

Haematological indices in pregnant women at booking in a tertiary hospital in Niger Delta, Nigeria

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Abstract

Background: Pregnancy is associated with changes in haematological values which could affect the pregnancy and its outcome. Anaemia, thrombocytopenia and leucocytosis can occur and adversely affect pregnancy outcome.

Objective: To evaluate the values of eleven haematological parameters in pregnant women at booking and determine any possible significant differences in the trimesters of pregnancy.

Methods: A retrospective study conducted from 1st January, 2015 – 31st December, 2020 at the antenatal clinic (ANC) of RSUTH. The laboratory records of 9990 pregnant women who booked for antenatal care were retrieved and reviewed. Socio-demographic characteristics and major haematological indices were studied. Extracted

data was coded and analyzed using the statistical package for social sciences, IBM SPSS version 23.0 (Armonk, NY). P-value <0.05 was considered statistically significant.

Results: A total of 9990 pregnant women booked for antenatal care during the study period. The mean age was 31.4 ± 4.7 years and modal parity was para 0. The mean gestational age was 20.5 ± 7.5 weeks. More than 70% had tertiary level of education and 67.9% were traders and civil servants. The mean packed cell volume (PCV) was $29.27 \pm 3.18\%$ and it remained low for the three trimesters. The mean value of white cell count (WBC) was $8.36 \times 10^9/L \pm 2.43$ and the values were within normal range in all the trimesters. The mean value of mean corpuscular volume (MCV) was $80.03 FL \pm 10.33 FL$. The mean values of MCV were 79.11FL, 80.02FL and

80.86FL in the 1st, 2nd, and 3rd trimesters respectively. The mean value for corpuscular haemoglobin (MCH) was $27.55\text{pg/cell} \pm 2.83$ and the values were within normal range in all the trimesters although in an increasing trend from 1st to 3rd trimesters. The mean value for mean corpuscular haemoglobin concentration (MCHC) was $33.05\text{g/dl} \pm 2.50$. The mean remained within the normal range in all the trimesters. Mean platelet volume (MPV) was $9.41\mu\text{m}^3 \pm 1.87\mu\text{m}^3$. Although their levels were within normal range in all the trimesters, the trend was in decreasing order from the 1st to 3rd trimesters. The mean value for red cell distribution width (RDW) was $11.77\% \pm 1.86$ and the mean remained within normal range in the three trimesters.

The mean value for platelets was $224.61 \times 10^9/\text{L} \pm 59.87$. The platelet values were normal in all the trimesters although with a decreasing trend from the first to the third trimester. Of all the haematological indices, only the differences in the values of MPV were not statistically significant for all the trimesters.

Conclusion: This showed reports of important haematological indices in apparently healthy pregnant women at booking. Most parameters showed significant differences in the three trimesters of pregnancy.

Keywords: Haematological indices, Pregnancy, Antenatal care, Booking, Trimesters, RSUTH.

Introduction

Haematological indices are reliable indicators of the general wellbeing of an individual. The test is easy, fast and cost effective.[1,2] These indices may affect pregnancy and the outcome as their values vary during pregnancy. Some of the indices are increased, reduced or remain normal during pregnancy.[3-8] These changes are due to physiological haemodilution which occurs in pregnancy as a result of increase in plasma volume.[2-8]

The physiological changes that occur during pregnancy make it difficult to define normal haematological reference interval for pregnant women.[1,9-14]

