

Evaluation of Some Haematological Parameters Among Pregnant Ijaw Women: An Indigenous West African Tribe.

Eledo, B.O[1*], Buseri, F.I[2] and Akhogba, A.O.[1]

1 Haematology and Blood Transfusion Department, Federal Medical Centre, Yenagoa, Nigeria.

2 Department of Medical Laboratory Science, Niger Delta University, Willberforce Island Amassoma, Bayelsa State Nigeria.

*E-mail: bewelldiagnosticsyen@gmail.com

ABSTRACT:

In this study, we evaluated the effect of pregnancy on some haematological parameters among 600 apparently healthy pregnant Ijaw women attending antenatal clinic at the Federal Medical Centre, Yenagoa, Nigeria. Each trimester consisted of 200 subjects. Another age-matched 200 apparently healthy non-pregnant adult females served as control. All subjects were between 18-40years. The results showed significant decrease in PCV and Hb among the pregnant women in the first, second and third trimesters when compared with the control subjects ($p<0.05$). There was also a significant decrease in the platelet count and lymphocyte count among pregnant women in the second and third trimesters when compared with the controls ($p<0.05$). But there was a significant increase in ESR and neutrophil count among pregnant women in the first, second and third trimesters when compared with the control subjects ($p<0.05$). There was also a significant increase in the total WBC among pregnant women in the second trimester when compared with the controls ($p<0.05$). There was no significant difference in the monocytes and eosinophils count between the pregnant women in all the three trimesters and the female controls ($p>0.05$). Also, there was no significant difference in the total WBC, platelet and lymphocyte count among pregnant women in their first trimesters when compared with the control subjects ($p>0.05$). A normal reference range has been established for pregnant women of Ijaw transient so as to enhance proper assessment and management of antenatal cases.

Keywords: Evaluation, haematological parameters, pregnancy, Ijaw tribe.

INTRODUCTION:

The term pregnancy refers to a state in which an ovum fertilized by a spermatozoon implants itself to the maternal uterus with subsequent development and growth into a foetus (WHO, 1992). Pregnancy is considered to last approximately 40 weeks (280 days) from the last menstrual period (LMP) or 38 weeks (266 days) from the date of conception. It starts with conception, the process of fertilization to form a zygote, and ends in childbirth, miscarriage or abortion. However a pregnancy is considered to have reached term between 38 and 42 weeks (Duvecot and Peters, 1994). Pregnancy is one of the physiological conditions capable of causing dramatic changes in haematological, cardiovascular, renal, metabolic, respiratory and immunological parameters. During normal pregnancy, plasma volume expands. In humans, it appears as early as the sixth week of pregnancy, thereafter, blood volume increases by 40% until the thirtieth week to reach plateau which is maintained until term (Duvekot and Peters, 1994). Plasma volume expansion is considered important for foetal growth (Steer, 2000). The haemoglobin concentration, haematocrit and red cell count fall during pregnancy because the expansion of the plasma volume is greater than that of the red cell mass (Van den broek, 1998). The expansion in red cell mass is proportionally smaller than that in plasma volume during the first trimester, leading to a 10% decrease in haematocrit. During the second trimester, the gap between the rates of plasma volume and red cell mass expansion becomes greater, producing a further reduction in haematocrit. The haematocrit changes little over the third trimester; the haemoglobin concentration also falls because of this haemodilution (Koller, 1982). Plasma volume expansion and lowered haemoglobin concentration are physiologic response to pregnancy (Whittaker *et al*., 1996). According to the World Health Organization (WHO), anaemia in pregnancy is a state in which the total circulating haemoglobin concentration is less than 11g/dl; or packed cell volume (PCV) less than 0.33L/L (WHO, 2001). In developed countries, not only maternal anaemia (Scholl *et al*.,1992) but also high haemoglobin concentration during pregnancy (Steer, 2000) has been reported to increase the risk of unfavourable outcomes of pregnancy such as small for gestational age (SGA), preterm birth and perinatal death. A high proportion of women in both industrialized and developing countries have low haemoglobin concentration during pregnancy (WHO, 2001).

