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Original Article

Iron deficiency anemia in adolescent pregnancy: investigation of its effects and the related factors

Adölesan gebelerde demir eksikliği anemisi; ilişkili faktörler ve etkilerinin incelenmesi

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ABSTRACT

Introduction: Adolescent pregnancies and their maternal and fetal complications are a global health burden. Iron deficiency anemia is among the factors, which might contribute to these negative consequences. In this study, we aimed to evaluate the frequency of iron deficiency anemia among pregnant adolescents followed at the Düzce University Medical Faculty Hospital and to investigate its maternal and fetal effects.

Methods: A total of 122 pregnant women under 19 years of age were included in this case-control study. The socio-economic characteristics, hematological status, and adverse maternal and perinatal outcomes possibly related to iron deficiency anemia were evaluated.

Results: The incidence of anemia among the studied women was 29.5%, and 56.5% were receiving iron supplementation. Oral iron supplementation rate was 33.3% in the anemic group and 66.2% in the non-anemic group (p = 0.01). While the serum ferritin and hemoglobin levels were lower in the anemic group, iron binding capacity was lower in the non-anemic group, and the difference between the groups was statistically significant (p = 0.01, p = 0.01, and p = 0.02; respectively). Concerning adverse perinatal outcomes, preeclampsia was seen in 11.4% of the anemic group and 4.6% in the non-anemic group; the difference was statistically significant (p = 0.01).

Conclusions: Iron deficiency anemia is a common problem in adolescent pregnancy. However, many anemic pregnant adolescents do not receive iron treatment. Positive effects on some maternal and perinatal outcomes can be achieved by administering iron supplementation to these women. Iron use should be increased to combat iron deficiency anemia during pregnancy.

Keywords: Adolescent pregnancy, anemia, iron deficiency

ÖZ

Giriş: Adölesan gebelikler ve bu gebeliklerde görülen maternal ve fetal olumsuz sonuçlar küresel bir sağlık problemidir. Demir eksikliği anemisi ise bu olumsuz sonuçlara neden olabilecek faktörler arasında gösterilmektedir. Biz bu çalışma ile Düzce Üniversitesi Tıp Fakültesi Hastanesinde takip edilmiş adölesan gebeler arasındaki demir eksikliği anemisi sıklığını, bununla ilişikli olabilecek demografik ve sosyo-ekonomik özellikleri ve adölesan gebeliklerde görülen demir eksikliği anemisinin maternal ve fetal sonuçlar üzerine olan etkisini değerlendirmeyi amaçladık.

Yöntem: Retrospektif vaka-kontrol niteliğindeki bu çalışmaya Düzce Üniversitesi Tıp Fakültesi Kadın Hastalıkları ve Doğum Kliniğine başvuran 19 yaş altındaki toplam 122 gebe dahil edildi. Gebelerin sosyo-ekonomik özellikleri, hematolojik durumları ve demir eksikliği anemisi ile ilişkili olabilecek olumsuz maternal ve perinatal sonuçları değerlendirildi.

Bulgular: Çalışmaya dahil edilen kadınlar arasında anemi görülme oranı %29,5'di ve demir suplemantasyonu alan kadın oranı %56,5'di. Anemik grupta oral demir suplemantasyon oranı %33,3 iken non-anemik grupta %66,2 idi (p=0,01). Serum ferritin, hemoglobin değerleri anemik grupta daha düşük iken, demir bağlama kapasitesi non-anemik grupta daha düşüktü ve gruplar arasındaki fark istatistiksel olarak anlamlıydı (p=0,01, p=0,01, p=0,02; sırasıyla). Olumsuz perinatal sonuçlar açısından yalnızca preeklampsi; anemik grupta %11.4 oranında görülürken, non-anemik grupta %4,6 oranında görüldü. Gruplar arasındaki fark istatistiksel olarak anlamlıydı (p=0,01).

Sonuç: Adölesan gebelikte demir eksikliği anemisi sık karşılaşılan bir sorundur. Buna rağmen birçok anemik adölesan gebe demir tedavisi almamaktadır. Demir eksikliği anemisi, demir suplemantasyonu ile tedavi edilirse bazı maternal ve perinatal sonuçlar üzerine olumlu etkileri olabilir. Gebelikte demir eksikliği anemisi ile mücadele için demir kullanımının yaygınlaştırılması gerekmektedir.

