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# Haematological Parameters in Pregnant Women Attended Antenatal Care at Sabratha Teaching Hospital in Northwest, Libya

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**Abstract:** The aim of this study was to evaluate the values of hematological parameters at different trimesters of pregnancy in pregnant women who attended antenatal care at Sabratha Teaching Hospital, Northwest Libya. This cross-sectional survey included consecutive pregnant women who attended the obstetrical department in Sabratha Teaching Hospital for prenatal booking. This study was carried out over period of 6 month from April 2016 to September 2016. The study involved 120 pregnant women as the study group and 40 non-pregnant women as control. The study pregnant women were between the ages of 18 to 45 years. 5 ml of venous blood samples were taken from each pregnant woman in K<sub>3</sub>-EDTA tubes for the haematological examinations. The analysis of haematological indices was done using automated hematological analyzer. The obtained results showed that the mean age of pregnant women was 30 years  $\pm$  5.8 SD, 48.4% of pregnant women were between 21-30 years old, 40.8% were at age between 31-40 years. The most prevalent blood group in pregnant women was group O, 47.5%; followed by blood group A, 28.3%; blood group B, 17.5% and blood group AB, 6.7%. 15.8% of the pregnant women were observed to lack Rh antigen in their blood. Highly significance decrease in Hb, Hct, MCH, MCHC, lymphocytes%, RBCs and blood platelets count and significant decrease in MCV as compared with non pregnant women. On the other hand, highly significance increased in WBCs count, and neutrophils % of pregnant women compared with non pregnant women. A progressive decline in Hb concentration and haematocrite values from the first to third trimester was observed. The mean corpuscular volume was significantly decreased in the second trimester. The values of MCH showed highly significant decrease in the second and third trimester, and MCHC decreased significantly in the first trimester. WBC count and neutrophils % showed highly significant increase from the first to the third trimester. Lymphocytes % were highly significant decreased from the first to the third trimester. Mixed percentage of leukocytes (eosinophil, basophil and monocytes) decreased significantly in the third trimester. Platelets count exhibited a highly significant decrease in the second and third trimesters, and a significantly decrease in the first trimester. It can be concluded that a significant changes in the haematological parameters at different trimesters of pregnancy in pregnant women. So it is essential to monitor and manage these parameters during pregnancy.

**Keywords:** Haematological Changes, Pregnant Women, Trimesters of Pregnancy, Blood Groups

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## 1. Introduction

Pregnancy is the time during which one or more offspring develops inside a woman's womb. In a pregnancy, there can be multiple gestations, as in the case

of twins or triplets. Childbirth usually occurs approximately 38 weeks after conception. In case of women who have a menstrual cycle length of 4 weeks, this is approximately 40 weeks from the last normal menstrual [1]. Pregnancy is influenced by many factors, some of

which include culture, environment, socioeconomic status, and access to medical care [2]. Pregnancy is a state characterized by many physiological hematological changes, which may appear to be pathological in the non-pregnant state [3]. The hematologic system undergoes a series of adaptive changes in preparation for fetal hematopoiesis and wellbeing while also serving as a cushion against expected blood loss at delivery. These changes range from the increased plasma volume and red blood cell mass, leucocytosis and adaptive immunological changes in the relative hypercoagulable state of pregnancy and tend to commence as early as the 6<sup>th</sup> week of gestation with a resolution by the 6<sup>th</sup> week postpartum [4].

Anemia is the most common hematological problem in pregnancy, followed by thrombocytopenia. Leukocytosis is almost always associated with pregnancy [5]. In 2011, 29% (496 million) of non-pregnant women and 38% (32.4 million) of pregnant women aged 15-49 years were anaemic [6]. About 20% of maternal deaths occur due to anaemia [7].

The platelets count is slightly lower in pregnant than in non pregnant women [8]. Most studies report an approximate 10% lower platelets level at term compared with at pre-pregnancy [9, 10].

Previous studies have reported that pregnancy is usually accompanied by leukocytosis, but the full sequential changes of the various cell types responsible for this observed leukocytosis have not been clearly determined in all geographical locations and physiological conditions [5, 11]. Few epidemiological studies on the haematological changes in pregnant women were done in a different part of Libya. Therefore, the aim of this study is to evaluate the values of major hematological parameters [(RBCs, WBC, and PLTs count, Hb concentration, hematocrite value (Hct), mean cell volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC)] at different trimesters of pregnancy in pregnant women who attended antenatal care at Sabratha Teaching Hospital, Northwest Libya.

## 2. Subjects and Methods

This cross-sectional survey included consecutive pregnant women who attended the obstetrical department in Sabratha Teaching Hospital for prenatal booking. This study was carried out over period of 6 month from April 2016 to September 2016. The study involved 120 pregnant women as the study group and 40 non-pregnant women as control. The study pregnant women were between the ages of 18 to 45 years. They were provided select information about a current pregnancy, existence or non-existence of prenatal follow-ups. Pregnant woman age was recorded. Each woman was underwent a thorough medical interview and clinical examination and complete blood count. A battery of tests were followed: HCV, HBV, and HIV screening, thick and thin blood films to identify blood parasites. 5 ml of venous blood specimens were take from each pregnant

woman in K<sub>3</sub>-EDTA tubes for the haematological examinations.