One of the most remarkable modifications of the immune system during pregnancy is the increase in the total number and proportion of granulocytes in the circulation (Luppi *et al*., 2002; Sacks *et al.*, 2000; Minagawa *et al*., 1999). There is a rise in white blood cells and this rise has been attributed to neutrophilia which results due to vascular damage, stress and the need to fight infection (Onwukeme and Uguru, 1990).

During pregnancy, there is continuous repair of micro tears in the endothelium lining of vessels including the capillaries. These injuries occur due to the expansion of the uterine wall as the foetus grows. Blood vessels at the uterus expand and stretch resulting in their laceration. This results in a massive haemorrhage. Platelets form the primary haemostatic plug where these tears occur (Burrows and Kelton, 1990). Thrombocytopenia is encountered in 7-8% of all pregnancies (Berkowitz *et al*., 2006). Platelet counts are slightly lower during pregnancy due to accelerated destruction leading to younger, larger platelets (Karim and Sacher, 2004). Most thrombocytopenia in pregnancy is due to increased destruction (Berkowitz *et al*., 2006). Levels of some clotting factors (VII, XII, IX and X) and fibrinogen increase whilst fibrinolytic activity decrease. These changes protect the pregnant woman from haemorrhage at delivery but also make pregnancy a hypercoagulable state with increased risk of thromboembolism (Cadroy *et al*., 1993).

Though changes in haematological parameters during pregnancy may not necessarily constitute a pathological process, sometimes pathological changes do occur that may even threaten the survival of the mother and/or the baby. Therefore measures should be taken to know the baseline and the extent of deviation as to constitute a disease condition.

Although several studies have been carried out to establish normal haematological values during pregnancy, few studies have taken cognizance of the comparison between the different trimesters of pregnancy to ascertain when antenatal care is most needed. And there is paucity of information concerning established normal reference haematological values during pregnancy among pregnant women in Nigeria. Therefore, the aim of this work is to assess some haematological parameters among pregnant ijaw women whose major occupation is fishing and farming; and suggest/establish a reference range for these parameters.

MATERIALS AND METHODS

This study was carried out in Yenagoa, Bayelsa state South-South Nigeria. Bayelsa state is located within Latitude 4^0 15^1 North and Latitude 5^0 and 23^1 South. It is also within longitude 5^0 22^1 West and 6^0 45^1 East. It is bounded by Delta State on the North, Rivers State on the East and the Atlantic Ocean on the Western and Southern parts .It has the highest collection of Ijaw tribe in Nigeria. Eight hundred persons participated in this study, comprising six hundred apparently healthy pregnant women (200 in first, second and third trimesters respectively) and 200 adult non pregnant females representing the control group. All the subjects were between the ages of 18 and 40 years. The haematological parameters analysed include haemoglobin concentration (Hb), packed cell volume (PCV), total white cell count (WBC), differential white cell count, platelet count; using Sysmex XS-1000i automated haematology analyser and erythrocyte sedimentation rate (ESR), using the Westergren method. The data obtained were analysed using Statistical Package for Social Sciences Version 16.0. The means were compared using Students T-test and $p<0.05$ was the level of significance.

RESULTS:

