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Research Article

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Hematological parameters among pregnant women in Derna city, Libya

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ABSTRACT

Background: Pregnancy is characterized by physiological hematological changes that may appear pathological in a non-pregnant state. These parameters significantly affect pregnancy outcomes, with anemia being the most common hematological complication. **Aim:** To assess and compare the hematological profiles of pregnant and non-pregnant women. **Methodology:** A cross-sectional study was conducted between June and October 2022, involving 120 women (62 pregnant and 58 non-pregnant) at Derna's public and private hospitals. Data were analyzed using SPSS version 26. **Results:** The mean age of pregnant women was 30 ± 5.8 years. A significant decrease was observed in Hemoglobin (Hb), Hematocrit (Hct), and lymphocyte percentage in pregnant women compared to the control group ($P < 0.05$). The prevalence of anemia was 88.7% among pregnant women and 11.7% among non-pregnant women. **Conclusion:** Regular monitoring of hematological parameters during pregnancy is essential. Further research is needed to investigate the specific causes of anemia and thrombocytopenia among Libyan pregnant women.

***Keywords**: Hematological parameters, pregnant women, Derna, Libya*

المعايير الدموية لدى النساء الحوامل في مدينة درنة – ليبيا

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الملخص:

الخلفية: يُعد الحمل حالة تتميز بالعديد من التغيرات الفسيولوجية الدموية، والتي قد تُصنف كحالات مرضية في غير حالات الحمل .تُعتبر المؤشرات الدموية من العوامل الحاسمة المؤثرة في مسار الحمل ونتائجه، ويعد فقر الدم أكثر الاضطرابات الدموية شيوعاً خلال هذه الفترة .**الهدف:** تقييم المعايير الدموية لدى النساء الحوامل ومقارنتها بغير الحوامل .**المنهجية: أُجريت** دراسة مقطعية في الفترة من يونيو إلى أكتوبر 2022، شملت 120 امرأة (62 امرأة حاملاً و58 امرأة غير حامل) في مستشفى درنة العام والمصحات الخاصة .حُللت البيانات باستخدام البرنامج الإحصائي

(SPSS)الإصدار 26 .**النتائج:** أظهرت النتائج أن متوسط عمر الحوامل كان 30 سنة (± 5.8) لوحظ انخفاض ذو دلالة إحصائية في مستويات الهيموجلوبين(Hb) ، والهيماتوكريت(Hct) ، والنسبة المئوية للخلايا الليمفاوية (LYM%) مقارنة بالنساء غير الحوامل .($P < 0.05$) بلغ معدل انتشار فقر الدم بين الحوامل 88.7% مقابل 11.7% بين غير الحوامل .**الخلاصة:** تستوجب الحالة الصحية الدموية للحوامل الليبيات ضرورة المراقبة الدورية للمؤشرات الدموية طوال مراحل الحمل. كما توصي الدراسة بتطوير بروتوكولات علاجية تتناسب مع النمط الوبائي المحلي، وإجراء دراسات مستقبلية طويلة لتحديد مسببات فقر الدم ونقص الصفائح الدموية".

الكلمات المفتاحية: المعايير الدموية، النساء الحوامل، درنة، ليبيا.

INTRODUCTION

Hematological profiles are those related to blood and the blood forming organs. The values of these profiles, some of which includes Packed Cells Volume (Hematocrit), Red and White Blood Cells counts, Platelet count, Erythrocyte Sedimentation Rate, Differential Leukocytes count, etc., enables the health worker to reach one of several diagnosis and decisions *(Shinton, 2008).*

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 *(Shinton, 2008).*

Pregnancy is influenced by many factors, some of which include culture, environment, socioeconomic status, and access to medical care *(Akinbami, 2013).*

Pregnancy is a state characterized by many physiological hematological changes, which may appear to be pathological in the non- pregnant state *(Kaur, et al. 2014).* 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 *(Townsley, 2013).*

