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IMPACT OF IRON DEFICIENCY ON THE COURSE OF PREGNANCY

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Summary

Background. Anemia is a very important factor affecting the health of a pregnant woman. The aim of the study was to assess the peculiarities of pregnancy in women with iron deficiency and iron deficiency anemia.

Material and methods. We examined 161 pregnant women with iron deficiency (main group, n=83) and with normal hemoglobin levels (comparison group, n=78). Serum iron content and total serum iron binding capacity were determined by a biochemical method using an Indiko biochemical analyzer. All pregnant women were examined in 2 periods: winter-spring (n=77) and summer-autumn (n=84).

Results. It was found that in the summer-autumn period, the iron content in the serum of pregnant women was statistically significantly higher than in the winter-spring period. The index of total serum iron-binding capacity, an increase in which indicates a tendency to iron deficiency in the body, on the contrary, was higher in the winter-spring period.

Conclusions. In pregnant women of the main group with a blood hemoglobin level of less than 90 g/l and iron deficiency anemia, such conditions as gestosis, threat of miscarriage, and fetal hypoxia occurred significantly more often than in pregnant women of the comparison group with a normal blood hemoglobin level. It was found that there is a dependence between the iron supply of pregnant women and the season.

Keywords: iron deficiency anemia, iron deficiency, pregnant women, pregnancy complications, nutrition

Introduction

Nutrition is a very important factor affecting the health of a pregnant woman, as normal fetal development requires regular and balanced nutrition with a sufficient amount of macro- and micronutrients [1,2]. Insufficient and inadequate nutrition leads not only to the development of congenital malformations but also to complications of the gestational process, such as preeclampsia, gestational hypertension, fetal growth retardation syndrome, premature birth, etc. [3-5].

One of the most important micronutrients for pregnant and lactating women is iron [6]. Iron deficiency leads to iron deficiency anemia, which is common in both developed countries (about 17-20% of women) and developing countries (30-49% of pregnant women). This disease causes hypoxia and fetal growth retardation, weakness of labor in pregnant women, and anemia in newborns [7,8]. In the prevention of iron deficiency anemia, early diagnosis and treatment of latent (hidden) iron deficiency, which is manifested by changes in biochemical parameters characterizing iron metabolism at normal hemoglobin concentrations in the blood, is crucial. Such biochemical indicators of iron deficiency include low serum ferritin and iron concentrations, low serum transferrin saturation, and total serum iron-binding capacity [9].

Pregnant women often have iron deficiency due to increased iron consumption during the entire period of gestation. It will help to maintain the level of iron necessary for the health of mother and child by maintaining a healthy and balanced diet during pregnancy, eating enough meat, liver, fish, poultry, legumes, and leafy greens [10].

A rational integrated approach to the management of pregnant women with iron deficiency anemia should include: 1) early identification of pregnant women at risk of developing anemia. These include women with a history of anemia with infectious, cardiovascular, endocrine and other diseases, women who have given birth three or more times,

women with multiple pregnancies, blood and gastrointestinal diseases, complications during pregnancy (early toxicosis, gestosis, etc.), autoimmune disorders, oncological diseases, etc.; 2) thorough examination of patients for the presence of iron deficiency anemia and identification of its cause; 3) timely implementation of preventive and therapeutic measures using a special diet (eating meat, fish) and modern medications that should be selected individually [11].

Aim of the work

The aim of the study was to evaluate the features of pregnancy in women with iron deficiency and iron deficiency anemia.

Material and methods

The study is based on the results of the examination of 161 pregnant women who were in the Department of Pregnancy Pathology and the Department of Extragenital Pathology of the Ternopil Regional Clinical Perinatal Center “Mother and Child”, Ukraine, for the period 2023.

To achieve the goal, 161 pregnant women who met the inclusion criteria were included in the study. Informed consent for examination and treatment was obtained from all women before their inclusion in the study. Inclusion criteria in the study: gestational age from 39-40 weeks, anemic syndrome, lack of iron preparations during pregnancy, consent of patients for inclusion in the study group. Exclusion criteria from the study: impaired iron absorption (sideroachretic anemia, lead anemia, pernicious anemia, hemolytic anemia), disease, pathology of the hemostasis system, patient's refusal of treatment or compliance with doctor's orders.