The mean and range of packed cell volume of pregnant women in their first, second and third trimesters were 30.2±1.6 (27-36%), 28. 1±2.0% (24-33%) and 32.6±2.2% (28-37%) respectively. The mean and range of haemoglobin values for pregnant women in the first, second and third trimesters were 9.9±0.6g/dl (8.8-11.8g/dl), 8.9±0.6g/dl (7.2-10.7g/dl) and 10.3±0.6g/dl (9.1-11.8g/dl) respectively. The mean and range of total WBC for the pregnant women were $6.1\pm0.5\times10^9$/L ($5.1\text{-}7.4\times10^9$/L), $8.1\pm0.9\times10^9$/L ($6.0\text{-}10.9\times10^9$/L) and $9.0\pm1.1\times10^9$/L ($6.1\text{-}13.4\times10^9$/L in the first, second and third trimesters respectively. The mean and range of ESR for the pregnant women in the first, second and third trimesters respectively were 35±7.2mm/hr (20-50mm/hr); 46±5.9mm/hr (38-69mm/hr) and 50±8.8mm/hr (40-72mm/hr). Mean and range of platelet count for the pregnant women were $188\pm32.2\times10^9$/L ($146\text{-}260\times10^9$/L), $155\ \pm9.7\times10^9$/L ($136\text{-}188\times10^9$/L) and $134\pm16.5\times10^9$/L ($98\text{-}160\times10^9$/L) in the first, second and third trimesters respectively. Mean and range of differential leukocyte count

for the pregnant women were, Neutrophils: 71±2.7% (65-79%), 78±2.2% (71-78%), 74±2.5% (69-80%); Lymphocytes: 27±2.4% (21-31%) 20±1.9% (16-27%) 23±2.5% (18-27%); Monocytes: 1±0.8% (0-3%) 1±0.7% (0-3%) 2±0.9 (0-4%); Eosinophils: 1±0.8% (0-3%), 1±0.6% (0-3%), 1±0.6% (0-3%) in the first, second and third trimesters respectively.

Table 4.1: A comparison of Haematological parameters between pregnant women in their first trimester and the female control

Parameters	1st trimester	Control	P- value
PCV (%)	30.2 ± 1.6	38.0 ± 2.1	< 0.05
Hb (g/dl)	9.9 ± 0.6	12.5 ± 0.7	< 0.05
WBC ($\times 10^9$/L)	6.1 ± 0.5	5.4 ± 0.4	> 0.05
ESR (mm/hr.)	35 ± 7.2	9 ± 1.5	< 0.05
PLATELETS $\times 10^9$/L)	188 ± 32.2	211 ± 29.8	> 0.05
Neutrophil (%)	71 ± 2.7	66 ± 3.8	< 0.05
Lymphocytes (%)	27 ± 2.4	31 ± 3.7	> 0.05
Monocytes (%)	1 ± 0.8	2 ± 0.9	> 0.05
Eosinophils (%)	1 ± 0.8	1 ± 0.7	> 0.05

In the table above, there was a significant difference in the PCV, HB, ESR and neutrophil count among the pregnant women in their first trimester when compared with the controls ($p<0.05$). While there was no significant difference in the other parameters between the test and control subjects ($p>0.05$)

Table 4.2: A comparison of Haematological parameters between pregnant women in their second trimester and the female control

Parameters	2nd trimester	Control	P- value
PCV (%)	28.1 ± 2.0	38.0 ± 2.1	< 0.05
Hb (g/dl)	8.9 ± 0.6	12.5 ± 0.7	< 0.05
WBC ($\times 10^9$/L)	8.1 ± 0.9	5.4 ± 0.4	< 0.05
ESR (mm/hr.)	46 ± 5.9	9 ± 1.5	< 0.05
PLATELETS ($\times 10^9$/L)	155 ± 9.7	211 ± 29.8	< 0.05
DIFFERENTIALS(%)			
Neutrophil	78 ± 2.2	66 ± 3.8	< 0.05
Lymphocytes	20 ± 1.9	31 ± 3.7	< 0.05
Monocytes	1 ± 0.7	2 ± 0.9	> 0.05
Eosinophils	1 ± 0.6	1 ± 0.7	> 0.05

In the table above, there was a significant difference in the PCV, HB, WBC, ESR, platelet count, neutrophil and lymphocyte count among the pregnant women in their second trimester when compared with the controls ($p<0.05$). While there was no significant difference in the other parameters between the test and control subjects ($p>0.05$)