The changes in the hematological status of pregnant women are profound. Modifications in the production of red cells and changes in plasma volume shift fundamental hematological indices such as red blood cell (RBC) count, hemoglobin (Hb) concentration, platelet (PLT) count, and white blood cell (WBC) count. Some of these are decreased – for example, RBC and PLT counts – partly as a result of the physiological haemodilution that occurs in pregnancy, while others are increased, such as the WBC count *(Akinbami, et al. 2013).*

Many physiological hematological changes occur during pregnancy to fulfill the demands of the developing fetus. While physiological in nature, but abnormal hematological profile does affect pregnancy and its outcome *(Kaur, et al., 2014).* One of the most important underlying causes of maternal mortality is due to underlying hematological complications. Anemia and thrombocytopenia are the most frequent complication during pregnancy *(Townsley, 2013).*

However, anemia is the most common hematological problem in pregnancy, followed by thrombocytopenia *(Akinbami et al., 2013).* Leukocytosis is almost always associated with pregnancy *(Stevens et al., 2013).* In 2011, 29% (496 million) of non-pregnant women and 38% (32.4 million) of pregnant women aged 15-49 years were anemic *(Darling B Jiji, et al. 2014).* About 20% of maternal deaths occur due to anemia *(Abbassi-Ghanavati et al., 2009).* The platelets count is slightly lower in pregnant than in non pregnant women.

Most studies report an approximate 10% lower platelets level at term compared with pre-pregnancy *(Boehlen, et al. 2000) and (Jensen, et al. 2011).*

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

(Onwukeme et al. 1990).

Few epidemiological studies on the haematological changes in pregnant women were done in a different part of Libya.

The aim of this study is to assess the hematological profiles of pregnant women in comparison with non-pregnant women attending antenatal care at Alwahda Teaching Hospital and private clinics in Derna, Libya. Specifically, the study seeks to determine the prevalence of anemia among pregnant women, identify the associated risk factors, and evaluate the values of key hematological parameters including RBC count, WBC count, platelet count, hemoglobin concentration, Hematocrit (Hct), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) across different trimesters of pregnancy.

Methods

A descriptive cross-sectional study was conducted in Derna City, Libya, over a five-month period from June to October 2024. The study population consisted of both pregnant and non-pregnant women attending obstetrics and gynecology clinics, including Taiba Clinic, Zahrat Al-Hayah Clinic, and Al-Wahda Teaching Hospital. Data were collected using a self-administered questionnaire that was adapted from previously published studies, translated into Arabic, and applied in its Arabic version for use with participants. Permission and Ethical Approval to conduct thestudy was granted from the College of MedicalTechnologyand Al-Wahda Teaching Hospital, Derna, Libya.

Statistical Analysis

Data analysis was analysis using SPSS software version 26. Descriptive statists, including percentage, mean, range, and standard deviations were calculated for all variables. The difference between means ± SE was test at $P < 0.05$ using T- test. In all statistical tests, the probability level of $P < 0.05$ was considered significant.

The significant association and the relation between different variables were evaluated using Pearson's correlation chi-square, with a significance level of $p \leq 0.05$.

Results

This study was carried out over period of 6 month from June 2022 to October 2022. 120 pregnant women were included. The mean age was 30.99 years ± 7.43 SD (ranged from 16 – 50 years). There were 52 women (44.3%) between 21-30 years old, 44 (36.7%) were with age between 31-40 years, 13 (10.8%) were with age >40 years, and 11(9.2%) were with age <20 years (Table 1). The study included 52 pregnant women as study subjects with age mean 28.84 ± 35.97 years and 58 non- pregnant women as control subjects with age mean of 33.29 ± 8.135 years.

In terms of employment, 70% (84/120) were employed, and 30% (36/120) were housewives. In terms of type of employment, 31.7% (38/120) were office workers, 15.8% (19/120) were teachers, 5% (6/120) were doctor, 15.5 (21/120) were have different job (Table 2).