According to the results of the examination, all patients were divided into two groups: main group (n=83) – women with anemic syndrome in the II and III trimesters of pregnancy;

control group (n=78) – women with a physiological course of pregnancy and normal indicators of hemoglobin concentration, the number of erythrocytes in peripheral blood and iron metabolism, in whom there was no history of chronic infectious and autoimmune diseases. The average age of women in the main group was 30.6±3.4 years, and women in the control group – 28.9±2.7 years.

The examination of pregnant women was conducted according to generally accepted rules by a general practitioner with the involvement of specialists (otolaryngologist, gastroenterologist, cardiologist, psychologist). The diagnosis of iron deficiency anemia was verified in accordance with the order of the Ministry of Health of Ukraine No. 907 dated November 2nd, 2015 [12]. The diagnostic criteria for iron deficiency anemia were hemoglobin level, microcytosis, and reduced ferritin level. Treatment of pregnant women was carried out with the help of foods with a high iron content. All women examined were also taking iron-containing supplements (pregnancy vitamins).

To assess the impact of the seasonal factor on dietary iron supply, pregnant women were examined in 2 periods: winter-spring (n=77) and summer-autumn (n=84).

The hemoglobin content was determined using an automatic hemoglobin analyzer H-18 Light. 5 ml of venous blood of pregnant women was taken in vacuum tubes “Vacumed” on an empty stomach. The vacuum tube was loaded into the gas analyzer, and the result was obtained after 30 minutes. Serum iron content and total serum iron binding capacity were determined by a biochemical method using an Indiko biochemical analyzer. A normal hemoglobin level was considered to be more than 105 g/l for women in the second trimester and more than 110 g/l for women in the third trimester.

The obtained data was processed by the method of variational statistics using the "Statistica 10.0", Exel, software packages. Mathematical processing was carried out with the calculation of average values, errors of the arithmetic mean, and mode. The reliability of the

shifts was assessed by the Student's t-test, which confirms the presence of a significant difference between the means with a probability of more than 95% ($p<0.05$), 99% ($p<0.01$), and 99.9% ($p<0.001$). When conducting a correlation analysis, the degree of connection between two signs was judged by the correlation coefficient (r), which lies in the range from +1 to -1 (85) [13].

Results

After interviewing the women in the main group, it was determined that the majority of this group (58%) were repeat mothers with a short interval between births (less than 3 years). In the comparison group, most women had their 1st and 2nd pregnancies with an interval between pregnancies of more than 3 years (73%). The age distribution of the surveyed pregnant women was as follows: most of them (42%) were aged 26-30 years, 37% were aged 31-35 years, 12% were over 35 years, and the least were aged 20-25 years (9%). 61% of the women surveyed lived in urban areas, and 39% lived in rural areas.

The obstetric anamnesis revealed the presence of previous pregnancies, their course, and outcome (abortions, childbirth). The percentage of patients with their first pregnancy was 47%, with their second – 42%, and 11% of women had three or more pregnancies. Special attention was paid to the course of this pregnancy: the presence of toxicosis and other pregnancy-related diseases.

Their pregnancy course was more unfavorable than that of the comparison group, and various complications of the gestational period were more frequent (Figure 1).

