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HEMATOLOGICAL INDICES CHANGES AMONG A GROUP OF PREGNANT LADIES IN SULAIMANIA CITY, IRAQ

Ali Ibrahim Mohammed[1]*, Najmaddin Salih Khoshnaw[2], Samer Ibrahim Mohammed[3], Asmaa Mohammed Thanun[4] and Zhwan Niazi Baker[5]

[1]Ass. Prof. of Hematopathology, College of Medicine, University of Sulaymaniyah, Iraq.
[2]Department of MLS, College of Science, Komar University of Science and Technology, Kurdistan Region, Iraq.
[3]Physician, Nineveh Health Directorate, Iraq.
[4]Hematopathologist, Kirkuk Directorate of Health, Iraq.
[5]Biologist, Slemani Directorate of Health, Iraq.

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***Corresponding Author: Ali Ibrahim Mohammed**

Ass. Prof. of Hematopathology, College of Medicine, University of Sulaymaniyah, Iraq.

ABSTRACT

The physiological changes in pregnancy that help in the raising and survival of the fetus are reflected in the hematological parameters changes and the abnormal hematological profile affects pregnancy and its outcome. Our study aimed to evaluate the values of hematological parameters at different trimesters of pregnancy. **Patients and methods:** A cross-sectional survey included 204 healthy pregnant women and 150 normal non-pregnant women as control. Healthy pregnant women of all gestational ages who attended the Sulaimania Obstetrics Hospital, for over 9 months from October 2019 to August 2020. Five milliliters of venous blood samples were taken from both the pregnant woman and control group, 2.5 ml in K3—EDTA tubes for the hematological examinations and the rest of 2.5 ml was placed in a gel tube for CRP. The analysis of hematological indices was done using the automated hematological analyzer. **Results:** Hb, Hct, MCH, MCV, lymphocytes, RBCs, and platelets count are decreased significantly while the WBCs count and neutrophils are increased in pregnant women in comparison with control. A progressive decline in Hb, hematocrit, and lymphocytes from the first to the third trimester, on the contrary, there is a progressive increase in granulocytes (absolute and percent) and RDW% with the advance of pregnancy, though there was no statistically significant difference in total WBC count among different gestational age. **Conclusion:** The hematological parameters are significantly changed at different trimesters of pregnancy. Anemia in pregnancy is the most common hematological problem, followed by thrombocytopenia.

KEYWORDS: Hematologic indices, pregnancy, Iraq.

INTRODUCTION

The hematological and physiological changes in pregnancy are attributed to changes in the hormonal milieu which affect pregnancy and puerperium.

These changes include raised red blood cell mass, increased plasma volume, adaptive immunological and leukocytosis changes, tendency to start as early as the sixth week of gestation with a resolution by the sixth week postpartum, and relative hypercoagulable state of pregnancy.

During normal pregnancy, profound changes occur in almost all organs and the system to meet the demands of the fetoplacental unit.[1] Pregnancy and its outcome are influenced by the hematological indices which reflect the individual's general health to a large extent.[2]

A frequently identified hematological abnormality, in pregnant women, is anemia (hemoglobin less than 11.0 g/dL) which can affect the pregnancy outcomes adversely. [3] It has been reported that miscarriages and low birth weight can be caused by anemia.

Thrombocytopenia is the second manifestation in pregnancy while leukocytosis is almost always accompanied by pregnancy.[4]

The present study aimed to determine the effects of normal pregnancy on different hematological parameters and at different gestational ages.

PATIENTS AND METHODS

This is a prospective cross-sectional study where 204 healthy pregnant women from 18 to 45 years pregnant women attended Sulaimania Obstetrics Hospital, Iraq over 9 months from October 2019 to August 2020.

Another 150 normal non-pregnant women were chosen from the different random regions as control.