Most of pregnant women 72(74.1%) had university degree, 44(36.7%) had secondary level and few 4(3.3%) were primary education (Table 3).

More than half of them 66(55%) come from low socioeconomic status (Table 4).

Most of pregnant women were among those who have their first pregnancy (primigravida) when their percent reach 31.7% (38 pregnant women) then these who had multigravida.

45% (54 pregnant women) had from 1-3 children and 25% (30 pregnant women) had ≥4 children. 25(20.8%) had 2 abortion and 17(14.2%) had 3 abortions.

The high number was in the second trimester (40.3%) follow by first (32.3%) and third (27.4%) (Table 5).

The majority of women 86.7% do not suffer from chronic disease and 13.6% suffer

from chronic disease (Figure 1). 5% had preeclampsia, 4.12% hypertension, 2.5% diabetes and 0.8% gestational diabetes (Table 6).

Few of pregnant women 18(29.1%) suffer from anemia (Figure 2). Eight nine of women (74.2%) took nutritional supplement, 60 of them were pregnant.

On the other hand, 31(25.8%) of t women stated that they never took nutritional supplement, 2 of them were pregnant (Figure 3).

So, among pregnant women, 60(96.8%) took nutritional supplement and 2(3.2%) never took nutritional supplement (Figure 4).

Among the pregnant women, 49 (79%) had been consumed iron.On the other hand, 18 (29.3%) of the pregnant women stated that they never used multivitamin and 44 (70.9%) used it. In this study, 40 (64.5%) pregnant women stated that they did not use Vitamin D and 30(48.4%) do not use folic acid, whereas 22 (35.4%) pregnant women stated that they used Vitamin D and 32(51.6%) used folic acid. In addition, calcium was consumed by 27(43.5%) pregnant women.Magnesium and Omega 3 were consumed by 2 (3.2%) (Table 7).

The results of this study showed in pregnant women highly significance decrease in Hb, Hct and LYM%, compared with non pregnant women ($P < 0.05$). On the other hand, highly significance increased in NEUT# and P-LCR of pregnant women compared with non pregnant women (Table 8).

However, there were no significant different between pregnant women and non-pregnant women on WBCs count, RBC, MCV, MCH, MCHC, PLT, MXD%, NEUT, LYM#, RDW and MPV(Table 8).

The data shown in table (9) indicated a highly significant decrease in RBCs counts at the first (4.178±0.52) x106 cell/µl, and third (4.46±1.45)x 106cell/µl trimesters, and a significant decreased at the second trimester (4.23±1.18)x 106 cell/µl compared to non pregnant women (4.5172±0.66)x106 cell/µl. However, there were no significant different. Highly significant increase in hemoglobin content was found in the first, second and third trimester respectively (9.79±1.23) g/dl, (10.07±1.39) g/dl, and (10.33±2.26) g/dl compared to non-pregnant women (10.92±2.02) g/dl. However, there were no significant different. Hematocrit values were highly significant decreased (33.05±5.559%, 30.66±4.56% and 32.60 ± 0.87%) in the first, second and third trimester respectively compared to non pregnant women (33.67±6.54%) However, there were no significant different (Table 9).

The prevalence of anemia among pregnant woman was 88.7% and 11.7% among non-pregnant women.

However, there were statistically significant different between pregnant and non pregnant women and anemia (P=0.036) (Table 10).

The mean weight of women was 65.54±11.68 range from 40 to 95 Kg. And the mean height of women was 160.47±9.54 range from 124 to 180 cm. The mean of BMI was 25.60±4.84 range from 16.79 to 40.43. However, most of women 53(44.2%) were in normal weight, 29 of them were pregnant. Few 6(5%) were underweight, 2 of them were pregnant and 24(20%) were obese, 14 of them were pregnant (Table 11).

