Preeclampsia, Anemia, Pregnancy problems

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Introduction

The World Health Organization defines maternal anemia during pregnancy as hemoglobin (Hb) concentrations of ≤11.0 g/dL. Anemia is dangerous for both the mother and the fetus [1]. Anemia is a disease that can be easily treated, but it is still widespread worldwide. Recent observational data from a multi-centered study on 2103 women in the United Kingdom show that the prevalence is higher than 24.4% [2]. Another global study revealed that anemia affects nearly 40% of women [3].

Anemia has been extensively researched and is believed to be related to a number of pregnancy problems. Greater risks of maternal and perinatal mortality have been associated with preterm birth, hypertension, low birth weight, small-for-gestational-age (SGA) live births, anemia during pregnancy, and cesarean delivery [4–9]. Additionally, iron deficiency anemia causes an increases in the risk for needing a blood transfusion and/or cesarean section and was linked to a lower Appearance, Pulse, Grimace, Activity, and Respiration (APGAR) scores in a different study involving anemia's effects on mothers and newborns [10].

A number of infiltrating trophoblast cells were discovered in anemia in a study evaluating trophoblast invasion and apoptosis in pregnant anemic women in contrast to the diminished invasion of preeclampsia spiral arteries [11]. These data contradict studies that support unfavorable outcomes.

Studies on the relationship between adverse neonatal outcomes, such as preeclampsia and anemia, have yielded conflicting results. Our study's goal was to discover the link between preeclampsia and anemia in the first trimester and secondarily, to evaluate outcomes of the newborns born to these mothers.

Materials and methods

Patients who gave birth in our hospital between January and June 2022 were screened retrospectively. The study was conducted with the approval of the Gazi University Ethics Committee (Decision no: 2022-1237). All procedures were carried out in accordance with the Helsinki Declaration's ethical rules and principles. Because of the retrospective nature of the study and the use of anonymous research findings, informed consent was waived.

Data from a total of 550 women who gave birth were scanned. Multiple pregnancies and the mother having comorbid conditions, such as diabetes mellitus, hypertension, kidney diseases, hematological diseases, thyroid hormone dysfunction, and connective tissue diseases, were among the study's exclusion criteria. Because of multiple pregnancies and additional maternal disease, 186 women were excluded from the study. In total, 364 pregnant women were included in the study.

Age, gravida, parity, and thyroid stimulating hormone (TSH) levels were recorded in the patients' first visit file. Hemoglobin counts in the first trimester were analyzed as hemogram values. Those with a hemoglobin value <11 g/dl during pregnancy were classified as anemic (n = 87), while those with hemoglobin values ≥11 g/dl were classified as non-anemic (n = 277). Patients' hemoglobin levels at the time of delivery were re-evaluated. In the second trimester, all pregnant women were given iron supplements. The patients' file records were reviewed to determine mode of delivery, birth weight, and APGAR scores (first and fifth minutes).

To confirm a diagnosis of preeclampsia, the American Congress of Obstetricians and Gynecologists (ACOG) criteria were used. After the 20th gestational week, preeclampsia is diagnosed when the arterial blood pressure measurement is 140/90 mmHg or higher, accompanied by proteinuria or thrombocytopenia, pulmonary edema, renal failure, abnormal liver function, and vision problems.

Statistical analysis

The data was analyzed using the IBM SPSS Statistics 22 program. Descriptive statistics (mean, standard deviation) for numerical variables are provided when analyzing the study data. To compare the two groups, the independent sample t- and the chi-squared tests were used. Pearson's correlation analysis was used to investigate the relationship between numerical variables. Statistics were deemed significant at $P < 0.05$.

Results

After exclusion of 186 women due to comorbidities and multiple pregnancies, 364 women were evaluated out of 550 women who gave birth. The number of anemic pregnant women in the first trimester was 87 (23.9%) and the number of non-anemic pregnant women was 277 (76.1%).

Anemic and non-anemic pregnant women's demographic data were compared. In terms of age, gravida, parity, body mass index (BMI), and TSH levels, no statistical differences between the groups were found (Table 1).

Table 1: Comparison of demographic features and birth characteristics

	Anemic group (n = 87)	Control group (n = 277)	*P*-value
Age*	33.3 (5.4)	32.5 (5.6)	0.18
Gravida (median [min-max]) ¶	2 (1–7)	2 (1–6)	0.06
Parity ¶	1 (0–3)	0 (0–3)	0.06
BMI*	22 (1.4)	23.3 (2.0)	0.22
TSH*	2.1 (1.3)	2.0 (1.3)	0.59

*Data are given as mean (standard deviation [SD]) ¶ Data is given as median (minimum–maximum), BMI: Body mass index, TSH: Thyroid stimulating hormone

The groups were compared in terms of mode of delivery, baby weight, and first and fifth minute Apgar scores. No statistically significant differences between groups were found (Table 2). Sixty (16.5%) pregnant women were diagnosed with preeclampsia in the study. Preeclampsia frequency was statistically higher in pregnant women who were anemic in the first trimester ($P = 0.032$) as shown in Table 3.