### 2.1. Determination of Haematological Parameters

Red blood cells (RBCs) count, haemoglobin concentration (Hb), haematocrite value (Hct), blood indices [Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), white blood cells (WBCs) count, differential count of leucocytes, and blood platelets count were determine using an automated haematology analyzer sysmax (KX 21) machine in Sabratha Teaching Hospital laboratory.

### 2.2. Determination of ABO and Rh Blood Groups

Blood group determination was done with forward and reverse cell typing using test tube agglutination method. Antiglobulin technique was applied to confirm Rh negativity [12].

### 2.3. Statistical Analysis

Results were expressed as mean  $\pm$  SE. Data were analyzed by one way ANOVA (SPSS for windows, USA). The difference between means  $\pm$  SE was test at  $P < 0.05$  using T- test. In all statistical tests, the probability level of  $P < 0.05$  was considered significant.

## 3. Results

### 3.1. Distribution of Pregnant Women According to Age Group

This cross-sectional survey was included consecutive pregnant women who were attended the obstetrical department in Sabratha Teaching Hospital for prenatal booking. This study was carried out over period of 6 month from April 2016 to September 2016. 120 pregnant women were included. The mean age was 30 years  $\pm$  5.8 SD (ranged from 18 – 45 years). There were 58 pregnant women (48.4%) between 21-30 years old, 49 (40.8%) were with age between 31-40 years, 07 (5.8%) were with age >40 years, and 06 (5%) were with age <20 years (Table 1).

*Table 1. Distribution of pregnant women according to age group.*

Age group (Years)	Frequency	Percentage (%)
<20	06	5
21 - 30	58	48.4
31- 40	49	40.8
>40	07	5.8

### 3.2. Frequency of Pregnant Women According to Number of Pregnancies

Most of pregnant women were among those who have their first pregnancy (primigravida) when their percent reach 33% (39 pregnant women) then these who had 2 children 25% (30 pregnant women), then these who had 3 children

22% (26 pregnant women), and for 21% (25 pregnant women) multipara (4-8 children). (Table 2).

**Table 2.** Frequency of pregnant women according to number of pregnancies.

Number of pregnancies	Frequency	Percentage (%)
Primigravid (1)	39	33
2	30	25
3	26	22
MultiPara (4-8)	25	21

### 3.3. ABO and Rhesus (D) Blood Group Distribution Among Pregnant Women

Group O was found to be the most abundant blood group, 47.5% (57 pregnant women); followed by blood group A, 28.3% (34 pregnant women); blood group B, 17.5% (21 pregnant women) and blood group AB, 6.7% (08 pregnant women). Out of the total pregnant women screened 15.8% (19 pregnant women) of them lack Rh antigen in their blood (Table 3). The negativity rate for Rh antigen was higher in O & A blood group (5.83%), followed by B blood group (3.30%), and AB blood group (0.80%) (Table 3).

**Table 3.** ABO and Rhesus (D) blood group distribution among pregnant women.

Blood group	Total No. (%)	Rh (D) +ve (%)	Rh (D) -ve (%)
A	34 (28.3)	27 (22.50)	07 (5.83)
B	21 (17.5)	17 (14.20)	04 (3.30)
AB	08 (6.7)	07 (5.83)	01 (0.80)
O	57 (47.5)	50 (41.70)	07 (5.83)
Total	120	101 (84.2)	19 (15.8)

### 3.4. Distribution of Pregnant Women According to Employment Status

In terms of employment, 67.5% (81/120) were employed, and 32.5% (39/120) were housewives. In terms of type of employment, 35.8% (43/120) were teachers, 15% (18/120) worked in hospitals, 8.3% (10/120) were office workers, 5.8 (07/120) were university staff members and 2.5% (03/120) were Engineers (Table 4).

**Table 4.** Distribution of pregnant women according to employment status.

Employment status	Frequency	Percentage (%)
Office workers	10	8.3
University staff members	07	5.8
Worked in hospitals	18	15
Housewife	39	32.5
Teachers	43	35.6
Engineers	03	2.5

**Table 6.** Haematological profile of non pregnant women and pregnant women based on trimesters.

Parameters	Groups	Pregnant Women (Trimesters)			
		Non Pregnant (Controls)	First	Second	Third
		Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
RBCs ( $\times 10^6/\mu\text{l}$ )		4.45 ± 0.06	4.09 ± 0.08**	4.22 ± 0.10*	4.03 ± 0.08**
Hb (g/dl)		12.84 ± 0.10	11.27 ± 0.19**	10.84 ± 0.23**	10.61 ± 0.26**
Hct%		37.62 ± 0.60	34.72 ± 0.69**	33.35 ± 0.90**	32.60 ± 0.87**

### 3.5. Haematological Profile of Non Pregnant Women and Pregnant Women

The results of this study showed in pregnant women highly significance decrease in Hb, Hct, MCH, MCHC, lymphocytes%, RBCs and blood platelets count and significant decrease in MCV compared with non pregnant women (Table 5). On the other hand, highly significance increased in WBCs count, and neutrophils % of pregnant women compared with non pregnant women (Table 5).