Table 1. Distribution of pregnant women according to age group

	No	%
<20	11	9.2
21-30	52	43.3
31-40	44	36.7
>40	13	10.8

Table 2. Distribution of pregnant women according to employment status

	No	%
Office worker	38	31.7
Teachers	19	15.8
Doctor	6	5.0
Housewife	36	30.0
Other	21	15.5

Table 3. Distribution of pregnant women according to education level

	No	%
Primary	4	3.3
Secondary	44	36.7
University	72	60.0

Table 4. Distribution of pregnant women according to family income

	No	%
Low(<1200 LD)	66	55.0
Medium(<2400 LD)	20	16.7
High (≥2400 LD)	4	3.3

Table 5. Frequency of pregnant women according to obstetrics and medical factors

	No	%
Number of pregnancies		
Primigravida	38	31.7
Multigravida	82	68.3
Number of children		
0	36	30.0
1-3	54	45.0
≥4	30	25.0
Abortion		
1	20	16.7
2	25	20.8
3	17	14.2
Gestational age		
First trimester	20	32.3
Second trimester	25	40.3
Third trimester	17	27.4

Figure 1: Percentage of women who suffer from chronic disease

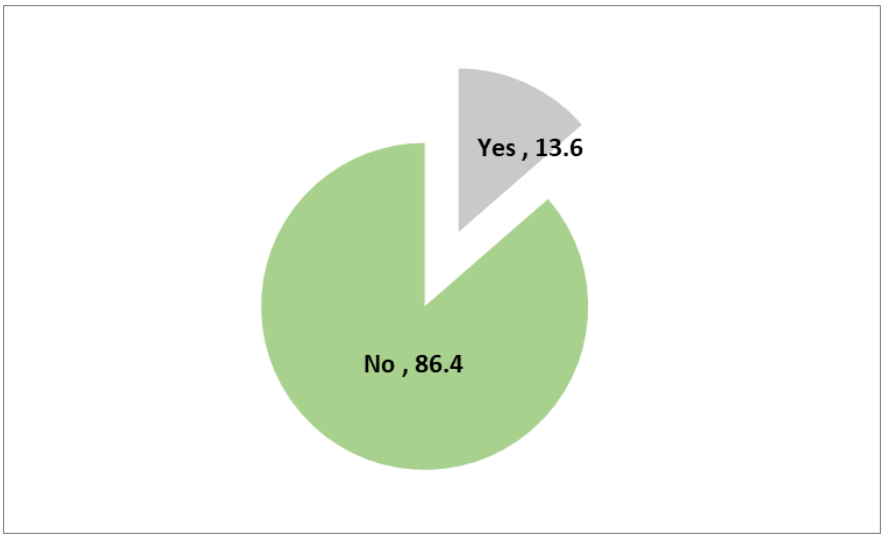

Table 6. Chronic disease among women

	No	%
Preeclampsia	6	5.0
Hypertension	5	4.2
Diabetes	3	2.5
GDM	1	0.8
Other	3	2.5

Figure 2. Percentage of pregnant women who suffer from blood disease

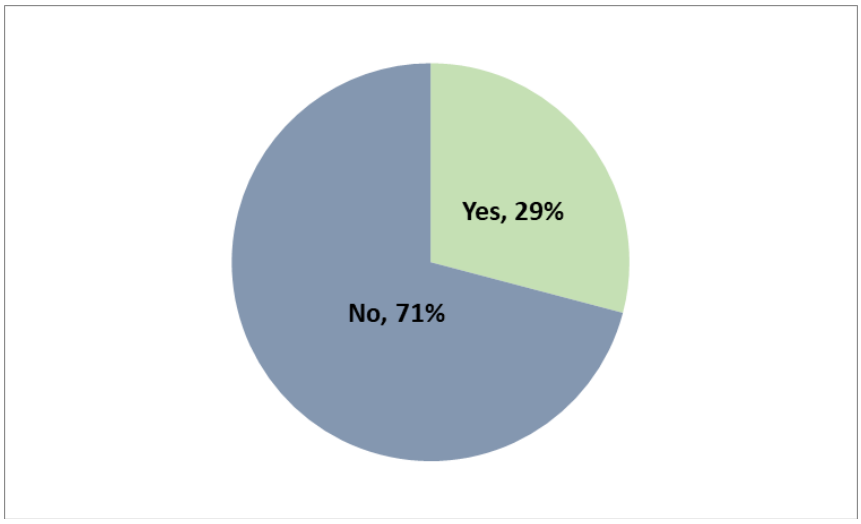

Figure 3. Percentage of women who took nutritional supplement

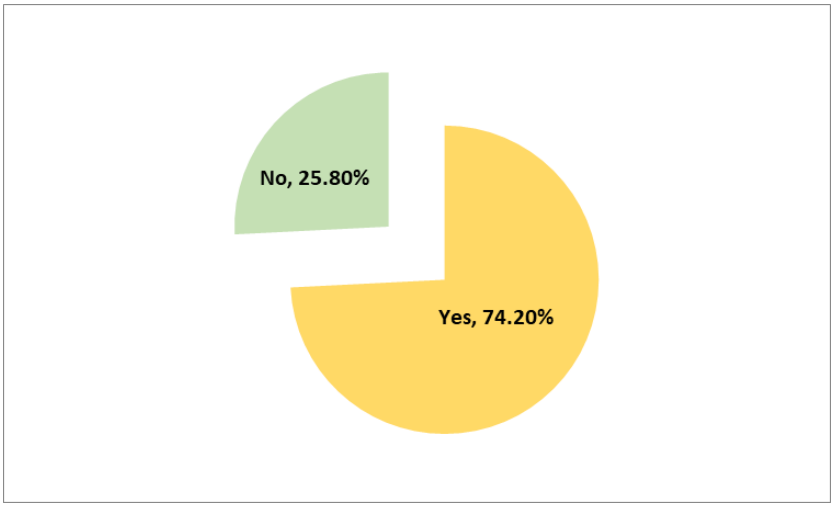

Figure 4. Percentage of pregnant women who took nutritional supplement

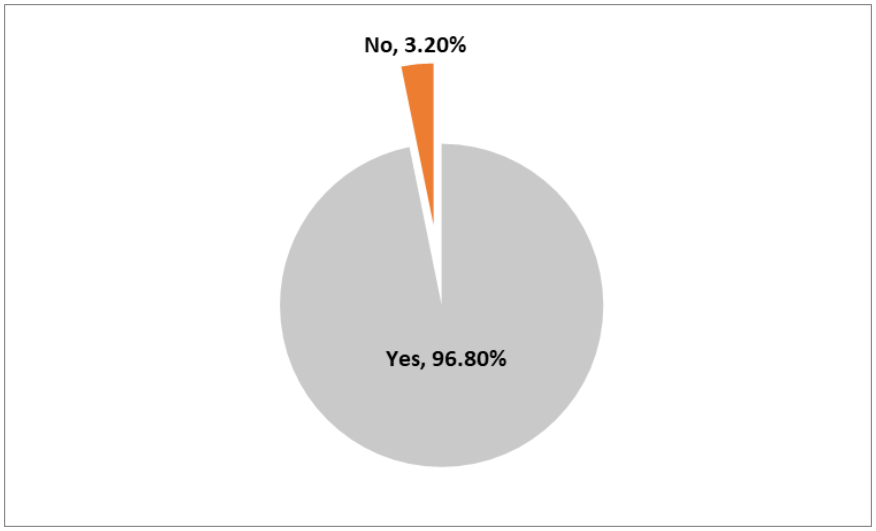

Table 7. Nutrient Intake During Pregnancy

	No	%
Vitamin D(600 – 2000) IU/day	22	35.4
Folic Acid(400 – 800)µg/day	32	51.6
Multivitamin(Usually 1 tablet/day)	44	70.9
Iron(27 – 60) mg/day	49	79.0
Calcium(1000 – 1300)mg/day	27	43.5
Magnesium(350 – 360) mg/day	2	3.2
Omega 3(200 – 300)mg/day	2	3.2

