Turk J Fam Pract 2025;29(3):127-139
DOI: 10.54308/TJFP.2025.806

Research Article

The effect of the presence of anemia during and after pregnancy on the development of postpartum depression symptoms

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ABSTRACT

Objective: Postpartum depression is a significant mental health issue that affects mothers in the postpartum period and can be influenced by various biological and environmental factors. This study aims to examine the impact of during pregnancy and the postpartum period on the occurrence of postpartum depression symptoms.

Methods: This cross-sectional observational study was conducted at Prof. Dr. Cemil Tascioglu City Hospital Training family health care center. A total of 104 patients within the first 6 months postpartum period were included in the study between September 5 and October 5, 2023. Data were collected through face-to-face interviews using questionnaires and analyzed using SPSS v.25 software. Symptoms of depression were assessed using the Edinburgh Postnatal Depression Scale (EPDS), and the results were evaluated based on this scale. Data obtained from the study were analyzed using IBM SPSS v.25 software, and $p < 0.05$ was considered statistically significant.

Results: A total of 104 postpartum women participated in the study. The mean age was 27.1±4.1 years; 50% of participants were university graduates, 53.8% were unemployed, and 94.2% were living with their spouses. Cesarean delivery was reported in 59.6% of cases. Prepartum anemia was observed in 14.4% of participants, while postpartum anemia was present in 43.3%. According to the Edinburgh Postnatal Depression Scale, the prevalence of postpartum depression symptoms was 14.4%. Low postpartum hemoglobin levels, living separately from the spouse, and the presence of postpartum anemia were found to be statistically significantly associated with depressive symptoms ($p<0.05$).

Conclusion: This study suggests that anemia and certain sociodemographic factors may be associated with depressive symptoms in the postpartum period. In primary care settings, conducting not only physical but also psychosocial assessments during postpartum follow-up is crucial for early identification and timely provision of appropriate support services.

Keywords: Anemia, postpartum depression, pregnancy

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Received: 13.09.2024 **Accepted:** 06.08.2025 **Published:** 30.09.2025

Introduction

Anemia is a condition characterized by a lower-than-normal concentration of hemoglobin (Hgb) or a reduced number of red blood cells (RBCs).[1] Erythropoietin, which is primarily produced in the kidneys, is known to be the most potent substance for stimulating RBC production. The production of erythropoietin is generally triggered by tissue hypoxia and is inversely proportional to Hgb concentration.[2] Anemias are typically classified into three categories: production deficiencies, increased destruction, and hemorrhagic anemias. These anemias can further be categorized based on red blood cell size (MCV values) as microcytic, normocytic, and macrocytic. For instance, iron deficiency anemia typically results in microcytic anemia, whereas deficiencies in folate and vitamin B12 are more commonly associated with macrocytic anemia. During pregnancy, a process initiated by a reduction in iron stores increases the need for iron. Approximately 1000 mg of iron is required throughout pregnancy. Some of this iron is needed for the fetus, some for blood loss during delivery, and some for increased erythrocyte production.[3]

Pregnancy and the postpartum period are times when both joy and stress are experienced. Psychological problems such as depression and anxiety are frequently observed during this time. In particular, postpartum depression (PPD) is a condition that often occurs in the first few months or even longer after giving birth. A study analysing data from 80 different countries found a PPD rate of 17.22%, while studies conducted in Türkiye reported rates of around 20%. The main symptoms of PPD include disinterest, fatigue, sadness and sleep disturbances.[4]

According to the DSM-5 diagnostic criteria, postpartum depression is defined as a major depressive episode that begins within the first four weeks following childbirth, making this period crucial for diagnostic evaluation.[5] However, in clinical practice and public health research, assessments extending beyond this period are often preferred. For instance, in several studies, including those by Mori and colleagues, depression symptoms in the postpartum period have been evaluated at different time points extending up to six months postpartum, and it has been shown that these symptoms have significant associations with physical and psychosocial variables throughout this period.[6,7]

Anemia during pregnancy and the postpartum period significantly increases the risk of postpartum depression. Possible causes of this include factors such as the reduction in Hgb levels affecting neurotransmitter function and the decrease in cytokine levels. Therefore, addressing anemia during pregnancy and implementing appropriate treatment and nutritional measures may play a crucial role in reducing the risk of postpartum depression.[8]

The objective of this study is to investigate the impact of anemia during pregnancy and the postpartum period on the likelihood of postpartum depression during the first six months following childbirth.

