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Research Article

Prevalence of Anaemia in Pregnant Women Registered in a Family Health Centre in Kütahya

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Abstract

Objective: The aim of this study was to determine the prevalence of anaemia in pregnant women enrolled in a family health centre in Kütahya and to determine the proportion of pregnant women with low haemotocrit, low ferritin and vitamin B12 deficiency and some factors affecting them.

Method: The population and sample of this retrospective study consisted of 91 pregnant women who were registered to Yıldırım Bayazıt FHC between 01 October and December 2021 and whose medical records were complete. Haemoglobin, haematocrit, ferritin, vitamin B12 values of pregnant women were examined.

Results: The mean age of the pregnant women included in the study was 28.83±8.61 years. Anaemia was found in 7 (7.7%), low haemotochrit in 3 (3.3%), low ferritin in 67 (73.6%), and B12 deficiency in 19 (20.9%) of the pregnant women. It was found that haemoglobin, haematocrit and ferritin values of pregnant women did not differ significantly according to age, educational status, number of pregnancies, nutrition and planning status of pregnancy (p>0.05).

Conclusion: Low ferritin levels were found to be high in pregnant women in our study group. Ferritin levels of pregnant women should be monitored in Family Health Centres.

Keywords: Pregnant women, Anaemia, Ferritin, Vitamin B12

1. Introduction

Anaemia is a condition in which the number of erythrocytes or the concentration of haemoglobin in them is lower than normal (1). When anaemia occurs, the capacity of the blood to carry oxygen to body tissues decreases. This results in symptoms such as fatigue, weakness, dizziness and shortness of breath (1). The optimal haemoglobin concentration required to meet physiological needs varies according to age, gender, high altitude, smoking habits and pregnancy status (1,2).

Anaemia can be classified as acquired or hereditary (2). Iron, folate and vitamin B12 deficiency anaemia, anaemias due to blood loss, anaemias of chronic diseases, acquired haemolytic anaemias and aplastic anaemias are considered acquired anaemias, while sickle cell anaemia, thalassemia and Fanconi anaemias are considered hereditary (1). Anaemia has mainly three causes: blood loss, increased blood destruction and decreased blood production (2). The most common causes of anaemia due to decreased blood production include nutritional deficiencies, especially iron deficiency (1-4). Folic acid and vitamin B12 deficiencies are other important causes (5). Anaemia is a very common disease affecting one third of the global population (1). In most cases, it is mild and asymptomatic and does not require any treatment. Its prevalence increases with age and is more common in women of reproductive age, pregnant women and the elderly (1). Anaemia is a global public health problem affecting especially children, women of reproductive age and pregnant women (5). It is estimated that one third of all

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women of reproductive age are anaemic. WHO estimates that 42% of children younger than five years and 40% of pregnant women are anaemic worldwide (5). The prevalence of anaemia in pregnant women is estimated to be 18% in developed countries and 35-75% in developing countries (4,5). In Türkiye, the prevalence of anaemia among women of reproductive age varies between 20.0% and 39.9% (6).
Maternal anaemia affects pregnancy outcomes negatively. Anaemia in pregnancy is associated with an increased risk of maternal morbidity and mortality and an increased risk of growth retardation, low birth weight, preterm birth and perinatal mortality in the foetus (6). In addition, maternal anaemia is responsible for 20-40% of maternal mortality due to direct or indirect causes including heart failure, pre-eclampsia, antepartum haemorrhage, postpartum haemorrhage and puerperal sepsis (6). Mild iron deficiency anaemia is observed in women of reproductive age; this condition is usually seen due to inadequate iron intake and monthly loss with the menstrual cycle (1). In pregnancy, iron deficiency anaemia is most common, followed by vitamin B12 and folic acid deficiency anaemia (7,8). In Türkiye, iron, vitamin and mineral supplements are provided free of charge to pregnant women by the Ministry of Health. By using these preparations, health problems related to anaemia and micronutrient deficiencies are tried to be prevented in all pregnant women (8).
Many studies related with anaemia of pregnancy have been conducted in Türkiye (9-15). However, no research on anaemia of pregnancy has been conducted in Kütahya. This will be the first study conducted in this subject in Kütahya. In addition, determining the prevalence of anaemia of pregnancy and some factors affecting it in Kütahya will contribute to the knowledge of the extent of the problem and the solution of the problem. In this study, we aimed to determine the prevalence of anaemia, the rate of pregnant women with low haemotocrit, low ferritin and vitamin B12 deficiency, and some factors affecting them in pregnant women registered to Yıldırım Bayazıt Family Health Centre in Kütahya.
Research Questions:
1: How common is anaemia during pregnancy?
2: What is the frequency of low Haematocrit and ferritin during pregnancy?
3: How common is vitamin B12 deficiency during pregnancy?
4: Is there any difference between the groups in pregnant women with anaemia, low haemotocrit, low ferritin and vitamin B12 deficiency?

