Haemorheological Profile of Pregnant Women in Ekpoma, Edo State, Nigeria

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Abstract
Knowledge of the relationship between Haemorheology and blood pressures in pregnancy may be necessary for the early detection and management of abnormal pregnancies. This study was carried out to measure the plasma concentrations of haemorheological parameters in relation to blood pressure in pregnant women attending basic maternal and child healthcare facilities in Ekpoma, Edo state. The blood pressure of 80 (eighty) pregnant women comprising of twenty five (25) first trimester, twenty nine (29) second trimester and twenty six (26) third trimester subjects as well as 40 (forty) control subjects who were healthy non pregnant females, were obtained using a well calibrated sphygmomanometer. The packed cell volume (PCV), relative whole blood viscosity (WBV), relative plasma viscosity (PV) and plasma fibrinogen concentration (PFC), were determined using standard methods. From the results obtained, PCV (35.7±3.8), Plasma viscosity (PV) (42.7±4.3) and Haemoglobin (HB) (11.9±1.3) were significantly lower ($p<0.05$) when compared with control (42.2±3.6, 55.7±5.7 and 13.8±1.1 respectively). There was a significant negative correlation between Erythrocyte Sedimentation rate and Diastolic pressure ($r=-0.231$; $sig=0.039$), and with Mean arterial pressure ($r=-0.231$; $sig=0.039$), but no significant correlation with systolic pressure ($r=-0.109$; $sig=0.334$). The determination of the haemorheological indices of pregnant women at various trimesters in relation to blood pressure have revealed important physiological and biochemical changes that occur in pregnancy.

Keywords: *Haemorheology, Blood pressure, Pregnancy, Trimesters*

Introduction

The aspect of haematology that studies the combined flow properties of blood and the mechanics of blood vessels is referred to as Haemorheology. Any alteration could result in diseases such as in sickle cell anaemia and cardiovascular diseases. The major factors which affect blood rheology include plasma and whole blood viscosity, haematocrit and erythrocytes filterability. Plasma fibrinogen concentration also affects blood rheology, elevation of plasma viscosity correlates to the progression of coronary and peripheral artery diseases (Njoum & Kyriacou, 2017). Blood viscosity influences blood flow primarily in the larger arteries, and the elasticity that is present in expandable deformability of red blood cells influences primarily the arterioles and the capillaries with resultant effects such as hypertension (Nader *et al*., 2019).

Hypertensive disorder incidence in pregnancy increased to 18.08 million from 16.30 million globally, amounting to an increase of 10.92% from the year 1990 to 2019 (Wang *et al*., 2021). Many causes of these variations exist, including differences and many variations in how these disorders are defined as well as diagnostic methods used. Also, many reports are based on hospital populations, which may be influenced by the special nature of the health services and do not reflect the situation in the whole population of a defined geographical area. In Nigeria, it is estimated 9.4% of pregnancies are complicated by the occurrence of pregnancy-induced hypertension (PIH), and in most cases preeclampsia constitutes the majority of PIH (Idris *et al*., 2020).

Viscosity of Blood is an important factor in the characteristics of local flow, and this exhibit shear thinning behaviour; with increasing shear rates it decrease exponentially (Nader *et al*., 2019). Some of the primary determinants of the characteristics of blood viscosity include the properties of the plasma concentration such as whole blood viscosity, plasma fibrinogen concentration and quality of erythrocytes and platelet (Nader *et al*., 2019).

Disorders of hypertension are some of the most common health challenges observed in pregnancies which could result in rise in cases of maternal and perinatal morbidity and mortality. Hypertension may be pregnancy induced or may be pre-existent, and in some cases both types can occur, and each type exerting its own unique effect on pregnancy outcome depending on the type of disorder concerned. Recent researches continue to show the significant morbidity and mortality associated with preeclampsia which extends beyond delivery, exhibiting long term effects on mother and child, such as susceptibility to hypertension and chronic kidney disease (Turbiville & Sasse, 2020). The trigger for pregnancy induced hypertension and its associated risk factors are still not known, although risk factors such as history of previous preeclampsia in multiparous women, nulliparity, and other few risk factors generally agreed upon. There are many attributes that have been reported to be related to pregnancy-induced hypertension and preeclampsia: maternal age, familial aggregation, race, smoking, socioeconomic level, diet, season and climate, quite apart from the geographical area (Singh *et al*., 2014).

