Journal of Blood & Lymph
ISSN: 2165-7831

Michael et al., J Blood Lymph 2017, 7:1
DOI: 10.4172/2165-7831.1000159

Research Article OMICS International

Haematological Indices of Nigerian Pregnant Women

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Abstract

Haematological profile to a large extent, reflects the overall well-being or otherwise of an individual. Anaemia, thrombocytopaenia and leucocytosis are among the most common changes observed in the haematological parameters of pregnant women. Paucity of documented reference values for pregnant women from this region necessitated this study, considering the importance of these parameters, the potential implication of its wrong interpretation and application and their effects on pregnancy and its outcome. A total of 253 women, aged 15-50 years were recruited. Two hundred and eleven of them were pregnant and 42 were non pregnant control. Assessment of some key haematological parameters showed higher WBC and ANC and lower platelets, Hb and ALC in the pregnant compared to the non-pregnant women ($p<0.05$). It also showed higher WBC and ANC and lower platelets and haemoglobin concentration with increasing trimester ($p<0.05$).

Keywords: White blood count; Absolute neutrophil count; Absolute lymphocyte count; Haemoglobin; Confidence interval

Abbreviations: WBC: White Blood Count; ANC: Absolute Neutrophil Count; ALC: Absolute Lymphocyte Count; HB: Haemoglobin; C/I: Confidence Interval

Introduction

Anaemia in pregnancy is considered as one of the factors that significantly affect pregnancy and its outcome, and it constitutes the commonest haematological problem in pregnancy [1]. Thrombocytopenia is the most common haemostatic abnormality in pregnancy [2]. Leucocytosis is almost always a feature of normal pregnancy [3]. There are normal values expected in pregnancy that deviate from the values of non-pregnant women. This normal deviation results from the physiological changes that occur in the course of normal pregnancy. Knowledge of these changes will help to avoid unnecessary blood and other component transfusions caused by misinterpretation of blood count results. Plasma volume increases by 10 to 15% at 6 to 12 weeks of gestation, and then expands rapidly until 30 to 34 weeks [4] and by the late second trimester, the plasma volume of the pregnant woman had increased by 50% above the non-pregnant value, while the red blood cell mass only increases by 25–30%, resulting in a fall in HB concentration. This is called physiological anaemia of pregnancy [5]. Anaemia in pregnancy was therefore defined as an Hb <110 g/L in the first and last trimester, and an HB <105 g/L in the second trimester [6]. By late third trimester, about 10% already have platelet count below the non-pregnant normal value of 150×10^9/L–400×10^9/L[2]. This refers to as gestational thrombocytopaenia [5]. The increased thrombotic risk in normal pregnancy is due to increase in some coagulation factors with reduced anticoagulant factor protein S [5]. The appropriate interpretation of haematological profiles of pregnant women and its application will depend largely on the knowledge of these changes, expected normal parameters, observed deviations from the normal and the knowledge of other pregnancy associated relevant factors. This study therefore aims to determine the normal cut-off reference haematological parameters of pregnant women in Benue State, north-central Nigeria.

Materials and Methods

This was a cross sectional study of 253 women aged 15-50 years. It comprised of 211 pregnant women who registered to obtained antenatal care at the Federal Medical Centre and Benue State University Teaching Hospital, Makurdi, Nigeria and 42 non-pregnant controls. Ethical approval was obtained from the research and ethical committee of Federal Medical Centre, Makurdi. Informed consent was obtained from all the participants. Relevant personal, social and demographic information were obtained with the aid of a pretested self-administered questionnaire. Those excluded from the study were non consenting pregnant women, those not within the age range of 15-50 years, those with bleeding disorders, hypertension or splenomegaly. HIV, and hepatitis B viral positive and women on non-steroidal anti-inflammatory drugs (NSAIDS) such as aspirin were also excluded. Three millilitres of venous blood was collected aseptically from each of the 253 consenting women and dispensed into an ethylene diamine tetra acetic acid (EDTA) anticoagulant bottle which was analysed within 5 h of collection, using an automated haematology analyser by Sysmex XN series. White cell count (WBC, Platelets count), Absolute Neutrophil Count (ANC), Absolute Lymphocyte Count (ALC) and haemoglobin (Hb) concentration were estimated. These tests were done according to manufacturer's instructions and the results were interpreted and documented accordingly.