2. Material and methods

2.1. Type of research

This is a retrospective study.

2.2. Place and time of the study

This study was conducted at Yıldırım Bayazıt Family Health Centre (FHC) in Kütahya between 01 October and December 2021. Kütahya is a province located in the west of the Republic of Türkiye. According to the year 2021, the population of Kütahya is 578640. This population consists of 284739 (49.21%) males and 293901 (50.79%) females. Of the total population of Kütahya, 277270 (47.92%) live in the central district. Of those living in the central district, 136730 were male, and 140540 were female (16). A total of 3994 people (2052 females and 1942 males) were registered to Yıldırım Bayazıt ASM where the study was conducted. At the time of the study, 91 pregnant women were registered to Yıldırım Bayazıt FHC. The research was conducted.

2.3. Population and sample of the study

The population and sample of the study consisted of the medical records of pregnant women registered to Yıldırım Bayazıt FHC. 91 pregnant women who were registered to Yıldırım Bayazıt FHC between 01 October and December 2021 and whose medical records were complete constituted the sample.

2.4. Data collection tools

Pregnancy Follow-up Form: Information on age (year) , educational status, number of pregnancies, medication, smoking and alcohol use were obtained. Family Medicine Information System (FHIS): Haemoglobin, haemotocrit, ferritin, vitamin B12 values of pregnant women were obtained from laboratory records of the Family Medicine Information System (FHIS).

In accordance with the recommendations of the Centers for Disease Control and Prevention (CDC), pregnant women with a haemoglobin value below 11 g/dl were considered anaemic and pregnant women with a haemotocrit value below 33% were considered to have a low haemotocrit value (17,18). Ferritin values below 20 ml/ng were considered as low ferritin and vitamin B12 values below 150 pg/ml were considered as low B12 (19,20).

2.5. Evaluation of data

SPSS 22.0 programme was used for data analysis. In descriptive statistics, continuous variables were defined as mean and standard deviation, and categorical variables were defined as number and percentage. Independent student t-test for continuous variables and one-way analysis of variance (ANOVA) were used to analyse the differences between groups. Tukey test was used as a post-hoc test to determine which group was responsible for the difference between more than two groups. Logistic regression (LR) analysis was performed to evaluate the relationship between the characteristics of the participants and B12 deficiency. Hosmer-Lemeshow goodness-of-fit test was used to evaluate model fit. $p< 0.05$ was considered significant.

2.6. Ethical approval

Ethics committee approval (Decision No: 2022/07-03 Date: 22.06.2022) was obtained from Kütahya Health Sciences University Non-Interventional Clinical Research Ethics Committee and necessary permission was obtained from Kütahya Provincial Health Directorate. The study was conducted in accordance with the Principles of the Declaration of Helsinki.

3. Results

A total of 91 pregnant women were included in the study. While 33 (36.3%) of the participants were under the age of twenty four years, 37 (40.7%) were between the ages of 25-34, and 21 (23.1%) were 35 years and over. Forty-four (48.4%) of the pregnant women were university graduates. Some descriptive characteristics of the pregnant women are shown in Table 1.

Table 1. Descriptive Characteristics of Pregnant Women (n=91)

Features	n (%)
Age (year)	
18-24 years	33 (36.3)
25-34 years	37(40.7)
35 years and over	21(23.1)
Educational status	
Primary school	12(13.2)
High school	35(38.5)
University	44(48.4)
Pregnancy number	
1st pregnancy	37(40.7)
2nd pregnancy	35(38.5)
3 and more pregnancies	19(20.9)
Pregnancy planning	
Yes	68(74.7)
No	23(25.3)

Medication	
Yes	4(4.4)
No	4(95.6)
Smoking	
Yes	2(2.2)
No	89(97.8)
Alcohol	
Yes	0 (0.0)
No	91(100.0)

Anaemia was found in 7 (7.7%), low haemotocrit in 3 (3.3%), low ferritin in 67 (73.6%) and B12 deficiency in 19 (20.9%) pregnant women. Table 2 shows the distribution of haematological values in pregnant women.