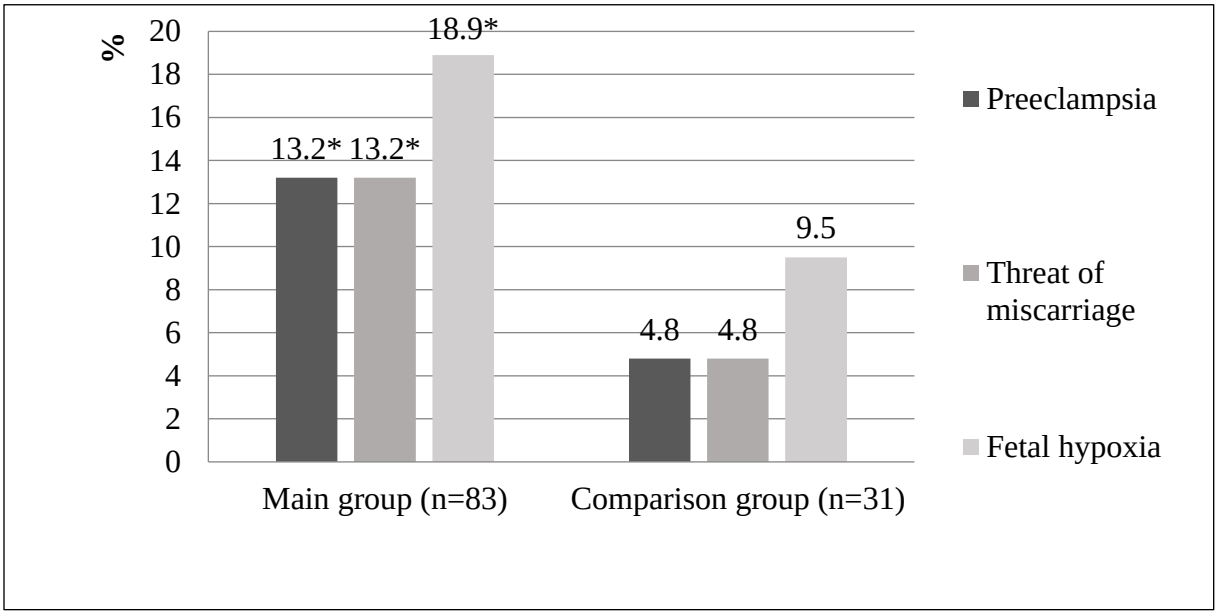

Figure 1. Frequency of pregnancy complications in women in the main group and the comparison group

Notes: * – differences are significant (p<0.05) compared to the same indicator in the comparison group.

Thus, pregnant women in the main group had statistically significantly more frequent gestosis, threatened abortion, and fetal hypoxia compared to the comparison group (p<0.05).

It was found that the incidence of pregnancy complications increased with a decrease in blood hemoglobin levels. In women with a hemoglobin level of less than 90 g/L and iron deficiency anemia, conditions such as gestosis, threatened miscarriage, and fetal hypoxia occurred significantly more often than in pregnant women with a hemoglobin level of more than 90 g/L (Figure 2).

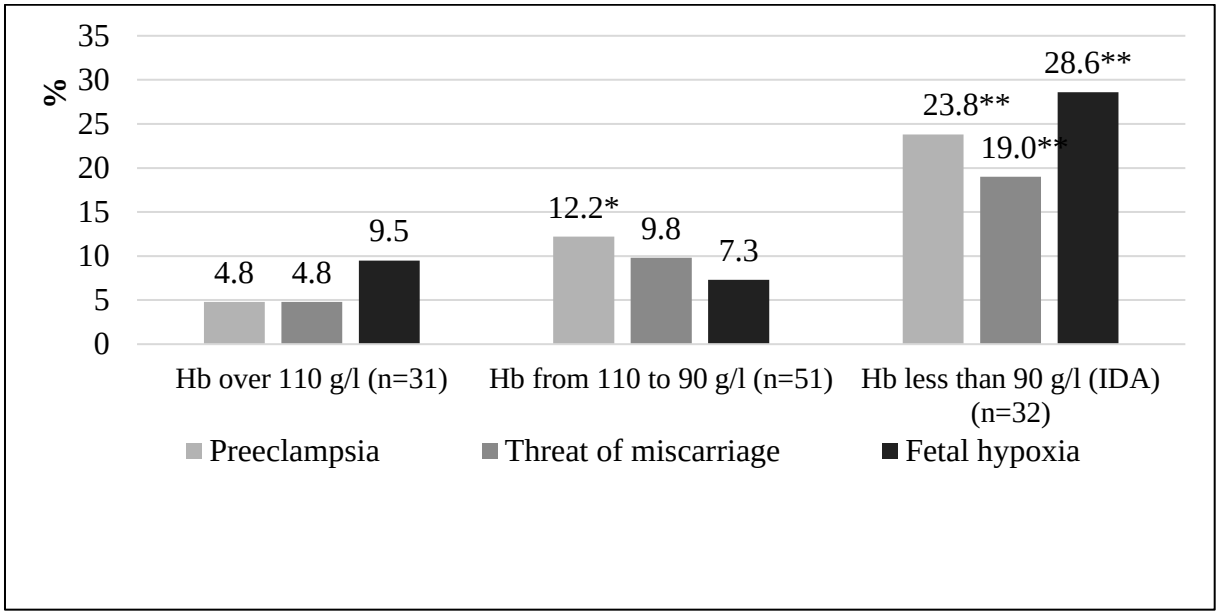

Figure 2. Frequency of pregnancy complications in women with different levels of hemoglobin in the blood of the main group

Notes: * – differences are significant (p<0.05) compared to the similar indicator of the group of pregnant women with Hb over 110 g/l; ** – differences are significant (p<0.05) compared to the similar indicator of the group of pregnant women with Hb fr.