Materials and Methods

This research, which is a cross-sectional descriptive survey, included 104 patients who met the inclusion criteria, were within the first six months postpartum, and presented to Prof. Dr. Cemil Tascioglu City Hospital Training Family Health Center between September 5 and October 5, 2023. 12 individuals who did not meet the inclusion criteria and 2 who declined participation were excluded from the study. After the clinical examination, written informed consent was obtained, and a 20-question face-to-face survey was administered to each participant for 10 minutes in a separate clinic room. The

study was concluded once the target sample size was reached. In line with this, the sample size was calculated to ensure the validity of the study. There were 196 patients registered at Prof. Dr. Cemil Tascioglu City Hospital Training Family Health Center who have given birth in the past year. A study conducted by Shefaly Shorey found the prevalence of postpartum depression (PPD) to be 17% in the literature.[9] Considering this rate, with a 95% confidence interval, a 5% margin of error, and a study power of 80%, the required minimum sample size was calculated to be 104 participants.

Between 5 September and 5 October 2023, postpartum patients within the first six months who presented at the Prof. Dr. Cemil Tascioglu City Hospital Training Family Health Centre and agreed to participate were enrolled in the study. The first six months postpartum is a frequently used period in the literature for monitoring depressive symptoms. Therefore, the sample of our study was limited to this period.[6,7] Patients who were more than six months postpartum, had previously been diagnosed with major depression, had a diagnosis of hemoglobinopathy, had delivered a baby with syndromic or mental-motor retardation, had experienced infant mortality, or declined to participate were excluded from the study.

A 20-question survey developed by the researchers was administered verbally to the participants and completed in the study room, which took approximately 10 minutes without disrupting clinic activities. The first 10 questions of the questionnaire were related to the sociodemographic characteristics of the participants, number of children, education level, history of smoking and alcohol consumption, education level, cohabitation with spouse, history of previous depression, employment status, income and expenditure status, mode of delivery, and history of iron treatment during pregnancy. Hemogram values used in the diagnosis of anaemia during pregnancy and postnatal care were from the Department of Turkish Ministry of Health guidelines for antenatal and postnatal care.[10,11] In addition to the 10-item survey, the Edinburgh Postnatal Depression Scale (EPDS) was used.[12] The content and methodology of the survey were explained to the women participating in the study, and their consent was obtained prior to the commencement of the study.

Edinburgh Postnatal Depression Scale (EPDS)[12]: This scale was developed for screening purposes to identify the risk of depression in women during the postpartum period. In the validity and reliability study conducted by Engindeniz, the internal consistency coefficient of the EPDS was found to be 0.79, and the split-half reliability was 0.80. When the cutoff point of the scale was set at 12/13, its sensitivity was found to be 0.84, specificity 0.88, positive predictive value 0.69, and negative predictive value 0.94. The Turkish adaptation of the EPDS is a self-report scale in a four-option Likert format. Responses are scored from 0 to 3; items 1, 2, and 4 are scored 0, 1, 2, and 3, while items 3, 5, 6, 7, 8, 9, and 10 are scored inversely as 3, 2, 1, and 0. The scale has a cutoff point of 13, and women with scores of 13 or higher were included in the risk group. The correlation coefficient between the EPDS and the General Health Questionnaire (GHQ) was found to be r: 0.7 ($p<0.001$), supporting the validity of the scale.[13]

Data analysis was performed using IBM SPSS v.25 software. The normality of continuous variables was assessed using the Kolmogorov-Smirnov test. For continuous variables, those with normal distribution were expressed as mean ± standard deviation, and those without normal distribution were expressed as median (minimum-maximum). Categorical variables were presented as frequency and percentage. For comparing two groups of continuous variables, either the independent t-test or the Mann-Whitney U test was used, and for comparing three groups, either ANOVA or the Kruskal-Wallis test was applied, depending on

the distribution. Post-hoc analysis for intergroup significance was performed using the appropriate test, either the Games-Howell or LSD test. Since the conditions for parametric tests were not met, relationships were examined using Spearman correlation analysis. For comparing prenatal and postnatal glucose values, since the data were non-parametric, the Wilcoxon test was used. Binary logistic regression with the Enter method was applied to examine the factors affecting postpartum depression (PPD). Variables with $p<0.25$ in univariate analysis and those considered clinically relevant to the dependent variable were included in the model. The model's goodness-of-fit was evaluated using the Hosmer-Lemeshow test, and its explanatory power was assessed using Nagelkerke R^2. A p-value of <0.05 was considered statistically significant.