Table 8. Haematological profile of non pregnant women and pregnant women

Parameters	Mean ± SE	Non Pregnant Women Mean ± SE	Pregnant Women Mean ± SE	P-value
WBCx10^3 /µl	8.57±3.73	8.6979±4.61	8.46±2.681	0.734
RBCx10^6/µl	4.38±0.90	4.5172±0.66	4.26±1.07	0.130
Hb(g/dL)	10.46±1.87	10.92±2.02	10.03±1.62	0.009
HCT(%)	33.43±5.74	34.62±5.81	32.32±5.48	0.028
MCV(µ^3)	79.13±9.46	79.08±9.54	79.16±9.48	0.962
MCH(pg)	28.03±10.48	26.80±4.35	29.21±14.03	0.214
MCHC(g/dl)	32.58±7.02	33.42±4.03	31.77±8.98	0.203
PLTx10^9/l	260.20±112.2	261.03±89.08	259.45±130.92	0.941
LYMx10^3/ µl	26.78±14.53	30.88±13.63	21.95±14.21	0.002
MXD%	15.52±43.75	11.77±11.129	20.66±66.64	0.454
NEUTx10^3/ µl	57.67±24.82	58.15±27.81	57.06±20.93	0.871
LYM#	3.80±6.96	2.79±1.62	5.49±11.15	0.126
NEUT#	7.55±14.18	4.59±6.14	12.53±21.27	0.053
RDW(%)	24.41±14.79	26.32±15.92	22.14±13.16	0.184
PDW(fL)	16.16±6.91	15.64±7.48	16.66±6.36	0.489
MPV(fL)	10.01±2.96	10.40±3.17	9.54±2.66	0.196
P-LCR	13.24±13.03	9.74±11.27	19.18±13.89	0.005

Table 9. Some haematological profile of pregnant women based on trimesters

	Pregnant Women (Trimesters)		
	First	**Second**	**Third**
Hb (g/dl)	9.79±1.23	10.07±1.39	10.33±2.26
RBCs (x10^6/ µl)	4.178±0.52	4.23±1.18	4.46±1.45
Hct%	33.05±5.559	30.66±4.56	33.67±6.54

Table 10: Prevalence of anemia among women

	Anemia		X2	P-value
	Hb <11.5 g/dl	**Hb >11.5 g/dl**		
Pregnant women	**55(88.7)**	**7(11.3)**	**5.136[a]**	**0.036**
Non-pregnant women	**42(11.3)**	**16(88.7)**		

Table 11. BMI among women

	No	%
Underweight	6	5.0
Normal weight	53	44.2
Overweight	37	30.8
Obese	24	20.0

Discussion

During pregnancy, the body undergoes normal physiologic changes. These changes affect mother laboratory results. In the absence of illness, the body can generally compensate for these changes. The mean age of pregnant women was 30 years ± 5.8 SD (ranged from 16 – 50 years). There were 44.3% of pregnant women between 21-30 years old, 36.7% were with age between 31-40 years, 10.8% were with age >40 years, and 9.2% 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±6.2 years *(Elzahaf et al. 2016). (Akinbami et al., 2013)* reported that the mean age of pregnant women in Lagos, Nigeria was 30.52 ± 4.6 years (range: 20–46 years old). But, the mean age of pregnant women in Northwestern Ethiopia was 26.13 year ± 4.55-year standard deviation. The minimum and maximum age of the study participants were 17 and 45 years, respectively *(Melku et al. 2015). (Melku et al. 2014).*, 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.

