



# Evaluation of Platelet Parameters in Patients with Preeclampsia in Comparison with Healthy Pregnant Women Referring to Ganjavian Hospital in Dezful City in 2019

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## Abstract

**Background:** Preeclampsia is one of the complications of pregnancy that endangers the life of the mother and the fetus. This complication accounts for 18% of maternal mortality and is the second leading cause of maternal mortality in Iran. Various studies have shown the important role of platelets in the pathogenesis of preeclampsia.

**Objectives:** This study was conducted to evaluate platelet parameters in patients with preeclampsia compared to healthy pregnant women who were referred to Ganjavian hospital in Dezful city in 2019.

**Methods:** In this study, which is a retrospective case-control study, the files of women who gave birth in Ganjavian hospital in 2019 were examined. The files of the case group, which included people with preeclampsia, were selected as available samples (104 people), and the control group, which included pregnant women without preeclampsia, were randomly selected using a table of random numbers (104 cases). Criteria for entering the study in the group with preeclampsia included BP  $\geq$  140/90 mmHg, proteinuria of more than 300 mg in 24-hour urine or 30 mg consistently in random urine samples, and gestational age over 20 weeks. Also, people with any underlying disease, such as diabetes, chronic hypertension, known platelet disorders, multiple birth, and drug use (heparin, aspirin) in the group with preeclampsia were excluded from the study. The data of this study were analyzed using SPSS software version 20, and independent *t*-test, and Mann-Whitney U test at a significant level lower than 0.05.

**Results:** There was no statistically significant difference in demographic factors between the two case and control groups. There was a statistically significant difference between the mean hemoglobin in healthy women  $11.91 \pm 1.30$  and preeclampsia  $10.89 \pm 1.09$  ( $P < 0.0001$ ). Also, according to the findings, the individuals of the two groups had a significant difference in terms of mean platelet volume (MPV): Healthy women:  $10.79 \pm 1.24$  and preeclampsia women:  $12.98 \pm 1.16$  ( $P < 0.0001$ ). Also, the results of the Mann-Whitney U test showed that there was a statistically significant difference between the number of platelets in healthy women ( $284.52 \pm 60.58 \text{ mm}^3$ ) and preeclampsia women ( $149.30 \pm 30.38 \text{ mm}^3$ ) ( $P < 0.0001$ ).

**Conclusions:** Considering the importance of reducing the complications and mortality of pregnant mothers, early detection of changes in platelet factors during pregnancy can be a predictive factor in identifying people at risk for preeclampsia.

**Keywords:** Pregnant Women, Preeclampsia, Platelet Indices, Mean Platelet Volume (MPV), Platelet Distribution Width (PDW)

## 1. Background

Preeclampsia (PE) is one of the main risk factors for maternal mortality (1). It is a specific pregnancy syndrome characterized by systolic blood pressure  $> 140$  mmHg or diastolic blood pressure  $> 90$  mmHg in two measurements at intervals of at least 4 hours, along with proteinuria (urinary protein content of 300 mg or more per 24 hours) and other signs that may occur in the 20th week

of pregnancy and last for six weeks after delivery (2, 3). The risk of infant mortality in preeclampsia is four times higher than normal pregnancies. This pregnancy disorder is dangerous and responsible for 15% of preterm births and affects about 5% to 8% of pregnancies. In developing countries, women die every year due to preeclampsia. This disorder is known as the third leading cause of death worldwide and the second most common cause of

maternal death in Iran (4-6). Despite extensive studies in recent years, there is no clear cause for the disease, but in some studies, some characteristics of mothers, including age, history of multiple births, history of miscarriage, multiple pregnancies, previous history of preeclampsia, high body mass index (BMI), nullipara, family history, and other factors, such as diabetes, chronic hypertension, coagulation disorders, renal disorders, hypothyroidism, migraine, maternal RH, vasospasm, cardiovascular damages, and inflammatory indices increase the risk of preeclampsia (4, 5, 7). Every year, 50,000 women worldwide die of preeclampsia and its complications. This disease can lead to some complications, such as heart failure, cerebrovascular injuries, acute renal failure, excessive platelet depletion (thrombocytopenia), and hemolysis in the mother, and in the fetus, it can increase the risk of preterm delivery, intrauterine growth restriction (IUGR), low birth weight, thrombocytopenia, and fetal hypoxia and can cause death in severe cases (8-11).