Results

A total of 104 participants were included in our study. Upon examining the educational background of the participants, 50% were university graduates, 34.6% had completed high school, and 15.4% had finished primary school. Regarding family structure, the vast majority of participants (94.2%) were found to live with their spouses. The rates of smoking and alcohol use were 12.5% and 8.7%, respectively. The mean age of the participants was 27.12 ± 4.14 years. The number of births and depression scale scores are presented in Table 1.

Among the participants, 16.3% (n=17) did not receive iron treatment during pregnancy, while 83.7% (n=87) received iron treatment. A history of treatment for major depression was reported by 15.4% (n=16) of the participants. Regarding the mode of delivery, cesarean section was more common (59.6%, n=62) compared to vaginal delivery (40.4%, n=42). When evaluating the presence of postpartum depression (PPD) symptoms, 14.4% of participants (n=15) were found to have PPD symptoms, while 85.6% (n=89) showed no symptoms. The rate of anemia before delivery was 14.4% (n=15), while the rate of anemia after delivery was 43.3% (n=45).

The total score of the Edinburgh Postnatal Depression Scale (EPDS) was examined among the pregnant women, and the median scores and statistical significance levels of the groups were evaluated based on education level, employment status, income level, smoking and alcohol use, depression treatment history, iron supplementation during pregnancy, mode of delivery, presence of anemia before pregnancy, and presence of postpartum anemia. No significant relationship was found between the EPDS score and education level, employment status, income level, smoking and alcohol use, depression treatment history, iron supplementation during pregnancy, or the presence of anemia before pregnancy. However, statistically significant differences in the total EPDS score were found between the groups based on family status (living with spouse vs. living separately) and mode of

Table 1. Participants' birth ınformation, depression scale scores, and hemoglobin values

Variable	Mean ± SD	Median (Min-Max)
Age (years)	27.12 ± 4.14	27 (19-38)
Number of births	1.73 ± 0.81	2 (1-4)
Number of children	1.75 ± 0.84	2 (1-4)
Total Edinburgh Postnatal Depression Scale score	7.62 ± 4.91	7 (0-21)
Prepartum hemoglobin	11.84 ± 0.88	11.9 (9.6-14.2)
Postpartum hemoglobin	11.13 ± 0.84	11.2 (9.6-12.9)

delivery (normal delivery vs. cesarean section). For instance, the median depression score of pregnant women living with their spouse (6.5) was significantly lower than those living separately (p<0.001). Similarly, the median depression score of women who had a normal delivery (4.5) was significantly lower than those who had a cesarean section (p=0.011) (Table 2).

Table 2. Edinburgh Postnatal Depression Scale total scores by various variables

Variable	Median (Min-Max)	p-value
Education level		
Primary school	6 (1-13)	0.163[a]
High school	6 (0-17)	
University	7.5 (0-21)	
Employment status		
Employed	8 (1-21)	0.248[a]
Not employed	6 (0-21)	
Quit work	6 (0-12)	
Income level		
Income less than expenses	6 (1-21)	0.839[a]
Balanced income and expenses	7 (0-21)	
Income greater than expenses	7 (0-18)	
Family status		
Lives with spouse	6.5 (0-18)	**<0.001**[b]
Lives separately from spouse	17 (11-21)	
Smoking status		
Smokes	10 (3-17)	0.079[b]
Does not smoke	7 (0-21)	
Alcohol use		
Uses alcohol	8 (1-17)	0.528[b]
Does not use alcohol	7 (0-21)	
Depression treatment history		
Did not receive depression treatment	6.5 (0-21)	0.177[b]
Received depression treatment	8 (1-20)	
Iron supplementation during pregnancy		
Did not receive iron treatment	6 (1-17)	0.644[b]
Received iron treatment	7 (0-21)	
Mode of delivery		
Normal spontaneous delivery (NSD)	4.5 (0-14)	**0.011**[b]
Cesarean section (C/S)	8 (0-21)	
Prepartum anemia status		
No anemia	7 (0-21)	0.889[b]
Anemia present	7 (0-20)	
Postpartum anemia status		
No anemia	5 (0-21)	**0.007**[b]
Anemia present	8 (0-21)	

a: Kruskal-Wallis Test, b: Mann-Whitney U Test.