Results

A total of 253 women aged 15-50 years were recruited, 211 (83.4%) of them were pregnant, with 23 (10.9%) in 1st trimester, 97 (46.0%) in second trimester and 91 (43.1%) in 3rd trimester. 42 (16.6%) were non pregnant control.

The overall Mean +SD of haematological parameters of the pregnant

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Received February 27, 2017; **Accepted** March 10, 2017; **Published** March 22, 2017

Citation: Michael OA, Theresa OA, Tyodoo MM (2017) Haematological Indices of Nigerian Pregnant Women. J Blood Lymph 7: 159. doi: 10.4172/2165-7831.1000159

women, irrespective of their trimester, were: WBC, 6.71+1.29× 10^9 L; Platelets, 222.38+57.75× 10^9/L; ANC, 9.16+3.17 × 10^9 /L; ALC, 2.13+0.60 × 10^9 /L & HB concentration of 11.09+0.71 g/dL (Tables 1 and 2). The mean haematological indices for the non-pregnant controls were WBC count of 5.39+1.08 × 109/L, platelet count of 305.14+41.98× 109/L, ANC of 3.40+2.13 × 109/L, ALC of 2.57+0.87 × 109/L and HB value of 12.01+0.83 g/dL (Tables 1 and 2). The WBC and ANC were higher in the pregnant compared to the non-pregnant women (Tables. 1 and 2), while platelets, HB and ALC were lower in the pregnant compared to the non-pregnant women (Tables 1 and 2).

When the women were grouped by trimester, the Mean+SD of their haematological parameters were:

WBC for 1st, 2nd, and 3rd trimesters were 6.30+1.15 × 10^9/L, 6.57+1.39 × 10^9/L & 6.97+1.18 × 10^9/L, respectively, Platelets 264.17+51.07 × 10^9/L, 240.73+54.05 × 10^9/L and 192.25+47.97 × 10^9/L, respectively; ANC were 6.94+2.74 × 10^9/L, 7.82+3.45 × 10^9/L and 11.16+1.30 × 10^9/L, respectively, ALC were 2.44+0.80 × 10^9/L, 2.08+0.52 × 10^9/L and 2.11+0.62 × 10^9/L, respectively and Hb were 11.99+0.67 g/dL, 11.01+0.61 g/dL and 10.94+0.67 g/Dl, respectively (Tables 3 and 4).

Means plots of blood count and gestation status

Based on trimesters, WBC and ANC increased with increasing gestational age (Figures 1 and 2), while Platelets and haemoglobin concentration decreased with increasing gestational age (Figures 3 and 4).

ALC though showed a similar decreased with increasing trimester, there was however a slight increase in ALC from 2nd to 3rd trimester of pregnancy (Figure 5).

Again of note was the sharp decline in the haemoglobin levels and ALC between the 1st and 2nd trimester of pregnancy as compared to the relative gradual decline of these parameters between non-pregnant & 1st trimester and between 2nd and 3rd trimester.

The differences observed in these parameters between the pregnant women and the non-pregnant controls as well as among the trimesters were statistically significant with $p<0.05$ (Figures 1-5).

Discussion

This study aimed to establish some key haematological indices in Nigerian pregnant women. The mean values of White Blood cell Count (WBC), Haemoglobin (HB), Platelet, Absolute Neutrophil Count (ANC) and Absolute Lymphocyte Count (ALC) were estimated with their 95% Confidence Interval (C/I) among 211 pregnant women at the three trimesters of pregnancy and 42 non-pregnant controls. The mean values of these parameters were also compared between the pregnant

		Haematological profile			
		WBC (× 10^9/L)		Platelets (× 10^9/L)	
Gestation status	N (%)	Mean+SD	95% C/I	Mean+SD	95% C/I
Pregnant women	211(83.4)	6.71+1.29	6.54-6.90	222.38+57.75	214.23-230.80
Non-pregnant control	42 (16.6)	5.39+1.08	5.08-5.69	305.14+41.98	292.05-317.20
Total	**253 (100)**	**6.49+1.35**	**6.32- 6.66**	**236.12+63.39**	**227.95-244.20**
		P=0.000		*P=0.000*	

Table 1: Overall normal haematological parameters of pregnant women.