Childbirth in women of the main group was more often complicated by premature amniotic fluid discharge, weakness of labor and bleeding in the postpartum and early postpartum periods than in women of the comparison group (Table 1).

Table 1. Frequency of complications during childbirth in women of the main group and the comparison group

Complications during labor	**Number of cases, % (number of people)**	
	Main group (n=83)	**Comparison group (n=78)**
Premature rupture of amniotic fluid	18.9 %	14.3 %
Weakness of labor activity	13.2 %	9.5 %
Bleeding in the third stage of labor	11.3 %	4.8 %

A comparative analysis of the iron status of expectant mothers in the summer-autumn (n=84) and winter-spring (n=77) periods was also conducted (Table 2).

Table 2. Iron status of pregnant women depending on the season

Indicator, units of measurement	Indicator norm	Research period	
		Winter-spring season (n=77)	Summer-autumn season (n=84)
Iron in blood serum, µM/l	over 12.5	10.6±0.8	12.2±0.4*
Total iron-binding capacity of blood serum, µM/l	44.7-71.6	70.5±5.9	62.7±2.2*

Notes: * – differences are significant (p<0.05) compared to the similar indicator of the winter-spring group.

It was found that in the summer-autumn period, the iron content in the serum of pregnant women was statistically significantly higher than in the winter-spring period. The index of total serum iron-binding capacity, an increase in which indicates a tendency to iron deficiency in the body, on the contrary, was higher in the winter-spring period (p<0.05). Thus, it can be argued that there is a dependence between the iron supply of pregnant women and the time of year.

Discussion

Studies have shown that iron deficiency anemia is common among people around the world, especially among pregnant women [14,15]. This figure depends on the socioeconomic standard of living of the population and therefore reaches 85-92% in underdeveloped countries and decreases to 8-20% in countries with high living standards and lower birth rates. Low hemoglobin values have been found in women in developing countries, such as India and Latin

America. According to some studies, 21% to 80% of pregnant women suffer from iron deficiency anemia [16-18].

The issue of pregnant women's anemia is especially relevant because maternal anemia has a negative impact on the fetus and newborn: 15.5-22.0% of pregnant women with anemia develop fetal or newborn asphyxia, often have central nervous system disorders, and infant mortality increases. Pregnant women's anemia negatively affects the red blood count of the newborn [19]. Children born to mothers with iron deficiency anemia often have depressed red blood cell maturation, and by the age of one and a half years, half of the children develop hypochromic anemia [20]. According to literature, iron deficiency leads to the development of complications [21], such as chronic placental insufficiency (18-24%), associated chronic fetal hypoxia and fetal growth retardation syndrome (15-20%), the threat of miscarriage and preterm birth (11-42%), and gestosis (40-50%) [22]. The percentage of pregnancy complications in women with iron deficiency in our study was also quite high. It should be noted that the severity of anemia in the fetus is always less pronounced than in the mother. Nevertheless, children born to anemic women have half the iron reserves of children born to healthy women [7].

The development of iron deficiency anemia in pregnant women is facilitated by the following factors: nutritional factor (insufficient iron intake), reduced iron intake from food due to malnutrition, gastrogenic causes and enterogenic factor (disorders of the processes of cavity and parietal digestion, limitation of iron absorption), impaired iron transport due to transferrin deficiency as a result of primary liver disease, alteration of iron deposition in severe acute and chronic liver disease. Frequently recurrent bleeding is important, especially in placenta previa. In recent years, 20-30% of pregnant women have been diagnosed with anemia along with weight loss. Iron metabolism disorders are also associated with high levels of estrogen during pregnancy, which affect iron utilization (inhibit red blood cell formation) [23].

Thus, anemia continues to be one of the most pressing problems of pregnancy. A prominent place among the preventive measures of anemia is given to a woman's full-fledged rational nutrition before conception with replenishment of the iron depot after a previous birth (the interval between births is at least 3 years) and during pregnancy.

Conclusions

1. In pregnant women in the main group with a blood hemoglobin level of less than 90 g/L and iron deficiency anemia, conditions such as gestosis, threatened miscarriage, and fetal hypoxia occurred significantly more often than in pregnant women in the comparison group with a normal blood hemoglobin level. At the same time, the level of hemoglobin in the blood of the women under study directly depended on the length of time between births.
2. It was found that there is a relationship between the iron supply of pregnant women and the time of year: in the summer-autumn period, the iron content in the serum of pregnant women was statistically significantly higher than in the winter-spring period.

Disclosures and acknowledgements

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