MATERNAL HEMATOLOGICAL PROFILE FROM THE FIRST TO THIRD TRIMESTER OF PREGNANCY IN NORMAL PREGNANT IRAQI WOMEN

Allaa H. Thanoon[1]*, Ali S. Sultan[1] and Ban H. Hameed[2]

[1]*Biology Department, College Of Science, Mustansiriyah University, Iraq.
[2]College Of Medicine, Mustansiriyah University, Iraq.

Abstract

The present study is conducted to evaluate some hematological parameters of normal pregnant women in Baghdad city. This work was carried out for eight months in Medical City, Baghdad teaching hospital during January to September 2019. Sixty pregnant women included in this cross-sectional study. Pregnant women were divided into three groups according to the different periods of pregnancy every trimester include 30 pregnant women. In present study Anemia in pregnant women was obvious and the values of red blood cells count (RBCs) showed significant ($p<0.05$) decrease in the 3rd trimester of pregnancy, while hemoglobin (Hb) and Packed cell volume (PCV %) showed highly decreased ($p<0.01$) values. Red cell distribution width (RDW) significantly increased ($p<0.05$) in the 3rd trimester of pregnancy and Hemoglobin distribution width (HDW) also showed highly significant increase ($p<0.01$) in the 3rd trimester of pregnancy. WBCs count showed non-significant variation among different trimesters, but lymphocytes percentage in the 2nd trimester showed the highly significant increase ($p<0.01$).

Key words: RBC, WBC, Hb, PCV, RDW, HDW, normal pregnancy, Pregnancy trimesters.

Introduction

Pregnancy is associated with profound anatomical, physiological, hematological, biochemical, and endocrine changes that affect multiple organs and systems, these changes are essential to help the woman adapt to the pregnancy state and to aid fetal growth and survival (Costantine, 2014). The most significant hematological changes are physiologic anemia, neutrophilia and thrombocytopenia (Paidas *et al.*, 2011).

In pregnancy, there is a gradual increase in circulating blood volume of up to 1.5 L by the third trimester (Tran, 2005). Although red cell mass increase, a physiologic anemia occurs in pregnancy as there is an even greater increase in plasma volume. In addition, Lurie and Mamet (2000) found that erythropoietin and erythrocyte production are increased during normal pregnancy; while erythrocyte mass per unit of body weight remains constant throughout the entire pregnancy, and hemoglobin and hematocrit continuously decrease into the third trimester. Erythrocyte life span is decreased during normal pregnancy due to emergency hemopoiesis in response to elevated erythropoietin levels. The two most common

causes of anemia in pregnancy are iron deficiency and acute blood loss (American College of Obstetrician and Gynecologists, 2006).

Thrombocytopenia is the second most common hematological finding in pregnancy after anemia, it affects 7-10% of all pregnant women. The cause for the physiologic decrease in platelet count is multifactorial and is related to hemodilution, and increased platelet consumption and increased platelets aggregation by increased levels of Thromboxane A2 (Bockenstedt, 2011, Khellaf *et al.*, 2012; Perepu, 2013).

Leukocytosis is another hematological feature during pregnancy. Leukocytosis is due to increased inflammatory response during normal pregnancy, which can be as a consequence of selective immune tolerance, immunosuppression and immunomodulation of fetus (Osonuge *et al.*, 2011). Leukocytosis during first trimester is associated with complication during pregnancy (Tzur *et al.*, 2013).

Materials and Methods

During the time from January to September 2019, a cross-sectional study was conducted with 60 pregnant

Author for correspondence : E-mail : alolbio@yahoo.com

women. The pregnant women were collected from Medical City- Baghdad Teaching Hospital, the range of their age was from (18-40 years). Pregnant women were divided into three groups according to the different periods of pregnancy every trimester include 30 pregnant women. Blood samples were taken from the pregnant women to perform the hematological test. The Sysmex® (2019) technique precisely tallies. This test performed at Baghdad teaching hospital/ Medical City. Sysmex Analyzer is a quantitative, mechanized hematology analyzers estimates these parameters in entire blood: (Hb, HCT, WBC, MCV, RBC, MCH, MCHC, Platelet, MPV, Neutrophil, Lymphocyte, Basophil, Eosinophil, Monocyte).

The Statistical Analysis System- SAS(2012) program was used to detect the effect of difference factors in study parameters. Least significant difference–LSD test (Analysis of Variation-ANOVA) was used to significant compare between means. Chi-square test was used to significant compare between percentage (0.05 and 0.01 probability) in this study.

Results

Table 1 shows that the third trimester shows significant ($p<0.05$) decrease in RBCs count (3.85 ± 0.11) in comparison with 1st trimester (4.23 ± 0.10) while 1st and 2nd trimesters also showed decrease in comparison with normal values. Hemoglobin (Hb) values (g/dl) in pregnant women in the 2nd (10.35 ± 0.30) and 3rd (9.77 ± 0.33) trimesters highly decreased ($p<0.01$) compared to pregnant women in the 1st trimester (11.43 ± 0.28). Packed cell volume (PCV%) values in the 2nd (32.41 ± 0.84) and 3rd (30.61 ± 0.80) trimesters highly decreased ($p<0.01$) in comparison with the 1st (35.02 ± 0.87) trimester. Platelets (plt) values (x $10^3/\mu L$) values showed non-significant variation among different trimesters.