**Table 5.** Haematological profile of non pregnant women and pregnant women.

Parameters	Groups	Non Pregnant (Controls)	Pregnant Women
		Mean ± SE	Mean ± SE
RBCs ( $\times 10^6/\mu\text{l}$ )		4.45 ± 0.06	4.11 ± 0.05**
Hb (g/dl)		12.84 ± 0.10	10.91 ± 0.13**
Hct%		37.62 ± 0.60	33.56 ± 0.48**
MCV ( $\mu^3$ )		84.74 ± 1.25	82.10 ± 1.01
MCH (pg)		28.96 ± 0.31	26.85 ± 0.37**
MCHC (g/dl)		34.46 ± 0.64	32.82 ± 0.34*
WBCs ( $\times 10^3/\mu\text{l}$ )		6.64 ± 0.36	8.26 ± 0.19**
Neutrophils %		50.08 ± 1.20	66.40 ± 0.77**
Lymphocytes %		37.11 ± 2.20	26.45 ± 0.66**
Mixed %		7.91 ± 0.30	7.25 ± 0.16*
Platelets ( $\times 10^3/\mu\text{L}$ )		264.1 ± 8.00	227.1 ± 4.6**

(\*) significant difference compared to non pregnant women (controls) group ( $P < 0.05$ ).

(\*\*) highly significant difference compared to non pregnant women (controls) group ( $P < 0.01$ ).

### 3.6. Haematological Profile of Non Pregnant Women and Pregnant Women Based on Trimesters

The data shown in table (6) and figure (1) indicated a highly significant decrease in RBCs counts at the first ( $4.09 \pm 0.08$ )  $\times 10^6$  cell/ $\mu\text{l}$ , and third ( $4.03 \pm 0.08$ )  $\times 10^6$  cell/ $\mu\text{l}$  trimesters, and a significant decreased at the second trimester ( $4.22 \pm 0.10$ )  $\times 10^6$  cell/ $\mu\text{l}$  compared to non pregnant women ( $4.45 \pm 0.06$ )  $\times 10^6$  cell/ $\mu\text{l}$ .

Highly significant decreased in hemoglobin content was found in the first, second and third trimester respectively ( $11.27 \pm 0.19$ ) g/dl,  $10.84 \pm 0.23$ ) g/dl, and ( $10.61 \pm 0.26$ ) g/dl compared to non pregnant women ( $12.84 \pm 0.10$ ) g/dl (Table 6 & Figure 2).

Hematocrite values were highly significant decreased ( $34.72 \pm 0.69\%$ ,  $33.35 \pm 0.90\%$  and  $32.60 \pm 0.87\%$ ) in the first, second and third trimester respectively compared to non pregnant women ( $37.62 \pm 0.60\%$ ) (Table 6 & Figure 3).

Parameters	Groups	Pregnant Women (Trimesters)			
		Non Pregnant (Controls)	First	Second	Third
		Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
MCV (μ <sup>3</sup> )		84.74 ± 1.25	85.27 ± 1.22	79.59 ± 1.87*	81.45 ± 1.97
MCH (pg)		28.96 ± 0.31	27.78 ± 0.45	26.09 ± 0.68**	26.67 ± 0.72**
MCHC (g/dl)		34.46 ± 0.64	32.65 ± 0.45*	33.03 ± 0.75	32.78 ± 0.54
WBCs (x10 <sup>3</sup> /μl)		6.64 ± 0.36	8.39 ± 0.36**	7.69 ± 0.31*	8.72 ± 0.32**
Neutrophils %		50.08 ± 1.20	65.27 ± 1.56**	66.47 ± 1.32**	67.46 ± 1.07**
Lymphocytes %		37.11 ± 2.20	27.73 ± 1.38**	26.10 ± 1.12**	25.53 ± 0.85**
Mixed %		7.91 ± 0.30	7.40 ± 0.27	7.36 ± 0.28	6.98 ± 0.28*
Platelets (X10 <sup>3</sup> /μL)		264.1 ± 8.00	241.7 ± 7.4*	234.9 ± 8.20**	204.8 ± 7.40**

n= 40, (\*) significant difference compared to non pregnant women (controls) group (P < 0.05).  
 (\*\*) highly significant difference compared to non pregnant women (controls) group (P < 0.01).

Significant decreased in mean corpuscular volume in the second trimester (79.59 ± 1.87 fl), and non significant changes (85.27 ± 1.22 fl, and 81.45 ± 1.97 fl) in the first and third trimesters respectively compared to non pregnant women (84.74 ± 1.25 fl) (Table 6 & Figure 4).