Complete blood count (CBC) is a blood panel that gives cell types in patient's blood. The cell types are red blood cells (erythrocytes), white blood cells (leucocytes) and platelets (thrombocytes). A normal adult has 5 litres of blood. The blood cells are synthesized in the bone marrow.[15-18] The red cell indices are red cell count (RBC), Haematocrit (PCV), Haemoglobin (Hb), Mean cell volume (MCV), Mean cell Haemoglobin (MCH) and Mean cell Haemoglobin Concentration (MCHC).[8,17,19] Mean cell volume, MCH and MCHC give evidence to support pathologies in red blood cells.[20] During pregnancy, there is increase in MCV due to increase in production of RBCs to meet with demand of pregnancy. There is no significant change in MCH and MCHC during pregnancy.[21,22] Packed cell volume and haemoglobin start to decline from the 16th week of gestation as a result of increase in plasma volume causing haemodilution. Compensatory mechanisms raise haemoglobin in the last trimester.[21] There is a decrease in platelet count with gestational age probably due to haemodilution although majority of pregnant women still have levels within normal range.[2,17] Normal pregnancy is associated with leucocytosis which begins in the first trimester and remains high throughout the pregnancy. Monocytes and lymphocytes may also increase in pregnancy.[2,17]

With all these changes in haematological profile in pregnancy, it is necessary to understand pregnancy induced changes in the blood in order to evaluate the women correctly. This will prevent the risk of misinterpretation of these results as pathological instead of physiological.

Therefore we evaluate eleven haematological indices at different trimesters of pregnancy in women booking for antenatal care at a teaching hospital in Niger Delta, Nigeria.

Materials and Methods

This is a retrospective study involving pregnant women, who booked for antenatal care at RSUTH from 1st January 2015 to 31st December, 2020. The hospital is a teaching hospital located in the southern part of Nigeria and serves as a major referral centre for all the primary and secondary centres and privately owned hospitals in and around the State. Rivers State has a population of more than 5 million. The antenatal clinic is run by Obstetrics and Gynaecology department of RSUTH. The average daily attendance to the antenatal clinic (ANC) is 70 women. The main religion in southern Nigeria is Christianity.

The data was obtained from laboratory registers where records of investigations done at booking in ANC were kept within the study period. Data obtained were socio-demographic characteristics and a full blood count of all the women that registered for antenatal care. Blood (5mls) was collected from each patient into a tube containing an anticoagulant, ethylenediaminetetraacetic acid (EDTA). The data was analyzed using the statistical package for social sciences, IBM SPSS version 23.0 (Armonk, NY). Comparative analysis was done with Chi square test and p-value <0.05 was considered statistically significant.

Results

The mean age of the women was 31.44± 4.72 years, modal age was 30 years and the age range was from 15years to 48 years. One thousand, nine hundred and twenty five (19.27%) women registered for antenatal care in the first trimester, 5822 (58.28%) women in the second trimester and 2243 (22.45%) women in the third trimester. The mean gestational age (GA) during the study period

was 20.51± 7.50 weeks and the GA range was from 6 weeks to 40 weeks. Mean packed cell volume (PCV) was 29.27 ± 3.18%. The minimum and maximum PCV were 18% and 42% respectively. The mean white cell counts (WBC) was 8.36 x 10⁹/L ± 2.43 x 10⁹/L and the range of WBC was from 2 to 20 x 10⁹/L. The mean of mean cell volume (MCV) was 80.03 ± 10.33 Femtolitres (FL) and its range was from 55FL to 110FL. The mean of mean cell haemoglobin (MCH) was 27.55 ± 2.83 picogram (pg) and its range was from 18pg to 36pg. Mean of mean cell haemoglobin concentration (MCHC) was 33.05± 2.50grams/deciliter (g/dl); the range of MCHC was from 15g/dl to 41g/dl. The mean of the lymphocyte levels was 28.69 ± 8.29% and a range of 8% to 65%. Mean of the neutrophil levels was 64.41 ± 10.61% and its range during the study period was from 27% to 85%. Mean of the monocyte levels was 0.62 ± 0.39%; the range was 0 to 1.8%. The mean of red blood cell distribution width (RDW) was 11.77± 1.86% and the range was from 7% to 16%. The mean of the platelet levels was 224.61x10⁹/L ± 59.87x10⁹/L and the range was 80x10⁹/L to 525x10⁹/L. Mean of the mean platelet volume (MPV) was 8.36± 2.43FL and the range of MPV was from 4FL to 15FL.