Anahtar kelimeler: Adölesan gebelik, anemi, demir eksikliği

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Introduction

Anemia is common worldwide; it is a significant public health problem, which affects mainly women of reproductive age and children. However, the whole society is under burden in terms of the outcomes [1]. Depending on the population screened, its prevalence varies between 9 to 43% [2].

Many factors can cause anemia. The most common of these factors is iron deficiency, which affects about 50% of the patients [3]. One of the vulnerable populations troubled by anemia is pregnant women. The development of anemia during pregnancy may be due to many factors. Iron deficiency is a significant cause of anemia in pregnancy [4]. Anemia during pregnancy may adversely affect not only the mother but also the fetus, and there are many studies linking anemia with adverse pregnancy outcomes, unusually low birth weight, prematurity, and delayed intrauterine growth [5-7].

Pregnant adolescents are at a higher risk for iron deficiency anemia (IDA). Extra iron is required to meet the needs of the mother and fetus when pregnancy is added to the rapid growth and profound biological changes during adolescence [8]. IDA has reached alarming levels among pregnant adolescents, especially in developing countries [9].

This study aimed to determine the frequency of IDA among pregnant adolescents in our clinics, to evaluate the relationship of IDA and demographic and socio-economic characteristics, and to study its effects on the maternal and fetal outcomes.

Methods

This case-control study included 122 pregnant adolescents below age 19, who were expecting single deliveries and were under the routine antenatal screening program of the Department of Obstetrics and Gynecology in Düzce University Hospital. The study was conducted during January 2015 and April 2018. Information about all pregnant women participating in the study was collected from the hospital's electronic medical records and patient files. Age, pregnancy history, parity, curettage and miscarriage numbers, last menstrual periods, gestational weeks, height, weight, and body mass index (BMI) were recorded. BMI was calculated using the formula [weight (kg) / height (m)2]. Socio-economic levels and per capita monthly household incomes of all participants were queried. The monthly household income per capita was categorized as low (<1500 TL), medium (1500–3000 TL), and high (> 3000 TL). Iron deficiency and related anemia were diagnosed according to the criteria proposed by the World Health Organization (WHO) [10]. Accordingly, women with serum hemoglobin concentrations less than 11 g / dl and ferritin levels <15 µg / dL were diagnosed as having iron deficiency anemia. The participants were examined for gestational complications such as gestational diabetes mellitus (GDM), preeclampsia, preterm delivery, and postpartum hemorrhage.

The diagnosis of GDM was made according to the WHO criteria [11]. Preeclampsia was defined as "Previous normotensive women with systolic blood pressure> 140 mmHg and diastolic blood pressure> 90 mmHg after 20 weeks of gestation accompanied by proteinuria (100 mg / dL in spot urine or 300 mg in 24-hour urine)". Preterm delivery was defined as births before 37 weeks of gestation. Low (SGA) and high (LGA) birth weights according to the gestational age were defined as <10th percentile and >90th percentile respectively, and birth weight Z-scores calculated according to Gardosi et al. [12] were used. All procedures in the study were carried out in accordance with the ethical standards of the institutional research committee and the 1964 Declaration of Helsinki, and subsequent amendments or comparable ethical standards (Ethical approval date:07/05/2018, No:2018/68). Women older than 19 years of age, those with multiple pregnancies, abortion, or stillbirth, and women receiving anemia treatment other than the oral route (intravenous iron or blood transfusion) were excluded from the study.

Statistical analyses

The Statistical Package for Social Sciences 22.0 (SPSS IBM Inc., Armonk, NY, USA) was used for statistical analysis. Quantitative data were presented as mean ± SD (standard deviation) and median (maximum-minimum) values. Categorical data were reported as n (number) and percentages (%). The Student t and Mann Whitney U tests were used to comparing independent groups. The Pearson Chi-Square and Fisher Exact tests were used in analyzing categorical data. Data were examined at 95% confidence level, and the significance level was set at p less than 0.05.

Results

Files of 122 adolescents, including 36 anemic and 86 non-anemic cases, were evaluated. The mean age was lower in the anemic group, but this difference was not statistically significant (17.1 years vs. 17.9 years, p = 0, 072). BMI, the total number of pregnancies, parity, and abortions in previous pregnancies were not significantly different between the groups. When the groups were compared regarding educational levels, only the ratio of primary school graduates was higher in the non-anemic group (33.3% vs. 51.1%, p = 0.036). There was no difference between the groups regarding dietary habits, and the percentage of those fed in vegetarian style in both groups was similar. There was no difference between the groups concerning income levels (Table 1).

