

Evaluation of Anemia and Related Factors in Pregnancy: A Cross-Sectional Study

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ABSTRACT

Aim: Anemia is a public health problem in developing countries. In our study, it is aimed to evaluate the relationship between the presence of anemia in pregnancy and the factors which influence anemia.

Methods: Our study was conducted with 567 voluntary pregnant contributors who attended as outpatients to Gulhane Education and Research Hospital Obstetrics Polyclinics between December 2018 and February 2019. The assessment questionnaire included questions about sociodemographic information, obstetric history and medication adherence, and the Patient Health Questionnaire-9.

Results: Mean age of 567 voluntary pregnant contributors was 28.1±5.0 (18-43) years and mean hemoglobin values were 12.4±1.3 (6.1-15.6) g/dL. Of the contributors, 12.3% had hemoglobin values <11 g/dL of which was described as anemia. Patients who had taken their medication regularly were less likely to have anemia than the ones who were not under regular treatment. Patients with a chronic disease before pregnancy showed significantly lower anemia prevalence compared to patients without the chronic disease. Based on Patient Health Questionnaire-9 scores, 43.9% of contributors showed mild signs of depression. There was no statistically significance between presence of anemia and signs of depression.

Conclusion: Anemia was more frequent in pregnant women who experienced anemia in their previous pregnancy, and women having chronic disease and becoming pregnant were less likely to have anemia. Early diagnosis and treatment of anemia, which significantly affects maternal and infant health, can be possible during pregnancy, since it should be evaluated in all women planning and conceiving a pregnancy.

Keywords: anemia, depression, pregnancy, family medicine

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Introduction

Anemia is defined as low hemoglobin and hematocrit values, with low number of red blood cells which are determined according to age and gender (1). According to the definition of the World Health Organization (WHO) defines anemia as low hemoglobin values which is below 13 g/dL in male adults, 12 g/dL in female adults, and 11 g/dL in pregnant women (2). The 2011 prevalence study of WHO detected that the prevalence of anemia was 38.2% in pregnant females, 29.4% in females of reproductive age, and 42.6% in children all around the world (3).

The most commonly seen hematologic pathology in pregnancy is anemia and the most frequent cause of it is iron deficiency (4). Especially in 20-28th weeks of gestation, blood plasma level increases around 30-50% and number of red blood cells also increases. Regarding the increase in red blood cells being relatively less, physiological dilutional anemia occurs (5). However, the additional 1000 mg iron requirement could not be provided by supplies of the mother or nutritional elements (5). Therefore, iron support for the pregnant program was commenced by the Ministry of Health in our country in 2007 (6). Besides, United States Preventive Services Task Force (USPSTF) recommends screening of iron deficiency anemia in asymptomatic pregnant women by checking hemoglobin and hematocrit levels (6).

The occurrence of iron deficiency anemia in pregnancy is affected by multiple factors such as parity, the number of dead or alive births, taking iron supplies between pregnancies or not, amount of blood loss during deliveries, gynecologic history (intrauterine device, hypermenorrhea, menometrorrhagia), nutritional history, consumption of sufficient iron-containing foods or not, individual iron absorption capacity (gastrointestinal diseases, parasitic infections, etc.), and whether appropriate treatment of existing anemia is received (7).

Anemia in pregnancy is associated with poor perinatal results (8). Anemia which is seen through pregnancy may lead to prematurity, an increase in baby/mother deaths, and neuro-developmental disorders during childhood (5,8). Maternal anemia

may also cause a tendency of having asthma, schizophrenia, allergy, and pulmonary functional impairments for children for further periods of life as demonstrated in animal experiments (9,10). In our study, it was aimed to investigate the prevalence of anemia and related factors in pregnant women whose anemia was often encountered.

Methods

This cross-sectional and descriptive study was performed on volunteer patients between the age of 18 and 45 who attended the University of Health Sciences, Gulhane Education and Research Hospital, Obstetrics, and Gynecology Polyclinics as outpatients and had clinically proven pregnancies. The patients' data of the research were obtained by survey method between the dates of November 1, 2018, and January 31, 2019.

In sample selection, the minimum required patient number was calculated as 292 by using the Open-Epi program with a 95% confidence interval and 5% tolerance. Laboratory test results used for the identification of anemia were obtained from patients or hospital information systems. Of 650 patients who filled out the questionnaire form, 567 (87.2%) patients records were accessible in terms of complete blood count parameters. A questionnaire form with a total of 39 questions that contains socio-demographic info, obstetric history, medication compliance status, and Patient Health Questionnaire (PHQ-9) was applied to patients who met the inclusion criteria.