Table 2. Distribution of Haematological Values in Pregnant Women (n=91)

Parameter	Reference range	n (%)
Haemoglobin	<11	7 (7.7)*
	≥11	84 (92.3)
Haematocrit	<33	3 (3.3)**
	≥33	88 (96.7)
Ferritin	≤20	67 (73.6)***
	>20	24 (26.4)
Vitamin B12	<150	19 (20.9)****
	≥150	72 (79.1)

*Anemic, **Low haemotocrit, ***Low ferritin, ****B12 deficiency

The mean haemoglobin values of the pregnant women included in the study were 12.88±1.15 g/dl (min-max: 9.10-15.50), 38.76±3.08 (min-max: 28.20-49.10), 19.83±18.96 ml/ng (min-max: 1.70-113.00) and 221.11±90.76 pg/ml (min-max: 60.00-670.00). Haemoglobin and haemotocrit values of pregnant women did not differ significantly according to age, educational status, number of pregnancies, nutrition and pregnancy planning status (Table 3). A statistical difference was found between pregnancy planning status and B12 values (t=2.131, p=0.036). A statistical difference was found between the age of pregnant women and B12 values (F=3.121, p=0.049). Post-hoc test was applied to determine which group the difference originated from. The difference was found between 18-24 years and 25-34 years (p=0.038) (Table 4).

Table 3. The Relationship Between Age, Education Level, Number of Pregnancy and Planning Status of Pregnancy and Haemoglobin and Haemotocrit Values of Pregnant Women

	Haemoglobin (g/dl)		Haemotocrit	
Features	**Mean±SD**	**F;p**	**Mean±SD**	**F;p**
Age (year)				
18-24 years[a]	12.73±1.11	0.485;0.617	38.48±2.85	0.207;0.814
25-34 years[b]	13.00±1.03506		38.93±2.59	
35 years and over [c]	12.90±1.40		38.90±4.18	
Educational status				
Primary education	12.55±1.08	0.592;0.556	38.15±2.63	0.445;0.642
High school	12.97±0.87		38.62±2.18	
University	12.89±1.35		39.04±3.77	
Pregnancy number				
1st pregnancy	12.82±1.18	0.466;0.629	38.37±2.97	0.621;0.540
2st pregnancy	12.82±0.97		38.88±2.37	
3 and more pregnancies	13.10±1.39		39.31±4.31	
Pregnancy planning				

Yes	12.97±1.22	1.284;0.203	39.12±3.22	1.936;0.056
No	12.61±0.88		37.70±20.39	

Mean: Average; SD: Standard deviation

Table 4. The Relationship Between Ferritin and B12 Values of Pregnant Women and Age, Education Level, Number of Pregnancy and Planning Status of Pregnancy

	Ferritin (ml/ng)		B12 (pg/ml)	
Feature	**Mean±SD**	**F;p**	**Mean±SD**	**F;p**
Age (year)				
18-24 years[a]	18.96±15.56	0.145;0.865	249.26±103.94	3.121;0.049
25-34 years[b]	21.14±20.96		196.21±77.06	Tukey test: a-b (p:0.038); a-c (p:0.485); b-c (p:0.571)
35 years and over[c]	18.91±20.85		220.7619±81.47	
Educational status				
Primary education	24.07±17.32	0.688;0.505	167.00±44.68	2.752;0.069
High school	21.18±21.18		222.25±113.10	
University	17.60±17.60		234.97±74.83	
Pregnancy number				
1st pregnancy	19.32±19.17	0.057;0.945	214.77±82.88	0.167;0.846
2nd pregnancy	20.69±17.13		227.18±101.48	
3 and more pregnancies	19.25±22.49		222.31±88.54	
Pregnancy planning				
Yes	20.69±18.07	0.742;0.460	232.68±95.29	2.131;0.036
No	17.29±21.62		186.93±66.37	