Among women included in the study, the incidence of anemia was 29.5%. While the serum ferritin and hemoglobin levels were lower in the anemic group, the iron binding capacity was lower in the non-anemic group, and the difference between the groups was statistically significant (p values 0.001, 0.041, and 0.023, respectively). Although the serum iron concentration was lower in the anemic group, the difference between the groups was not statistically significant. Of the pregnant women included in the study, 56.5% (n = 69) received iron supplementation. Oral iron supplementation rate was 33.3% in the anemic group and 66.2% in the non-anemic group (p = 0.001). The mean duration of iron use was 4.9 weeks in the anemic group and 8.4 weeks in the non-anemic group. There was a significant difference between the groups concerning oral iron use (p = 0.003) (Table 2).

Maternal weight gain during pregnancy was similar in both groups. There was no difference between the groups in terms of birth weight, term delivery, and preterm delivery. While the SGA ratio was similar among the groups, the LGA ratio was higher in the non-anemic group (8.3% vs. 6.9%, p = 0.813 and 5.5% vs. 13.9%, p = 0.032, respectively). The incidence of preeclampsia was higher in the anemic group compared to the

non-anemic group (11.8% vs. 4.6%, p = 0.003). There was no significant difference between the groups regarding gestational diabetes and postpartum hemorrhage (Table 3).

Table 1. Evaluation of obstetric history, sociodemographic status, and lifestyle according to the presence of anemia.

	Has anemia (n=36)	No anemia (n=86)	*p*
Mother's age (years)	17.12 ± 1.32	17.98 ± 0.92	0.072
BMI	24.93 ± 4.52	24.07 ± 3.87	0.629
Number of past pregnancies	1 (1-2)	1 (1-3)	0.378
Number of past deliveries	0 (0-1)	0 (0-2)	0.534
Previous abortion	0 (0-1)	0 (0-2)	0.534
Education			
Literate	8 (22.2%)	7 (8.1%)	0.054
Primary school	12 (33.3%)	44 (51.1%)	0.036*
High school	16 (44.5%)	35 (40.8%)	0.506
Vegetarian	9 (25%)	17 (19.8%)	0.520
Income			
Low	6 (16.7%)	17 (19.8%)	0.793
Medium	17 (47.2%)	41 (47.7%)	0.917
High	13 (36.1%)	28 (32.5%)	0.717

BMI: Body mass index. Values are given as mean ± standard deviation, median (min-max), and n (%). * p<0.05 is accepted as statistically significant.

Table 2. Serum hemoglobin, ferritin, and iron supplementation status.

	Has anemia (n=36)	No-anemia (n=86)	*p*
Hemoglobin (g/dL)	9.43 ± 1.13	11.41 ± 1.01	0.041
Serum ferritin (µg/L)	12.31 ± 3.57	26.42 ± 7.52	0.001*
Serum iron	57.47 ± 16.95	69.10 ± 28.08	0.124
Total iron binding capacity	365.16 ± 137.01	302.23 ± 123.08	0.023*
Oral iron intake	12 (33.3%)	57 (66.2%)	0.001*
Duration of iron intake (weeks)	4.91 ± 1.18	8.47 ± 1.56	0.003

Values are presented as mean ± standard deviation and n (%). * p<0.05 is accepted as statistically significant.

Table 3. Obstetric results associated with anemia.

	Has anemia (n=36)	No-anemia (n=86)	*p*
Weight gain during pregnancy (kg)	12.76 ± 6.63	12.05 ± 5.75	0.609
Week of pregnancy at birth			
<37 weeks	5 (13.8%)	11 (12.7%)	0.670
≥37 weeks	31 (86.2%)	75 (87.3%)	0.824
Birth weight (g)	2956 ± 663	3408 ± 727	0.183
SGA	3 (8.3%)	6 (6.9%)	0.813
LGA	2 (5.5%)	12 (13.9%)	0.032*
Pregnancy complications:			
Preeclampsia	5 (13.8%)	4 (4.6%)	0.003*
Gestational diabetes	3 (8.3%)	8 (9.3%)	0.643
Postpartum bleeding	3 (8.3%)	5 (6.8%)	0.570

SGA: Small for gestational age, LGA: Large for gestational age. Values are given as mean ± standard deviation, median (min-max), and n (%). * p<0.05 is accepted as statistically significant.