Statistical Package for Social Sciences (SpSS) for Windows 22 program was used for data analysis. The normality of continuous variables was evaluated by using Kolmogorov-Smirnov, histogram, Shapiro-Wilk tests. Descriptive statistics were indicated as mean $\pm$ standard deviation for continuous variables and as case numbers and percentages for nominal variables. Continuous variables that have normal distribution were compared by Student t-test and continuous variables without normal distribution were compared by using the Mann Whitney-U test. Spearman correlation analysis was conducted. The Chi-Square test was used for the comparison of categorical

variables. The statistical significance level was accepted as a p-value lower than 0.05.

Results

The mean age of 567 pregnant women who contributed to the study was 28.1 ± 5.0 , and the mean gestation week at the time of attendance was 21.1 ± 11.6 . Of the participants, 44.4% (n=252) graduated from university whilst 45.8% (n=257) of their spouses graduated from university. Mean systolic blood pressure (SBP) was 119.2 ± 13.7 mmHg and diastolic blood pressure (DBP) was 68.8 ± 10.6 mmHg. Only 5.8% of the participants were smokers. Characteristics regarding the obstetric history of the participants were shown in Table 1.

Table 1. Obstetric history characteristics of pregnant women

Parameters		n (%)
Number of previous pregnancies	0	245 (43.3)
	1	175 (30.6)
	2	92 (16.3)
	3 and above	56 (9.8)
Number of previous live births	0	310 (54.8)
	1	167 (29.5)
	2	78 (13.8)
	3 and above	11 (1.9)
Number of previous abortions	0	426 (75.3)
	1	101 (17.8)
	2	29 (5.1)
	3 and above	10 (1.8)
Frequency of planned pregnancies (n=557)	Yes	441 (77.8)
	No	116 (22.2)
Prevalence of chronic diseases before pregnancy (n=563)	Yes	112 (19.9)
	No	451 (80.1)

Mean hemoglobin (Hb) level was detected as 12.4 ± 1.3 g/dL, mean hematocrit (Hct) value was $36.5\% \pm 3.5$, mean erythrocyte volume was (MCV) 84.6 ± 6.4 fL, mean red blood cell count (RBC) was 4.3 ± 0.4 $10^3/\text{mm}^3$, mean erythrocyte distribution (RDW) width was 41.8 ± 7.3 fL and mean ferritin level was 28.4 ± 59.1 ng/mL based on laboratory data of the participants obtained from hospital information system or the participants themselves. Of the participants, 12.3% (n=70) were anemic concerning current Hb levels. The frequency of anemia was significantly associated with incremental trimester date of pregnancy (p=0.005) (Table 2).

Table 2. Comparison of sociodemographic characteristics between groups with and without anemia

Parameters	n=567	Without anemia n=497 (87.7%)	With anemia n=70 (12.3%)	p
Age groups (years)	18-25	155(86.6%)	24(13.4%)	0,879 ^a
	26-35	290(88.1%)	39(11.9%)	
	36-45	49 (87.5%)	7 (12.5%)	
Trimester	1.	184(92.9%)	14 (7.1%)	0,005^a
	2.	133(88.1%)	18(11.9%)	
	3.	172(82.3%)	37(17.7%)	
Health insurance	SGK (SSI)	468(87.5%)	67(12.5%)	1,0 ^b
	Other	27 (90.0%)	3 (10.0%)	
Place of residence	Provincial			0,834 ^a
	district	309(88.0%)	42(12.0%)	
	Other	188(87.4%)	27(12,6%)	
Education level	Primary	86 (85.7%)	16(14.3%)	0,233 ^a
	Highschool	164(85.4%)	28(14.6%)	
	University	232(90.3%)	25 (9.7%)	

*column percentage; ^a Pearson Chi-Square, ^b Fisher Chi-Square, ^c Continuity Correction

There was no significant correlation between anemia and the number of previous pregnancies, alive birth, or abortus numbers of the participants (p=0.381, p=0.353, p=0.077 respectively). The mean SBP of the individuals who had anemia was 115.5 ± 13.45 mmHg and mean DBP was 65.7 ± 10.59 mmHg and mean SBP of individuals without anemia was 119.8 ± 13.72 mmHg and mean DBP was 69.2 ± 10.54 mmHg (p=0.0018, p=0.01, respectively). Distribution of chronic diseases, presence of previous or current anemia of the pregnant with and without anemia were compared in Table 3.