Correlation analysis was conducted to examine the relationship between the total score of the Edinburgh Postnatal Depression Scale (EPDS) and variables such as age, number of births, number of children, prepartum Hgb levels, and postpartum Hgb levels. A weak positive correlation was identified between age and the total EPDS score (r=0.204, p=0.038), suggesting that as age increases, the depression score tends to rise. No significant association was found between the number of births or the number of children and the depression score (r=0.144, p=0.146 and r=0.123, p=0.215, respectively). Additionally, no significant relationship was observed between prepartum Hgb levels and depression score (r=-0.062, p=0.531). However, a moderate negative correlation was found between postpartum Hgb levels and depression score (r=-0.230, p=0.019), indicating that higher postpartum Hgb levels are associated with a reduction in depression scores (Table 3). A statistically significant positive relationship was observed between the difference in Hgb levels before and after delivery and the postpartum depression scale score (p=0.003).

A statistically significant difference was observed between prepartum Hgb levels and employment status (p=0.025) (Table 4). Post-hoc analysis showed that working women had significantly higher prepartum Hgb levels compared to their non-working counterparts (p=0.012). However, no significant difference was found between postpartum Hgb levels and employment status (p=0.248). A significant difference was also found between prepartum Hgb levels and income level (p=0.025). Post-hoc analysis indicated that women with balanced income and expenses had significantly higher prepartum Hgb levels than those with lower income than expenses (p=0.014). No significant difference was found between postpartum Hgb levels and income level (p=0.474).

No significant relationship was found between prepartum and postpartum Hgb levels and family status, smoking and alcohol use, depression treatment history, iron supplementation, and mode of delivery. Pregnant women with prepartum anemia were found to have significantly lower postpartum Hgb levels (p<0.001). Similarly, women with postpartum anemia had significantly lower prepartum Hgb levels (p<0.001). A comparison of prepartum and postpartum Hgb levels revealed a statistically significant decrease in postpartum Hgb levels (p<0.001).

Table 3. Correlation analysis between Edinburgh Postnatal Depression Scale total score, prepartum Hgb, and postpartum Hgb

Variable	Edinburgh Postnatal Depression Scale Total Score	Prepartum Hgb	Postpartum Hgb
Age	r = 0.204	r = -0.188	r = -0.169
	p = **0.038**[a]	p = 0.055[a]	p = 0.087[a]
Number of births	r = 0.144	r = -0.103	r = -0.189
	p = 0.146[a]	p = 0.299[a]	p = 0.055[a]
Number of children	r = 0.123	r = -0.105	r = -0.184
	p = 0.215[a]	p = 0.288[a]	p = 0.062[a]
Prepartum Hgb	r = -0.062		**r = 0.727**
	p = 0.531[a]		**p < 0.001**[a]
Postpartum Hgb	r = -0.230	**r = 0.727**	
	p = 0.019[a]	**p < 0.001**[a]	
Difference in Hgb values (prepartum Hgb - postpartum Hgb)	**r = 0.292**	**r = 0.303**	**r = -0.342**
	p = 0.003	**p = 0.002**	**p < 0.001**

a: Spearman's correlation test, Hgb: hemoglobin.