The prevalence of the women in the trimesters at booking is shown in figure 1. The mean values, standard deviation and ranges of the 11 parameters for the trimesters are shown in table 1. The haematological indices of the women in all the trimesters are shown in figures 2a to 2k and comparison of all the parameters according to the trimesters are shown in table 2.

Figure 1: Prevalence of the women at booking in the trimesters.

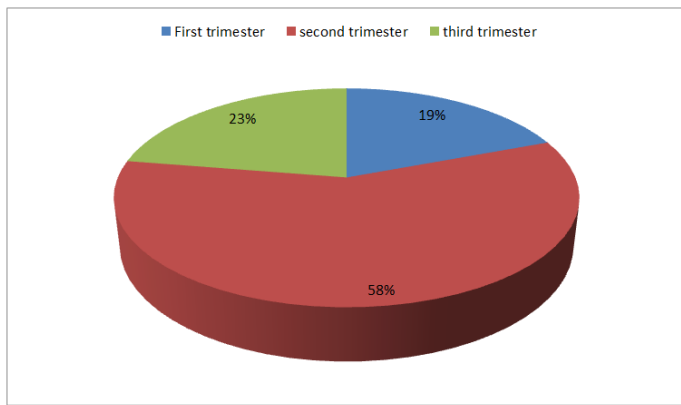


Table 1: The mean values, standard deviation and ranges of the 11 parameters for the trimesters.

Parameters	First trimester N= 1925	Second trimester N= 5822	Third trimester N= 2243
PCV (%)	29.08± 3.21 (20-42)	29.38± 3.09 (18-42)	29.14± 3.36 (18-42)
WBC (x10 ⁹ /L)	7.92± 2.28 (2-20)	8.52± 2.51 (2-20)	8.32± 2.31 (2-20)
MCV (fL)	79.11± 9.59 (55-110)	80.02± 10.57 (55-110)	80.86± 10.27 (55-110)
MCH (pg)	27.21± 2.83 (18-36)	27.62± 2.83 (18-36)	27.65± 2.80 (18-36)
MCHC (g/dl)	33.27± 2.48 (26-41)	33.06± 2.51 (26-41)	32.85± 2.49 (26-41)
Lymphocytes (%)	30.95± 8.28 (8-65)	28.48± 8.35 (8-65)	27.30± 7.71 (8-65)
Neutrophils (%)	62.23± 9.69 (27-85)	64.69± 10.83 (27-85)	65.58± 10.53 (27-85)
Monocytes (%)	0.59± 0.37 (0-1.8)	0.64± 0.39 (0-1.8)	0.61± 0.40 (0-1.8)
RDW (%)	11.61± 1.82(7-16)	11.72± 1.86 (7-16)	12.02± 1.88 (7-16)
MPV (fL)	9.39± 1.74 (4-15)	9.43± 1.89 (4-15)	9.40± 1.94 (4-15)
Platelets (x10 ⁹ /L)	233.43± 58.71(80-425)	224.05± 58.87(80-525)	218.48± 62.54 (80-525)

All values: mean ± standard deviation; range in parenthesis.

Table 2: Comparison of all the eleven parameters according to the trimesters.

Parameters	First trimester	Second trimester	Third trimester	F-test	P-value	Post hoc by trimester
Mean PCV	29.08	29.38	29.14	8.637	0.000	1 st /2 nd p=0.001 1 st /3 rd p=0.811 2 nd /3 rd p=0.010
Mean WBC	7.923	8.524	8.30	47.847	0.000	1 st /2 nd p=0.000 1 st /3 rd p=0.000 2 nd /3 rd p=0.002
Mean MCV	79.11	80.02	80.86	16.284	0.000	1 st /2 nd p=0.001 1 st /3 rd p=0.000 2 nd /3 rd p=0.003
Mean MCH	27.21	27.62	27.65	16.671	0.000	1 st /2 nd p=0.000

