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Original Article

Evaluation of Some Hematological Parameters in Pregnant Women and Their Clinical Indicators

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Abstract

The current research has been performed in the Martyr Hussein Naji Health Centre at Kufa/Najaf/Iraq, from 1st October 2025 to 2nd February 2026. This study aimed to determine some of the hematological variables in pregnant women depending on their gestational age (post-conception), as well as their relation to some clinical parameters such as BP and blood sugar levels. 100 women were included in the study and classified based on pregnancy status (60 were pregnant women aged 19 to 37 years; 40 were non-pregnant women aged 20 to 35 years). Collection of blood samples from each subject via venipuncture for a wide variety of laboratory tests, including measurement of hematological variables (hemoglobin concentration, white blood cell counts, platelet count, packed cell volume) and clinical parameters (blood glucose and BP), occurred for every subject. Statistical analyses revealed significant reductions ($p<0.01$) in hemoglobin concentration, platelet counts, and packed cell volume in pregnant compared to healthy, non-pregnant women. There was also a significant increase ($p<0.01$) in white blood cell count for pregnant women compared with healthy women. In addition, there were significant increases ($p<0.01$) in clinical indicators of blood glucose measurements and blood pressure for pregnant women compared to non-pregnant women. The results indicate that blood parameter changes occur during the last third of the normal pregnancy compared with those of normal, non-pregnant women. These physiological changes in the blood parameters and clinical indicators are caused by both increases in blood volume and hormone changes. Therefore, monitoring these blood parameters throughout the course of the pregnancy is important.

Keywords: pregnant women, Hematological parameters, Gestational diabetes mellitus, Blood pressure.

1-Introduction

The embryo develops into a fetus inside a mother's uterus when she is pregnant (1). While the majority of the mother's bodily systems will undergo considerable change during her short gestation period, there are also metabolic alterations in her blood that can detect other pregnancy-related or non-pregnancy-related disorders. Numerous studies have shown that normal clinical laboratory reference intervals differ between pregnant and non-pregnant women (2,3). Pregnancy is defined as the fertilization of the ovum by a spermatozoon to form a zygote, which then develops into a fetus through the process of gestation. Maternity will ultimately result in birth (live birth), abortion, or miscarriage. (4,5). The expected length of pregnancy is approximately 40 weeks from the first day of the last menstrual period or 38 weeks for conception (6) and may continue anywhere from 38 to 42 weeks during normal pregnancies. The physiological changes that take place during pregnancy are a normal response to the fetus' needs and development, and a pregnant

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woman will undergo multiple changes physiologically and morphologically--not only to support the growing fetus, but also in order to provide the supports necessary to meet the fetus' needs (7)The circulatory system will adapt in multiple ways to prepare the mother's body for the blood supply of the fetus and also provide protection against anticipated blood loss during delivery. (examples include increasing red blood cell mass, increasing plasma volume, adopting a different immune response, and experiencing a hypercoagulable state due to an increase in leukocytes). These adaptations typically begin in the 6th week of pregnancy and continue for another 6 weeks after pregnancy (8). The researcher discovered in his study (9) that the pathophysiological principles associated with GDM and PIH are similarly governed through increased oxidative stress, resulting in the activation of a cascade activation and creating an inflammatory state in vitro due to endothelial dysfunction in vitro.

2. Materials and methods

2.1 Subject

This study was conducted at the Martyr Hussein Naji Health Center in Kufa/Najaf, Iraq, from October 1, 2025, to February 2, 2026. The study included 100 women divided into two groups according to their physiological status: 60 pregnant women aged 19–37 years and 40 non-pregnant women (control group) aged 20–35 years. Venous blood samples were collected for a range of laboratory tests, including measurements of hematological parameters (hemoglobin, white blood cells, platelets, and packed cell volume), and clinical indicators (blood glucose and blood pressure).

2. 2 Blood samples collection

The following hematological parameters (hemoglobin, white blood cells, platelets, and packed cell volume) were estimated using an automated hematological analyzer after 2.5 ml of venous blood was drawn from both pregnant and non-pregnant subjects into an EDTA bottle at a concentration of 2 mg/ml of blood. To measure blood glucose levels in pregnant and non-pregnant women, blood samples were drawn by trained nurses or laboratory technicians. A sample of blood was allowed to sit at room temperature (20 °C) for 10 min prior to collecting serum by centrifugation for a total of 20 minutes (10 minutes without centrifugation and then another 10 minutes of centrifugation at 6000 rpm). Serum samples were aliquoted and frozen at -20 °C until analysis in order to preserve their stability. Blood pressure (BP) measurements were recorded using an automated oscillometric BP monitor after women (either pregnant or non-pregnant) had rested for at least five minutes, in a comfortable seated position with legs uncrossed and feet flat on the floor, and back supported. The clothing on the arm where the cuff will be placed was removed, and the arm was supported at heart level with the palm facing up and the elbow slightly flexed. Women were instructed not to speak during the time BP was being measured. Blood Pressure measurements (systolic BP and diastolic BP) were measured twice per trimester (two days apart) in order to determine whether or not women had chronic Hypertension or normal BP levels.