We excluded all the situations which could affect the CBC parameters. The criteria of exclusion in our study include the women aged less than 18 years and above 45 years, CRP positive women, smokers, and alcoholic women, women with medical problems (such as bleeding, IDA, thalassemia, diabetes, and high blood pressure), twins or triple pregnancy are also excluded.

Data on pregnant women were grouped according to their age, gestational age, and different hematological parameters were compared between these two groups and between the three gestational trimesters.

Five milliliters of blood was taken from each pregnant woman, 2.5 ml of blood was transferred to an EDTA tube for hematological tests such as CBC and the rest 2.5 ml were placed in a gel tube for CRP. The tests were performed the same day within two hours of collection.

An automated analyzer (i.e., Medonic coulter, Stockholm, Sweden) was used for CBC, and bio kit (France) to show either CRP was negative or positive.

The study was approved by the medical ethical committee of the directorate of health in Sulaimania. Verbal consent was obtained from all participants. All procedures were done according to the Helsinki declaration and its updates.

Statistical Analysis

Statistical Package for Social Sciences (SPSS version 23) was used for analysis, all the data were presented as means ± standard deviation. Comparison between the means of continuous data between different trimesters was performed by one-way ANOVA test and student's t-test for the difference in means between the two groups. Statistical Package for Social Sciences (SPSS version 23) was used. All reported P values were considered significant at a level of $P \leq 0.05$.

RESULT

The mean age of those 204 pregnant women involved in this study was 29 years ± 6.0 SD (ranging from 18 to 45 years). Their age group is shown in (Figure 3.1).

The mean age of 150 control healthy women's group was 31.67 years ± 6.7 SD (ranging from 18 to 45 years).

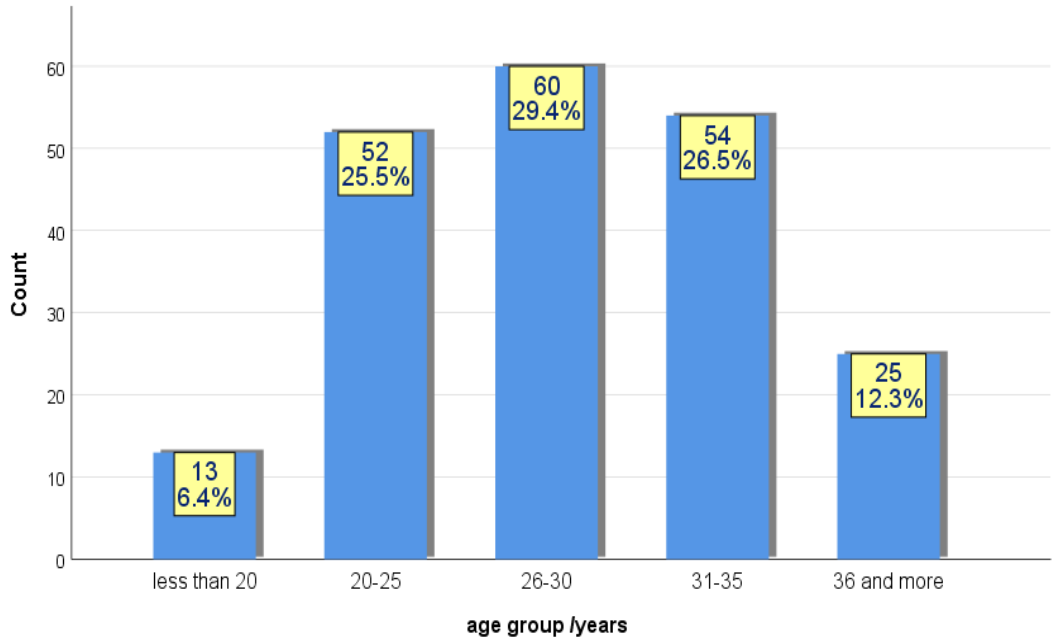

Figure 3.1: Age group distribution among pregnant women.

