



## RELATIONSHIP BETWEEN MATERNAL ANAEMIA AND RISK OF PREECLAMPSIA

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### ABSTRACT

**Background:** Preeclampsia is among the leading causes of morbidity and mortality worldwide, affecting approximately 4.6% of all pregnancies. In contrast, anemia during pregnancy significantly increases the risk of pre-eclampsia as well as fetal complications.

However, the importance of this association is still inconclusive, and it is suggested that the increased risk of pre-eclampsia be associated with the severity of iron deficiency, and not only with the presence of anemia. **Objective:** To determine the prevalence of iron deficiency anemia among pre-eclampsia patients among pregnant women attending the obstetrics department at Tishreen University Hospital, to extrapolate the relationship between them and compare it with the control sample. **Materials and Methods:** This prospective study included 120 pregnant women in the third trimester of pregnancy who attended the outpatient department or admissions in the Department of Obstetrics and Gynecology at Tishreen University Hospital, Latakia, during the period between March 2022- March 2023. Pregnant women were followed up until the end of their pregnancy to determine outcomes. The participants in the research were classified into two groups: a control group that included healthy pregnant women, and a case group that included pregnant women with pre-eclampsia. Their iron deficiency anemia was investigated by measuring hemoglobin, hematocrit, iron, and serum binding capacity. **Results:** The average age of the research sample patients was  $26 \pm 5.2$  years. We did not find statistically significant differences between the two research samples in terms of basic characteristics or the number of pregnancies, deliveries, and miscarriages. (0.001). And we had a statistical relationship between the severity of preeclampsia and the severity of serum iron deficiency (with iron deficiency  $p = 0.002$ , and

with severe serum iron deficiency  $p = 0.003$ ). **Conclusion:** Pre-eclampsia patients are exposed to anemia with a rate of approximately twice that of pregnant women who do not suffer from pre-eclampsia, and a deficiency of serum iron by more than 4 times, and the more severe the iron deficiency, the more severe the pre-eclampsia.

**KEYWORDS:** Pre-eclampsia, anemia, iron deficiency.

## INTRODUCTION

- Approximately 10% of pregnancies are mixed with high blood pressure disorders, including pre-eclampsia, and constitute one of the Major causes of maternal and neonatal mortality and morbidity.WHO2012
- There are indications that pre-eclampsia occurs more frequently in patients with iron deficiency anemia than Pregnant women who do not suffer from anemia, the nature of the relationship between anemia and pre-eclampsia is not yet clear, as it is possible that pre-eclampsia interferes with the gastrointestinal absorption of blood-forming elements, or causes impairment of liver and kidney function, affecting Folic acid metabolism or erythropoietin production.
- Anemia is an important health problem during pregnancy and its incidence is still high. Estimates indicate that a third of women are around The world, and 32.8 % of them are in Syria in particular, suffer from anemia at the age of reproductive activity (15-49 years).The prevalence of anemia among pregnantwomen is about 40%.
- The two most common causes of anemia during pregnancy are iron deficiency anemia andhemorrhagic anemia due to severe blood loss.
- Iron deficiency anemia is the most common and widespread nutritional deficiency around the world, particularly among pregnant women and children, especially in developing countries.
- The daily need for iron increases during pregnancy for several reasons, including the increased needfor iron to meet the requirements of the growing fetus and placenta.
- An increase in the mass of red blood cells, and an increase in blood volume. However, there are many risk factors for iron deficiency anemia during pregnancy includes: A limitation of iron absorption Iron- poor nutrition, intestinal problems that affect, or the approach of pregnancies. An Other causes of anemia include parasitic hemoglobin infections, other nutritional deficiencies.
- The average daily need for iron is about 6.5 mg during the second half from pregnancy to

insurance requirements the fetus and the placenta.