		Haematological profile					
	N (%)	ANC (× 10^9/L)		ALC(× 10^9/L)		HB(g/dL)	
Gestation Status		Mean+SD	95% C/I	Mean+SD	95% C/I	Mean+SD	95% C/I
Pregnant Women	211 (83.4)	9.16+3.17	8.73-9.58	2.13+0.60	2.05-2.22	11.09+0.71	10.99 -11.19
Non-Pregnant Control	42 (16.6)	3.40+2.13	2.78-4.06	2.57+0.87	2.31-2.85	12.01+0.83	11.78-12.27
Total	**253 (100)**	**8.21+3.71**	**7.73-8.66**	**2.21+0.67**	**2.12-2.29**	**11.24+0.81**	**11.14-11.35**
		P=0.000		*P=0.012*		*P=0.000*	

Table 2: Overall normal haematological parameters of pregnant women contd.

		Haematological profile			
		WBC (× 10^9/L)		Platelets (× 10^9/L)	
Gestational age	N (%)	Mean+SD	95% C/I	Mean+SD	95% C/I
1st Trimester	23(10.9)	6.30+1.15	5.82-6.73	264.17+51.07	241.27-285.49
2nd Trimester	97(46.0)	6.57+1.39	6.30-6.85	240.73+54.05	229.91-251.38
3rd Trimester	91(43.1)	6.97+1.18	6.73-7.22	192.25+47.97	182.33-202.13
Total	**211(100)**	**6.71+1.29**	**6.54-6.90**	**222.38+57.75**	**214.22-230.80**
		P = 0.000		*P = 0.000*	

Table 3: Normal haematological parameters of pregnant women by gestational age.

		Haematological profile					
		ANC (× 10^9/L)		ALC (× 10^9/L)		HB (g/dL)	
Gestational age	N (%)	Mean+SD	95% C/I	Mean+SD	95% C/I	Mean+SD	95% C/I
1st Trimester	23(10.9)	6.94+2.74	5.86-8.13	2.44+0.80	2.12-2.79	11.99+0.67	11.68-12.25
2nd Trimester	97(46.0)	7.82+3.45	7.05-8.48	2.08+0.52	1.97-2.18	11.01+0.61	10.89-11.14
3rd Trimester	91(43.1)	11.16+1.30	10.89-11.41	2.11+0.62	1.99-2.24	10.94+0.67	10.80-11.07
Total	**211(100)**	**9.1640+3.17**	**8.73-9.58**	**2.13+0.60**	**2.05-2.22**	**11.09+0.71**	**10.99-1.19**
		P = 0.000		*P = 0.012*		*P = 0.000*	

Table 4: Normal haematological parameters of pregnant women by gestational age contd.

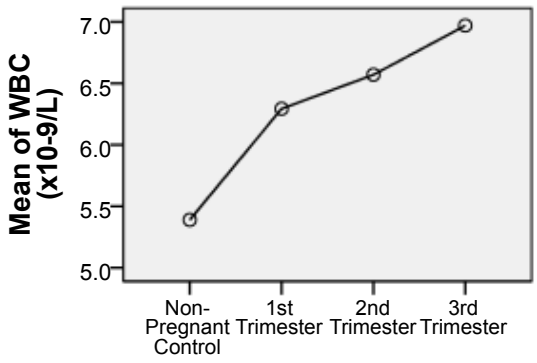

Figure 1: Gestation status.