Platelet changes are one of the major changes in blood factors in pregnancy. Normal pregnancy is characterized by an increase in platelet aggregation and a decrease in the number of circulating platelets. Platelet longevity is decreased, and mean platelet volume is increased slightly during pregnancy. Increased platelet intake in placental uterine circulation has been suggested as an explanation for the decrease in circulating platelet count. Increased intake of uterine-placental circulation has been suggested as an explanation for the decrease in circulating platelet count (platelets in pregnancy).

Some studies have shown that platelets play an important role in the pathogenesis of preeclampsia. Preeclampsia increases platelet activity and platelet consumption and, ultimately, thrombocytopenia, which produces younger platelets by increasing the average volume to compensate for them. Therefore, platelet indices may be a way to predict preeclampsia and resolve this dangerous complication (12, 13). Given the importance of the issue and the differences in the results of published studies, it is important to study the platelet indices of pregnant women as a prognosis for preeclampsia. If platelet counts are associated with preeclampsia, platelet counts can be used as a simple, inexpensive, and affordable way to diagnose preeclampsia and prevent many problems by monitoring pregnant mothers.

## 2. Objectives

The current study aimed to evaluate the platelet parameters in patients with preeclampsia in comparison with healthy pregnant women who were referred to Ganjavian hospital in Dezful city in 2019.

## 3. Methods

The present study is a case-control and retrospective study. The research samples were healthy pregnant women and those with preeclampsia who were referred to Dr. Ganjavian hospital in Dezful city in 2019. After obtaining the ethical clearance from the Dezful University of Medical Sciences (IR.DUMS.REC.1398.015), the files of pregnant women without and with preeclampsia who gave birth in 2019 in Dr. Ganjavian hospital were examined. Individuals in the case group (files of patients with preeclampsia) were selected as available samples. Individuals in the control group were randomly selected using random number tables due to a large number of available files and increasing the study's accuracy. Criteria for entering the study in the group with preeclampsia were blood pressure  $\geq 140/90$ , proteinuria of more than 300 mg in 24-hour urine or 30 mg consistently in random urine samples, and gestational age over 20 weeks. Exclusion criteria in the group with preeclampsia included any underlying disease, such as diabetes, chronic hypertension, known platelet disorders, multiple birth, and drug use (heparin or aspirin). Women with preeclampsia with BP  $\geq 140/90$  with proteinuria > 20 weeks gestation were included in the study. The individuals of the control group were also healthy pregnant women with no pregnancy complications and no history of underlying diseases, such as diabetes, chronic hypertension, known platelet disorders, multiple birth, and drug use (heparin or aspirin). Samples studied in both case and control groups were matched in terms of maternal age (women 18 - 35 years old), gestational age (gestational age of 20 - 41 weeks), the number of pregnancies, having a live fetus at the time of hospitalization, and being Iranian. To do this, first, the patient admission offices in the maternity hospital of the mentioned hospital were examined in the desired time interval, and the details of the patients who had the inclusion criteria were recorded then by referring to the hospital archive unit, the required information, including platelet indices of the case group, such as platelet distribution width (PDW), mean platelet volume, and platelet count were extracted from the CBC test in patients' files, which was done at the beginning of the hospitalization and the information that was not recorded in these files were obtained during contact with them. The files of 104 people in the case group and 104 people in the control group were selected as available samples, and with the criteria for entering the study from those who were referred to the maternity ward of Dr. Ganjavian hospital. Platelets indices, such as mean platelet volume (MPV), platelet count (PC), platelet distribution width (PDW), as well as hematocrit (Hct), hemoglobin (HB), and white blood cell count (WBC) were compared in these two

groups, and the results were recorded and reported.

Data were analyzed using SPSS software version 20 and independent t-test and Mann-Whitney U test at a significant level lower than 0.05.

#### 4. Results

In this study, the files of 104 pregnant women with preeclampsia and 104 healthy pregnant women were examined. Individual information of the studied individuals is presented in [Table 1](#). Samples in the two groups did not differ significantly in terms of the mother's age, frequency of pregnancies, and the number of previous pregnancies. Other demographic characteristics of the women studied are listed in [Table 1](#).

The results showed that there was a statistically significant difference between the mean hemoglobin level in healthy women ( $11.91 \pm 1.30$  gm/dL) and those with preeclampsia ( $10.89 \pm 1.09$  gm/dL) ( $P < 0.0001$ ). Also, according to the findings, the individuals of the two groups had significant differences in terms of mean platelet volume and platelet distribution width ( $P < 0.0001$ ).

Also, the results of the Mann-Whitney U test showed that there was a statistically significant difference between the number of platelet counts in healthy women ( $284.52 \pm 60.58$  mL) and women with preeclampsia ( $149.30 \pm 55.38$  mL) ( $P < 0.0001$ ) ([Figure 1](#)).