Table 2: Comparison of maternal and neonatal outcomes

	Anemic group (n = 87)	Control group (n = 277)	*P*-value
Baby weight *	2677.87 (622)	2966 (818)	0.47
First minute Apgar *	8.3 (1.6)	7.8 (2.3)	0.31
Fifth minute APGAR score*	9.5 (1.2)	9.1 (2.0)	0.30

APGAR: Appearance, Pulse, Grimace, Activity, and Respiration, *Data are given as mean (SD)

Table 3: Comparison of the presence of preeclampsia in pregnancy based on anemia status

	Anemic group (n = 87)	Control group (n = 277)	*P*-value
Preeclampsia Group (n = 60)	21 (24.1%)	39 (14.1%)	0.032
Non-Preeclampsia Group (n = 364)	66 (75.9%)	239 (85.9%)	

Chi-squared test

At the time of delivery, the patients' hemoglobin levels were re-evaluated. The number of pregnant women who were anemic had decreased to 48. This value represented 13.2% of the population.

Discussion

Anemia, a serious public health issue, is becoming increasingly important in terms of causing fetal and maternal mortality during pregnancy. After excluding pregnant women with comorbidities and multiple pregnancies from our study, we found anemia in about a quarter (23.9%) of the pregnant women. Preeclampsia occurs at a statistically significant higher rate in anemic pregnant women.

Anemia and hypertensive diseases could not be linked in an old meta-analysis conducted by Xiong et al. [12] regardless of pregnancy stage. According to the review by Pea-Rosas et al. [13], no association between preeclampsia and anemia exists. Lin et al. [14] found no link between hypertensive diseases of pregnancy and anemia in a multicenter study of the Chinese population. Although this study included a large number of patients, the fact that it was multicenter raises concerns about data bias and inconsistency. Ali et al. [8] discovered that the risk of severe anemia and preeclampsia increased by 3.6 times in their study. However, a correlation was found in this study with patients who were diagnosed with anemia at the time of admission. It is difficult to conclude from this study that anemia detected at any stage of pregnancy causes preeclampsia. Because our study included pregnant women who were anemic in the first trimester, we believe that using our methodology would be more accurate in evaluating anemia as an increase in the risk of preeclampsia. The unadjusted odds ratios (ORs) for preeclampsia and mild, moderate, and severe anemia increased with anemia severity and were highest in women with unspecified anemia, according to a study by Smith et al. [15].

We also reviewed neonatal outcomes in our study. No difference in baby weights and APGAR scores of pregnant women who were anemic in the first trimester according to these evaluations were found. Bora et al. [16] studied 580 newborn babies and discovered that the baby birth weight decreased significantly with the decrease in hemoglobin. In 2018, a systematic review and meta-analysis found a relationship between maternal anemia and low birth weight, and 7243 articles were discussed in this study [17]. Iron replacement in these pregnant women may explain the lack of difference in neonatal outcomes in our study. Iron replacement is performed as a national health policy in the follow-up of pregnant women regardless of whether or not anemia is found. Anemic pregnant women recover with iron replacement in the subsequent trimesters. As a result, no statistically significant difference in neonatal outcomes was found. According to Haider et al.'s review [18], daily iron supplementation improves birth weight in a dose-response manner and may lead to a reduction in the risk of low birth weight.

Limitations

The study's most significant limitation is its retrospective design.

Conclusion

According to our findings, anemia plays a significant role in our society’s health. Preeclampsia was found to be more common in pregnant women who were anemic in the first trimester. Although it would seem that neonatal outcomes are unaffected, we believe that this finding is due to iron replacement. In order to avoid pregnancy complications, it's crucial for women not to be anemic prior to becoming pregnant.