Mean: Average; SD: Standard deviation

Logistic Regression (LR) analysis was performed by including age groups, educational status, number of pregnancies and whether the pregnancy was planned or not in the model, which were found to be statistically significant by ANOVA and t-test and which could be risk factors for B12 deficiency. According to the Hosmer-Lemeshow test, the fit of the model was evaluated as good ($\chi 2=9.693$, $p=0.287$, $R2=0.213$). As a result of logistic regression analysis, B12 deficiency was found to be 9.687 times higher in the 25-34 age group compared to the 35 years and older group ($p=0.04$). As a result of logistic regression analysis, B12 deficiency was found to be 4.932 times higher in the group with 1st pregnancy, 4.932 times higher in the group with 2nd pregnancy ($p=0.039$) and 7.711 times higher in the group with 3rd or more pregnancies ($p=0.043$). No relation was found between educational status and planned pregnancy and B12 deficiency (Table 5).

Table 5. Logistic regression analysis for factors associated with B12 deficiency

	β	St. Error	Wald	p	OR	95% Confidence interval for OR	
						Lower limit	Upper limit
Age (year)							
35 years and over*			7.053	0.029	1		
25-34 years	2.271	1.108	4.198	0.040	9.687	1.104	85.019
18-24 years	0.160	0.820	0.038	0.845	1.174	0.235	5.854
Pregnancy planning							
Yes*					1		
No	-0.566	0.636	0.793	0.373	0.568	0.163	1.973
Educational status							
Primary Education*			1.762	0.414	1		
High school	0.959	0.843	1.293	0.255	2.609	0.500	13.630
University	1.014	0.795	1.629	0.202	2.757	0.581	13.084
Pregnancy Number							
1st pregnancy*			5,354	0.069	1		
2nd pregnancy	1.596	0.775	4,244	0.039	4.932	1.081	22.507
3rd and higher pregnancy	2.043	1.011	4,083	0.043	7.711	1.063	55.932

β: Regression coefficient, St. Error: Standard error; OR: Odds Ratio; *: reference category

4. Discussion

Anaemia was found in 7.7% and low ferritin in 73.6% of the pregnant women. No significant difference was found between haemoglobin, haemotocrit and ferritin values of pregnant women according to age, educational status, number of pregnancies, nutrition and planning status of pregnancy. The percentage of pregnant women with vitamin B12 deficiency was 20.9%. B12 deficiency was found to be 9.687 times higher in the 25-34 age group than in the 35 years and older group, 4.932 times higher in the group with the first pregnancy than in the group with the second pregnancy, and 7.711 times higher in the group with the third or more pregnancies. No relationship was found between educational status and planned pregnancy and B12 deficiency.

Many studies have been conducted in our country regarding the prevalence of anaemia in pregnant women (9-15). According to these studies, the prevalence of anaemia in pregnancy in our country varies between 20% and 74.1%. However, the prevalence of anaemia in our country is still not known exactly (21,22). In a study conducted in Elazığ, the prevalence of anaemia in pregnancy was found to be 27.9%, in a study conducted in women presenting for delivery, the prevalence of anaemia was found to be 41.6%, in the study by Öztürk et al. the prevalence of anaemia was found to be 20.0%, and in the study by Çıkım et al. the prevalence was found to be 24.2% (12-15). It was found to be 23.5% in a study conducted in Tokat, 19.7% in a study conducted in Batman, and 23.3% in a study conducted in Şanlıurfa (9-11). In our study, the prevalence of anaemia in pregnant women enrolled in Kütahya Yıldırım Bayazıt FHC was found to be 7.7%. According to our study, the prevalence of anaemia in pregnant women is not similar to other studies. When compared with these studies, it is seen to be lower. The fact that the studies were conducted in different samples may have led to this result. The other reason for this result may be considered as a result of the successful implementation of iron supplementation for pregnant women by the Ministry of Health in the ASM where the study was conducted. However, in order to make this evaluation, studies specifically analysing this issue are needed.