Discussion

The findings of this study demonstrated that nearly one-third of the study population had IDA, the mean age of the anemic women was lower compared to the non-anemic group, despite the increased iron requirement 45% of the pregnant women in this age group did not receive iron supplementation, iron supplementation was less in the anemic group, and the ratio of IDA was higher in the perinatal group having preeclampsia.

In the report of the global prevalence of anemia, the WHO states that more than 800 million children and women are affected by anemia every year in the world, and half of them are caused by IDA [12]. Iron deficiency anemia is encountered in less than 20% of pregnant women in developed countries, while it is seen in over 60% in low-income and developing countries [13, 14]. A relatively high proportion (29.5%) was observed in our study.

In the WHO 2025 targets, some suggestions were made to reduce anemia by 50%. One of these suggestions was the integration of iron supplementation with the other measures [13]. Oral iron supplementation plays a critical role in the prevention of IDA seen in pregnancy. Many studies have advocated the use of oral iron supplementation for the treatment of IDA in protecting both maternal and fetal health [14, 15]. The relationship between maternal-fetal outcomes and iron deficiency depends on the degree of anemia and the week of gestation when anemia was detected. Many authors argue that anemia and negative perinatal outcomes will coexist [16-18], while in their prospective study, Bencaiova et al. [19] claimed that there was no relationship between mild anemia and negative perinatal outcomes and that even mild placental hyperplasia caused by slight anemia may increase the support for fetal nutrition and the frequency of macrosomia. In our study, we found no difference between anemic and non-anemic groups concerning gestational diabetes, preterm labor or SGA frequencies, but contrary to the claims of Bencaiova et al., we found higher LGA rates in the non-anemic women.

In our study, the rate of preeclampsia was higher in the anemic group. The reason for this might be, as Gambling et al. stated, maternal and fetal stress induction by iron deficiency, resulting in corticotropin-releasing hormone (CRH) secretion, increased cortisol production, and oxidative stress, causing endothelial damage [20]. Although adolescent pregnancies are seen as a global health problem, the proportion of these pregnancies is relatively low among all pregnancies. Kaya et al. reported the ratio of adolescent pregnancies in all pregnancies at 2.8% [21, 22]. Mahavarkar et al. [23] mentioned that the biggest problem in adolescent pregnancies is preeclampsia, and this is twice as common as other pregnancies. In our study, the prevalence of preeclampsia among all pregnant adolescents was 7.3%, while it was approximately 3 times more in those with IDA. Therefore, we think that IDA is a risk factor for preeclampsia in pregnant adolescents.

Currently, the WHO recommends the use of daily 30-l60 mg of elemental iron routinely throughout the pregnancy, to prevent IDA. This recommendation is based on the Cochrane Review, which was published in 2012, and shows the positive effects of daily iron supplementation on perinatal outcomes [24]. However, some studies have suggested that routine iron supplementation during pregnancy may be associated with SGA deliveries and hypertensive disorders [25, 26]. Therefore, instead of routine iron supplementation, they suggested giving iron to selected women. In our study, we found that 56% of pregnant adolescents received iron supplementation and compared to the anemic group, iron intake was higher among non-anemic women.

There are some limitations of the work we offer, which can be listed as follows: First, only patients who received oral iron supplements were included in the study; patients using intravenous iron were not included. Second, the diagnosis of IDA was based on serum hemoglobin and ferritin levels. Methods for measuring serum transferrin receptor (sTfR) levels or sTfR / ferritin index were not utilized. Another limitation is the retrospective nature of the study. On the other hand, being one of the few studies investigating IDA in adolescent pregnancies [15, 21, 23, 27] is a strength of this study.

Conclusion

The prevalence of iron deficiency anemia in adolescent pregnancies is as high as 39.5% in our province, which is in the East Marmara region and has relatively high industrialization and monthly average household incomes per capita compared to the other regions of Turkey. However, only one-third of pregnant women diagnosed with anemia were using iron supplementation, and the average duration of iron use was as short as 5 weeks. Both adolescent pregnancies and the IDA seen among these women has become a public health problem that cannot be solved solely by obstetricians. For this purpose, a national screening program should be implemented to collect more data, and strategies for combating IDA should be determined, which is very important for healthy mothers and healthy generations.

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