In the present study 70% of pregnant women were employed, and 30% were housewives. Similarly, the study of pregnant women attended antenatal care at Sabratha teaching hospital in northwest, Libya *(Azab, et al., 2017).* In Iran, *(Khojasteh, et al., 2016)*, 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 moderate anemia, may have adverse impact on pregnancy outcome and in most developing countries makes an important contribution to maternal mortality and morbidity *(Purohit et al. 2015).* Significant effort is therefore given to monitoring and responding to hematological parameters *(Shah, et al. 2012).*

The results of the present study showed a highly significance decrease in Hb, Hct and lymphocytes%. On the other hand, highly significance increased in NEUT# and P-LCR of pregnant women compared with non-pregnant women.

However, there were no significant different between pregnant women and non-pregnant women on WBCs count, RBC, MCV, MCH, MCHC, PLT, MXD%, NEUT, LYM#, RDW and MPV.

In our study a progressive decline in Hb concentration from the first to third trimester. Similar results were demonstrated by *(Akinbami et al. 2013)*, who found that a progressive decline in Hb concentration from the first to the third trimester. These findings corroborate those of a similar study under-taken in Ibadan, south-western Nigeria, by *(Akingbola et al. 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 *(Akinbami et al. 2013).* 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 *(Akinbami et al. 2013).*

Data in the present study showed that a significant decreased in mean corpuscular volume (MCV) in pregnant women compared to non- pregnant women. *(Akinbami et al. 2013).* reported that MCV declined in pregnant women. These findings may be a reflection of iron deficiency anemia.

In the present study, WBC count was significant decreased in pregnant women. The decrease observed in WBC count in this study is different with the findings of *(Akinbami et al. 2013)*, *(Onwukeme et al. 1990),* and *(Akingbola et al. 2006).* The values of MCH were highly significant decreased in the pregnant, and MCHC were significantly decreased in compared to non-pregnant women.

In contrast, *(Akinbami et al. 2013)* 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 *(Akinbami et al. 2013)*.

In the present study, WBC count was significant decreased during pregnancy is dissimilar with the findings of Akinbami *et al.*, Onwukeme *et al. (Akinbami A. A,2013), (Akingbola et al., 2006) and (Onwukeme et al. 1990)*

The data obtained in the present study revealed that Neutrophils % were significant

decreased in the pregnant women compared with non-pregnant women. Unalike, the Neutrophil count begins to increase in the pregnancy at which time the total white blood cell counts range from 9000 to 15,000 cells/µl *(Kuvin et al. 1962).*

The prevalence of moderate anemia obtainedin this study was 88.7% among pregnant women, based on WHO criterion for the diagnosis of anemia in pregnancy, i.e. hemoglobin <11.0 g/dl *(Pavord et al. 2010).* This result is higher than other cross sectional study carried out in TikurAnbesa Specialized Hospital (21.3%) *(Jufar et al.2014),* Mekele town (19.7%) *(Abriha et al.2014),* Gondar Teaching Hospital (16.6%) *(Melku et al., 2014),* Hawassa (15.1%) *(Gies et al. 2003),* Azezo Health Center (21.6%) *(Alem et al., 2013).* The high prevalence of anemia in the current study might be due to differences in sample size geographical variation, and difference in socioeconomic status.

Conclusion

This study showed that statistically significant difference in Hb, Hct and lymphocytes%. On the other hand, highly significance increased in NEUT# and P-LCR of pregnant women compared with non-pregnant women. However, there were no significant different between pregnant women and non-pregnant women on WBCs count, RBC, MCV, MCH, MCHC, PLT, MXD%, NEUT, LYM#, RDW and MPV. Also, high prevalence of anemia among 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.

Recommendation

- Routine hematological tests particularly RBCs, Hb, PLT, WBCs and differential count should be done for pregnant women. So that pregnancy complications could be detected and managed.
- In Libya, data concerning hematological profile of pregnant women are few so future longitudinal studies are needed to help health authorities to implement polices to improve health status of pregnant women.

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