The values of MCH were highly significant decreased (26.09 ± 0.68pg, and 26.67 ± 0.72pg) in the second and third trimester respectively, and non significant changed in the first trimester (27.78 ± 0.45 pg) compared to non pregnant women (28.96 ± 0.31 pg) (Table 6 & Figure 5).

MCHC of the pregnant women was a significantly decreased in the first trimester (32.65 ± 0.45g/dl), and non significantly changes (33.03 ± 0.75 g/dl), (32.78 ± 0.54 g/dl) in the second and third trimesters respectively as compared to non pregnant women (34.46 ± 0.64 g/dl) (Table 6 & Figure 6).

The data recorded in table (6) and figure (7) indicated a highly significant increase in WBCs count at the first (8.39 ± 0.36) x 10<sup>3</sup> cell/μl, and third (8.72 ± 0.32) x10<sup>3</sup> cell/μl trimesters, and a significant at the second trimester (7.69 ± 0.31) x10<sup>3</sup> cell/μl when compared with non pregnant women (6.64 ± 0.36) x10<sup>3</sup> cell/μl.

The data obtained are presented in table (6) and demonstrated by figure (8). It is apparent from the result, neutrophils % were highly significant increased (65.27 ± 1.56%), (66.47 ± 1.32%), (67.46 ± 1.07%) in the first, second, and third trimesters, respectively as compared with non pregnant women (50.08 ± 1.20%).

As shown in table (6) and figure (9) lymphocytes % was highly significant decreased (27.73 ± 1.38%), (26.10 ± 1.12%), (25.53 ± 0.85%) in the first, second and third trimesters, respectively compared to non pregnant women (37.11 ± 2.20%).

Mixed percentage of leukocytes was decreased significantly in the third trimesters (6.98 ± 0.28%), and non significant changed (7.40 ± 0.27%), (7.36 ± 0.28%) in the first and second trimesters when compared with non pregnant women (7.91 ± 0.30%) (Table 6 & Figure 10).

Blood platelets count exhibited a highly significant decreases (234.9 ± 8.20x10<sup>3</sup>) cell/μl, (204.8 ± 7.40) x10<sup>3</sup> cell/μl in the second and third trimesters, respectively, and significant decreases in the first trimester (241.7 ± 7.4) x 10<sup>3</sup> cell/μl compared to non pregnant women (264.1 ±

8.00) x10<sup>3</sup> cell/μl as shown in table (6) and figure (11).

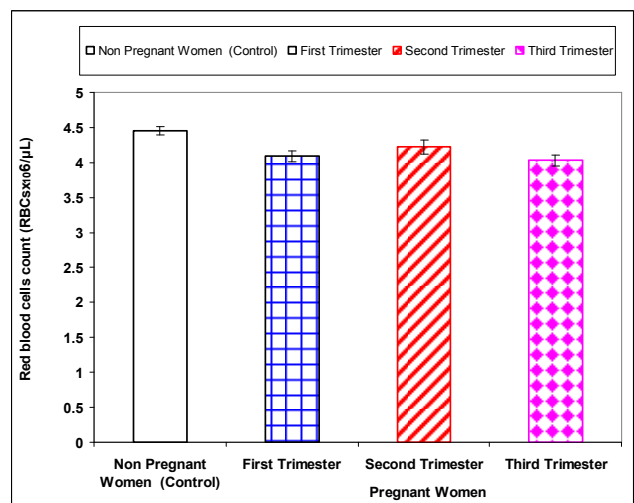


Figure 1. RBCs count in non pregnant and pregnant women at the first, second and third trimesters.

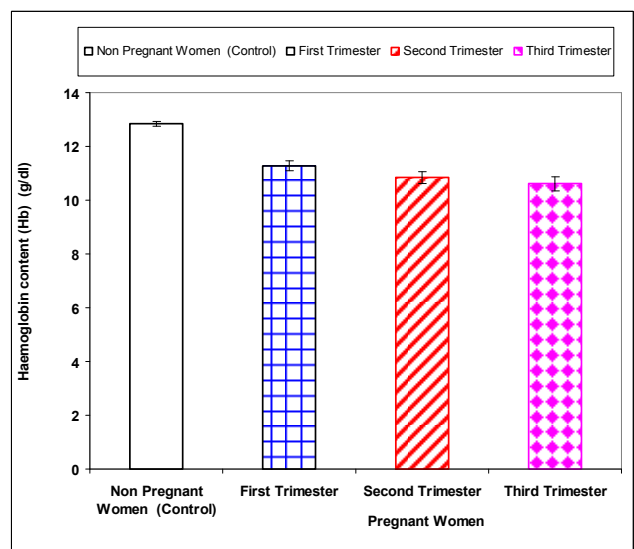


Figure 2. Hemoglobin content in non pregnant and pregnant women at the first, second and third trimesters.