						1 st /3 rd p=0.000 2 nd /3 rd p=0.866
Mean MCHC	33.27	33.06	32.85	14.748	0.000	1 st /2 nd p=0.004 1 st /3 rd p=0.000 2 nd /3 rd p=0.002
Mean Lymphocytes	30.96	28.48	27.30	110.29	0.000	1 st /2 nd p=0.000 1 st /3 rd p=0.000 2 nd /3 rd p=0.000
Mean neutrophils	62.23	64.69	65.58	64.03	0.000	1 st /2 nd p=0.000 1 st /3 rd p=0.000 2 nd /3 rd p=0.002
Mean monocytes	0.59	0.64	0.61	10.896	0.000	1 st /2 nd p=0.000 1 st /3 rd p=0.111 2 nd /3 rd p=0.072
Mean RDW	11.61	11.72	12.02	29.901	0.000	1 st /2 nd p=0.052 1 st /3 rd p=0.000 2 nd /3 rd p=0.000
Mean MPV	9.39	9.43	9.40	0.464	0.629	1 st /2 nd p=0.641 1 st /3 rd p=0.966 2 nd /3 rd p=0.832
Mean platelets	233.43	224.05	218.48	32.704	0.000	1 st /2 nd p=0.000 1 st /3 rd p=0.000 2 nd /3 rd p=0.001

Figure 2: The haematological indices of the women in all the trimesters are shown in figures 2a to 2k

2a: Mean PCV

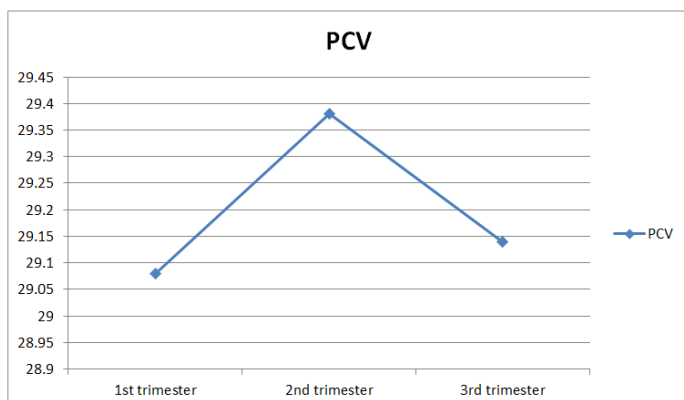
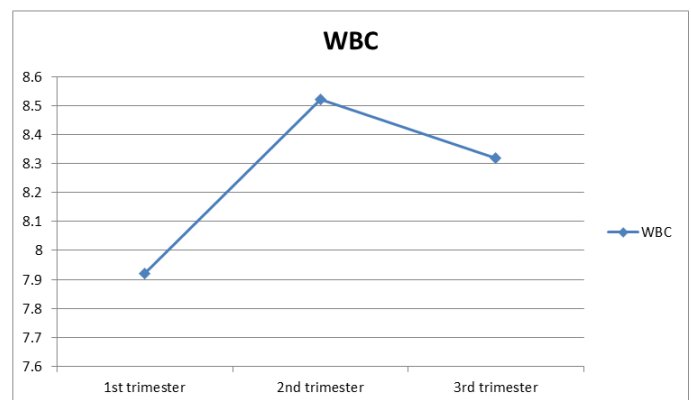
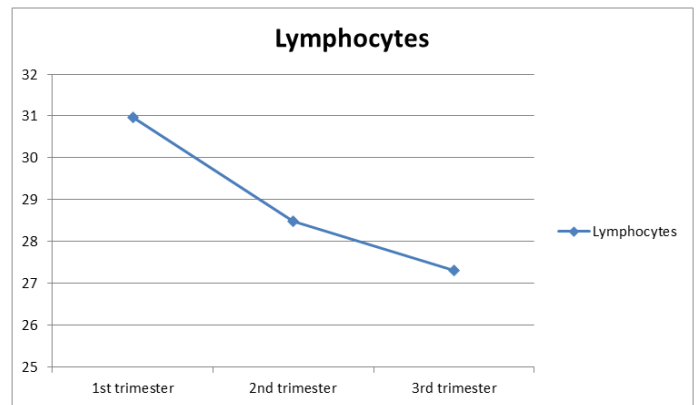
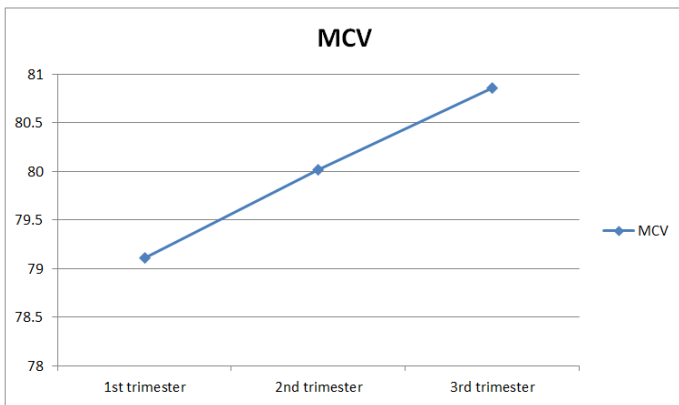