There were 54 (26.5%) pregnant women in the first trimester and 73(35.8) women in the second trimester and 77 (73.7%) women in their third trimester (Figure 3.2).

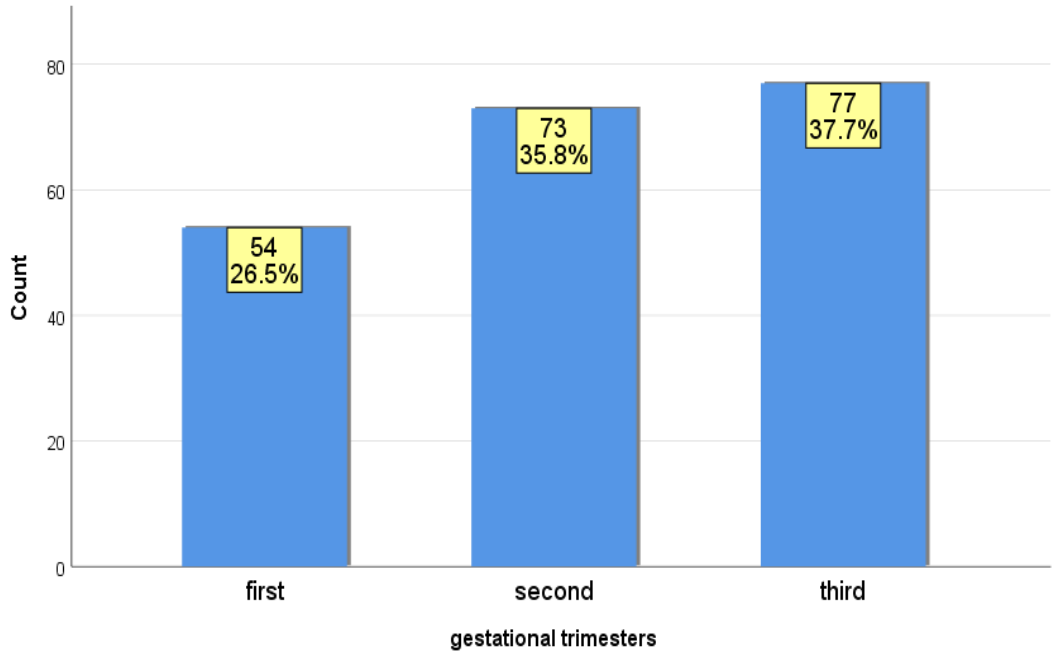

Figure3.2: Distribution of pregnant women among different gestational ages.

Most of the pregnant women in our sample are primigravida, 159 (77.9%), while 35 (17.2%) were from 2-to 5 and only 10 (4.9%) women had more than five pregnancies. (Figure 3.3).

