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Full Length Research Paper

Haemorrheologic and fibrinolytic activities in pregnant women: Influence of gestational age and parity

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Haemorrheologic and fibrinolytic activities in pregnancy have been scarcely examined in Nigeria especially on the influences of gestational age and parity. In order to assess these influences, 100 pregnant and 100 non pregnant subjects (controls) of age range 18 – 40 years were studied. Packed cell volumes (PCV), relative whole blood viscosity (RWBV), relative plasma viscosity (RPV), plasma fibrinogen concentration (PFC), euglobulin lysis time (ELT), total proteins and albumin were estimated. The differences in the values of PCV, RWBV, RPV, PFC, total proteins, albumin and globulin with gestational age were not statically significant (P>0.05) while the values of ELT decreased with increase in gestational age (P < 0.01). The differences in the values of PCV, RWBV, RPV, PFC, ELT, total proteins, albumin and globulin with parity were not statistically significant (P > 0.05). In conclusion, this study has shown that gestational age and parity had little or no effect on the haemorrheologic and fibrinolytic activities during pregnancy.

Key words: Haemorrheologic, fibrinolytic activity, Nigerian pregnant women.

INTRODUCTION

The magnitude of the increase in the blood volume during pregnancy varies due to the number of pregnancies, infants and fetuses (Koos and Moore, 2003). Plasma volume increases earlier in pregnancy and faster than red blood cell volume leading to the fall of haematocrit until the end of second trimester when the increase in red blood cells is synchronized with the plasma volume increase (Koos and Moore, 2003; Stuart and Christoph, 2000).

Physiological changes characterized by haemodilution, increased levels of plasma proteins and reduced fibrinolytic activity have been observed in pregnancy (Tommaso et al., 1991; Bennett et al., 1993; Adediran et al., 1999) .

Plasma fibrinogen concentrations have been observed to increase during the third month of pregnancy and progressively rise until late pregnancy (Koos and Moore, 2003; Akinsete and Uyanwah (1989) while euglobulin lysis time was found to prolong as the pregnancy advanced in age (Akinsete and Uyanwah, 1989). Increase in blood viscosity and plasma viscosity in the third trimester of pregnancy and subsequent fall with advancing gestation has been reported (Kametas et al., 2001) while some women in the final three months of pregnancy have been observed to have increase in plasma viscosity (Harkness and Whittington, 1971).

Haemorrheologic and fibrinolytic activities have been scarcely examined in Nigeria especially on the influence of gestational age and parity which therefore necessitated this study.

MATERIALS AND METHODS

The study was carried out from January to June, 2007 after the Ethical Committee of the University of Calabar Teaching Hospital, Calabar had approved the study. Informed consent of each of the one hundred (100) apparently healthy subjects attending the antenatal clinic in the hospital and 100 non pregnant subjects (controls) of similar age of 18 - 40 years was duly obtained. Apart from the subjects living within Calabar metropolis, the entire apparently healthy subjects studied were of systolic blood pressure of 90 – 130 mmHg and diastolic blood pressure of 60 – 90 mmHg with absence of protein and glucose in their urine.

Eight ml of venous blood was asceptically collected into a dispos-

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Table 1. Effect of pregnancy on haemorrgheologic and fibrinolytic parameters.

Parameter	1st trimester (n=10)	2nd trimester (n=30)	3rd trimester (n=60)	Non-pregnant women (n=100)	P-value
PCV l/l	0.33 ± 0.04	0.31 ± 0.03	0.32 ± 0.01	0.36 ± 0.03	< 0.01
RWBV	3.99 ± 0.4	4.01 ± 0.63	4.07 ± 0.69	4.23 ± 0.45	> 0.05
RPV	1.65 ± 0.15	1.67 ± 0.16	1.72 ± 0.18	1.58 ± 0.17	< 0.01
PFC (g/l)	3.3 ± 0.7	3.0 ± 0.8	3.3 ± 0.9	2.3 ± 1.2	< 0.01
ELT (mins)	426.4 ± 66.0	371.7 ± 65.4	340.3 ± 76.4	270.5 ± 170.6	< 0.01
Total protein (g/l)	62.8 ± 10.8	60.2 ± 9.8	61.5 ± 10.4	62.0 ± 10.1	> 0.05
Albumin (g/l)	40.7 ± 10.2	36.3 ± 8.4	38.6 ± 7.4	38.3 ± 8.0	> 0.05
Globulin (g/l)	18.8 ± 3.7	20.8 ± 6.4	19.6 ± 9.9	21.2 ± 8.1	> 0.05

able plastic syringe from each subject and 4.5 ml of it was mixed with 0.5 ml of 31.3 g/l sodium citrate solution while 2.5 ml of blood was added to di-potassium ethylene diamine tetra -acetic acid (EDTA) bottle to the final concentration of 1.5 mg/ml for the determination of packed cell volume (PCV) using standard micro-haematocrit method (Bain and Bates, 2002). Whole blood viscosity (WBV) and plasma viscosity (PV) were determined using method of Reid and Ugwu (1987). Sample collected from each subject was analysed within 2 h for the purpose of precision and accuracy. In the calculations for relative plasma viscosity (RPV) and relative whole blood viscosity (RWBV), the mean values of the flow rates of whole blood (Tb), plasma (Tp) and distilled water (Tw) in s were applied as thus:

RPV = Tp (s) /Tw (s)

RWBV = Tb (s) / Tw (s)

Blood sample in the citrated container was centrifuged at 2,500 g for 10 min to separate the plasma for the determination of plasma fibrinogen concentration by dry clot weight method of Ingram (1961) and euglobulin lysis time by Haugie method (Haugie, 1986) .