- The amount of iron absorbed also increases during the second half (especially in the third term).
- About six times the amount absorbed from the food sources of the woman outside the time of pregnancy.
- Anemia is not a diagnosis but a manifestation of the underlying disorder. Therefore, mild, not symptomatic, anemia should be investigated. The main problem has been found and resolved.
- Until it.
- Iron deficiency anemia is diagnosed based on laboratory values, as hemoglobin and hematocrit are. Primary screening tests are for the detection of anemia, but they are not specific for the determination of iron deficiency.
- Initial laboratory tests indicating iron deficiency anemia show the presence of hypochromic microcytic anemia, with evidence of iron deficiency anemia. Iron stores are depleted, serum ferritin is low, serum iron is low, iron capacity is high, and high Portoporphyrin levels in erythrocytes.

## METHODS

Total subjects in both the cohorts. This was a prospective cohort study conducted at Tishreen University Hospital in Latakia. Sample size: 120 pregnant women in the third trimester of pregnancy who attended Tishreen University Hospital in Latakia.

### **The patient sample was divided into two subgroups**

The first group: includes pregnant women whose pregnancy was mixed with pre-eclampsia (the group of cases).

The second group: includes pregnant women who had a quiet pregnancy without medical complications (the control group).

The value of hemoglobin less than 11 g/dl was adopted as a cut-off for identifying anemic patients in the two samples.

The necessary approvals to conduct the research were obtained from the competent councils. The patient's consent was taken according to the attached informed consent form after she met the entry criteria for the study.

The information and data required for the research were collected according to a special form for the research, with an ultrasound imaging procedure to determine the entry conditions.

A venous blood sample was drawn, an analysis of hemoglobin, serum iron, transferrin saturation, arterial pressure was measured, the woman was placed in the appropriate group, and the prevalence of anemia among pregnant women, its severity, and its relationship with the severity of pre-eclampsia were studied.

The pathological sample: consisted of 50 pregnant women in the last trimester who had a degree of pre-eclampsia (defined as defined by the presence of a rise in arterial pressure  $\geq 140/90$  mm Hg, taken by at least two measurements, 4 hours apart, after the 20th week of pregnancy in a normal woman Previous arterial hypertension, with proteinuria  $\geq 300$  mg/24 hours).

The control sample: It consisted of 70 pregnant women in the last trimester who were admitted to the hospital in the same previous period and at the same gestational age, and they had no previous eclampsia.

The condition of the woman was followed up and the registered obstetric and parental complications were monitored until delivery occurred.

After collecting the complete data, it was computerized and statistical analysis was conducted using Excel 2000.

The results of the research were compared with the results of previous international research published in medical journals.

## RESULTS

The research sample included 120 pregnant women in the third trimester of pregnancy with a single, single pregnancy from outpatient visits or admissions in the Department of Obstetrics and Gynecology at Tishreen University Hospital in Lattakia during the time period 2022-2023, and the investigators met the inclusion criteria in the research.

The age of the women ranged from 19 to 45 years, and the average age was  $28.9 \pm 2.8$  years. The aim of the research was to determine the prevalence of iron deficiency anemia in pre-eclampsia patients and to extrapolate the relationship between them and compare it with the

control sample.

**Table (1): Basic characteristics in a sample of 120 patients.**

Basic characteristics	case	control	p-value
age	28.5±2.3	29.4±1.6	0.2
Gestational age	37.8±0.2	38.2±0.1	0.1
BMI	23.6±1.4	22.4±1.5	0.6
Load number	3.8±0.9	3.6±0.6	0.8
Number of births	2.9±0.6	3.3±1.1	0.09
Number of abortions	1.6±0.4	1.4±0.2	0.5

We note from the previous table that there are no statistically significant differences between the two research groups due to all the basic characteristics.

**Table (2): Distribution according to the number of cases of anemia for patients.**

Hg(g/dl)	case	control	p-value
<11	32(64%)	27(38.6%)	0.03
≥11	18(36%)	43(61.4%)	

We note from the previous table that there are statistically significant differences between the two research groups due to the presence of anemia and those classified according to hemoglobin values, as anemia was more common in the case group and reached 64% compared to 38.6% in the control group.