#### 5. Discussion

The aim of this study was to investigate the platelet indices, including platelet count, MP, and PDW, in healthy pregnant women and women with preeclampsia in Dezful city. The results showed that the hemoglobin level had a statistically significant difference between the two groups. This finding is consistent with the results of a study by Heydari *et al.* They examined platelet indices as a predictor of preeclampsia, which its mean was  $11.63 \pm 1.29$  in the case group (and  $12.04 \pm 1.11$  in the control group) (8). Also, in the present study, the amount of hematocrit in both the case and control groups had a statistically significant difference. This finding is consistent with the results of Shojaeian *et al.*, who examined the value of hematocrit and hemoglobin levels in predicting preeclampsia (14).

In the current study, the MPV in both studied groups had a statistically significant difference. These results were consistent with the findings of Thalor *et al.* In their study, they examined the relationship between platelet indices and preeclampsia (15). There was a significant difference in MPV between women with preeclampsia and healthy women in the study by Mannaerts *et al.* This finding was consistent with the current study (16). In line

with the present study, Orgul *et al.* showed that the MPV and PDW were significantly different between women with preeclampsia and healthy women (17).

Bellos *et al.* found variations of MPV between women with preeclampsia and healthy women in a systematic review study. In their study, MPV in women with preeclampsia was significantly more than in women without preeclampsia (18), which is consistent with the results of the present study. Also, in the present study, the number of platelets in both groups was statistically different; this finding was also consistent with that of Kashanian *et al.* Also, in their study, the MPV was significantly different in both preeclampsia and non-preeclampsia groups in the third trimester of pregnancy, which is similar to the results of the present study. In their study, they investigated the value of measuring the mean platelet volume in the first and third trimesters of pregnancy in diagnosing preeclampsia (19). AlSheeha *et al.* showed a significant difference in the platelet count between two groups of pregnant women with preeclampsia and healthy pregnant women, which was consistent with the current study (20). In the present study, a statistically significant difference was observed in the platelet distribution of women with preeclampsia and without preeclampsia, who had lower platelet counts than healthy pregnant women. These results are consistent with the results of Yang *et al.* In their study, they examined the importance of platelet distribution as a clear marker in the incidence of preeclampsia (21). However, the results of Zanganeh *et al.* are not consistent with these results. They did not observe a significant difference between the two groups in terms of platelet distribution. They investigated the platelet counts and indices in healthy pregnant women and those with mild and severe preeclampsia (22). There was also no significant difference in MPV levels between women with preeclampsia and healthy women in the study by AlSheeha *et al.* (20). The difference in the results may be due to differences in race and geographical areas.

##### 5.1. Conclusions

Platelet counts and platelet indices, including platelet count, MPV, and PD are affected by preeclampsia during pregnancy. These criteria can be used as a predictor of preeclampsia in the pregnancy care system. Also, preeclampsia is one of the most important factors in maternal and infant morbidity and mortality, and early detection of changes in platelet factors during pregnancy can be a predictor in the early detection of women at risk for preeclampsia. More studies seem to be needed using larger sample sizes and more geographical areas.