Table 2 shows the red blood cells Indices which include MCV, MCH, MCHC, RDW, HDW and MPV. Table shows that the Mean corpuscular volume (MCV) values (fL), Mean corpuscular hemoglobin (MCH) values (pg) and Mean corpuscular hemoglobin concentration (MCHC) values(g/dl) showed non-significant variation among different trimesters. But, red cell distribution width (RDW) value (%) shows that the 3rd (15.90 ± 0.50) trimester significantly increased ($p<0.05$) in comparison with the 1st (14.58 ± 0.34) trimester. Hemoglobin distribution width (HDW) values g/dl shows that in the 3rd (3.40 ± 0.09) trimesters highly increased ($P<0.01$) in comparison with the 1st (2.87 ± 0.09) trimester. Mean platelets volume (MPV) values (fL) showed non-significant variation among different trimesters.

Table 3 shows the comparison in WBCs count between different trimesters. WBCs count(x $10^3/\mu L$), Neutrophils count(x $10^3/\mu L$), Lymphocytes count(x $10^3/\mu L$), Monocytes count (x $10^3/\mu L$), Eosinophils count (x $10^3/\mu L$) and Basophils count(x $10^3/\mu L$) showed non-significant variation among different trimesters.

Table 4 shows the comparison in WBCs percentage between different trimesters . Neutrophils, Monocytes, Eosinophils and Basophils percentage showed non-significant variation among different trimesters. While, Lymphocytes

Table 1: Hematological values (M±SE).

CBC Parameters Normal values	Trimesters			LSD value
	First	Second	Third	
RBCs(4-5.2x10⁶/µL)	4.23 ± 0.10 a	4.01 ± 0.11 ab	3.85 ± 0.11 b	0.310 *
Hb(11.5–15 g\dL)	11.43 ± 0.28 a	10.35 ± 0.30 b	9.77 ± 0.33 b	0.874 **
PCV(35-45%)	35.02 ± 0.87 a	32.41 ± 0.84 b	30.61 ± 0.80 b	2.380 **
PLT(130-400x10³/µL)	248.75 ± 18.54	242.20 ± 17.49	245.25 ± 9.35	44.40 NS

Means having with the different letters in same row differed significantly. * (P<0.05), ** (P<0.01).

Table 2: Red Blood Cells Indices (M±SE).

CBC Parameters Normal values	Trimesters			LSD value
	First	Second	Third	
MCV(79-93 fL)	82.99 ± 1.59	81.25 ± 1.68	79.75 ± 2.38	5.438 NS
MCH(27-31 pg)	27.19 ± 0.68	26.01 ± 0.76	25.48 ± 0.95	2.288 NS
MCHC(33-37 g/dL)	32.71 ± 0.35	31.89 ± 0.35	31.82 ± 0.31	0.971 NS
RDW(11.5-14.5 %)	14.58 ± 0.34 b	15.23 ± 0.32 ab	15.90 ± 0.50 a	1.128 *
HDW(2.2-3.2 g/dL)	2.87 ± 0.09 b	3.15 ± 0.10 a	3.40 ± 0.09 a	0.274 **
MPV(6.4-11 fL)	8.09 ± 0.26	7.86 ± 0.19	7.97 ± 0.23	0.662 NS

Means having with the different letters in same row differed significantly.* (P<0.05), ** (P<0.01).

Table 3: Comparison in WBC count (M±SE) among 1st, 2nd and 3rd trimesters.

WBC Count Normal values	Trimesters			LSD value
	First	Second	Third	
WBCs(5.2-12.4x 10³/µL)	7.78 ± 0.47	7.42 ± 0.46	8.12 ± 0.49	1.353 NS
Neutrophils(1.9-8 x 10³/µL)	4.79 ± 0.44	4.70 ± 0.35	5.23 ± 0.38	1.120 NS
Lymphocytes(0.9-5.2 x 10³/µL)	2.23 ± 0.32	1.98 ± 0.11	1.78 ± 0.12	0.583 NS
Monocytes(0.16-1x 10³/µL)	0.435 ± 0.04	0.397 ± 0.02	0.400 ± 0.02	0.092 NS
Eosinophils(0.1-0.6 x 10³/µL)	0.160 ± 0.02	0.199 ± 0.02	0.171 ± 0.02	0.066 NS
Basophils(0-0.2 x 10³/µL)	0.032 ± 0.01	0.031 ± 0.01	0.028 ± 0.01	0.008 NS

NS: Non-Significant.

Table 4: Comparison in WBC percentage among different trimesters.