**Table (3): Distribution according to the number of cases of serum iron deficiency among patients.**

Serum iron	case	control	p-value
<60	36(72%)	12(17.1%)	0.001
>60	14(28%)	58(82.9%)	

We note from the previous table that there are statistically significant differences between the two research groups due to the presence of a deficiency in serum iron, as iron deficiency was more common in the case group and amounted to 72% compared to 17.1% in the control group.

**Table (4): The relationship between the severity of pre-eclampsia and the presence or absence of serum iron deficiency in a sample of 50 patients.**

Serum iron	Un sever preeclampsia	sever preeclampsia	p-value
<60	23(67.6%)	13(81.2%)	0.002
>60	11(32.4%)	3(18.8%)	

We note from the previous table that there are statistically significant differences between the severity of pre-eclampsia in the presence of serum iron deficiency, as with the increase in the severity of pre-eclampsia, the percentage of patients who have a deficiency in serum iron increases.

**Table (5): The relationship between the severity of pre-eclampsia and the severity of serum iron deficiency in a sample of 50 patients.**

Serum iron	Un sever preeclampsia	sever preeclampsia	p-value
40-60	15(65.2%)	4(30.8%)	0.003
<40	8(34.8%)	9(69.2%)	

We note from the previous table that there are statistically significant differences between the severity of pre-concussion and the severity of serum iron deficiency, as with the increase in the intensity of pre-concussion, the severity of the decrease in serum iron increases.

## DISCUSSION

The research sample showed that the average is close between the two samples with regard to the basic characteristics, and this plays an important role in eliminating the secondary factors that may affect in one way or another on the results.

The largest prevalence of female patients in the two samples was within the age group of 26-40 years (about 60% in the control sample and 64% in the pathological sample), and this is the highest age for childbearing in our country, and the distribution of patients to age groups sometimes converges or diverges, but within limits acceptable.

It is noted that more than 60% of both research groups were located within the group with a number of pregnancies >4, and this slightly reduces the role of multiple pregnancies as a main cause of anemia.

It is also noted that more than 60% of patients in both groups fall within the category with a number of births >4, and the vast majority of patients were those who had not previously experienced any miscarriage, and this gives the same previous observation, which serves the purpose of the research.

When comparing the indicators of the two research groups, they were somewhat close, and despite that, the levels of iron in the control group were one and a half times more than their level in pre-eclampsia patients, and this leads us to the first result ((pre-eclampsia patients

have low levels of iron in their serum)).

When calculating the number of anemia cases in the two samples, we noticed that anemia was very common in the pathological sample compared to the control sample, and from here we reached the second result ((a pre-eclampsia patient is exposed to anemia at a rate that is approximately twice that of a pregnant woman who does not suffer from preeclampsia concussion)).

The prevalence of serum iron deficiency among the patients of the sick sample was much more than it was among the patients of the control sample, and this brings us to the third result ((The pre-eclampsia patient is exposed to a deficiency in her serum iron by more than 4 times compared to the pregnant woman who does not suffer from pre-eclampsia)).

When calculating the percentage of anemia in pre-eclampsia cases according to its severity, we noticed that no matter how severe the pre-eclampsia was, about 60% of the patients had anemia.

When studying the relationship of the degree of anemia with the severity of pre-eclampsia, we noticed that the severity of pre-eclampsia does not have a significant effect on the hemoglobin number of anemic patients, although there is a slight tendency for the anemia to be more severe if the pre-eclampsia was more severe.

On the other hand, when studying the relationship of iron deficiency in terms of its presence and severity with the severity of pre-eclampsia, we found that the greater the severity of pre-eclampsia, the greater the percentage of patients who had a deficiency in serum iron, and the percentage of deficiency in their serum iron was greater, and from here we reach the fourth result ((if it is The iron numbers are deficient, so the pre-eclampsia tends to be severe, but if the iron numbers are within the normal limits, the pre-eclampsia tends to be not severe)).