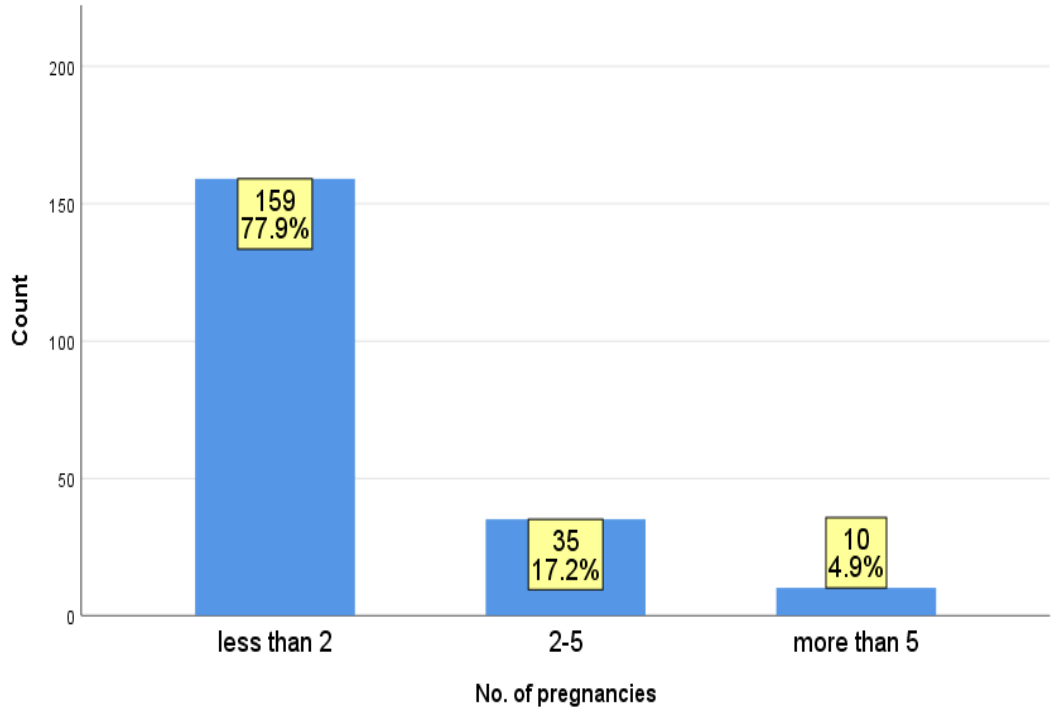

Figure 3. 3: Number of pregnancies among pregnant women.

The decrease in Hb, Hct, MCH, lymphocytes, RBCs, platelet count, and MCV is significantly decreased compared with the control women.

On the other hand, a highly significant increase in WBC counts and neutrophils of pregnant women compared with control women and no statistical difference in MID% (Table 3.1).

Table 3.1: Comparison of mean, and SD of blood count parameters for pregnant and non-pregnant women.

parameters	Non-Pregnant women		Pregnant women		P-value
	Mean	*SD*	*Mean*	*SD*	
WBC ($x10^9$/l)	7.60	1.78	9.25	1.81	<0.0001
Lym	2.36	.65	1.85	.52	<0.0001
MID	.41	.21	.55	.16	<0.0001
GRAN	4.80	1.59	6.82	1.62	<0.0001
RBC$x10^{12}$/L	4.61	.36	4.22	.44	<0.0001
HCT (%)	38.45	3.24	35.62	3.30	<0.0001
HGB (g/dl)	12.64	1.11	11.86	1.04	<0.0001
MCV (fL)	84.94	6.23	83.58	6.35	0.045
MCH (pg)	27.57	2.48	28.39	2.38	0.002
RDW%	12.53	1.39	12.21	.94	0.012
PLT ($x10^9$/L)	242.75	67.42	221.41	50.94	0.001

There is a high statistical difference in RBC, HCT, and HGB are decreasing with the advance of pregnancy, this is also true for the lymphocytes.

There was a statistically significant increase in granulocytes and RDW% with the advance of pregnancy.

In our sample, there was no statistically significant difference in total WBC count among different trimesters and also for the rest of the data. (table 3.2)

Table 3.2: Comparison of mean, and SD of blood count parameters for different gestational ages among pregnant women.

	1st Trimester		2nd Trimester		3rd Trimester		P-value
parameters	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	
WBC ($x10^9$/l)	9.0	1.9	9.6	1.8	9.1	1.8	0.203
Lym	2.0	.6	1.9	.5	1.7	.4	0.010
MID	.6	.1	.6	.2	.5	.2	0.871
GRAN	6.4	1.6	7.1	1.6	6.9	1.6	0.033
RBC$x10^{12}$/L	4.42	.38	4.24	.42	4.07	.47	<0.0001
HCT (%)	37.5	3.0	35.6	3.1	34.3	3.1	<0.0001
HGB (g/dl)	12.5	.9	11.9	.9	11.4	1.0	<0.0001
MCV (fL)	83.0	5.8	83.6	5.9	83.6	7.2	0.391
MCH (pg)	28.6	2.1	28.4	2.2	28.2	2.8	0.622
RDW%	11.9	.6	12.2	.9	12.4	1.1	0.020
PLT $x10^9$/L	232	56	219	44	216	53	0.194

Generally, there was no statistical difference in hematological data among pregnant women in different age groups apart from lymphocytes and RBC counts. (table 3.3)

Table 3.3 Comparisons of blood count parameters among different age groups among pregnant women.

