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Original Article

The effect of ferritin, vitamin B12 and folic acid on pregnancy outcomes

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Abstract: Purpose: A reduction occurs in levels of some minerals and vitamins due to physiological adaptation during pregnancy, and this situation causes anemia in pregnancy. The aim of the present study was to evaluate the effect of ferritin, vitamin B12 and folate levels on outcomes of pregnancy in 3rd trimester pregnant women. Materials and Methods: This retrospective study included a total of 72 pregnant women in the third trimester of pregnancy. Vitamin and mineral analyses of the patients were applied. Patients were questioned in respect of whether or not iron and vitamin supplements were taken during pregnancy, the mode of delivery and the history of postpartum problems in infant. Results: As the number of children increased, so an increase was seen in the incidence of anemia. Of the mothers of newborns with medical problems, 60% had anemia. There was no statistically significant difference in the mean birth weight according to the presence or absence of maternal anemia. Anemia in pregnant women is defined as hemoglobin level below 11.0 g/dL in the first and third trimester and below 10.5 g/dL in the second trimester. No significant difference was determined in anemia status according to the mode of delivery. No difference in anemia was detected in infants, regardless of whether or not their mothers took vitamin and mineral supplements. Conclusion: Anemia in the third trimester has no effect on the mode or time of delivery, weight and general condition of the newborn. To decide the effect of anemia on the outcome of pregnancy, further studies with more participants are needed.

Keywords: Pregnancy, anemia, ferritin, vitamin B12, folate

Introduction

Significant changes in some vitamin and mineral levels occur during physiological adaptation in pregnancy. Vitamin B6, vitamin B12, and folate levels decrease by 50%, and 1.25 Dihydroxyvitamin D level increases during pregnancy [1]. Serum iron, total and ionised calcium, magnesium and zinc levels decrease and copper level increases.

Vitamin-deficiency anemia may occur when vitamin B12 and folate are deficient. These two vitamins are needed to make red blood cells. Conditions leading to anemia caused by vitamin deficiency are megaloblastic anemia and pernicious anemia [2]. Vitamin deficiencies cause a variety of anemia. Anemia causes physical and mental retardation in the fetus, and leads to failure of the development of the immune system. It also leads to a high rate of premature birth and low birth weight infants [3].

The aim of the present study was to evaluate the effect of ferritin, vitamin B12 and folate levels on outcomes of pregnancy in 3rd trimester pregnant women.

Patients and methods

Study design

The study was conducted in accordance with the principles of the Helsinki Declaration and was approved by the local Institutional Review Board. A total of 72 third trimester pregnant

Table 1. Parity according to the anemia status of pregnant women

Number of children	Anemic group (n=29)	Non-anemic group (n=43)	Total
1	5	18	23
2	13	21	34
3 and more	11	4	15

Table 2. Medical problems in newborns according to the anemia status of pregnant women

	Medical problem in infant		Total
	Present (n=10)	Absent (n=62)	
Anemic group (n=29)	6 (20.7%)	23 (79.3%)	29 (100%)
Non-anemic group (n=43)	4 (9.3%)	39 (90.7%)	43 (100%)

women admitted to the Obstetrics and Gynecology Clinic in Training and Research Hospital in Istanbul, Turkey, were retrospectively enrolled.

Anemia in pregnant women is defined as hemoglobin level below 11.0 g/dL in the first and third trimester and below 10.5 g/dL in the second trimester [4]. As 3rd trimester pregnant women were included in this study, women with hemoglobin level of 11 g/dL and below were considered anemic [5]. Full-term delivery is defined as 39 to 41 weeks' gestation, and early-term delivery is defined as 37 to 38 weeks' gestation [6].

The pregnant women were separated into anemic (n=29) and non-anemic (n=43) subgroups according to the hemoglobin level of the participants. Pregnant women with chronic illnesses (acute or chronic liver disease, heart disease, chronic renal failure, diabetes mellitus, hypertension etc.), gestational diabetes, pregnancy-induced hypertension, multiple pregnancy, acute or chronic blood loss were excluded from this study.