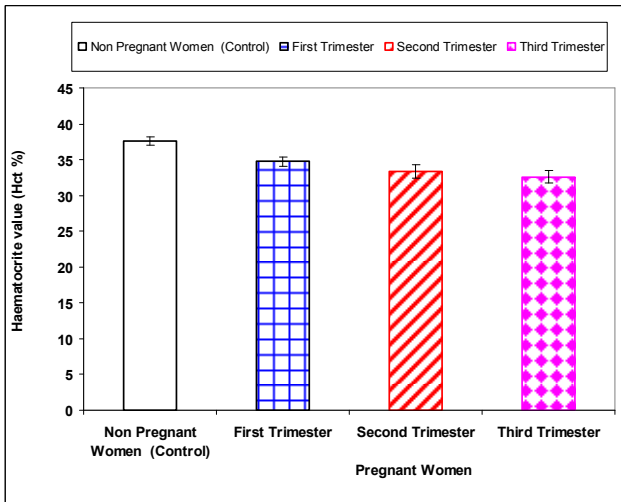


Figure 3. Haematocrite value in non pregnant and pregnant women at the first, second and third trimesters.

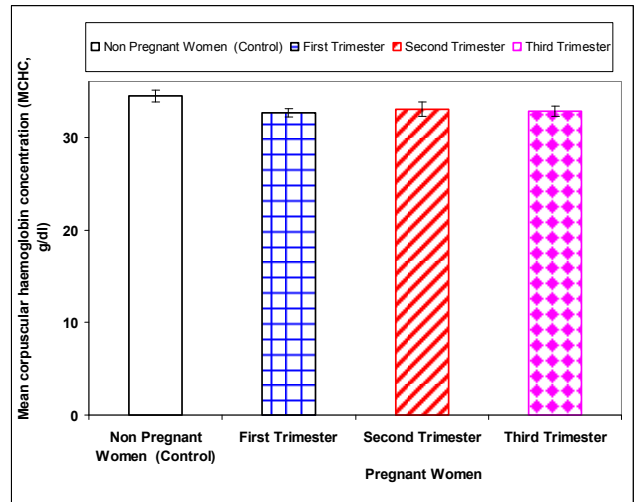


Figure 6. Mean corpuscular hemoglobin concentration (MCHC) in non pregnant and pregnant women at the first, second and third trimesters.

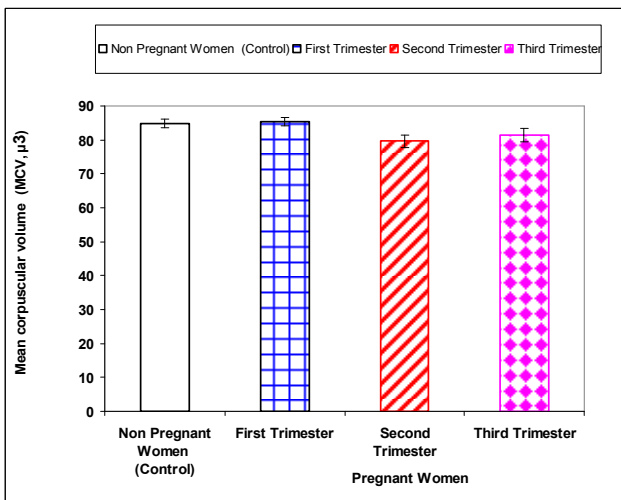


Figure 4. Mean corpuscular volume (MCV) in non pregnant and pregnant women at the first, second and third trimesters.

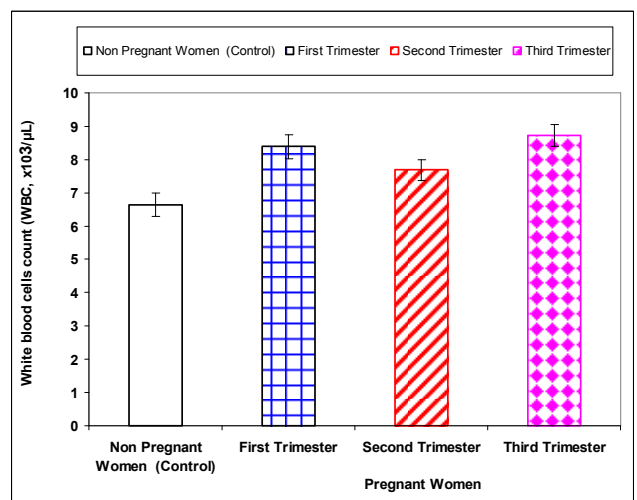


Figure 7. White blood cells (WBCs) count in non pregnant and pregnant women at the first, second and third trimesters.