Parameters	<20		20–25		26–30		31–35		>35		P-value
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	
WBC ($x10^9$/l)	9.9	1.3	9.5	1.7	9.2	1.8	9.0	2.1	9.2	1.6	0.486
Lym	2.0	.4	2.0	.6	1.7	.4	1.9	.6	1.7	.5	0.027
MID	.6	.1	.6	.2	.5	.2	.6	.2	.5	.1	0.720
GRAN	7.5	1.5	6.9	1.5	6.9	1.6	6.6	1.8	6.6	1.5	0.409
RBC ($x10^{12}$/l)	4.26	.36	4.37	.47	4.14	.41	4.24	.47	4.07	.41	0.023
HCT (%)	36.3	2.2	36.6	3.4	35.1	3.4	35.4	3.6	35.0	2.2	0.079
HGB (g/dl)	12.0	.7	12.1	1.0	11.7	1.1	11.8	1.1	11.6	.7	0.191
MCV (FL)	86.3	5.8	84.5	6.6	84.6	6.2	85.0	6.9	86.0	5.4	0.766
MCH (pg)	28.6	2.2	28.1	2.3	28.4	2.3	28.5	2.7	28.6	2.2	0.872
RDW%	12.3	1.3	12.4	1.0	12.1	.8	12.2	1.0	12.1	.8	0.300
PLT $x10^9$/L	225	53	227	49	215	51	225	52	216	52	0.709

DISCUSSION

According to the results of this study, we noticed that the rate of HGB was significantly lower for pregnant women, 11.86 ± 1.04 g/dL (9.5 - 14.8 g/dL), in comparison to the control group (non-pregnant women), 12.6 ± 1.1 g/dL (10.5 - 15.3 g/dL), and that this rate decreased gradually with gestational age: HGB was 12.5 ± 0.9 g/dL (9.9 - 14.8 g/dL), 11.9 ± 0.91 g/dL (10.1 - 14.7 g/dL) and 11.4 ± 1.06 g/dL (9.5 - 13.9 g/dL) in the 1st, 2nd and 3rdtrimester of pregnancy, respectively. Our results are in agreement with that of the study of Geetanjali et al. which revealed HGB of 10.03 ± 1.12 g/dL for pregnant women versus 11.2 ± 1.16 g/dL for non-pregnant women.[5] The mean values of the HGB obtained in our population were approximately similar to that reported in the United States and to that of the Caucasian population.[6]

The continuous Hb decrease from the first to third trimester may be due to an increased demand for iron as pregnancy progresses more iron is required to meet the expansion of maternal Hb mass and the needs for fetal growth.[7] The additional progesterone and estrogen that are secreted by the placenta during pregnancy cause a release of renin from the kidneys. Renin stimulates the aldosterone-renin-angiotensin mechanism, leading to sodium retention and increased plasma volume.[8] The increase in plasma volume is relatively greater than the increase in red cell mass, which results in a fall in maternal Hb, hence the physiological anemia that occurs in pregnancy. The physiological hemodilution associated with pregnancy contributes to the drop in PCV in the first and second trimester, while it is less obvious in late pregnancy resulting in a slight increase in hematocrit in the third trimester.[9]

The mean values of the RBC and those of the HCT or PCV are, similarly, decreased significantly for pregnant women compared to non-pregnant women ($p < 0.0001$).[10]

The WHO defines the threshold of anemia for a pregnant woman when the rate of hemoglobin is lower than 11 g/dL and that of the HCT lower than 33% at any time of the pregnancy.[11] Based on these criteria we found that 46 pregnant women (22.5%) are anemic. For practical clinical use, other authors, in previous studies led in industrialized countries, suggested a rate of HCT lower than 30% as the discriminatory value of anemia for pregnant women.[12]

The decline of MCV is noted throughout all gestational ages while the MCH remained relatively stable. Probably iron deficiency anemia is the cause in this case.