While extensive mechanism and association research links antenatal multiple micronutrients to plausible materno-fetal health advantages, its relationship with Haemorheological parameters has been ignored. Little or no data exist on the effect of pregnancy on relative whole blood viscosity (RWBV), relative plasma viscosity (RPV) and plasma fibrinogen concentration (PFC) levels as an index for pregnancy-induced hypertension and preeclampsia in genetically and environmentally predisposed women hence, this study was carried out to reveal the possible relationship between pregnancy and haemorheological parameters.

Materials and Methods

Study Area

This study was undertaken in Ekpoma, a semi-urban area of Edo state, Nigeria. It is the headquarters of the Esan West Local Government Area. It is a semi urban area, home to the Ambrose Alli University. Ekpoma and has the following coordinates; 6 º45'N 6º08'E.

Ethical Permission

Ethical permission was sought and obtained from the ethics committee of Ambrose Alli University, Ekpoma, Nigeria (NHREC/12/06/2013/011/19) and informed consent was sought from the various test and control subjects.

Inclusion Criteria

Apparently healthy pregnant women were recruited for this study.

Exclusion Criteria

Individuals and pregnant women with acute and chronic illnesses were excluded from the study.

Study Design

The blood pressure of the pregnant women and control were obtained using a well calibrated sphygmomanometer, after which 10ml of blood was collected using disposable needle ($21g^{1/2}$) and 10 ml syringe. After each collection, blood was dispensed into anticoagulant containers containing EDTA and properly labelled with the subject number.