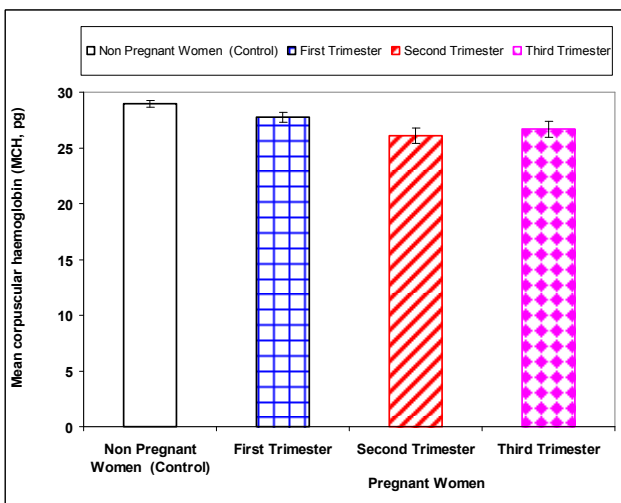


Figure 5. Mean corpuscular hemoglobin (MCH) in non pregnant and pregnant women at the first, second and third trimesters.

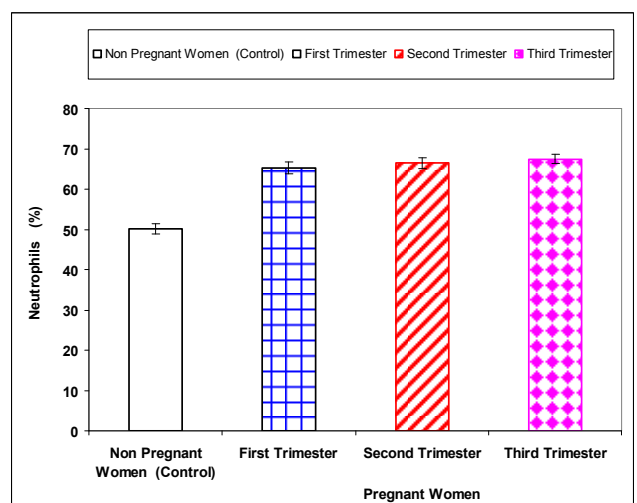


Figure 8. Neutrophils percentage (%) in non pregnant and pregnant women at the first, second and third trimesters.

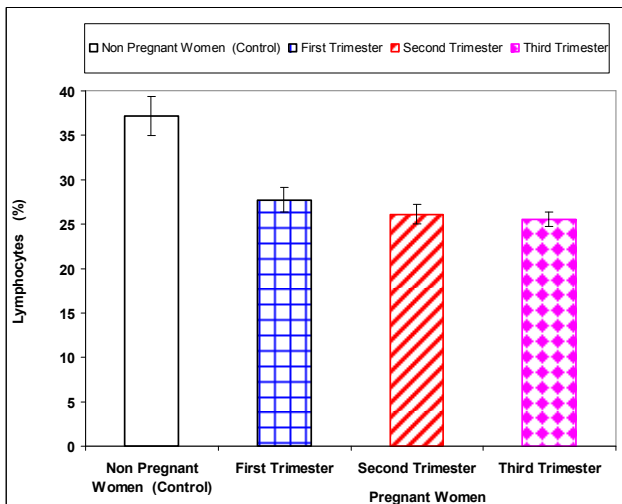


Figure 9. Lymphocytes percentage (%) in non pregnant and Pregnant women at the first, second and third trimesters.

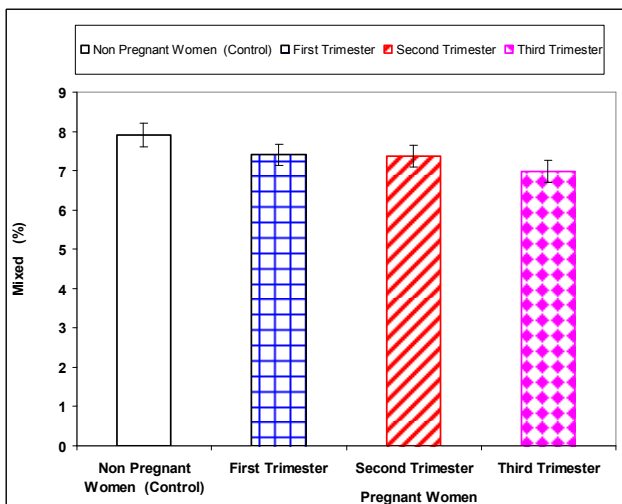


Figure 10. Mixed percentage (%) in non pregnant and pregnant women at the first, second and third trimesters.

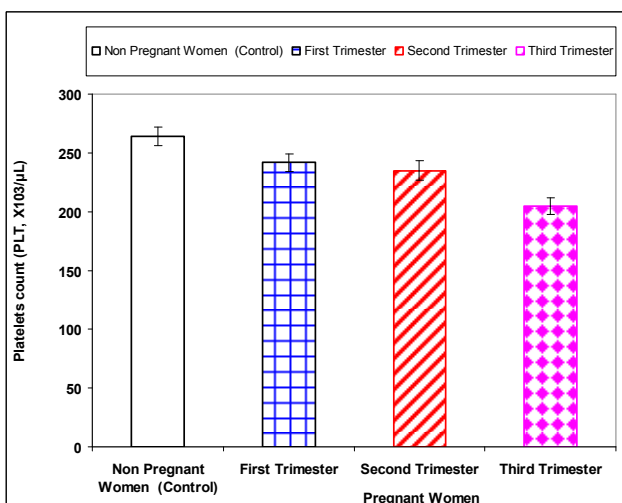


Figure 11. Platelets count in non pregnant and pregnant women at the first, second and third trimesters.