The remaining 1 ml of blood was put in a plain bottle for the determination of total protein and albumin. Total protein determination using Biuret method was carried out by adding 1 ml of colour reagent to 20 µl of serum sample or standard in a test tube and the contents were mixed and incubated for 5 min at room temperature. The absorbance of the sample and the standard were measured against the reagent blank within 30 min while albumin concentration was determined using Randox Kit by adding 3.0 ml of BCG reagent (R1) to 0.01 ml of distilled water, standard and serum sample respectively in three different test – tubes. The contents were mixed and incubated for 5 min at room temperature and colorimetric measurement of the absorbance of the sample and standard against the reagent blank at 620 nm determined.

Data analysis

Data generated were expressed as mean ± standard deviation while one-way analysis of variance (ANOVA) was used to compare the means with the difference of $P \leq 0.05$ considered significant.

RESULTS

Table 1 shows the effect of pregnancy on haemorrheologic and fibrinolytic parameters. The first, second and third trimesters had lower PCV of 0.33 ± 0.041, 0.31 ± 0.03 and 0.32 ± 0.01 l/l respectively as compared to 0.36 ± 0.03 l/l for non – pregnancy women and these differences were statistically significant ($P < 0.001$). The values of RWBV in the first, second and third trimesters and non–pregnant women were 3.99 ± 0.4, 4.01 ± 0.63, 4.07 ± 0.69 and 4.23 ± 0.45 respectively and these differences in values were not statistically significant ($P > 0.05$). RPV values increased with gestational age as follows: 1.65 ± 0.15, 1.67 ± 0.16 and 1.72 ± 0.18 for first, second and third trimesters, respectively, but when compared to 1.58 ± 0.17 of non-pregnant women showed statistically significant increase ($P < 0.01$). The values of PFC in the first, second and third trimesters were 3.3 ± 0.7, 3.0 ± 0.8 and 3.3 ± 0.9 g/l respectively as compared to 2.3 ± 1.2 g/l for non-pregnant women ($P < 0.01$).

ELT values decreased with increase in gestational age as follows:- first, second and third trimesters values were 426.4 ± 66.0 , 371.7 ± 65.4 and 340.3 ± 76.4 min respectively as compared to 270.5 ± 170.6 for non-pregnant subjects ($P < 0.01$). This implies that fibrinolytic activity increased as the pregnancy advanced.

The differences in the values of total protein, albumin and globulin with regard to first, second and third trimesters as compared to non-pregnant subjects were not statistically significant ($P > 0.05$).

Table 2 shows changes in haemorrheologic and fibrinolytic parameters with gestational age. The differences in the values of PCV, RWBV, RPV, PFC, total proteins, albumin and globulin were not statistically significant ($P > 0.05$) while the values of ELT decreased with gestational age ($P < 0.01$) which implies that fibrinolytic activity increased as the pregnancy advanced in age.

Table 3 shows parity and changes in haemorrheologic and fibrinolytic parameters in pregnant women. The differences in the values of PCV (0.32 ± 0.041, 0.32 ± 0.031 and 0.31 ± 0.04 l/l), RWBV (4.03 ± 0.43, 4.05 ± 0.61 and 4.15 ± 1.13), RPV (1.73 ± 0.19, 1.69 ± 0.17 and 1.7 ± 0.55), PFC (3.3 ± 0.8, 0.3.1 ± 0.8 and 3.4 ± 1.1 g/l), ELT (365.7 ± 94.0, 351.2 ± 83.2 and 334.5 ± 56.7 min), total protein (62.0 ± 9.9 , 61.4 ± 11.0 and 60.4 ± 12.6 g/l), albumin (38.1 ± 7.6, 37.8 ± 7.2 and 40.4 ± 9.0 g/l) and

Table 2. Effect of gestational age on haemorrheologic and fibrinolytic parameters.