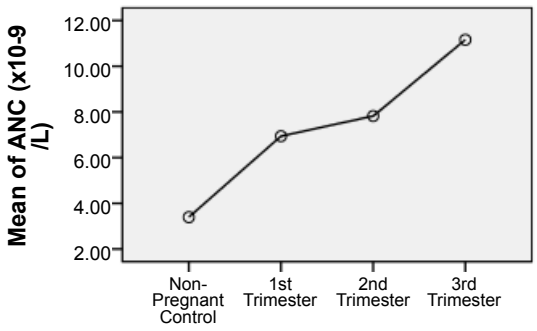

Figure 2: Gestation status.

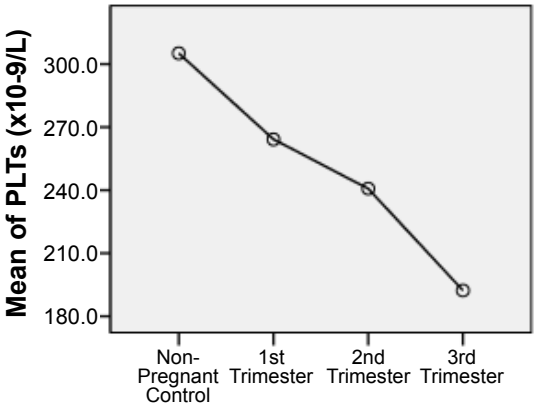

Figure 3: Gestation status.

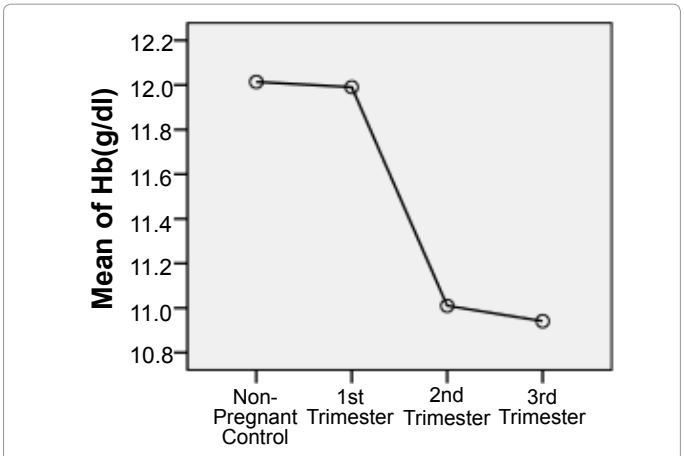

Figure 4: Gestation status.

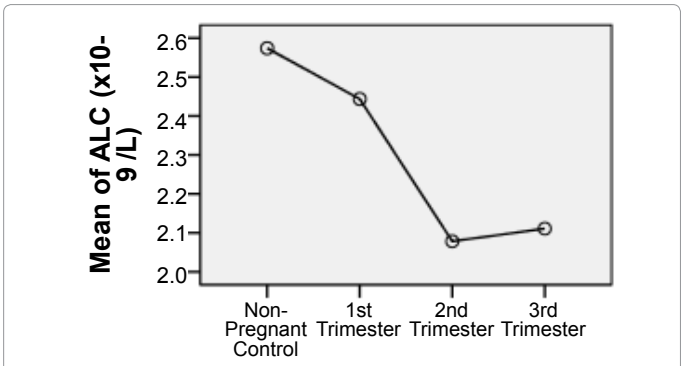

Figure 5: Gestation status.

women and the non-pregnant controls and then among the pregnant women at the three trimesters of pregnancy. In our study, WBC & ANC were significantly higher in pregnant women compared to the non-pregnant women. It also showed a rising WBC and neutrophil count with increasing trimester. This is consistent with leucocytosis reported in normal pregnancies by Akinbami et al. [3] in Lagos, Nigeria. Platelets, HB and ALC were lower in the pregnant compared to the non-pregnant women ($p<0.05$). It also showed lower platelets and haemoglobin concentration with increasing trimester ($p<0.05$)

Akinbami et al. also found lower platelet counts and haemoglobin concentration in pregnant women. The platelet counts decreased significantly with increasing gestational age, lowest at the 3rd trimester of pregnancy. But in contrast to our finding, Akinbami et al. found no significant association between the declining platelet counts with the increasing gestational age. A study by Onwukeme and Uguru [7], from Jos North-central Nigeria, found a significant fall in Hb and platelet in pregnancy, with a significant rise in WBC count in pregnancy due to neutrophilia. This again agrees with our finding.