## 4. Discussion

The mean age of pregnant women was 30 years  $\pm$  5.8 SD (ranged from 18 – 45 years). There were 48.4% of pregnant women between 21-30 years old, 40.8% were with age between 31-40 years, 5.8% were with age >40 years, and 5% were with age <20 years. Similarly, the ages of the pregnant women in Derna city, Libya were ranged from 15 to 48 years with a mean age of 30.3 $\pm$ 6.2 years [13]. Akinbami *et al.*, [5] reported that the mean age of pregnant women in Lagos, Nigeria was 30.52  $\pm$  4.6 years (range: 20–46 years old). But, the mean age of pregnant women in Northwestern Ethiopia was 26.13 year  $\pm$  4.55 year standard deviation. The minimum and maximum age of the study participants were 17 and 45 years, respectively [14]. Melku and Agmas [14], recorded that 38.2% of pregnant women were between 26-30 years old, 37.4% were with age between 20-25 years, 12.3% were with age <20 years, 8.6% were with age between 31-35 years, and 3% were with age >35.

The present study showed that the most prevalent blood group in pregnant women was group O, followed by blood group A, blood group B, and blood group AB. The ABO blood group distribution varies in different geographical and ethnic groups. Nevertheless, in almost all, O blood group is the predominant followed by A blood group while AB is the rarest which is in line with the finding of this study [15, 16]. Comparable results were reported in Pakistan where blood group B is rather the most common phenotype [17]. Blood group A was the second most abundant phenotype in this study (28%), which was in contrast with a study in Nepal where phenotype A is the predominant phenotype [18].

In the present study 15.8% of the pregnant women were lack Rh antigen in their blood. This result is similar with study conducted in Ethiopia. The study conducted in Southwest Ethiopia where 955 men and 1010 women were included, the Rh negativity was 14.8% [15]. Rh (D) distribution also varies worldwide. In contrast, Rh (D) negative blood group is documented as 5.5% in south India [19], 5% in Nairobi [20], 4.8% in Nigeria [21], 7.7% in Rawalpindi [17], 8.8% in North Ethiopia [16].

In the present study 67.5% of pregnant women were employed, and 32.5% were housewives. 35.8% of pregnant women were teachers, 15% worked in hospitals, 8.3% were office workers, 5.8 were university staff members and 2.5% were Engineers. In Iran, Khojasteh *et al.*, [22], found that 46.7% of pregnant women were employed, and 53.3% were housewives. In terms of type of employment, 38.7% were teachers, 18.9% worked in hospitals, and 42.5% were office workers.

Haematological abnormalities, especially anemia, may have adverse impact on pregnancy outcome and in most developing countries makes an important contribution to maternal mortality and morbidity [2]. Significant effort is therefore given to monitoring and responding to hematological parameters [2, 23].

The results of the present study showed a highly significance decrease in Hb, Hct, MCH, MCHC,



lymphocytes%, RBCs and blood platelets count and significant decrease in MCV in pregnant women compared with non pregnant women. On the other hand, highly significance increased in WBCs count, and neutrophils % of pregnant women compared with non pregnant women. In our study a progressive decline in Hb concentration from the first to third trimester. Similar results were demonstrated by Akinbami *et al.*, [5], who found that a progressive decline in Hb concentration from the first to the third trimester. These findings corroborate those of a similar study undertaken in Ibadan, south-western Nigeria, by Akingbola *et al* [24] in 2006, which reported exactly the same pattern. The progressive decline in Hb concentration from the first to third trimester may be due to an increased demand for iron as pregnancy progresses [5]. More iron is required to meet the expansion of maternal Hb mass and the needs of fetal growth. The additional progesterone and estrogen that are secreted by the placenta during pregnancy cause a release of renin from the kidneys [5]. During pregnancy, plasma renin activity tends to increase and atrial natriuretic peptide levels tend to reduce, though slightly. This suggests that, in pregnant state, the elevation in plasma volume is in response to an under filled vascular system resulting from systemic vasodilatation and increase in vascular capacitance, rather than actual blood volume expansion, which would produce the opposite hormonal profile instead (i.e., low plasma renin and elevated atrial natriuretic peptide levels) [25, 26]. During pregnancy, the total blood volume increases by about 1.5 liters, mainly to supply the demands of the new vascular bed and to compensate for blood loss occurring at delivery [27]. 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 [5]. The drop in hemoglobin is typically by 1–2 g/dL by the late second trimester and stabilizes thereafter in the third trimester, when there is a reduction in maternal plasma volume owing to an increase in levels of atrial natriuretic peptide [3].