Outcome prameters

Iron, total iron binding capacity, ferritin, folic acid, and vitamin B12 levels of the patients were analyzed before delivery. Maternal age, medical history of obstetrics (gravida, parity, use of iron and/or vitamin supplements), medical history of the infant after birth (birth time, mode of delivery, birth weight, problems after birth which required medical intervention in the newborn period) were obtained from the medical records.

Statistical evaluation

SPSS 15.0 software for statistical evaluation was used in this study. The Chi-square test for categorical variables in comparative statistical analysis, and the t test for comparison of the two groups for continuous variables were applied. A value of $P<0.05$ was accepted as statistically significant.

Results

A total of 72 third trimester pregnant women (aged, 19-42 years) who were admitted to our clinic were retrospectively enrolled. Pregnant women were separated into anemic (n=29) and non-anemic (n=43) subgroups. The average age of the anemic group was 29.1 years, while the average age of the non-anemic group was 26.6 years.

Anemia rates in primiparous women were low while an increase in the incidence of anemia in participants with 2 or more children was detected. An increase was seen in the incidence of anemia as the number of children increased (P=0.017) (**Table 1**).

Medical problems were observed in 20.7% of the infants of the pregnant women in the anemic group, and in 9.3% of the infants of the pregnant women in the non-anemic group. No statistically significant difference was determined between the presence of medical problems in newborns and the anemia status of their mothers (P=0.17) (**Table 2**). The mean birth weight of the infants of anemic mothers was 3225.5±392.6 g and the mean birth weight of the infants of non-anemic mothers was 3182.0±281.2 g. No statistically significant difference was found between the two groups.

No statistically significant difference was determined between the mode of delivery and anemia status (P=0.8), gestation at delivery and anemia status (P=0.7), and iron/vitamin supplementation and anemia status (P=0.08) (**Table 3**).

Table 3. Mode of delivery, birth time, vitamin and mineral supplements according to the anemia status of pregnant women

		Anemic group (n=29)	Non-anemic group (n=43)	Total	
Mode of delivery	Natural childbirth	21	32	53	72 (100%)
	Caesarean section	8	11	19	
Birth time	Term	27	39	66	72 (100%)
	Premature	2	4	6	
Vitamin-mineral supplements	Taking	23	40	63	72 (100%)
	Not taking	6	3	9	

Table 4. Mean ferritin, vitamin B12, folate, hemoglobin and MCV levels according to iron-vitamin use

Mineral vitamin use	Ferritin	Vitamin B12	Folate	Hemoglobin	MCV
Present	12.7±8.6	197.1±64.6	12.7±7	11.1±1.3	87.8±7
Absent	6.7±4.7	175.6±73.5	7.2±3.8	9.9±1.3	81.1±9.7
Total	11.9±8.4	194.5±65.6	12±6.9	10.9±1.3	86.9±7.7
P value	0.045	0.3	0.02	0.01	0.01

Folate deficiency was determined in only 1 pregnant woman (1.4%). There were no significant correlations between vitamin-mineral use of patients and mean ferritin, vitamin B12, folate, hemoglobin, or MCV levels (P>0.05) (**Table 4**).

Discussion

Hemodilution due to pregnancy reduces hemoglobin concentration. The Hb level during pregnancy is variable and reaches its lowest level in the second trimester. WHO declared that 27% of pregnant women were anemic in 2011 [5]. The most common anemia in pregnancy is iron-deficiency anemia; other deficiencies include folate deficiency, vitamin B12 deficiency, hemoglobinopathies [7]. The main cause of megaloblastic anemia during pregnancy is folic acid deficiency. The folic acid requirement in non-pregnant women is 50-100 µg per day but this increases during pregnancy to as much as 400 µg per day. The amount of folic acid stored in the body can provide for about 4-5 months. Therefore, megaloblastic anemia due to folic acid deficiency does not occur in the 1st and 2nd trimester, but in the 3rd trimester [8]. Megaloblastic anemia due to vitamin B12 deficiency in pregnancy is very rare. It depends on the cause of vitamin B12 deficiency present before pregnancy and can be diagnosed incidentally during pregnancy. The effects of Vitamin B12 deficiency during pregnancy have been suggested to be spontaneous abortion, arterial and venous thrombosis, pre-eclampsia, abruptio placenta, fetal congenital anomalies (neural tube defects, heart defects) and intrauterine fetal death and intrauterine growth retardation [9]. Maternal anemia has also been suggested to be associated with maternal complications in addition to intrauterine growth retardation, preterm delivery, fetal and low birth weight; pre-eclampsia, eclampsia [7].