The most important cause of anaemia in pregnancy is iron deficiency (1-3,5). Serum ferritin level is an indicator of total iron storage and its low level indicates iron deficiency (23). In our study, the mean ferritin level was found to be 19.83±18.96, whereas it was found to be 27.5±24.7 in a study conducted in Şanlıurfa (24). In addition, the rate of pregnant women with ferritin values below 20 µg/L was 73.6%

in our study. In the study by Çıkım et al. the rate of pregnant women with low ferritin was 20.8% (14). In the study by Sayar et al. low ferritin was found in 28% of pregnant women (22). When compared with other studies, both the mean ferritin values were lower and the rate of pregnant women with low ferritin levels was higher in our study. In iron deficiency, the decrease in ferritin levels occurs earlier than serum iron, transferrin saturation and haemoglobin values (14). Therefore, low ferritin levels are more important than others. Although the prevalence of anaemia was low in the pregnant women included in our study, the high rate of low ferritin values suggests that there is a risk of anaemia if the pregnant women are followed up. Iron deficiency in pregnancy has been reported to cause cognitive function and learning disorders in the fetus even in the absence of anaemia. Ferritin deficiency is also important in this respect (25,26). In our study, no relation was found between ferritin deficiency and age, educational status, number of pregnancies, nutrition and planning status of pregnancy. Therefore, ferritin deficiency may be due to the fact that the drugs given to pregnant women for iron supplementation have not been provided or used regularly recently. In the study of Sayar et al. a difference was found between pregnant women who used iron preparations regularly and pregnant women who used iron preparations irregularly or did not use iron preparations in terms of ferritin levels (22). In addition, other factors that may affect ferritin deficiency should be investigated. However, firstly, it should be investigated whether the drugs given within the scope of the Ministry of Health application are provided regularly or used regularly. However, iron supplementation given to pregnant women with normal iron levels may lead to Fenton reaction, formation of free oxygen radicals and precipitation of iron into tissues (14,27). In order to avoid these adverse effects and for early diagnosis of anaemia, monitoring of ferritin levels in pregnant women should be given importance.

Vitamin B12 deficiency is a common cause of anaemia in pregnant women. The most important function of vitamin B12 is to synthesise DNA which is necessary for cell division and proliferation. Vitamin B12 deficiency in the mother is important in terms of causing maternal anaemia as well as affecting the baby. Newborns whose mothers have vitamin B12 deficiency are born with low vitamin B12 stores and are at risk of megaloblastic anaemia, delayed neuromotor maturation and growth retardation (22,28). Vitamin B12 deficiency is observed between 10% and 30% in the world. B12 deficiency is more common in pregnant women (29). In our study, the mean B12 level was 221.11±90.76. Pregnant women with low vitamin B12 were found to be 20.9%. In the study by Sayar et al. vitamin B12 deficiency was found in 90.4% of pregnant women (22). While the rate of pregnant women with B12 deficiency in our study was compatible with the prevalence in the world, it was found to be lower than the study of Sayar et al. The study of Sayar et al. may have been high because it was conducted with term pregnant women who presented to the gynaecology and obstetrics clinic for delivery. According to our study findings, B12 deficiency was associated with age and number of pregnancies. As a result of LR analysis, the risk of B12 deficiency increased in the 25-34 age group and with increasing number of pregnancies. In a study conducted in Şanlıurfa, no relation was found between age and number of births and B12 deficiency, which is different from our study (24). In our study, although B12 deficiency and pregnancy planning status were found to be significant in univariate analysis, it was concluded that it did not cause an increased risk in multivariate analysis. Since vitamin B12 cannot be made in the human body, it should be taken from outside through diet. Vitamin B12 is found in foods of animal origin. Since it is found very little in vegetables, B12 deficiency due to inadequate intake is common, especially in those who are fed a vegetarian diet. Dietary habits are one of the most important factors determining whether vitamin B12 deficiency is present or not (30,31). Failure to make changes in dietary habits in consideration of vitamin B12 even if the pregnancy is planned may be the reason for the lack of difference with unplanned pregnancies.

4.1. Limitations of the study

The study was conducted in a family health centre in Kütahya and in a small number of pregnant women. Therefore, it is not representative of Kütahya and Türkiye. In this retrospective study using records, factors that may cause anaemia, vitamin B12 deficiency in pregnant women such as nutrition and medication habits could not be evaluated because they were not recorded.

5. Conclusions

It has been found that low ferritin is still a serious and common health problem in pregnant women in our study group. Although not as common as low ferritin levels, low B12 levels are also frequently encountered in our study group. However, the results of the study can only be generalised to the family health centre. In this retrospective study using records, factors that may cause anaemia and vitamin B12 deficiency in pregnant women such as nutrition and medication habits could not be evaluated. According to the data we evaluated; B12 deficiency is more common in pregnant women aged 25-34 years and in women with more than one pregnancy. As the number of pregnancies increases, the likelihood of low B12 levels increases.