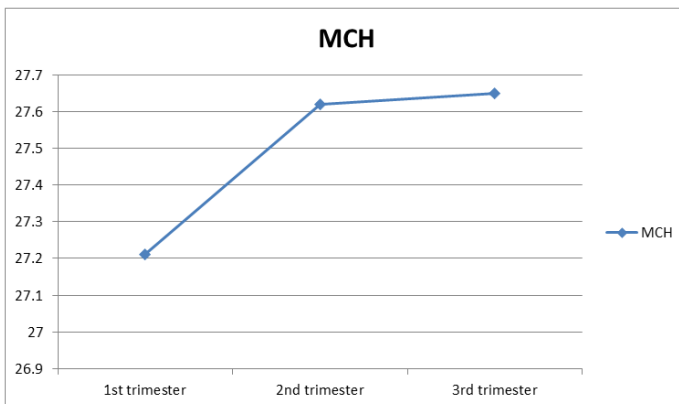
Figure 2b: Mean WBC



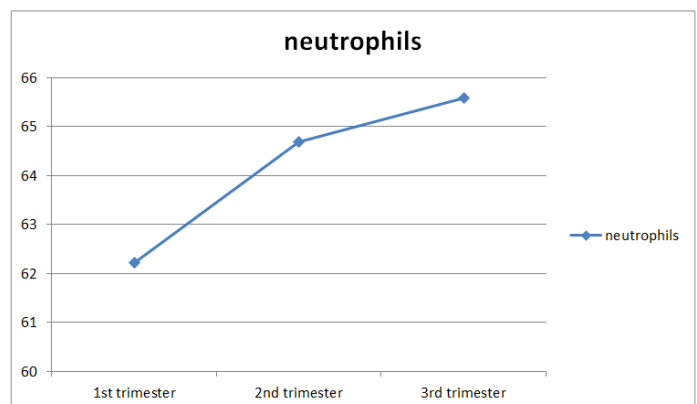
2c: Mean MCV



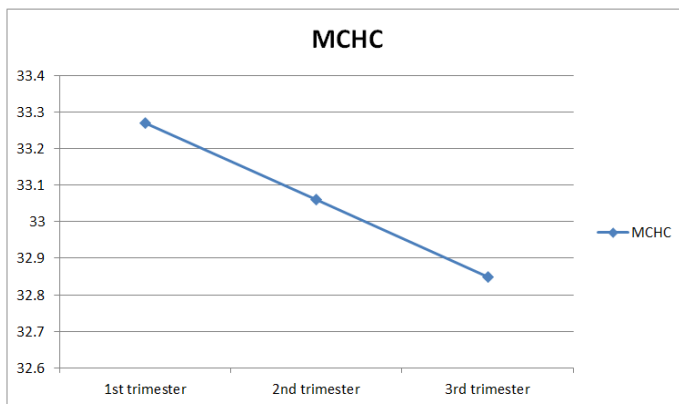
2d: Mean MCH



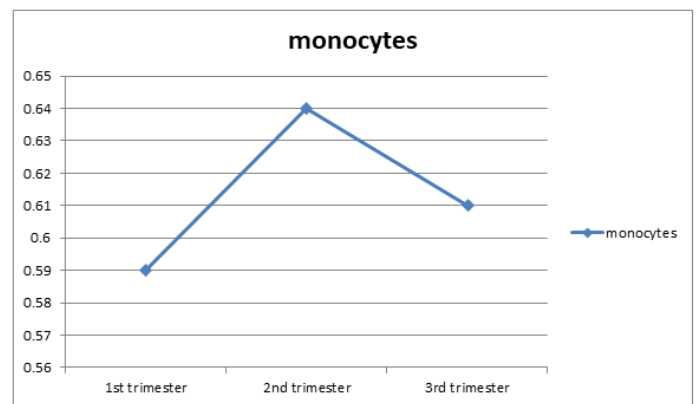
2g: Mean neutrophils



2e: Mean MCHC

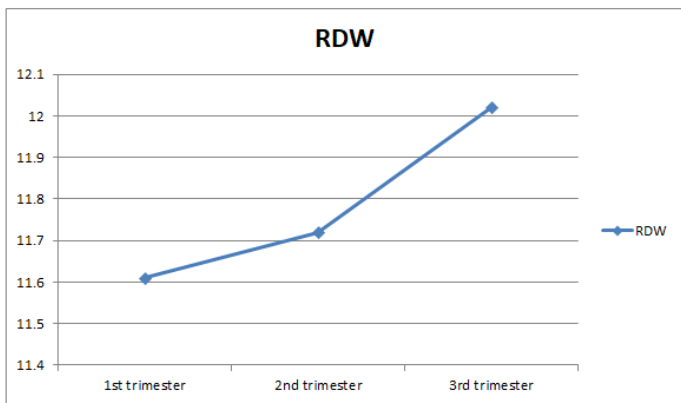


2h: Mean monocytes

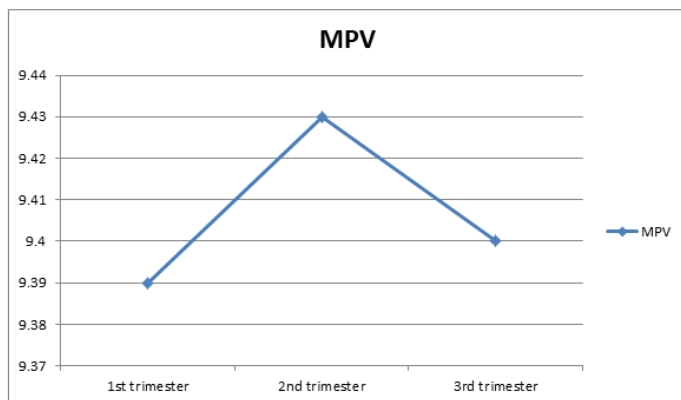


2f: Mean lymphocytes

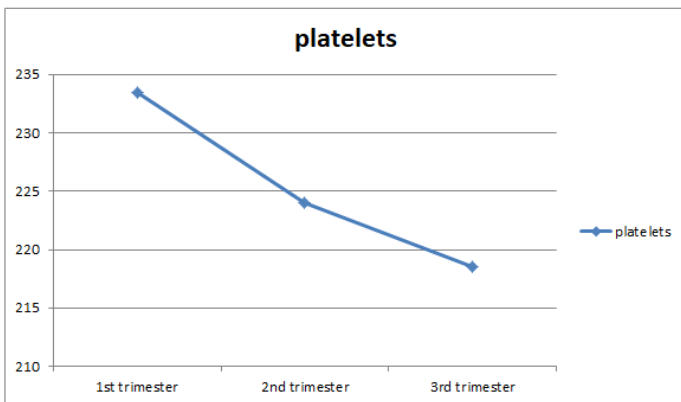
2i: Mean RDW



2j: Mean MPV



2k: Mean platelets



Discussion

Ten out of the eleven haematological indices showed significant differences in all the trimesters. This is similar to the study done by Azab et al. [6] In a study done by Dapper et al, among the eight haematological parameters studied, only packed cell volume values showed significant differences in the three trimesters.[18] Mean platelet volume was the only one in our study that did not