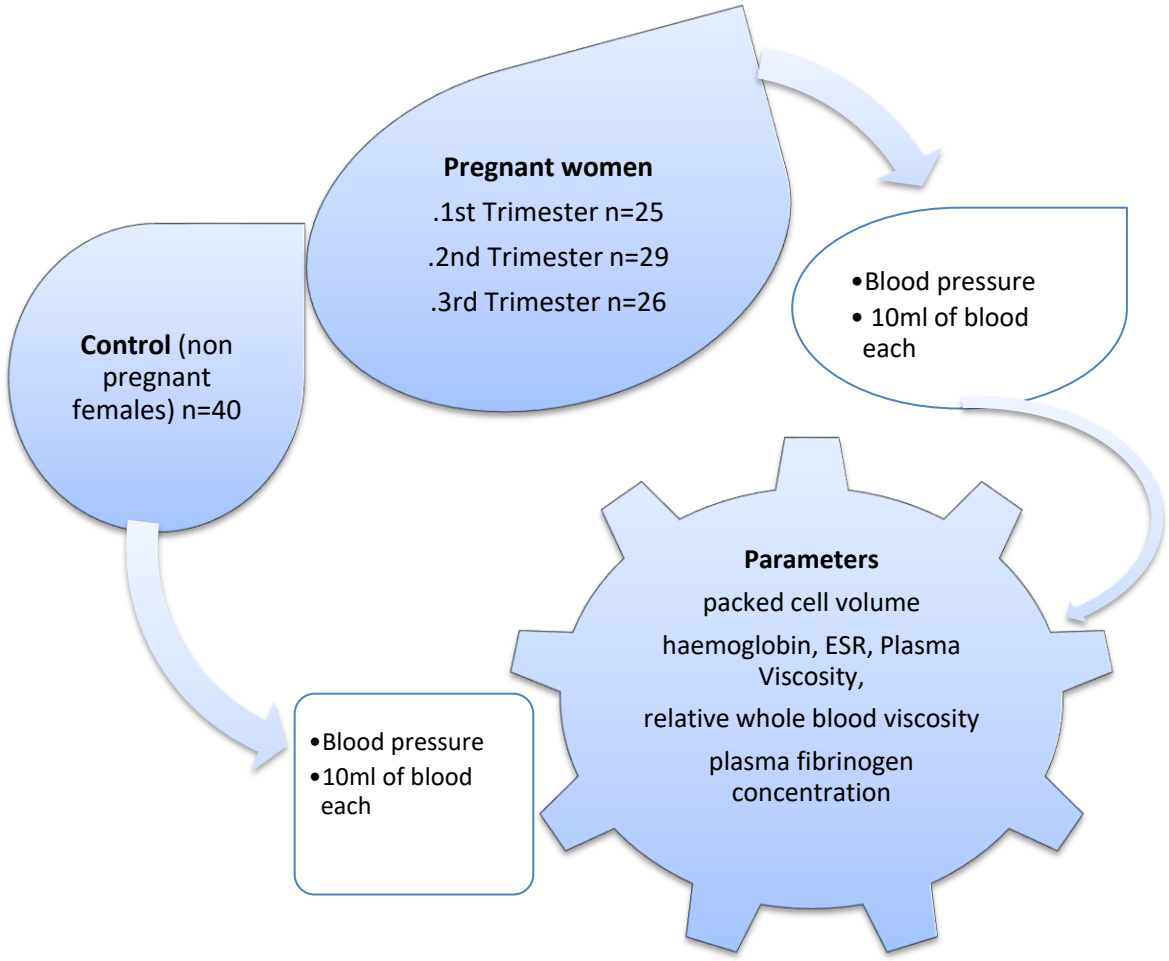

Figure 1; Study design cycle

The packed cell volume (PCV), haemoglobin estimation (Hb), relative whole blood viscosity (RWBV), Plasma viscosity, ESR, relative plasma viscosity (RPV) and plasma fibrinogen concentration (PFC) levels were determined. Simple random sampling technique was used to select the subjects for this research.

Methods

Packed Cell Volume (PCV) was determined using the micro haematocrit method with plain capillary tubes as described by Hassan *et al*., (2014) and Haemoglobin Estimation was estimated using the Cyanmetheamaglobin method.

Whole Blood and Plasma Viscosity was determined as demonstrated by Ifeanyichukwu *et al*., (2015). This method for whole blood and plasma viscosity measurement is based on comparing the flow rate of relative whole blood/ plasma with distilled water, done under equivalent pressure and constant temperature across a capillary tube of equal bore and length .The result is expressed as viscosity of whole blood / plasma relative to that of distilled water.

Plasma Fibrinogen Concentration (PFC) was determined using the Ingram's clot weight Method as demonstrated by Ifeanyichukwu *et al*., (2015).

Erythrocyte Sedimentation Rate (ESR) was determined using the Westergren method as described by Tishkowski & Gupta, (2023).

Mean arterial pressure (MAP) was estimated from the Systolic blood pressure (SP) and Diastolic blood pressure (DP) using the formula; MAP=DP + 1/3 (SP-DP). The MAP was expressed in mmHg.

Statistical Analysis

At the end of the laboratory analysis, the data generated from the study was subjected to basic statistical measurement and inter comparisons was carried out to test for significant differences in the haemorheological parameters and micronutrients levels using parametric analysis of variance (ANOVA),values were significant at $P<0.05$. Post Hoc test was performed to determine the location of significant differences using the computer SPSS 20.0 windows application**.**

Results

From table 1, age frequency of 18-20 years had a total of seven (8.5%) pregnant subjects, 21-25 years had a total of twenty-eight pregnant subjects (35%), 26-30 years had a total of twenty seven pregnant subjects (33.75%), 31-35 years had a total of fifteen pregnant subjects (18.75%), 36-40 years had a total of three pregnant subjects (3.75%) while age group 41-45 years had no pregnant subject (0%).

The mean weight of the first trimester subjects was 73.9 ± 2.4 kg, 72.4 ± 1.5 kg for second trimester subjects, 76.7 ± 4.1 kg for third trimester subjects.