The causes of anaemia, low ferritin and vitamin B12 deficiency in pregnant women included in the study despite the routine free distribution of iron and vitamin preparations during pregnancy should be investigated. In addition, it may be recommended to investigate the prevalence of anaemia, low ferritin levels and vitamin B12 deficiency in a sample representative of Kütahya and whether the distributed preparations are used correctly and regularly by pregnant women

References

1. Turner J, Parsi M, Badireddy M. Anemia. In: StatPearls. Treasure Island (FL): StatPearls Publishing; August 8, 2023.

2. Conrad ME. Anemia. In: Walker HK, Hall WD, Hurst JW, eds. Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd ed. Boston: Butterworths; 1990.

3. Abu-Ouf NM, Jan MM. The impact of maternal iron deficiency and iron deficiency anemia on child's health. Saudi Med J. 2015 Feb;36(2):146-9. doi: 10.15537/smj.2015.2.10289.

4. Petry N, Olofin I, Hurrell RF, Boy E, Wirth JP, Moursi M, Donahue Angel M, Rohner F. The Proportion of Anemia Associated with Iron Deficiency in Low, Medium, and High Human Development Index Countries: A Systematic Analysis of National Surveys. Nutrients 2016;8:693. https://doi.org/10.3390/nu8110693.

5. World Health Organization. Anaemia. https://www.who.int/health-topics/anaemia#tab=tab_1 (Accessed August 14, 2022).

6. Bilgin Z, Demirci N. Current Approaches Based on Evidence in Iron and Folate Deficiency Anemia in Pregnancy. Medical Bulletin of Zeynep Kamil. 2019;50(3):167-174. https://doi.org/10.16948/zktipb.469571

7. Karbancıoğlu Cantürk F, Songur Dağlı S. Effects of Maternal Anemia on Perinatal Outcomes. The Journal of Gynecology-Obstetrics and Neonatology. 2019;16(1);22-26.

8. T.C. Ministry of Health, General Directorate of Public Health, Department of Women and Reproductive Health. Prenatal Care Management Guide. Ankara, 2018. Ministry of Health Publication No: 925. https://hsgm.saglik.gov.tr/depo/Yayinlarimiz/Rehberler/dogum_oncesi_bakim_08-01-2019_1.pdf (Accessed August 14, 2022).

9. Bucak FK, Ozcanarslan F, Demir M. The Prevalence Of Anemıa And Related Factors In Pregnant Women Admıtted To Sanlıurfa Maternity Hospıtal. Journal of Helath Academics. 2017;4(2):103-109. https://doi.org/10.5455/sad.13-1492422573

10. Çıtıl R, Yakıştıran Barut S, Eğri M, Önder Y. Anemia Prevalance and Related Factors in Pregnant Women Admitted to State Hospital. Journal of Contemporary Medicine. 2014;4(2):76-83.

11. Tunc SY, Görük NY, Ceylan B, Tunc N. The Relationship Between Gestation and Iron Deficiency Anemia in Women Applied to Obstetrics and Gynecology Outpatient Clinic. J Clin Exp Invest. 2012;3(1):49-52.

12. Yakar B, Pirincci E, Kaya MO, Onalan E. Prevalence of Anemia and Associated Risk Factors among Pregnant Women, What is the Role of Antenatal Care in Prevention? A Cross-sectional Study. J Coll Physicians Surg Pak. 2021;(11):1341-1345. doi: 10.29271/jcpsp.2021.11.1341.

13. Taner CE, Ekin A, Solmaz U, Gezer C, Çetin B, Keleşoğlu M, Erpala MB, Özeren M. Prevalence and risk factors of anemia among pregnant women attending a high-volume tertiary care center for delivery. J Turk Ger Gynecol Assoc. 2015;16(4):231-6. doi: 10.5152/jtgga.2015.15071.

14. Cıkım G, Tok A. Evaluation of the Frequency of Iron Deficiency Anemia in Healthy Pregnants According to Trimesters. F.Ü.Sağ.Bil.Tıp.Derg. 2020;34(3): 249 – 253.