Table 4.3: A comparison of Haematological parameters between pregnant women in their third trimester and the female control

Parameters	3rd trimester	Control	P- value
PCV (%)	32.6 ± 2.2	38.0 ± 2.1	< 0.05
Hb (g/dl)	10.3± 0.6	12.5 ± 0.7	< 0.05
WBC ($\times 10^9$/L)	9.0 ± 1.1	5.4 ± 0.4	< 0.05
ESR (mm/hr.)	50 ± 8.8	9 ± 1.5	< 0.05
PLATELETS ($\times 10^9$/L)	134 ± 16.5	211 ± 29.8	< 0.05
Neutrophil	74 ± 2.5	66 ± 3.8	< 0.05
Lymphocytes	23 ± 2.5	31 ± 3.7	< 0.05
Monocytes	2 ± 0.7	2 ± 0.9	> 0.05
Eosinophils	1 ± 0.6	1 ± 0.7	> 0.05

In the table above, there was a significant difference in the PCV, HB, WBC, ESR, platelet count, neutrophil and lymphocyte count among the pregnant women in their third trimester when compared with the controls ($p<0.05$). While there was no significant difference in the other parameters between the test and control subjects ($p>0.05$).

DISCUSSION

This study has clearly demonstrated the effect of pregnancy on some haematological parameters among pregnant Ijaw women with significant difference in some haematological parameters between pregnant women in their different trimesters and the female controls.

There is abundant evidence that haematological values vary considerably during pregnancy (Onwukeme and Uguru, 1990). These changes may be due to several factors, which include the placental hormones secreted in pregnancy, increased erythropoietin production (Kasili *et al*., 1992) and increased plasma volume (Duvekot and Peters, 1994). Reports from all over the World have been published on haemoglobin, packed cell volume, erythrocyte sedimentation rate, platelets and white cell count variables in pregnancy. So far, most of these findings were obtained outside Bayelsa; hence it is necessary that similar data be made available so as to compare the parameters of pregnant Ijaw women for reference purposes.

Anaemia in pregnancy remains one of the most intractable public health problems in developing countries. This is because it is still very much common and strongly associated with maternal and foetal morbidity and mortality (WHO, 2001; Marchant, 2002; Crawley, 2004). In this study, the mean haemoglobin concentration of 12.5±0.7g/dl for the non-pregnant women (control group) was significantly higher than the mean of 9.9±0.6g/dl,

8.9±0.6g/dl and 10.3±0.6g/dl recorded for the pregnant women in the first, second and third trimesters respectively. The results of the present study as shown on tables 4-1 – 4.3 show a statistically significant difference in the haemoglobin concentration in the first, second and third trimesters ($p<0.05$). Anaemia was more pronounced in the second trimester than the first and third trimester. This finding is similar to that of Aluka *et al*., (2001) that anaemia is more in the second trimester, but contrary to the findings of Saadiya *et al*., (1990) that anaemia is more common in the third trimester.

The packed cell volume or haematocrit was also higher in the control group than the pregnant women in their different trimesters ($p<0.05$). This confirms the study by Van den broek *et al*., (1998) that haemoglobin and packed cell volume fall during pregnancy because the expansion of plasma volume is greater than that of the red cell mass. The fall in packed cell volume was significantly higher in the second trimester than the first and third. This confirms the finding by Koller, (1982) that during the second trimester, the gap between the rate of plasma volume increases and red cell mass expansion becomes greater, producing a further reduction in haematocrit. In this study, the mean packed cell volume of pregnant women in the third trimester was higher than that of the second trimester. This is contrary to the findings by Iloabachie and Meniru, (1990) that anaemia increases with gestational age, but confirms the finding by Brabin *et al.,* (2001) that red cell mass increases steadily between the end of first trimester and term. This may account for the slight increase in packed cell volume and haemoglobin concentration in the third trimester.