Table 4. Prepartum and postpartum Hgb levels by various variables

Variable	Prepartum Hgb Mean ± SD	p-value	Post-hoc	Postpartum Hgb Median (Min-Max)	p-value	Post-hoc
Education Level						
Primary school	11.91 ± 0.64	0.895[b]	-	11.40 (10.00-12.60)	0.474[e]	-
High school	11.87 ± 0.89			11.10 (9.80-12.70)		
University	11.80 ± 0.95			10.95 (9.60-12.90)		
Employment Status						
Employed	12.11 ± 0.93	**0.025**[b]	**(a-b) 0.012**[c]	11.20 (10.00-12.90)	**0.011**[e]	**(b-c) 0.016**[f]
Not employed	11.63 ± 0.81			11.00 (9.60-12.40)		
Quit work	12.07 ± 0.87			11.80 (10.20-12.70)		
Income Level						
Income less than expenses	11.46 ± 0.97	**0.039**[b]	**(a-b) 0.014**[c]	11.20 (9.60-12.40)	0.407[e]	-
Balanced income and expenses	12.01 ± 0.84			11.20 (9.80-12.90)		
Income greater than expenses	11.73 ± 0.81			10.80 (9.80-12.70)		
Family Status						
Lives with spouse	11.85 ± 0.86	0.857[a]	-	10.65 (9.80-12.20)	0.288[d]	-
Lives separately from spouse	11.78 ± 1.26			11.20 (9.60-12.90)		
Smoking Status						
Smokes	11.86 ± 0.85	0.924[a]	-	11.00 (10.10-12.40)	0.844[d]	-
Does not smoke	11.84 ± 0.89			11.20 (9.60-12.90)		
Alcohol Use						
Uses alcohol	12.20 ± 0.86	0.213[a]	-	11.60 (10.20-12.90)	0.129[d]	-
Does not use alcohol	11.81 ± 0.88			11.00 (9.60-12.70)		
Depression Treatment History						
Did not receive depression treatment	11.87 ± 0.89	0.531[a]	-	11.20 (9.60-12.90)	0.735[d]	-
Received depression treatment	11.71 ± 0.87			11.10 (10.10-12.70)		
Iron Supplementation during Pregnancy						
Did not receive iron treatment	11.77 ± 1.03	0.721[a]	-	10.90 (9.60-12.70)	0.860[d]	-
Received iron treatment	11.86 ± 0.85			11.20 (9.60-12.90)		
Mode of Delivery						
Normal spontaneous delivery (NSD)	11.77 ± 0.83	0.476[a]	-	11.10 (9.60-12.70)	0.513[d]	-
Cesarean section (C/S)	11.89 ± 0.92			11.20 (9.80-12.90)		
Prepartum Anemia Status						
No anemia	12.07 ± 0.73	**<0.001**[a]	-	11.20 (9.80-12.90)	**<0.001**[d]	-
Anemia present	10.50 ± 0.36			10.20 (9.60-11.20)		
Postpartum Anemia Status						
No anemia	12.27 ± 0.65	**<0.001**[a]	-	11.80 (1.00-12.90)	**<0.001**[d]	-
Anemia present	11.28 ± 0.84			10.30 (9.60-10.90)		

a: Independent Samples Test, b: One-Way Anova Test, c: LSD Test, d: Mann-Whitney U Test, e: Kruskal-Wallis Test, f: Games-Howell Test.

Table 5. Factors affecting postpartum depression risk - logistic regression analysis

Variable	n (%)	OR (95% CI)	p-value
Education Level (High school graduate vs others)	36 (34.6)	1.61 (0.12-21.40)	0.716
Education Level (University graduate vs others)	52 (50.0)	1.87 (0.19-18.17)	0.589
Family Status (Ref: Living with spouse)	6 (5.8)	46.13 (3.51-605.71)	**0.004**
Employment Status (Employed vs others)	33 (31.7)	1.53 (0.37-6.28)	0.553
Employment Status (Quit work vs others)	15 (14.4)	0.00 (0.00-0.00)	0.999
Mode of Delivery (Ref: Normal spontaneous delivery - NSD)	62 (59.6)	3.28 (0.57-18.73)	0.180
Postpartum Anemia	15 (14.4)	2.10 (0.49-8.93)	0.312
Postpartum Hgb Drop	-	1.25 (0.48-3.26)	0.643
R= 0,37, -2 loglikelihood= 61,20, Omnibus test: 0,002, Hosmer ve Lemeshow test: 0,736			

Ref: Reference, Hgb: Hemoglobin.

Variables influencing postpartum depression (PPD) scores were initially evaluated through univariate logistic regression analysis. Variables with a p-value of <0.25, including education level, family status, employment status, the change in postpartum Hgb levels compared to prepartum levels, mode of delivery, and the presence of postpartum anemia, were subsequently incorporated into a multivariate logistic regression model, which was constructed using the Enter method. The analysis revealed that education level, employment status, mode of delivery, and presence of postpartum anemia did not have a significant impact on the occurrence of PPD symptoms. However, it was found that living separately from one's spouse significantly increased the likelihood of PPD, with an odds ratio of 46.13 (95% CI: 3.51-605.71) (Table 5).