The prevalence of iron deficiency in pregnant women in Iran was found to be 28.5% in a study by Karimi. This was close to the reported prevalence of iron deficiency anemia in pregnant women in other developing countries (25-35%). The rate in developed countries has been reported as 5-8% [10]. Malhotra identified the prevalence of anemia in pregnancyin India as 72.5% in 2002 [11]. In the present study, the prevalence of anemia in the last trimester of pregnancy was determined as 40.3%. This finding is consistent with the literature on the prevalence of anemia.

Serum ferritin level is considered to be an indicator of body iron stores [12, 13]. Even though the ferritin level may be influenced by plasma dilution later in pregnancy, a concentration below 15 µg/l indicates iron depletion at all stages of pregnancy. In a 2000 study by Hou, mean serum ferritin levels in women were determined as 22.3 µg/L [14]. Karimi found maternal mean ferritin levels to be 24.8±9.32 µg/L [10]. In a study by Kilbride, the values were 7.6±5.5 µg/L and 21.9±21.4 µg/L respec-

tively in anemic and non-anemic pregnant groups [15]. In the present study, mean values of 13.65±8.0 μg/L were detected in the non-anemic pregnant women and 9.48±8.6 μg/L in anemic pregnant women in accordance with the literature (P<0.05).

Pathak detected vitamin B12 deficiency in 74.1% of pregnant women over 28 weeks, folic acid deficiency in 26.3%, and serum ferritin deficiency in 67% [16]. In the present study, 27% of pregnant women had vitamin B12 deficiency, 1.4% had folic acid deficiency and 55% had ferritin deficiency.

In a study by Okuyamo, anemic and non-anemic maternal serum ferritin values were determined as 5.2±2.2 μg/L and 19.4±11.7 μg/L respectively [17], and as 7.6±5.5 μg/L and 21.9±21.4 μg/L, respectively in the study by Kilbride [15]. In the present study, the serum ferritin value of the anemic pregnant group was 9.48±1.59 μg/L, and 13.65±1.22 μg/L in the non-anemic pregnant group.

According to a study by Malhotra, which investigated the relationship between maternal anemia and the birthweight of the newborn, profound anemia (Hb≤7) was found to be associated with low birthweight infants [11]. In contrast, in a study by Arslan, no difference was found in the birthweight of infants to anemic and non-anemic pregnant women [18].

Benli found that the hemoglobin and hematocrit values of pregnant women using iron supplements were no different from those of pregnant women not taking iron supplements. No relationship was found between anemia and iron supplement use [19]. Similar results were found in a study by Kanber [20], while Citil stated that anemia was detected less frequently in pregnant women who took iron and multivitamin supplements [12]. In the present study, 87% of pregnant women were taking iron-multivitamin supplements and 36% had anemia. The hemoglobin, ferritin and MCV levels in those taking supplements were higher at a statistically significant level. The present study differs from the Benli and Kanber studies in this respect but these findings are in parallel with Citil. The reason could be that the other studies considered only iron use but in the current study and that by Citil, iron and multivitamin use together was considered.

Sahin reported that Hb value is significantly decreased with an increase in the number of pregnancies [21]. Consistent with the findings in literature, it was seen in the present study that as the number of children increased, so the incidence of anemia also increased (P= 0.017).

To conclude, anemia of third trimester pregnancy has no effect on mode of delivery and birth time, weight of the newborn or medical condition. It was determined that anemia has no effect on the outcome of pregnancy. Further studies with larger sample sizes are required to clarify the effect of anemia on pregnancy outcome.

Acknowledgements

The results of this study imply that anemia in the last trimester has no effect on the mode or time of delivery, weight and general condition of the newborn.

Disclosure of conflict of interest

None.

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