3. Results

3. 1 Comparison based on Hb levels in pregnant and non-pregnant women

The results showed a highly significant decrease ($p<0.01$) in the concentration of hemoglobin (Hb) in pregnant women (9.61±0.07) compared to the non-pregnant women (12.43±0.28) in Table 1.

3.2 Comparison based on WBC levels in pregnant and non-pregnant women

The statistical results showed a highly significant increase ($p < 0.01$) in the WBC levels in pregnant women (11.10±0.19) compared with the non-pregnant women (6.92±0.21) in Table 2**.**

3. 3 Comparison based on PCV levels in pregnant and non-pregnant women

Table (3) the results showed a significant decrease highly ($p<0.01$) in the PCV levels of pregnant women (29.39±0.44) compared to the non-pregnant women (37.69±0.49).

Table (1) Comparison based on Hb levels in pregnant and non-pregnant women

Groups	Hb (gm/dl)
Pregnant women	9.61±0.07
Non-pregnant women	12.43±0.28
T value	9.41
P value	<0.0001(HS)

HS; Highly significant difference at (P<0.01)

Table (2) Comparison based on WBC levels in the pregnant and non-pregnant women

Groups	WBC ($x10^3$ /µl)
Pregnant women	11.10±0.19
Non-pregnant women	6.92±0.21
T value	14.47
P value	<0.0001(HS)

HS; Highly significant difference at (P<0.01)

Table (3) Comparison based on PCV levels in the pregnant and non- pregnant women

Groups	PCV (%)
Pregnant women	29.39±0.44
Non-pregnant women	37.69±0.49
T value	12.18
P value	<0.0001(HS)

HS; Highly significant difference at (P<0.01)

3. 4 Comparison based on PLT levels in pregnant and non-pregnant women

Table (4) the results showed a significant highly decrease ($p < 0.01$)

In the PLT levels, pregnant women (144.85±4.71) were compared to the healthy group, non-pregnant women (315.17±12.21).

3. 5 Comparison based on Blood sugar levels in pregnant and non-pregnant women

The statistical results showed a highly significant increase ($p< 0.01$) in Fasting Glucose levels FBS of Pregnant women (168.25±3.14) compared with the non-pregnant women (98.50±1.32) in Table 5**.**

3. 6 Comparison based on Blood pressure levels in pregnant and non-pregnant women

The study results indicate a significant ($P<0.01$) and clear increase in both systolic (126.6±1.20) and diastolic blood pressure (82.13±0.48) in pregnant women compared to non-pregnant women systolic (117.5±1.42) and diastolic blood pressure (77±0.81), with statistically significant differences. This indicates that pregnancy clearly affects the physiological values of blood pressure, as shown in the table 6.

Table 4: Comparison based on PLT levels in the pregnant and non-pregnant women

Groups	PLT ($X10^3$ /µL)
Pregnant women	144.85±4.71
Non-pregnant women	315.17±12.21
T value	14.80
P value	<0.0001(HS)

HS; Highly significant difference at ($P<0.01$)

Table (5) Comparison based on Blood sugar levels in pregnant and non-pregnant women

Groups	Blood sugar FBG (mg/dl)
Pregnant women	168.25±3.14
Non-pregnant women	98.50±1.32
T value	20.43
P value	<0.0001(HS)

HS; Highly significant difference at ($P<0.01$)

Table (6) Comparison based on Blood pressure levels in pregnant and non-pregnant women

Groups	Blood pressure	
	Systolic (mmHg)	Diastolic (mmHg)
Pregnant women	126.6±1.20	82.13±0.48
Non-pregnant women	117.5±1.42	77±0.81
T value	4.87	5.41
P value	<0.0001(HS)	<0.0001(HS)

HS; Highly significant difference at (P<0.01)

4. Discussion

4. 1 Comparison based on Hb levels in pregnant and non-pregnant women

The results showed a significant decrease highly ($p < 0.01$) in the concentration of hemoglobin pregnant women compared to the healthy group (non-pregnant women), because of hemodilution, which could possibly result from the fact that the majority of them are not following up with their healthcare provider, It was also found that the number of pregnant women who did not take iron supplements or consume iron-free foods during pregnancy was much higher than the number of women who attended a prenatal clinic regularly The result is in agreement with study carried by (10), A significant decrease in hemoglobin levels has been observed in pregnant women. This decrease, which occurs between the first and third trimesters of pregnancy, is likely due to the body's increased need for iron as the pregnancy progresses, since the body requires larger amounts of iron to meet the growing hemoglobin mass needs of both the mother and the developing fetus (11).