Table 3. Distribution of chronic diseases, previous or current anemia status of the pregnant with and without anemia

Parameters		With anemia (n=497)	Without anemia (n=70)	p
Chronic diseases prior to pregnancy (n=563)	Yes	105 (93.3%)	7 (6.3%)	0.034^a
	No	390 (86.5%)	61 (13.5%)	
Anemia treatment during previous pregnancy (n=563)	Yes	75 (81.4%)	18 (19.4%)	0.027 ^a
	No	418 (88.9%)	52 (11.1%)	
Current iron supplement usage	Yes	180 (83.3%)	36 (16.7%)	0.011 ^a
	No	315 (90.5%)	33 (9.5%)	

*column percentage; ^a Pearson Chi-square, ^b Fisher Chi-Square, ^c Continuity Correction

While the rate of anemia prevalence in women who experienced side-effects from using iron supply in pregnancy was 22.5% ($p=0.026$), this rate was 16.2% in women who neglected using these drugs ($p=0.018$). A significant correlation between presence of anemia and depressive symptoms was not detected ($p=0.299$) (Table 4).

Table 4. Association of anemia presence with drug usage compliance and depressive signs

Parameters		With anemia (n=497)	Without anemia (n=70)	p
Side effects of iron drugs (n=217)	Yes	79 (77.5%)	23 (22.5%)	0.026^a
	No	102 (88.7%)	13 (11.3%)	
PHQ-9 levels	None	114 (83.8%)	22 (16.2%)	0.231 ^a
	Mild	221 (89.4%)	25 (10.6%)	
	Moderate	110 (90.2%)	12 (9.8%)	
	Severe	40 (93.0%)	3 (7.0%)	
“Do you ever forget to take your medicine?”	Yes	198 (83.8%)	38 (16.2%)	0.018^a
	No	293 (90.4%)	31 (9.6%)	

*column percentage; ^a Pearson Chi-square, ^b Fisher Chi-Square, ^c Continuity Correction

Discussion

Due to the precise association of anemia with the incremental risk of premature birth, low birth rate, mortality, and morbidity, anemia in pregnancy should be prevented, early diagnosed, and treated. Anemia prevalence was detected as 12.3% in our study. Prevalence of anemia is increased by the advancement of gestation week. Systolic and diastolic blood pressure were detected to be significantly lower in pregnant women with anemia. The prevalence of anemia was found to be lower in pregnant women who had chronic diseases before pregnancy. Anemia was found to be more prevalent in pregnant women who stated that they did not use iron supplements regularly. An association between the presence of anemia and depressive signs was not found.

Globally, according to the 2011 report of the World Health Organization, of pregnant women all over the world, 44.6% in Africa, 17.1% in North America, 39.3% in Asia, and 24.5% in Europe have anemia (3). The prevalence of anemia in pregnancy was detected as 38.1% in Afghanistan, 23.1% in

Albania, 22% in Iceland, 21.7% in Sweden, 25% in France, 23.4% in Belgium, 21.9% in Finland, 22.7% in Denmark and 23.1% in the Netherlands (3) as reported in other studies. When the studies performed in different regions of our country were examined, the prevalence of anemia in pregnancy was observed to be changing from 13.1% to 50.3% (11-14). The prevalence of anemia obtained in our study was 12.3% and it was similar to the result of the study conducted by Küçükceran et al. (13). The prevalence of anemia obtained in our study is approximate to the European data of the WHO 2011 report (3). We consider that the reason for anemia prevalence being lower in our study could be that the study took place in a central district and a tertiary care healthcare service and also education levels of participants were higher.