Similarly, a study by Lurie et al. among pregnant women reported that the leukocyte and neutrophil counts gradually and significantly increased form the 1st to the 3rd trimester [8].

Haven mentioned such factors as physiological anaemia and gestational thrombocypenia, the effect of erythropoietin release with the cross-stimulating megakaryocytopoiesis in response to regular menstruation among the non-pregnant women have also been implicated in the higher haemoglobin and platelet count observed among the non-pregnant women [9].

Still in agreement with our finding was a study by Akingbola et al. [10], from Ibadan South-west Nigeria, that found a significantly higher platelet counts in their non-pregnant women compared to the pregnant women. Their results of Hb and WBC in pregnancy were also consistent with ours.

Dapper et al. [11] from Port Harcourt South-south Nigeria, found haemoglobin concentration (HB) to be highest amongst subjects in the second trimester; White Blood Cell (WBC) count was highest amongst subjects in the first trimester of pregnancy. These differences were however, not statistically significant ($p > 0.05$).

Shen et al. [12] in a study among pregnant Chinese women found lower reference values for HB and platelet count during pregnancy of 9.5 g/dL and 61×10^9/L respectively compared to those of white and black pregnant women. Sejeny et al. in their study confirmed the finding of a significant progressive fall in platelet counts during normal pregnancy, the lowest counts in some of women was said to be outside the recognized normal range of values [13]. Low platelet count in pregnancy is said to be most frequently a benign process that does not require intervention. However, 35% of cases of low platelet in pregnancy are related to disease processes that may have serious bleeding consequences at delivery which may require emergency maternal and fetal care. This study therefore recommended that all pregnant women with platelet counts of less than 100,000 should undergo hematological and obstetric evaluation to rule out serious systemic disorders [14].

In a study by Purohit et al. [1] among pregnant Indian women, HB was significantly lower in the pregnant compared to the non-pregnant women and was also decreased with increasing gestational age. It was lowest in the 3rd trimester of pregnancy. This is consistent with our study result. In this same study, Platelet was also significantly lower in the pregnant compared to the non-pregnant women, this value in pregnancy falls significantly with increasing gestational age. This again agrees with our finding. In our study, Absolute Lymphocyte Count (ALC) was lower in pregnancy and decreased with increased trimester through 1st to 2nd trimester with a slight increase during the 3rd trimester. Purohit et al. also recorded significantly higher overall lymphocyte count in pregnancy. But this lymphocyte values significantly decreased through 1st and 2nd trimester but with a slight increase in the 3rd trimester in agreement with our study finding.

Conclusion

This study has established the reference values for some of the key haematological parameters of pregnant women in Benue State, North-Central Nigeria. It also established reference haematological indices of these pregnant women in the different trimesters of pregnancy. Review of literature from the region and other parts of the world have been consistent on these established pattern: that pregnant women in this region have higher risk of anaemia compared to their non-pregnant counterparts, that non-pregnant women have higher levels of platelets, and even the low levels of platelets in the pregnant women still decreases with advancing age of pregnancy. Most of these studies also agreed with our finding of neutrophilic leucocytosis in pregnancy which increases with increasing trimester of pregnancy. Against this back drop, the need for haematinic supplementation and well-informed result interpretation for pregnant women attending antenatal clinics in the region cannot be over emphasized.

Funding

Funding for the study was purely by the authors. There was no external funding support.

Contributors

Author Onawa AM conceptualized analysed and prepared the manuscript for publication. Author Onoja TA collected data and contributed to manuscript preparation for publication while author Mannongun wrote and reviewed the manuscript for publication

Conflicts of Interest

This study has no conflict of interest.

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