Discussion

This study investigated the relationship between anemia and depressive symptoms during the first six months postpartum. According to our findings, postpartum depression (PPD) risk was identified in 14.4% of the participants. Notably, a decline in postpartum hemoglobin levels, the presence of anemia, and living separately from a spouse were found to be significantly associated with depression. In the multivariate analysis, it was determined that living separately from a spouse increased the risk of PPD by 46 times, making it one of the most striking results of the study. Additionally, individuals with a significant decrease in hemoglobin levels were observed to have higher depression scores.

In our study, the mean EPDS score was 7.62 ± 4.91. This rate was reported as 5.61 ± 4.51 in the study by Özşahin et al., 10.06 ± 5.54 in Çınar et al., and 8.77 ± 5.40 in Erkal Eksoy et al.[14-16] These discrepancies in EPDS scores may be attributed to sociocultural differences between regions and variations in sample characteristics. While the probability of PPD based on EPDS was 14% in our study, Demir et al. reported 34.8%, and Tan et al. found 15.8%.[17,18] A global study involving 133,313 postpartum women reported an average PPD prevalence of 14%, with higher rates observed in developing countries (e.g., China).[16] Similarly, a comprehensive meta-analysis of 565 studies from 80 countries estimated the worldwide PPD prevalence at 17.22%, while the rate was 21.87% across 26 studies from Türkiye.[19] The PPD risk prevalence identified in our study aligns with rates reported in Türkiye and European countries.

In our study, no significant association was found between EPDS scores and education level, employment status, income level, or tobacco/alcohol use. However, Babacan Gümüş et al. reported a negative correlation between

education level and PPD.[20] Similarly, a study of 324 postpartum women in Türkiye found higher depression rates among those with secondary education or lower compared to those with high school or higher education.[17] In contrast to these national findings, our study observed a non-significant trend toward higher EPDS scores with increasing education levels. This discrepancy may stem from our smaller sample size, as a meta-analysis of 33 global studies demonstrated that lower education levels are consistently associated with higher depression risk.[19] In the literature, it is observed that the rate of postpartum depression (PPD) increases as education level decreases. The lack of this association in our study may be attributed to the small sample size.

Existing literature consistently demonstrates an inverse relationship between socioeconomic status and postpartum depression (PPD), with lower income levels being associated with a higher likelihood of depressive symptoms.[19,21,22] Similarly, numerous studies have identified smoking as a significant risk factor for PPD.[20,23,24] Furthermore, a large-scale study (n=50,377) revealed that maternal alcohol consumption was positively associated with increased PPD risk.[25] Contrary to these established findings, our study failed to demonstrate a statistically significant association between smoking, alcohol use, and PPD risk. This discrepancy may be attributable to the limited number of participants reporting tobacco or alcohol use in our sample, potentially resulting in insufficient statistical power to detect existing associations.

In our study, we examined whether a history of depression treatment was associated with an increased risk of postpartum depression (PPD), but found no significant relationship. This contrasts with numerous studies in the literature, which demonstrate that a history of depression significantly elevates the risk of PPD.[21,26,27] While the increased PPD risk among individuals with prior depression episodes is an expected outcome — and indeed, 15.4% of our participants reported previous depression treatment, with correspondingly higher EPDS scores — the magnitude of this difference was not statistically significant in our study population.

In our study, when evaluating prepartum anemia status, 85.6% (n=89) of the participants were found to be without anemia, while 14.4% had anemia. Postpartum anemia was detected in 43.3% of the participants. In the literature, a study conducted by Karbancıoğlu Cantürk et al.[28] with 2169 pregnant women in Türkiye found the prepartum anemia rate to be 14%. Another study conducted in 2024 in Ankara examined 567 pregnant women, with anemia detected in 12.3% of them.[29] A study conducted in Elazığ, Türkiye, found the anemia rate among pregnant women to be 27.9%.[30] According to the World Health Organization's 2019 data, the anemia rate among pregnant women in Türkiye is 29.8%.[31] Studies conducted in Türkiye have shown that the prevalence of anemia in pregnant women varies by region, and our study's findings are similar to those of studies conducted in metropolitan areas, although they are lower compared to the national average. A global study on anemia in pregnant women conducted between 2000 and 2019 reported an anemia rate of 32.3% (5.2–65.3) worldwide, and 22.0% (6.3–48.2) in Europe.[32] The prevalence of anemia is highly influenced by various factors, including income level, geographical location, and dietary habits, which contribute to the significant variation in anemia rates.