While the iron requirement is less in the first trimester of pregnancy because of the absence of menstruation, it increases in the second and third trimesters because of increasing fetal growth speed (7). In a study performed in Eskişehir, a statistically significant correlation between anemia and advancing trimesters was detected (11). In the study conducted in Ankara, prevalence of anemia was found as 6.2% in the first trimester, and in the second and third trimesters, it was 9% and 15% (13). In another study conducted in Ankara, prevalence of anemia in trimesters was found as respectively 9%, 22%, and 18% (15). In a study performed by Suryanarayana et al. (16) in India, prevalence of anemia in the first trimester was detected as 14.3% and in 2nd and 3rd trimesters they were 39.8% and 45.9% and these values were not found as statistically significant. In our study, the prevalence of anemia in trimesters was found out compatible with literature results as 7.1%, 11.9%, and 17.7% respectively, and the relationship between the rates of anemia and incremental trimester weeks was significant.

In some studies conducted in Turkey, a significant association between anemia in pregnancy and age was not detected (13-15). When international literature was examined, a significant relationship between age and anemia in pregnancy was not found in the studies conducted by Suryanarayana et al. (16)

and Vindhya et al. (17) in India and by Mehrotha et al. (18) on the Andaman Islands. Kartal's (11) study in Eskişehir, the study of Drassinower et al. (19) in the USA, and the study of Wainstoc et al. (20) in Israel found a significant association between anemia and maternal age groups. In our study, a significant association between age and anemia was not detected. This result could be raised from the exclusion criteria of participants' age and high education level in the majority of the study sample.

Since people of higher levels of income have more accessibility to healthcare facilities and have more sufficient nutrition they may show a lower prevalence of anemia. In the study conducted in Eskişehir, the level of income of the participants was classified as good, medium, and bad, and its relationship with anemia was found as significant (11). In a study conducted in Sri Lanka, an association of monthly income levels with iron deficiency and inadequate iron supplies of participants was not detected (21). A significant association of socio-economical level with severity of anemia and hematocrit level was found in a study conducted in USA (21). In a study that took place in South India, 12.9% of the women had medium-high socioeconomic levels and a significant association between socioeconomic level and anemia was not detected (17). In our study, a significant association between total income level and anemia was not found. This may be because most pregnant women can use antenatal care services for free, the numbers of previous pregnancies were not many and the interval between pregnancies was longer than 2 years.

Anemia may cause changes in systemic circulation depending on its severity. Systemic vascular resistance decreases due to severity of anemia, mean DBP moderately drops, mean SBP is generally not affected (22). In a study in which data obtained from the blood bank information system were examined, a correlation of DBP and SBP with hemoglobin levels was detected both in males and females. It was observed that systolic and blood pressure increase by increasing hemoglobin levels (23). However, some studies have shown that in cases which maternal hemoglobin levels increase ($Hb > 14.6$

g/dL), stillbirth risk also increases, and in pregnant women who has high hemoglobin levels at the end of the 2nd trimester the risk of preeclampsia increases due to lack of expansion of plasma volumes (24,25). Therefore, it is very important to maintain hematologic stability and to avoid higher or lower hemoglobin levels to protect the health of the baby and the mother. In our study, SBP and DBP of the pregnant women with anemia were found to be lower as expected and the relationship between blood pressure and anemia was found to be statistically significant.

There are different opinions about the relationship between the prevalence of anemia and the number of stillbirths, abortus, and previous pregnancies. Even a negative correlation between hemoglobin levels and the number of previous pregnancies, live births, and abortus was detected in non-pregnant women who attended obstetric and gynecology polyclinics in Batman, a statistical significance was not detected (26). In another study conducted in our country, in pregnant women who attended routine check-ups and did not use any vitamin supplements yet in the first trimester, a significant difference between anemia and the number of previous pregnancies and alive births was not found (27). In a study that took place in Umman, it was detected that as the parity increases, the risk of anemia also increases, however in a study conducted in Zurich, it was detected that there is not an association between parity and abnormal hemoglobin levels (28,29). A relationship between obstetric history and anemia was not detected in the study of Vindhya et al. (17) which was conducted in India. In our study, a statistically significant association between anemia and the number of previous pregnancies, live births, or abortus was not detected. The most possible cause of this situation is that the study took place in a central district, it was easy to reach prenatal care services or the number of previous pregnancies, live births, or abortions being fewer. The effect of the duration of the interval between pregnancies on the iron supply capacities of women and anemia possibility in future pregnancies should not be ignored.