Parameters Normal values	Trimesters			LSD value
	First	Second	Third	
Neutrophils(40-74%)	61.11 ± 3.56	62.61 ± 1.36	67.33 ± 1.18	6.531 NS
Lymphocytes(19-48%)	29.18 ± 3.88 b	60.59 ± 2.98 a	23.0 ± 1.08 b	8.203 **
Monocytes(3.4-9 %)	5.59 ± 0.45	5.26 ± 0.27	5.46 ± 0.31	0.995 NS
Eosinophils(0-7%)	2.10 ± 0.29	2.51 ± 0.22	2.32 ± 0.32	0.799 NS
Basophils(0-1.5%)	0.410 ± 0.03	2.25 ± 1.82	0.365 ± 0.03	2.992 NS

Means having with the different letters in same row differed significantly.** (P<0.01).

percentage in the 2nd (60.59 ± 2.98) trimester shows the highly significant increase (p<0.01) percentage in comparison with 1st (29.18 ± 3.88) and 3rd (23.0 ± 1.08) trimesters.

Discussion

In pregnancy, hematological changes occur during fetal development, these changes are usually physiological, nevertheless regular monitoring of hematologic profile is important because pregnancy outcome is associated with the degree of change in hematological profile (Akinbami *et al.*, 2013). Total blood volume increases by 40% above non pregnant levels; plasma volume rises from 6 weeks gestation and stabilizes by 32-34 weeks, RBC mass increases early in the second trimester to 20-35% above non pregnant levels by term, the disproportionate rise in plasma volume compared with the RBC mass result in hemodilution and decreased hemoglobin and hematocrit count (Priya *et al.*, 2016). Even in normal pregnancy, the hemoglobin concentration becomes diluted according to the increase in the volume of circulating blood.

Most of studies showed that the total red blood cells count significantly decreased during pregnancy compared to non-pregnant women, RBCs count decreases linearly, as pregnancy progress (Purohit *et al.*, 2015). The hemoglobin content of pregnant women is lower than to non-pregnant women, there is a significant decrease in Hb from first to third trimester compared to non-pregnant women (Mba *et al.*, 2019). Verma *et al.*, (2013) showed that Hb, RBCs and PCV fall progressively from the end of the first trimester and returning to normal 1-2 months after post-partum. Mohamed *et al.*, (2016) reported that the platelet count is constant during pregnancy. Henri *et al.*, (2019) showed that there is non-significant variation in platelet count in 3 trimesters of pregnancy.

The red blood cell indices change little in pregnancy. MCV does not change significantly during pregnancy and a hemoglobin concentration 9.5 g/dL in association with a mean corpuscular volume 84 fl probably indicates co-existent iron deficiency or some other pathology(Surabhi *et al.*, 2012). According to Akinbami *et al.*, (2013) MCV

significantly increased in all trimesters of the pregnancy. From other side enhanced maternal erythropoiesis during pregnancy results in release of more young erythrocytes to the circulation, which are usually larger in size compared with the mature RBCs. High young erythrocytes count explains the steady increment of MCV throughout pregnancy (Mohamed *et al.*, 2016). Study conducted by Purohit *et al.*, (2015) showed that there was non-significant changes in MCH during pregnancy and remains constant throughout the 3 trimesters. But another study conducted by Azab *et al.*, (2017) showed that the values of MCH decreased significantly in the 2nd and 3rd trimester. These results agreed with Abrar *et al.*, (2019) who found that the MCHC is constant during pregnancy. Ifeanyi *et al.*, (2014) showed that the increased plasma volume with a lack of adequate erythrocyte mass leads to decreased hemoglobin levels and development of anemia. The unexpected rise in RDW over the last few weeks suggests increased activity in the bone marrow. Noteworthy, the physiological changes in RBCs count, HB, HCT, MCV and RDW during pregnancy are further modified by nutritional, medical and obstetric complications, which explains trimester variations of hematological profile (Zhang *et al.*, 2009). Surekha *et al.*, (2017) reported a similar results and they approved that the HDW was strongly and substantially associated with RDW, and negatively with Hb, RBCs and ferritin serum. Dundar *et al.*, (2008) showed that there was a non-significant change in MPV in normal pregnancy with progressing of gestation.

Musa *et al.*, (2016) reported that there was non-significant change in WBC counts and platelet indices. Taj *et al.*, (2019) reported that the neutrophils, lymphocytes, monocytes and eosinophils level were normal in pregnant women, while Okpokam *et al.*, (2015) showed that the count of lymphocyte increase in pregnancy and there was non-significant changes in eosinophilic counts. The reactions of the mother's immune system to fetal antigens actually play an essential role. There is evidence that T lymphocytes play an important role in preventing fetal rejection (Darmochwal-Kolarz *et al.*, 2012). The lymphocytes percentage was significantly increased, which agreed with other studies who also found that in the third trimester of pregnancy the percentage of lymphocytes was raised (Monif , 2002), Norton *et al.*, (2009) Study have shown decreased lymphocyte, while Somerset *et al.*, (2004) and Chandra *et al.*, (2012) reported that there was a slight increase in

lymphocytes.

Conclusions

Red blood cell count, hemoglobin content and hematocrit value were significantly lower in pregnant women while, Red cell distribution width (RDW) and Hemoglobin distribution width(HDW) value were significantly higher in pregnant women. Lymphocyte percentage was increased in pregnant women.

Acknowledgment

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