In our study, no relationship was found between iron supplementation during pregnancy, prepartum anemia, and the likelihood of PPD. However, it was observed that postpartum anemia increased the likelihood of PPD, and the risk of PPD rose as Hgb levels decreased. A study conducted in Bursa, Türkiye, with 140 postpartum women found a correlation between hemoglobin

levels measured upon hospital admission and fatigue and depression. It was observed that as the mothers' hemoglobin levels increased, their fatigue levels decreased, energy levels increased, and depression levels decreased.[33]

In a literature review conducted by Wassef et al., eight out of ten studies examined showed that the risk of PPD was higher in anemic women.[34] In a double-blind, placebo-controlled study conducted in the first week postpartum, which involved 70 women with PPD, iron supplementation was provided, and the EPDS score was assessed after the supplementation. It was found that the group receiving iron supplementation had a significantly lower EPDS score compared to the group that did not receive supplementation.[35] A prospective study conducted with Japanese pregnant women, involving 1128 participants, found no significant relationship between anemia in the second and third trimesters and PPD; however, postpartum anemia was found to increase the risk of PPD.[36]

According to the 2013 WHO data, the prevalence of cesarean section by continent was reported as 36% in America, 23% in Europe, 9% in Asia, and 4% in Africa. This variation may be attributed to factors such as access to healthcare services, differences in medical practices, and cultural influences across geographical regions.[37] In Türkiye, the cesarean rate was 52.4% according to 2014 data, and it increased to 60.9% in 2021. In our study, the cesarean rate was found to be 59.6%.[38,39] Over the years, cesarean birth rates have increased in many countries worldwide.[37]

In a study conducted by Erkal Aksoy et al. with 324 postpartum women, no significant effect of mode of delivery on the likelihood of PPD was observed.[16] Although a higher rate of PPD was found among mothers who delivered via cesarean section in the study by Gülnar et al., the result was not statistically significant.[40] A meta-analysis conducted by Sun et al. found no difference in the risk of depression between cesarean and vaginal deliveries.[41] Similarly, in our study, the likelihood of PPD did not differ according to the mode of delivery.

In a study by Malus et al., it was found that married women exhibited fewer postpartum depression symptoms.[42] Another study reported that the prevalence of PPD was significantly lower in married women compared to those who were not married.[43] A study conducted by Aydın et al. found a significant relationship between increased perceived spousal support and a reduction in PPD symptoms.[44] Similarly, in our study, it was determined that living separately from the spouse increased the risk of PPD by 46.13 times (95% CI: 3.51-605.71).

This study has several limitations that should be considered when interpreting the findings. First, the relatively small sample size may have reduced statistical power to detect significant associations. Second, data collection was restricted to the first six months postpartum, potentially overlooking later-onset cases of postpartum depression. Third, depression assessment relied solely on the Edinburgh Postnatal Depression Scale (EPDS) rather than clinical diagnosis, which may affect the accuracy and generalizability of our findings. These methodological constraints suggest caution when extrapolating our results to broader populations or clinical settings.

This study was designed to investigate the prevalence of postpartum depression (PPD) and evaluate its associated risk factors among postpartum women. Our analysis identified several statistically significant predictors of PPD, including marital status (living without a partner), postpartum hemoglobin (Hgb) decline, and the presence of postpartum anemia. Notably, women who were not cohabiting with their partners demonstrated a substantially elevated risk of developing PPD symptoms. These findings underscore the critical importance of comprehensive postpartum care that integrates

both biological parameters (e.g., Hgb levels) and psychosocial assessment in primary healthcare settings. Family physicians conducting postpartum follow-ups should be particularly attentive to these biopsychosocial risk factors to ensure early identification and intervention for at-risk mothers.

Ethical approval

This study has been approved by the Health Science University Istanbul Prof. Dr. Cemil Tascioglu City Hospital Clinical Research Ethics Committee (approval date 28.08.2023, number 146). Written informed consent was obtained from the participants.

Author contribution

The authors declare contribution to the paper as follows: Study conception and design: SA; data collection: AK, FE; analysis and interpretation of results: AK; draft manuscript preparation: AK, NCA. All authors reviewed the results and approved the final version of the article.

Source of funding

The authors declare the study received no funding.

Conflict of interest

The authors declare that there is no conflict of interest.

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