Chronic diseases which are already present before

pregnancy may have critical effects on obstetric outcomes. In a study that took place in Turkey, a relationship of iron deficiency and anemia with the presence of systemic disease in pregnancy was not detected, nevertheless, it was observed that hemoglobin and ferritin levels are lower in the presence of systemic disease (15). In a study conducted by Tapalı (30), the prevalence of anemia was found to be 7% higher in pregnant women who had chronic diseases compared to the ones who had not, however, this was not statistically significant. In a study performed in Ethiopia, anemia prevalence was found to be significantly higher in pregnant women with chronic diseases (31). In our study, the prevalence of anemia is lower in pregnant women who had systemic diseases before pregnancy and the relationship between anemia and chronic disease was found as statistically significant. This relationship may occur regarding the fact that these women had more frequent check-ups in antenatal periods and they might have had more inspections which may allow early diagnosis and treatment of anemia.

Incompliance with iron treatment consists of varying factors. These are financial support, lack of social support and education, insufficient motivation by healthcare personnel, misunderstanding of usage instructions, frequent doses, side effects (32). Gastrointestinal side effects which arise during the usage of iron supplements impair the compliance of these drugs. However, some articles defend that arising side effects do not impair drug compliance (33). In our study, the prevalence of anemia was significantly higher in the group that had side effects during iron supplement usage compared to other groups that did not have. The possible reason for this result could be explained by the association of higher side effects with low drug compliance.

Studies seeking the relationship between depression and anemia in pregnancy show differences. In the study conducted by Chen et al. (34) in Taiwan, a significant association between iron deficiency and depressive signs was detected in children and adolescents. In a study conducted on healthy, adult patients by Vulser et al. (35) in Paris, after adjustments

of gender and age, the prevalence of anemia was found to be higher in depressive participants. In a study by Lukose et al. (36) in India, depressive symptoms were less encountered in patients with anemia. On the other hand, according to the study of Yılmaz et al. (1) conducted in Turkey, the prevalence of depression was found to be significantly higher in the group of people with anemia compared to the other group without anemia. Since depression is a mental disorder that has an etiologically multifactorial nature and some of the symptoms may be confused with the symptoms induced by hormonal changes of pregnancy, more detailed investigations and evaluations are needed.

The most important factor which has a direct effect on the results of treatment or prophylaxis applications of any disease is compliance with drug treatment. In a study performed in Ethiopia, the participants who were defined as drug compatible formed 55.3% of the sample (37). The most frequent reason for compliance was reported as the recommendation of a specialist and the most frequent reason for the incompliance was the fear of side effects and the second one was forgetting to use the drugs (37). In another study conducted in Kenya, the compliance to iron supplements was found to be affected by healthcare recommendations, knowledge level of mothers about iron deficiency, monthly income, and having first pregnancy (38). In a study investigating iron deficiency during pregnancy in Turkey, 70% of the participants reported that they use their supplements regularly all the time (15). In our study, we asked the question of “Do you ever forget to take your medicine?” to evaluate compliance of pregnant women to iron treatment and prophylaxis. Of the participants, 16.2% told that they have neglected doses, and 9.6% claimed that they use their drugs regularly were detected to have anemia. The percentage of the participants expressing that they have regular use of the iron supplements was 58.1%. Poor drug compliance could be based on varying reasons. In our study, only one factor was examined in terms of drug compliance, and more detailed investigations are needed.

Limitations of the study:

There are some limitations of our study. First, as all of our patients also use primary healthcare services, we were not able to investigate all blood tests in our hospital. Secondly, as our study was conducted in a tertiary-care hospital, we can not generalize the results to all pregnant women. Third, randomization with blood tests in every trimester was not provided because the pregnant women received new pregnancy diagnoses in their first prenatal visits and the ones who were in their third trimesters had mostly NST and ultrasound check-ups. Lastly, drug compliance was examined by one question, and further investigations are needed.

Conclusion

Anemia was found to be less prevalent than expected with a rate of 12.3% in our study. The relationship between anemia and the incremental gestational week was significant. Therefore, the

detection of anemia by blood tests before birth and in the late months of pregnancy may improve obstetric outcomes.

A significant association between anemia and received anemia treatment during the previous pregnancy was detected. The number of previous alive or stillbirths, abortus, the duration between pregnancies in women planning pregnancy should be investigated in detail and any risky condition should be earnestly evaluated.

In our study, approximately half of the participants were found not to be using their iron supplements regularly. Prevalence of anemia was detected to be higher in individuals who had a history of not using iron supplements regularly compared to regular users. Patients should be informed about the usage of drugs, enlightened about the side effects, and followed to increase drug compliance.

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