Table 1. Demographic Distribution of Study Subjects According to Trimester, Age and Weight

Age (Years)	First Trimester	Second Trimester	Third Trimester	Total (%)
16-20	3 (3.75%)	2 (2.5%)	2(2.5%)	7(8.75%)
21-25	12 (15%)	10 (6.25%)	6 (7.5%)	28(35%)
26-30	4 (5%)	12 (15%)	11(13.75)	27(33.75%)
31-35	5 (6.25%)	5 (6.25%)	5 (6.25%)	15(18.75%)
36-40	1 (1.25%)	0 (0%)	2 (2.5%)	3(3.75%)
41-45	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	25	29	26	80 (100%)
Mean Weight (kg)	73.9 ± 2.4	72.4 ± 1.5	76.7 ± 4.1	p=0.09

Table 2 shows the haemorheological parameters of pregnant women in comparison with control. The mean Packed cell volume (PCV) (35.7±3.8) was significantly lower (p=0.00) when compared with control (42.2±3.6). A higher mean Erythrocyte sedimentation rate (ESR) for the pregnant subject (47.6±2.8) than the control (40.4±4.0) was recorded, although it wasn't statistically significant (p=0.14). The Whole Blood Viscosity for the pregnant subjects (98.5±4.5) was not statistically significant (p=0.18) when compared with the control (101.9±8.3). Significantly lower mean values were obtained for Plasma Viscosity (PV) (42.7±4.3) and Haemoglobin (HB) (11.9±1.3) when compared with their controls (55.7±5.7) and (13.8±1.1), with p-values of 0.00 and 0.01 respectively. Although a higher mean plasma fibrinogen concentration (PFC) of pregnant subjects (542.1±32.6) was obtained in comparison with the control (504.0±54.1), it was not statistically significant (p=0.53).

The mean systolic pressure had no significant difference between the control (109.3±6.0) and pregnant subjects (109.8±9.6) (p=0.75). The mean diastolic pressure and mean arterial pressure (MAP) had no significant difference between the control (70.4±9.5 & 83.3±7.3) and pregnant subjects (69.6±10.1 &82.9±8.7) (p=0.71 & p=0.76 respectively).

Table 2; Haemorheological parameters of pregnant subjects in comparison with control using t-test.

Parameter	Control (Mean ±SD) n=40	Pregnant Subjects (Mean ±SD) n=80	p-value	Significance
PCV (%)	42.2±3.6	35.7±3.8	0.00	Sig
ESR (mm/1stHr)	40.4±4.0	47.6±2.8	0.14	NS
WBV (Pa.s)	101.9±8.3	98.5±4.5	0.18	NS
PV (Pa.s)	55.7±5.7	42.7±4.3	0.00	Sig
HB (g/dl)	13.8±1.1	11.9±1.3	0.01	Sig
PFC (mg/dl)	504.0±54.1	542.1±32.6	0.53	NS
Systolic Pressure(mmHg)	109.3±6.0	109.8±9.6	0.75	NS

Diastolic Pressure(mmHg)	70.4±9.5	69.6±10.1	0.71	NS
Mean Arterial Pressure (MAP) (mmHg)	83.3±7.3	82.9±8.7	0.76	NS

Key:

Values are significantly different statistically at $p \leq 0.05$;

PCV=Packed Cell Viscosity; **ESR**=Erythrocyte Sedimentation Rate; **WBV**=Whole Blood Viscosity; **PV**=Plasma Viscosity; **HB**=Haemoglobin Concentration; **PFC**=Plasma Fibrinogen Concentration; **n**=sample size; **Sig**=Significant; **NS**= Not Significant, **SD**=Standard deviation; **p**=probability.

Table 3 shows the comparison of haemorheological parameters of pregnant women at various trimester and control. The packed cell volume for the first (34.4±3.0), second (35.9±4.0) and third (36.8±3.9) trimester were significantly lower than the control (42.2±3.6) (p=0.00). There was no statistically significant difference between the first and second trimester (p=0.32), but the third trimester was significantly higher than the first trimester (p=0.01).

The Erythrocyte sedimentation rate was lowest for control (40.4±4.0), while first trimester (43.6±4.4), second trimester (49.0±5.5) and third trimester (49.9±4.3) had concurrent increase in mean values, although it was not statistically significant (p=0.38).

The mean Whole blood viscosity in first trimester (90.3±8.5) was significantly lower than the second trimester (97.8±13.7) and third trimester (107.2±15.4) ((p=0.02 & p=0.00 respectively), but in comparison with the control (101.9±8.3) it was not statistically significant (p=0.09). The second trimester was statistically significant in comparison with first and third trimester (p=0.01 & p=0.03 respectively), but wasn't significant in comparison with control (p=0.12). The third trimester was not significant in comparison with control (p=0.24). As shown on the table, the mean Plasma viscosity of the control (55.7±5.6) was significantly higher than the first (42.2±4.5), second (42.9±4.3) and third (42.7±4.1) trimesters respectively (p=0.01; p=0.02; p=0.03 respectively). There was no statistically significant difference between the various trimesters (p>0.05).