4.2 Comparison based on WBC levels in pregnant and non-pregnant women

The statistical results showed a significant increase highly ($p < 0.01$) in the WBC levels in pregnant women compared with non-pregnant women as a result of increased levels of neutrophils; the white blood cell (WBC) counts are higher during pregnancy; this especially occurs during the first trimester of pregnancy (12,13). Mild leukocytosis resulting from the stress associated with being pregnant is considered to be within the normal range (13). Similar findings were reported by (11), where the increase in WBCs from the first to the third trimester was established. Physiological stress causing leukocytosis is due to an increased inflammatory response mediated through immunosuppression, immunomodulation, and selective fetal immune tolerance. (14,15) observed that leukocytosis develops after normal delivery, (16) indicated that the immune response causes elevated WBC, which is supported by our findings.

4. 3 Comparison based on PCV levels in pregnant and non-pregnant women

The results showed a significant decrease highly ($p < 0.01$) in the PCV levels of pregnant women compared to non-pregnant women. Decreased PCV could be attributed to the increased plasma volume in pregnancy, resulting in hemodilution, the effect of hormones leading to increased fluid retention, and iron deficiency (17). An analogous result was found at (18), in their study of hematological parameters during pregnancy, which found that PCV levels were

significantly lower ($p < 0.01$) when comparing the first and second trimesters to other groups of women. This drop is likely as a result of an increase in plasma volume during normal pregnancy, which dilutes all other cells and circulating factors, creating physiological anemia (19).

4. 4 Comparison based on PLT levels in pregnant and non-pregnant women

The results showed a significant decrease highly ($p < 0.01$) in the PLT levels of pregnant women compared to the healthy group of non-pregnant women. As the pregnancy progresses, the number of platelets decreases significantly with the increasing gestational age (4) because large tears in blood vessels in the uterine wall occur as it expands during pregnancy to allow for the growth of the fetus. The platelets that form the primary hemostatic plug created at the site of these tears also have a decreased platelet count (20,21). Gradual decreases in PLT counts were seen to be consistent with the observations of (11). The authors attribute the decline to the combined effects of both dilution and increased destruction of the PLTs that move across the frequently damaged trophoblast tissue on the placenta.

4.5 Comparison based on Blood sugar levels in pregnant and non-pregnant women

The statistical results showed a highly significant increase ($p < 0.01$) in Glucose levels **(**FBG) of pregnant women compared with the non-pregnant women. Hormonal changes during pregnancy can lead to insulin resistance in the mother, as the pancreas responds by producing more insulin. However, this adaptation does not occur in women with gestational diabetes, resulting in elevated blood glucose levels (22). Abnormal blood lipid levels in pregnant women also indicate insulin resistance and dyslipidemia (23,24).

4.6 Comparison based on Blood pressure levels in pregnant and non-pregnant women

The study results indicate a significant ($P<0.01$) and clear increase in both systolic and diastolic blood pressure in pregnant women compared to non-pregnant women, indicating mild to moderate gestational hypertension. Treatment for mild to moderate hypertension, which is often not dangerous but requires appropriate management, aims to correct the underlying imbalance in cardiac output and reduce vascular resistance, thereby lowering the risk of severe hypertension without any alleged adverse effects on fetal development (25).

Conclusion

1- It can be concluded that altered hematological indices, such as (Hb, RBC, WBC, PCV, and Plt), are seen during the third trimester of normal pregnancy in comparison to non-pregnant women.

2-Physiological changes occur during a normal pregnancy in blood parameters due to an increase in blood volume and hormonal changes. Therefore, it is necessary to monitor these parameters during pregnancy.

3-High blood sugar significantly affects blood parameters in pregnant women, and gestational diabetes is associated with metabolic disorders, including insulin resistance and dyslipidemia.

4-Blood pressure measurement is a key component of pregnancy care guidelines to clarify the risk of developing pre-existing hypertension or other pregnancy-related complications.

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