Based on these results, we address the following question: Can the presence of iron deficiency play the role of the first warning or the risk factor in the fact that this patient will suffer from pre-eclampsia, and can she be protected from that by simply giving her iron early? Does the presence of normal iron levels in any pregnant woman mean She will not have a pre-eclampsia.

Based on this, future research must be conducted in order to more accurately define the

relationship between pre-eclampsia and serum iron deficiency and find solutions to treat or avoid the cause in order to reach a better result for the health of the pregnant woman and the health of the fetus, which represent the first goal that the obstetrician seeks to maintain.

### **Comparison with several studies**

Anemia is one of the most common problems associated with pregnancy, and iron deficiency is the most common cause, as a result of the increased need for iron to meet the requirements of pregnancy and fetal development, and insufficient nutritional intake.

This research was conducted to determine the association of iron deficiency anemia with pre-eclampsia within the research sample taken from admitted patients at Tishreen University Hospital in Lattakia during the period between 2022-2023.

Smith and colleagues 2019 study in Columbia of 515,270 women on perinatal morbidity and mortality associated with maternal anemia found that in anemic women we had longer hospitalizations and higher rates of pre-eclampsia.

In a study conducted by Hari's.<sup>[75]</sup> in Indonesia in 2017, it was conducted on 204 women who were divided into a sick sample that included 68 pregnant women with pre-eclampsia (34 patients had anemia at a rate of 50%) and a control sample that included 136 healthy pregnant women (53 patients had anemia with an average 39%).

A study conducted by AbdelAzim.<sup>[76]</sup> and his colleagues in Sudan in 2011 on 9578 women showed that the greater the severity of anemia, the greater the risk of pre-eclampsia with statistical significance  $p < 0.001$ .

In a study conducted by Yakoob and his colleagues in 2011, he emphasized an increased risk of developing pre-eclampsia in iron-deficiency anemia patients.

A study conducted by Rabia Sattar and his partners in Pakistan in 2017 on 78 women divided into 62 pregnant women with pre-eclampsia and 16 healthy pregnant women. When evaluating hemoglobin in the two research groups, it was found that hemoglobin values deteriorated in pre-eclampsia patients.

In a 2017 study by Suryanarayana and colleagues, anemia was one of the leading causes of pregnancy-related complications, the most important of which was pre-eclampsia.



A study conducted by<sup>[77]</sup> Dr.M.M. Dunda in Indonesia in 2020 on 264 women divided into 132 pregnant women with pre-eclampsia and 132 healthy pregnant women. The result of the study was that there was no statistical significance between anemia and pre-eclampsia with  $p>0.05$ .

A study conducted by Dr. GarimaGupta<sup>[78]</sup> in India in 2018. The research sample was divided as follows: a case sample that included 180 pregnant women with pre-eclampsia and severe anemia and impotence of a witness that included 180 pregnant women with pre-eclampsia and moderate and mild anemia, where it was found that the maternal and fetal complications were more in the sample pathogenesis, anemia was considered key to preventing the increased risk of pre-eclampsia.

A 2019 study in China by Sen Chen found that supplementing iron with folic acid from the beginning of pregnancy in pregnant women reduced the risk of pre-eclampsia compared to giving folic acid alone.

Finally, the results of this research call attention to the need for early evaluation and awareness-raising among women about the importance and seriousness of this condition in order to mitigate the direct negative effects of the mother and the newborn.

## CONCLUSION

1. A pre-eclampsia patients have low serum iron levels.
2. A pre-eclampsia patient is exposed to anemia at a rate nearly twice as high as a pregnant woman who does not suffer from a pre-eclampsia.
3. A pre-eclampsia patient is exposed to a deficiency in her serum iron by more than 4 times compared to a pregnant woman who does not suffer from a pre-eclampsia.

If the iron numbers are deficient, then the pre-eclampsia tends to be severe, but if the iron numbers are within the normal limits, the pre-eclampsia tends to be not severe.

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