The mean Haemoglobin concentration of the control (13.8±1.1) was significantly higher than the first trimester (11.5±1.0), second trimester (11.9±1.3) and third trimester (12.3±1.3) (p=0.00). The third trimester Haemoglobin concentration was also significantly higher than the first trimester (p=0.02).

The Plasma fibrinogen concentration of the control (504.0±54.1) was not statistically significant when compared with the First (560.4±51.2), second (433.4±43.1) and third (645.8±67.9) trimesters (p=0.12, p=0.32 & p=0.11 respectively), but the second trimester was significantly lower than the third trimester (p=0.05). Table 4 also shows the comparison of Blood pressure parameters of pregnant women at various trimesters and control. The mean systolic pressure of control (109.3±6.0) in comparison with the first (109.8±7.7), second (107.9±9.4) and third (111.9±11.0) trimesters was not statistically significant, also no significant difference between first, second and third trimester groups (p=0.39) was observed.

The mean diastolic pressure of control (70.4±9.5) in comparison with the first (68.4±10.3), second (70.0±9.3) and third (70.4±11.1) trimesters was not statistically significant, also there was no significant difference between first, second and third trimester groups (p=0.87).

As shown on the table above, the mean of the mean arterial pressure of control (83.3±7.3) in comparison with the first (81.7±8.6), second (82.6±7.6) and third (84.2±9.9) trimesters was not statistically significant, also there was no significant difference between first, second and third trimester groups (p=0.72).

Table 3; Comparison of Haemorheological parameters of pregnant subjects at different Trimesters using ANOVA

Parameter	**Control (Mean ±SD)** **n=40**	**First Trimester (Mean ±SD)** **n=25**	**Second Trimester (Mean ±SD)** **n=29**	**Third Trimester (Mean ±SD)** **n=26**	**p-value**	**Significance**
PCV	42.2 ± 3.6^{a}	34.4 ± 3.0^{b}	35.9 ± 4.0^{bc}	36.8 ± 3.9^{c}	0.00	Sig
ESR	40.4 ± 4.0^{a}	43.6 ± 4.4^{a}	49.0 ± 5.5^{a}	49.9 ± 4.3^{a}	0.38	NS
WBV	101.9 ± 8.3^{ac}	90.3 ± 8.5^{b}	97.8 ± 13.7^{a}	107.2 ± 15.4^{c}	0.00	Sig
PV	55.7 ± 5.6^{a}	42.2 ± 4.5^{b}	42.9 ± 4.3^{b}	42.7 ± 4.1^{b}	0.01	Sig
HB	13.8 ± 1.1^{a}	11.5 ± 1.0^{b}	11.9 ± 1.3^{bc}	12.3 ± 1.3^{c}	0.00	Sig
PFC	504.0 ± 54.1^{ab}	560.4 ± 51.2^{ab}	433.4 ± 43.1^{a}	645.8 ± 67.9^{b}	0.05	Sig
Systolic Pressure	109.3 ± 6.0^{a}	109.8 ± 7.7^{a}	107.9 ± 9.4^{a}	111.9 ± 11.0^{a}	0.39	NS
Diastolic Pressure	70.4 ± 9.5^{a}	68.4 ± 10.3^{a}	70.0 ± 9.3^{a}	70.4 ± 11.1^{a}	0.87	NS
Mean Arterial Pressure	83.3 ± 7.3^{a}	81.7 ± 8.6^{a}	82.6 ± 7.6^{a}	84.2 ± 9.9^{a}	0.72	NS

Key:
Values with different superscript $^{a, b, c}$ are significantly different statistically at $p\leq0.05$; while values with one or more same superscript $^{a, b, c}$ are not statistically significant ($p > 0.05$).
PCV=Packed Cell Volume; **ESR**=Erythrocyte Sedimentation Rate; **WBV**=Whole Blood viscosity; **PV**=Plasma viscosity; **HB**=Haemoglobin Concentration; **PFC**=Plasma Fibrinogen Concentration; **n**=sample size; **Sig**=Significant; **NS**= Not Significant, **SD**=Standard deviation; **p**=probability

From table 4 showing correlates of haemorheological parameters and Blood Pressure parameters in pregnancy, there was no significant negative correlation (r) between packed cell volume and Systolic pressure (r=-0.042), Diastolic pressure (r=-0.043), Mean arterial pressure (r= -0.053).