References

1. World Health Organization (WHO). The Prevalence of Anemia in women: a tabulation of available information. Geneva, Switzerland: WHO; 1992/MCH/MSM/92.2.
2. Barroso F, Allard S, Kahan BC, Connolly C, Smethurst H, Choo L, et al. Prevalence of maternal anaemia and its predictors: a multi-centre study. Eur J Obstet Gynecol Reprod Biol. 2011;159:99–105.
3. Murphy JF, O’Riordan J, Newcombe RG, Coles EC, Pearson JF. Relation of haemoglobin levels in first and second trimester to outcomes of pregnancy. Lancet 1986;8488:992–5.
4. Stoltzfus R, Mullany L, Black RE. Iron deficiency anaemia. In: Ezzati M, Lopez A, Rodgers A, Murray CJL, editors. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Geneva (Switzerland): World Health Organization; 2004:163–210.
5. Brabin BJ, Hakimi M, Pelletier D. An analysis of anemia and pregnancy-related maternal mortality. J Nutr 2001;131:604–14s.
6. Klebanoff MA, Shiono PH, Selby JV, Trachtenberg AI, Graubard BI. Anemia and spontaneous preterm birth. Am J Obstet Gynecol 1991;164:59–63.
7. Ren A, Wang J, Ye RW, Li S, Liu JM, Li Z. Low first trimester hemoglobin and low birth weight, preterm birth and small for gestational age newborns. Int J Gynaecol Obstet 2007;98:124–8.
8. Ali AA, Rayis DA, Abdallah TM, Elbashir MI, Adam I. Severe anaemia is associated with a higher risk for preeclampsia and poor perinatal outcomes in Kassala Hospital, eastern Sudan. BMC Res Notes 2011;4:311.
9. Vural T, Toz E, Ozcan A, Biler A, Ileri A, Inan A. Can anemia predict perinatal outcomes in different stages of pregnancy? Pak J Med Sci. 2016;32:1354–9.
10. Drukker L, Hants Y, Farkash R, Ruchlemer R, Samueloff A, Grisaru-Granovsky S. Iron deficiency anemia at admission for labor and delivery is associated with an increased risk for cesarean section and adverse maternal and neonatal outcomes. Transfusion. 2015;55:2799–806.
11. Kadyrov M, Kingdom JC, Huppertz B. Divergent trophoblast invasion and apoptosis in placental bed spiral arteries from pregnancies complicated by maternal anemia and early-onset preeclampsia/intrauterine growth restriction. Am J Obstet Gynecol. 2006 Feb;194(2):557-63. doi: 10.1016/j.ajog.2005.07.035. PMID: 16458661.
12. Xiong X, Buekens P, Alexander S, Demianczuk N, Wollast E. Anemia during pregnancy and birth outcome: a meta-analysis. Am J Perinatol. 2000;17(3):137–46.
13. Pena-Rosas JP, De-Regil LM, Garcia-Casal MN, Dowswell T. Daily oral iron supplementation during pregnancy. Cochrane Database Syst Rev. 2015;7:CD004736.
14. Lin L, Wei Y, Zhu W, Wang C, Su R, Feng H, Yang H; Gestational diabetes mellitus Prevalence Survey (GPS) study Group. Prevalence, risk factors and associated adverse pregnancy outcomes of anaemia in Chinese pregnant women: a multicentre retrospective study. BMC Pregnancy Childbirth. 2018 Apr 23;18(1):111. doi: 10.1186/s12884-018-1739-8. PMID: 29685119; PMCID: PMC5914057.
15. Smith C, Teng F, Branch E, Chu S, Joseph KS. Maternal and Perinatal Morbidity and Mortality Associated With Anemia in Pregnancy. Obstet Gynecol. 2019 Dec;134(6):1234-1244. doi: 10.1097/AOG.0000000000003557. PMID: 31764734; PMCID: PMC6882541.
16. Bora R, Sable C, Wolfson J, Boro K, Rao R. Prevalence of anemia in pregnant women and its effect on neonatal outcomes in Northeast India. J Matern Fetal Neonatal Med. 2014 Jun;27(9):887-91. doi: 10.3109/14767058.2013.845161. Epub 2013 Oct 24. PMID: 24041147.
17. Figueiredo ACMG, Gomes-Filho IS, Silva RB, Pereira PPS, Mata FAFD, Lyrio AO, Souza ES, Cruz SS, Pereira MG. Maternal Anemia and Low Birth Weight: A Systematic Review and Meta-Analysis. Nutrients. 2018 May 12;10(5):601. doi: 10.3390/nu10050601. PMID: 29757207; PMCID: PMC5986481.
18. Haider BA, Olofin I, Wang M, Spiegelman D, Ezzati M, Fawzi WW; Nutrition Impact Model Study Group (anaemia). Anaemia, prenatal iron use, and risk of adverse pregnancy outcomes: systematic review and meta-analysis. BMJ. 2013 Jun 21;346:f3443. doi: 10.1136/bmj.f3443. PMID: 23794316; PMCID: PMC3689887.

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