15. Öztürk M, Öztürk Ö, Ulubay M, et al. Anemia prevalence at the time of pregnancy detection. Turk J Obstet Gynecol. 2017;14(3):176-180. doi:10.4274/tjod.06337.

16. TUIK, Turkish Statistical Institute. Geographic Statistics Portal, National Data Page. https://data.tuik.gov.tr/Kategori/GetKategori?p=Nufus-ve-Demografi-109 (Accessed September 7, 2022).

17. WHO (2001) Iron deficiency anemia: assessment, prevention and control. WHO/NHD/01.3, Geneva. World Health Organization, Switzerland

18. Centers for Disease Control (CDC). CDC criteria for anemia in children and childbearing-aged women. MMWR Morb Mortal Wkly Rep. 1989;38(22):400-4.

19. Yıldız Y, Yapar Eyi EG. Gebelikte annenin anemisi (Maternal anemia in pregnancy). The Journal of Gynecology - Obstetrics and Neonatology. 2012;9 (35):1456-1459.

20. Koebnick C, Hein UA, Dagnelie PC, Wickramasinghe SN, Ratnayaka ID, Hothorn T. Longitudinal concentrations of vitamin B12 and vitamin B12-binding protein during uncomplicated pregnancy. Clin Chem. 2002;48:928–33.

21. Davas I, Marangoz D, Varolan A, Akyol A, Baksu B. The influence of iron intake to maternal and perinatal outcomes. J Turk Soc Obstet Gynecol. 2008;5:174–81.

22. Sayar EH, Orhaner BB, Sayar E, NesrinTuran F, Küçük M. The frequency of vitamin B12, iron, and folic acid deficiency in the neonatal period and infancy, and the relationship with maternal levels. Turk Pediatri Ars. 2020;55(2):139-148. doi: 10.14744/TurkPediatriArs.2020.14042.

23. Gülücü S, Güçlü M, Çelik S, Can İS, Soyer Çalışkan C, Çelik S. The Relationship of First Trimester Vitamin D, Vitamin B12 and Ferritin Levels with Preeklampsia Ahi Evran Med J. 2021;5(3):229-235. doi: 10.46332/aemj.865619

24. Yenigül NN, Buldum D. Hemoglobin, ferritine, folate, B12 and vitamine D levels in first trimester pregnancies in Şanlıurfa. Genel Tıp Derg. 2021;31(1):24-28.

25. Chouthai NS, Sampers J, Desai N, et al. Changes in neurotrophin levels in umbilical cord blood from infants with different gestational ages and clinical conditions. Pediatr Res. 2003;53: 965-969.

26. Dalal E, Shah J. A comparative study on outcome of neonates born to anemic mothers versus non anemic mothers. Natl J Med Res. 2014; 4:270-273.

27. Winterbourn CC. Toxicity of iron and hydrogen peroxide: The Fenton reaction.Toxicol Lett. 1995; 82-83:969-974.

28. Keskin EY, Keskin M, Karaibrahimoğlu A. Association of Maternal Vitamin B12 Status With Infant Findings and Neurodevelopment in Vitamin B12-Deficient Breast-fed Babies. J Pediatr Hematol Oncol. 2022;44(1):e91-e95. doi: 10.1097/MPH.0000000000002122.

29. Sukumar N, Adaikalakoteswari A, Venkataraman H, Maheswaran H, Saravanan P. Vitamin B12 status in women of childbearing age in the UK and its relationship with national nutrient intake guidelines: Results from two National Diet and Nutrition Surveys. BMJ Open. 2016;6:e011247. doi: 10.1136/bmjopen-2016-011247

30. Emen B, Kılıç Öztürk Y, Eren MA, Özdemir E, Öztürk F, Düzenli E, Sarıaslan D. Retrospective Analysis Of The Correlation Of Etiological Factors With Laboratory Features In Vitamin B12 Defficient Patients, The Anatolian Journal of General Medical Research. 2013;23(1):19-23. doi: 10.5222/terh.2013.95182

31. Şimşek H, Karaağaç Y, Tunçer E, Yardımcı H. Is It Necessary Folic Acid, Vitamin B12, Vitamin D and Iodine Supplementation in Pregnancy?: Posssible Risks. KSU Medical Journal. 2021;16(3):439-447. doi:10.17517/ksutfd.832401

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