In pregnant subjects as shown in the above table, there was a statistically significant weak negative correlation between Erythrocyte Sedimentation rate and Diastolic pressure (r=-0.231; sig=0.039), Mean arterial pressure (r=-0.231; sig=0.039), but no significant correlation with systolic pressure (r=-0.109).

There was no statistically significant correlation between Whole Blood Viscosity, Plasma Viscosity, Haemoglobin, and Plasma Fibrinogen Concentration with systolic, diastolic and mean arterial pressure in the pregnant subjects.

Table 4; Correlates of Haemorheological Parameters and Blood Pressure Parameters in Pregnancy

		Systolic	**Diastolic**	**MAP**
PCV	Pearson Correlation (r)	-0.042	-0.043	-0.053
ESR	Pearson Correlation	-0.109	-0.231*	-0.231*
WBV	Pearson Correlation	-0.022	-0.207	-0.138
PV	Pearson Correlation	-0.074	-0.041	-0.047
HB	Pearson Correlation	-0.036	-0.044	-0.052
PFC	Pearson Correlation	-0.045	-0.094	-0.079

Key:

*=The Correlation is significant at the 0.05 level (2-tailed); MAP=Mean Arterial Pressure; PCV=Packed cell volume; ESR=Erythrocyte Sedimentation Rate; WBV=Whole Blood Viscosity; PV=Plasma Viscosity; Hb=Haemoglobin Concentration; PFC=Plasma Fibrinogen Concentration; Sig=Significance.

Discussion

The Haemorheological properties influenced by PCV, plasma viscosity, and other parameters have been observed to be affected in pregnancy. Pregnancy is known to have effects on the haemorheological properties of blood, such as PCV, plasma viscosity and relative whole viscosity (Weidman *et al*., 2016; Njoum & Kyriacou, 2017; Tsikouras *et al*., 2018), and these findings are also visible in this study too, although the inter-relationship between pregnancy-Blood pressure-Haemorheology is not well documented which has necessitated this study to evaluate the relationship between pregnancy and haemorheological parameters.

From this study, age groups 21-25 years with 35% of pregnant subjects and 26-30 years with 33.75% of pregnant subjects had the highest number of pregnant subjects. This agrees with the study by Ifenne & Utoo, (2012), in which pregnant age groups 20-24 years and 25-29 years had the highest percentages (26.1% and 37.4 % respectively). The age of 20 to 29 years is the popular social age of marriage and conception in many parts of Nigeria, especially in the southern part, which account for its highest demographic representation. Also from this study, ages between 31-45 years had the least number of pregnant subjects, which also agrees with the work of Ifenne & Utoo, (2012).

The outcome of this study shows a significantly lower packed cell volume (PCV), Plasma viscosity (PV) and Haemoglobin (HB) in pregnant women in comparison with control, which is indicative of anaemia in pregnancy among pregnant subjects, which is consistent with previous reports by Imoru & Emeribe, (2008). A higher plasma fibrinogen concentration (PFC) and Erythrocyte sedimentation rate (ESR) in pregnant subjects was obtained in comparison with the control, which agrees with the study by Imoru & Emeribe, (2008). This shows that Haemorheological parameters such as PCV, plasma viscosity, ESR, whole blood viscosity and plasma fibrinogen concentration are affected by pregnancy, which is consistent with findings of Oke *et al*., (2011).