Our results showed a significant increase in the mean number of the total WBC for pregnant women compared with non-pregnant women (9.25 ± 1.81 vs. 7.60 ± 1.7) ($p < 0.0001$) and the increase is also observed in WBC count from the first to the third trimester (9.0, 9.6 and 9.1 respectively) though the difference of mean WBC was not statistically significant among different trimesters, this is consistent with the findings of Akingbola et al.[13] and Pughikumo et al.[14] The increase is primarily due to an increase in neutrophils and may represent a response to stress due to redistribution of the WBCs between the marginal and circulating pools [15] therefore the rising WBC count in pregnancy is not a reliable indicator of infection.[16]

In our pregnant women sample, the absolute neutrophil count was statistically different from that of non-pregnant women (6.82 ± 1.62 vs. 4.8 ± 1.59) respectively ($p < 0.0001$).

The mean value of the lymphocytes number was significantly decreased for pregnant women compared with non-pregnant women (1.85 ± 0.52 vs.2.36±0.65) respectively ($p < 0.0001$). This result is in agreement with that of a recent study performed in Turkey by Gökçen Örgül et al.[17] Probably, this is attributed to the hormonal changes associated with pregnancy which would affect the blood count of the total lymphocytes.[17] It has been reported in many studies that no changes in the mean eosinophil and basophils among normal pregnant women but they tend to decrease with gestational age, while monocytes tend to be slightly increased.[18]

Concerning platelet count, in our study, the mean value of the PLT number for pregnant women was significantly lower than that observed in non-pregnant women (221.41 ± 50.94 vs 242.75 ± 67.42) respectively ($p < 0.001$). This result is similar to that study of Obeagu Emmanuel Ifeanyi et al.[19] This study also reported a gradual reduction in PLT count as pregnancy advanced though it was of no statistical significance ($p=0.194$) this is similar to a study of Akingbola.[20] while this reduction in platelet counts was statistically significant in the study of James et al.[4]

Thrombocytopenia during pregnancy called gestational thrombocytopenia (PLT number lower than 150×10^9/L) is, indeed, a relatively frequent situation and usually asymptomatic with most of this decrease occurring during the third trimester. [21] A rate of PLT between 100,000 and 150,000/mm^3 was described by Burrows[22] in approximately 10% of the pregnancies, this rate normalizes mainly four weeks after the childbirth . This report could be attributed, on the one hand, to dilution by an increase of the plasmatic volume and, on the other hand, to a compensatory phenomenon due to maximal platelet destruction during the third trimester as shown by the increase of the mean platelet volume nevertheless the PLT count usually remain within the normal reference range in most pregnant women. [23] This gestational thrombocytopenia comes along with a platelet hyperreactivity to diverse agents aggregating, bound to a greater synthesis of thromboxane A2.[20] The thrombocytopenia incidence in pregnancy is 8% but if we exclude any obstetric or medical conditions drops to

5.1%.[21] In our study, there were 15 pregnant women (7.4%) with platelet count less than 150 × 10^9/L all of them were in the 3rd trimester.

CONCLUSIONS AND RECOMMENDATIONS

In this study WBC, Hb, HCT, lymphocyte, and neutrophil counts are significantly differing in pregnant women. The anemia and thrombocytopenia are mild, predominantly, with the prevalence of 11.62 and 7.7%, respectively.

Using non-pregnant women reference ranges for clinical evaluation of pregnant women is not appropriate and may lead to misdiagnosis while the understanding of these changes can spare us many unnecessary investigations.

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