The present study revealed that a highly significant decreased in haematocrite values in the first, second and third trimesters compared to non pregnant women. Similar result was observed by Wulsa *et al.*, [28], who reported that haematocrite values showed statistically significant decrease in pregnant women of 1<sup>st</sup> Trimester, 2<sup>nd</sup> trimester and 3<sup>rd</sup> trimester when compared to controls with ( $p < 0.01$ ). This decrease in haematocrite values could be due to marked increase in plasma volume associated with normal pregnancy causing dilution of many circulating factors and cells resulting in physiological anemia [29 – 31].

Data in the present study showed that a significant decreased in mean corpuscular volume (MCV) in the second trimester, and non significant changes in the first and third trimesters compared to non pregnant women. Akinbami *et al.*, [5] reported that MCV declined from the first to third trimesters. These findings may be a reflection of iron deficiency anemia [5]. 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 [32].

The values of MCH were highly significant decreased in the second and third trimester, and MCHC were significantly decreased in the first trimester compared to non pregnant women. In contrast, Akinbami *et al.*, [5] reported that MCH remained relatively stable through all trimesters. MCHC was stable in the first and second trimester but dropped in the third. These findings may be a reflection of iron deficiency anemia [5].

In the present study, WBC count was highly significant increased from the first to the third trimester. The increase observed in WBC count from the first to third trimester in this study is consistent with the findings of Akinbami *et al.*, [5], Onwukeme and Uguru [11], and Akingbola *et al.*, [24]. 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 [5, 33]. Pain, nausea, vomiting, and anxiety have been reported to cause leukocytosis in the absence of infection [5, 34]. A rising WBC count in pregnancy is not a reliable indicator of infection in subclinical chorioamnionitis; rather, clinical methods of detection such as maternal pyrexia, offensive vaginal discharge, and fetal tachycardia are better indicators, especially of preterm labor and membrane rupture [5].

The data obtained in the present study revealed that neutrophils % were highly significant increased in the first, second, and third trimesters as compared with non pregnant women. Similarly, the neutrophil count begins to increase in the second month of pregnancy and plateaus in the second or third trimester, at which time the total white blood cell counts range from 9000 to 15,000 cells/microL [35]. Neutrophils are the major type of leucocytes on differential counts [36, 37]. This is likely due to impaired neutrophilic apoptosis in pregnancy [36]. The neutrophil cytoplasm shows toxic granulation. Neutrophil chemotaxis and phagocytic activity are depressed, especially due to inhibitory factors present in the serum of a pregnant female [38]. There is also evidence of increased oxidative metabolism in neutrophils during pregnancy. Immature forms as myelocytes and metamyelocytes may be found in the peripheral blood film of healthy women during pregnancy and do not have any pathological significance [39]. They simply indicate adequate bone marrow response to an increased drive for erythropoiesis occurring during pregnancy.

The present study demonstrated a highly significant decreased in lymphocytes % in the first, second and third trimesters compared to non pregnant women. The present results are in agreement with those obtained by Kline *et al.*, [40] who found a significant decreases in lymphocyte count during pregnancy through the first and second trimesters.

The present work showed that mixed percentage of leukocytes (eosinophil, basophil and monocytes) were decreased significantly in the third trimesters, and non significant changed in the first and second trimesters when compared with non pregnant women. In contrast, Kline *et*

*al.*, 2005 reported that there is an absolute monocytosis during pregnancy, especially in the first trimester, but decreases as gestation advances. Monocytes help in preventing fetal allograft rejection by infiltrating the decidual tissue (7th– 20th week of gestation) possibly, through PGE2 mediated immunosuppression [40]. Eosinophil and basophil counts, however, do not change significantly during pregnancy [41].

In the present study blood platelets count exhibited a highly significant decreased in the second and third trimesters, and a significant decreased in the first trimester compared to non pregnant women. Similar results were noticed by Akinbami *et al.*, [5], and Akingbola *et al.*, [24] who reported a gradual reduction in PLT count as pregnancy advanced. Also, Abbassi-Ghanavati *et al.*, [8] reported that PLT count was slightly lower in pregnant than in non pregnant women. Due to hemodilution secondary to expansion of plasma volume, the PLT count in normal pregnancies may decrease by approximately 10%, with most of this decrease occurring during the third trimester [42, 43], although the absolute PLT count tends to remain within the normal reference range in most patients [9, 42, 43]. PLT counts may be lower in women with twin compared with singleton pregnancies, possibly due to greater thrombin generation [44]. The mechanisms for this are thought to be due to dilution effects and accelerated destruction of PLTs passing over the often scarred and damaged trophoblast surface of the placenta ([5, 45]. Although most cases of thrombocytopenia in pregnancy are mild, with no adverse outcome for mother or baby, occasionally a low PLT count may be part of a complex disorder with significant morbidity and be (rarely) life-threatening [5].

## 5. Conclusion

It can be concluded that a significant changes in the haematological parameters at different trimesters of pregnancy in pregnant women. So it is essential to monitor and manage these parameters during pregnancy. Further studies should be conducted to indicate the prevalence and causes of anemia and thrombocytopenia in Libyan pregnant women.

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