The total white cell count was significantly higher in the pregnant women in the second and third trimesters than in the female controls ($P<0.05$). But there was no significant difference in the total white cell count between the pregnant women in the first trimester and the female controls ($p>0.05$). The variations observed were all in line with the reports of Dacie and Lewis, (1994) and Baldwin and Bruse, (1994). Onwukeme and Uguru, (1990) attributed this leukocytosis to neutrophilia. In this study, the neutrophil count in the first, second and third trimesters were significantly higher than that of the female controls ($p<0.05$). The mean neutrophil count in the second trimester was higher than that of the first and third. This confirms the finding by Luppi *et al*., (2002) that neutrophils reach significance at 13-28 weeks of pregnancy. It also agrees with the finding by Andrew and Bonsries, (1991) that neutrophil rises in the first trimester up till the 30^{th} week after which count remains steady.

On the other hand, the mean lymphocyte count in the control subjects were significantly higher than that of the pregnant women in the second and third trimesters ($p<0.05$). These confirm the findings by Awodu *et al*., (2002) that neutrophil counts increase during pregnancy while lymphocyte counts decrease. The pattern of lymphocytes count in this study was in agreement with the findings by Luppi *et al*., (2002) that at 29-36 weeks, lymphocytes count are higher than 13-28 weeks. But there was no significant difference in the lymphocyte count between the pregnant women in their first trimester and the female controls ($p>0.05$). There was also no significant difference in the monocytes and eosinophils count between the pregnant women and the female controls ($p>0.05$).

The significantly higher erythrocyte sedimentation rate observed in the pregnant women may be attributed to a variety of factors that are common in pregnancy as earlier explained in this study. The erythrocyte sedimentation rate of the pregnant women in the first, second and third trimesters were significantly higher than that of the control subjects ($p<0.05$). The rate of increase was higher in the third trimester and this confirms the findings by Van den broek and Lesky, (2001) that erythrocyte sedimentation rate increases with gestational age.

The platelet counts in the female controls were significantly higher than that of the pregnant women. This confirms the findings by Karim and Sacher, (2004) and Berkowitz, (2006) that platelets are slightly lower during pregnancy due to accelerated destruction leading to younger and larger platelets. In the study, the platelet counts of pregnant women in the third trimester was lower than that of the second and first. This agrees with the finding by Turkiye, (1995) that platelet count is lower in the third trimester than first and second. But there was no statistically significant difference between the mean platelet count of the pregnant women in the first trimester when compared with the female controls ($p>0.05$).

CONCLUSIONS

Given the fact that both apparently healthy pregnant women and non- pregnant adult females were selected for this study and analyzed by the same standard techniques, and differences have been noted from comparison, one can convincingly conclude that there is need for a separate reference values of haematological parameters for pregnant women in our population. Data from healthy adults may not be ideal for the evaluation of test results from our pregnant women. The importance of reference values in the interpretation of haematological data in clinical practice and research studies cannot be over-emphasized. Normal haematological values are necessary for the assessment, monitoring and management of patients. This is because in interpreting an individual patient's laboratory test results, the clinician usually compares the reported values with reference values. Therefore, the reference values established in this study will in no small measure help in the proper assessment and management of pregnant women during antenatal care. Absence or inappropriate reference values may increase the risk of either unnecessary additional investigation or failure to detect the underlying disease. Since haematological measurements are frequently used as screening procedures to detect abnormalities within a population, recognition of these variables in pregnant women will prevent needless medical and laboratory investigations. The reference values established in this study will also serve as baseline for further research studies on pregnant women.

The findings have also brought to fore that some apparently abnormal haematological values are pregnancy dependent physiologic changes without constituting a pathological process. Hence it is proper for the medical professionals to be aware of these pregnancy related alterations for the proper assessment and management of pregnant women.

ACKNOWLEDGEMENT:

We hereby acknowledge the immense contributions of the staff and management of Bewell Diagnostics Yenagoa, Nigeria in this research work.

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