The result of this study showed that there was significantly lower Haemoglobin concentration and PCV in the first trimester, second trimester and third trimester than in the control subjects. The change in anaemic-indices which was lowest in the first trimester could be due to rapid physiological changes in early pregnancy characterised by hormonal changes, emesis and loss of appetite. The PCV of first trimester subjects which increased through the second to the third trimesters was at variance with report of Oke *et al.*, (2011), who reported decreasing PCV from first to third trimester. This could be due to progressive dietary changes, use of supplements and better antenatal care in our study population, as all pregnant subjects were undergoing antenatal care. The anaemia in pregnancy is sometimes referred to as physiological anaemia. This occurs as a result of increased plasma viscosity associated with normal pregnancy causing dilution of the whole blood without resultant effect of increase on cellular component of blood especially the red cells. The reduced PCV values in pregnancy as compared to non-pregnant subject could be due to this factor (Imoru & Emeribe, 2008).

Although the Plasma fibrinogen concentration (PFC) in the various trimesters were not statistically significant in comparison with control ($p>0.05$), the first and third trimester PFC was higher than the control, which indicates that there is pregnancy induced hypercoagulability which is consistent with reports by Imoru & Emeribe, (2008), Oke *et al.*, (2011) and Okwesili *et al*., (2016). This study strongly confirms the study by Okwesili *et al*., (2016) which observed a similar increase in fibrinogen and reported that the highly elevated fibrinogen concentration was markedly seen in the third trimester. This state of hypercoagulability is likely due to hormonal changes and increased the risk of thromboembolism in pregnancy, which aligns with the assertion of Mizoguchi *et al.*, (2010) and Amilo *et al*., (2013). The elevated fibrinogen concentration observed during normal pregnancy might also be due to increased protein synthesis by liver hepatocytes to cope with increase protein needed for the mother and foetus development during pregnancy which could have made liver to produce more fibrinogen (Mizoguchi *et al.*, 2010).

The ESR is one of the measurements of acute phase response. It is helpful in detecting presence of inflammation and its response to treatment. It is influenced by anaemia, which may be present in inflammatory diseases, and by proteins of acute phase response. The Erythrocyte sedimentation rate (ESR) increased in the course of the pregnancy from first trimester through second to third trimester, which confirmed older studies such as by Oke *et al.*, (2011). This can be attributed largely to increased fibrinogen levels during pregnancy and partly due to anaemia. It is well known that ESR can be increased by many factors such as anaemia, and this elevation in ESR can be as a result of change in protein as observed in fibrinogen concentration, and this change the fibrinogen-globulin ratio that can induce rouleaux formation.

The mean Whole blood Viscosity (WBV) in first trimester subjects was significantly lower than the second trimester and third trimester ($p=0.02$ & $p=0.00$ respectively). The highest WBV levels was obtained in the third trimester, which was higher than control levels, although not statistically significant ($p=0.24$), it agrees with the findings of Oke *et al.*, (2011).

The pregnant subjects recruited for this study were normotensive, because the systolic and diastolic blood pressures were within the normal blood pressure range. There was no statistical difference between blood pressure parameters of the pregnant subjects and control. An increase in systolic, diastolic and mean arterial pressure from first to third trimester, with minimal difference between first and second trimesters was observed in the study, which could be attributed to genetic predisposition, obesity, nutritional changes, change in haemorheology and physiological changes associated with pregnancy. The finding of this study agrees with the findings of Singh *et al*., (2014) which reported a prevalence of hypertensive disorders in pregnancy among Nigerian pregnant women in Nigeria.

Although the MAP was not statistically significant when different trimesters were compared with each other, the increase in value with progression from first to third trimester was consistent with previous research that recorded that in uncomplicated pregnancies, pattern of arterial blood pressure is typically made up of consistent decrease in blood pressure through the first trimester - mid second trimester, then increase till the time of delivery (van der Tuuk *et al*., 2017; Mayrink *et al*., 2019). One of the scientific researches over time in pursuit for the prediction of preeclampsia is mean arterial blood pressure (MAP). It forms part of antenatal surveillance as a feasible tool.

Conclusion

The haemorheology of pregnant women at various trimesters have revealed important physiological and biochemical changes that occur in pregnancy. The relationship between some haemorheological indices and blood pressure of pregnant women at various trimesters could be an indicator for blood pressure abnormalities and associated diseases such as preeclampsia. This has revealed that parameters such as erythrocyte sedimentation rate as well as other haemorheological parameters can be used as effective simple tests in low resource settings to monitor pregnancy progress and predict pregnancy complications.

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