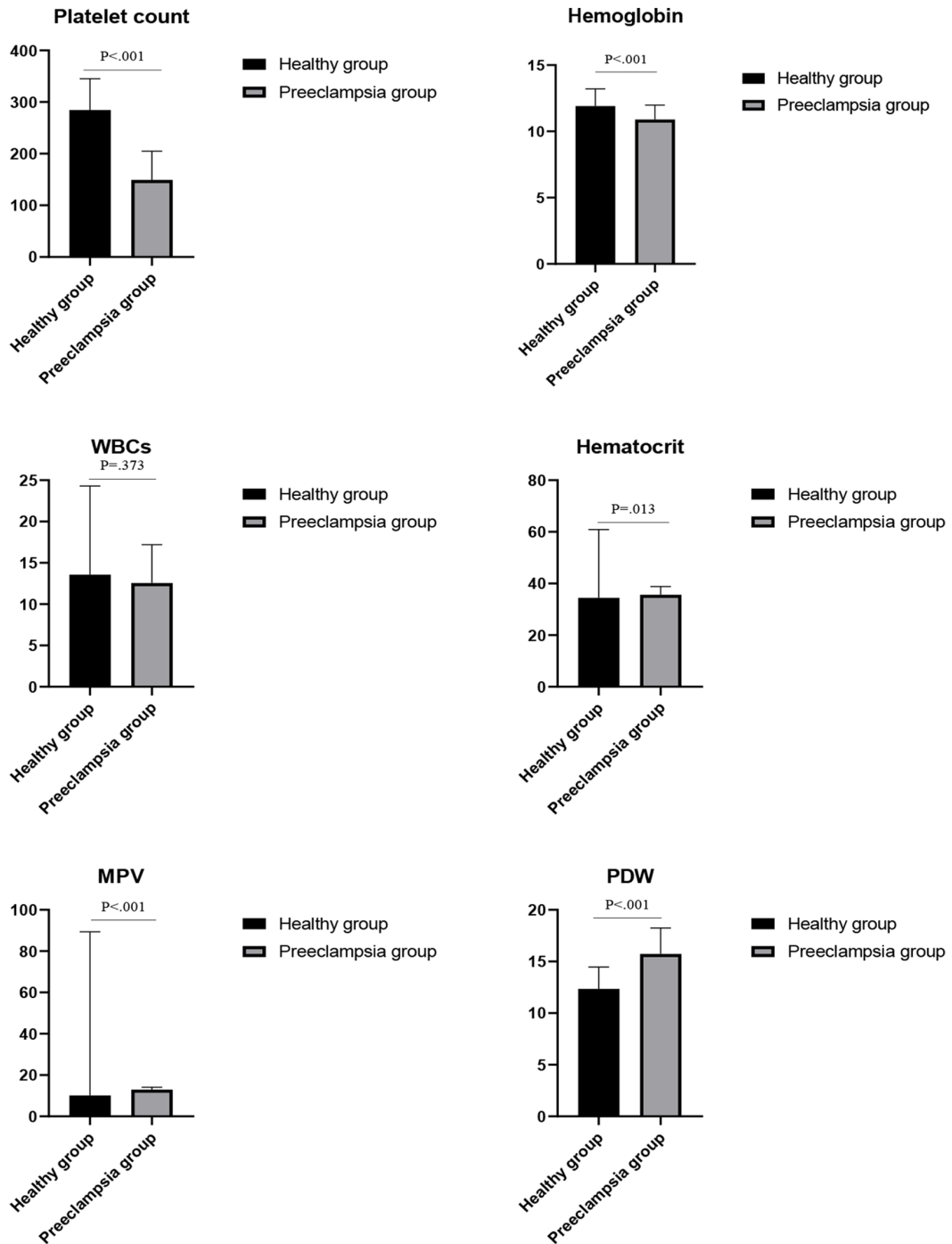


Figure 1. Comparison of laboratory characteristics in pregnant women with preeclampsia and healthy pregnant women

**Table 1.** Comparison of Laboratory Characteristics of Pregnant Women with Preeclampsia and Healthy Pregnant Women <sup>a</sup>

Laboratory Characteristics	Healthy Group (N = 104)	Preeclampsia Group (N = 104)	P-Value
Age	30.12 ± 1.92	30.42 ± 1.42	0.274
<b>Frequency of pregnancy</b>			
First pregnancy	48 (46.15)	47 (45.20)	0.346
Second pregnancy or more	56 (53.85)	57 (54.80)	
Age of pregnancy	36.21 ± 1.56	36.30 ± 1.49	0.286
<b>Hemoglobin</b>	11.91 ± 1.30	10.89 ± 1.09	< 0.0001*
<b>WBCs</b>	13.57 ± 10.74	12.55 ± 4.65	0.373
<b>Hematocrit</b>	34.4 ± 26.52	35.63 ± 3.21	0.013
<b>Platelet count</b>	284.52 ± 60.58	149.30 ± 55.38	< 0.0001*
<b>Mean platelet volume (MPV)</b>	10.1 ± 79.24	12.98 ± 1.16	< 0.0001*
<b>Platelet distribution width (PDW)</b>	12.34 ± 2.11	15.72 ± 2.52	< 0.0001*

<sup>a</sup> Values are expressed as No. (%) or mean ± SD.

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## Footnotes

**Authors' Contribution:** In this study, F.P. and N.M. collected data and analyzed the data. R.A., H.B. and L.M. collaborated in writing the article. M.N. as the responsible author of the article, has done the main writing.

**Conflict of Interests:** The authors express that there is no conflict of interests regarding the publication of this paper.

**Ethical Approval:** Ethical issues of the research were approved by the Research Ethics Committee of Dezful University of Medical Sciences, Iran (IR.DUMS.REC.1398.015) (link: [ethics.research.ac.ir/ProposalCertificateEn.php?id=73807](http://ethics.research.ac.ir/ProposalCertificateEn.php?id=73807)).

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