show significant difference. Majority of our women booked for antenatal care late (second and third trimesters). This is similar to studies done earlier.[2,18] This trend is not good because the women were already anaemic before booking for antenatal care. This anaemia has been attributed to an increased demand for iron as pregnancy progresses or due to haemodilution caused by increase in plasma volume which is relatively greater than the increased red cell mass. [23,24] More iron is needed for expansion of maternal haemoglobin mass and needs of fetal growth.[2] This also explained why the PCV levels of the women were low throughout the trimesters as seen in other study.[18] The MCH remained relatively stable throughout the trimesters and MCHC dropped throughout the trimesters especially in the third. This is similar to other studies [2,6,18] and may be an indication of iron deficiency anaemia.[2,6]

The WBC levels for all the trimesters were similar to the ones done by Akinbami et al. [2] The WBC levels of the women were increased though still within normal range, similar to other studies. [2,6,18] In a study done by Mensah et al and Luppi et al, the WBC levels increased from the first to puerperal period. They concluded that WBC rising in early pregnancy will remain elevated through pregnancy.[24,25] The increase might be due to rise in neutrophils count as a response to stress due to redistribution of WBCs. The WBC increase may also be that they are body defense cells and are responsible for body immunity building of the fetus.[24,26-30] The neutrophils were significantly increased in all the trimesters. This finding is similar to that of Azab et al.[6] There was a significant decrease in lymphocytes in all the trimesters. This is in agreement with the findings by Kline et al and Azab et al.[5-7,31] During the study periods, there was a significant increase in the monocytes between

the 1st and 2nd trimesters. Thereafter, there was a drop between the second and third trimesters. Kline et al reported an absolute monocytosis during pregnancy especially in the first trimester but reduces as gestation advances as seen in our study. Monocytes help in preventing fetal allograft rejection by infiltrating the decidual tissue possibly through prostaglandin E2 mediated immunosuppression.[31]

During pregnancy, there is increase in MCV due to increase in production of red blood cells to meet the demands of pregnancy.[17,22,29,32] The findings from our study is in keeping with the above finding as there was a significant increase in levels of MCV in all the trimesters but not in keeping with findings of a study by Akinbami et al [2] where MCV declined from the first to the third trimesters of pregnancy. Red cell distribution width (RDW) is part of full blood count. If RDW is high, it may be due to nutrient deficiency like in iron or folate deficiency. When RDW is low, it means that the cells vary very little in size.[17] Our study revealed significant increase in RDW in all the trimesters which is still in keeping with probably iron deficiency anaemia.

Platelet count was significantly reduced in the 1st, 2nd and 3rd trimesters similar to other studies [2-4, 6] Platelet count in normal pregnancy may reduce by 10% especially in the third trimester due to haemodilution. It is important to state that absolute platelet count tends to remain within normal reference range in most patients. [2,6,33] Although most cases of thrombocytopenia in pregnancy are mild, without adverse effect for both mother and baby, few cases can still cause significant maternal and fetal morbidity and mortality.[2] Thrombocytopenia occurs in 8% of all pregnancies and is the second most common haematologic abnormality in pregnancy after anaemia. [2,27]

Conclusion and Recommendation

The study showed the haematologic indices in pregnant women at antenatal booking in Port Harcourt. All the parameters except one showed significant changes in the three trimesters of pregnancy. It is therefore very important to monitor and manage these parameters in pregnancy in order to prevent both maternal and fetal morbidity and mortality. Also pregnant women should be encouraged to register early in pregnancy in order to start correcting the anaemia in pregnancy early with the use of haematinics and antimalarials; and any other haematological disorder in pregnancy.

Study limitation

This is a retrospective study with information restricted to what is in the client's card.

Ethical approval: Ethical approval was given by the Hospital's Ethics committee.

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