Parameter	1st Trimester (n = 10)	2nd Trimester (n = 30)	3rd Trimester (n = 60)	P – Value
PCV l/l	0.33 ± 0.04	0.31 ± 0.03	0.32 ± 0.01	>0.05
RWBV	3.99 ± 0.4	4.01 ± 0.63	4.07 ± 0.69	> 0.05
RPV	1.65 ± 0.15	1.67 ± 0.16	1.72 ± 0.18	>0.05
PFC g/l	3.3 ± 0.7	3.0 ± 0.8	3.3 ± 0.9	>0.05
ELT (mins)	426.4 ± 66.0	371.7 ± 65.4	340.3 ± 76.4	<0.01
Total proteins (g/l)	62.8 ± 10.8	60.2 ± 9.8	61.5 ± 10.4	>0.05
Albumin (g/l)	40.7 ± 10.2	36.3 ± 8.4	38.6 ± 7.4	>0.05
Globulin (g/l)	18.8 ± 3.7	20.8 ± 6.4	19.6 ± 9.9	>0.05

Table 3. Parity and changes in haemorrheologic and fibrinolytic parameters in pregnant women.

Parameter	0 Parity (n=44)	1-2 Parity (n=42)	3+ Parity (n=14)	P-value
PCV l/l	0.32 ± 0.04	0.32 ± 0.03	0.31 ± 0.04	>0.05
RWBV	4.03 ± 0.43	4.05 ± 0.61	4.15 ± 1.13	>0.05
RPV	1.73 ± 0.19	1.69 ± 0.17	1.7 ± 0.55	>0.05
PFC (g/l)	3.3 ± 0.8	3.1 ± 0.8	3.4 ± 1.1	>0.05
ELT (mins)	365.7 ± 94.0	351.2 ± 83.2	334.5 ± 56.7	>0.05
Total proteins (g/l)	62.0 ± 9.9	61.4 ± 11.0	60.4 ± 12.6	>0.05
Albumin (g/l)	38.1 ± 7.6	37.8 ± 7.2	40.4 ± 9.0	>0.05
Globulin (g/l)	20.6 ± 9.1	20.5 ± 9.5	16.6 ± 8.5	>0.05

globulin (20.6 ± 9.1, 20.5 ± 9.5 and 16.6 ± 8.5 g/l) for 0, 1, -2 and 3^+ parities respectively were not statistically significant ($P > 0.05$). This implies that parity had no effect on haemorrheologic and fibrinolytic parameters.

DISCUSSION

This study has shown that gestational age had no effect on PCV, RWBV, RPV, PFC, total proteins, albumin and globulin except ELT value which decreased as the pregnancy progressed and this implies that the fibrinolytic activity increased as the pregnancy advanced. The ELT result agrees with the report of Wright et al. (1988) but disagrees with the observation of Akinsete and Uyanwah (1989). The decreased ELT value as the pregnancy advanced in age reflects a gradual decline to normal fibrinolytic activity after delivery. Significant differences were observed in the values of PCV, RPV, PFC and ELT with regard to the first, second and third trimesters when compared to non-pregnant subjects (controls). These findings are in agreement with earlier authors (Adediran et al., 1999; Kametas et al., 2001; Usanga et al., 1994; Salawu and Durosinmi, 2001). However, the differences have been attributed to haemodilution, changes in the concentration of one or more plasma proteins fractions and reduced fibrinolytic activity in pregnancy (Koos and Moore, 2003; Stuart and Christoph, 2000) while total proteins, albumin and globulin concentrations have not shown significant differences in pregnancy in this study.

Increase in the blood and plasma volumes during pregnancy varies due to the number of previous pregnancies, infants and fetuses (Koos and Moore, 2003). However, increased fibrinogen concentration during pregnancy is due to increase in its synthesis which has been associated with its utilization in the uteroplacentral circulation while prolonged ELT value reflects reduced fibrinolytic activity in this condition. These findings are in line with previous reports(Koos and Moore, 2003; Choi and Pai, 2002).

It is concluded that gestational age had effect on the fibrinolytic activity since the decreased activity was gradually back to normal as the pregnancy advanced while parity had no effect on haemorrheologic and fibrinolytic activities in pregnancy. This study has shown that pregnancy may be associated with reduction in PCV and increase in RPV, PFC and ELT while gestation had no effect on PCV, RPV and PFC.

REFERENCES

Koos JB Moore JP (2003). Maternal Physiology during pregnancy. In H.D. Alan and N. Lauren, (Eds). Current obstetric and gynaecologic diagnosis and treatment, 9th edition. New York: Mc Graw Hill companies pp. 154-162.

Stuart C, Christoph L (2000). Physiological changes in pregnancy. In

In obstetrics by ten teachers, 17th edition. Indian; Ajanta offset and Packagings Limited pp. 47-50.
Tommaso MD, Ferretti C, Conforti D, D'Ancona RL, Baronci D, Cianciulli D, Branconi F (1991). Haematocrit and haemoglobin, parameters of hematic viscosity in pregnancy–induced hypertension. Minerva Ginecologica, 43 (5): 237-240
Bennett B, Moore NR, Cruickshank DJ, Reith A, Booth WA (1993). Plasminogen activator inhibitors (PAI-1) and (PAI-2) in normal pregnancies, preeclampsia and hydatiform mole. British J. Obstetrics and Gynaecology, 100: 370-374.
Adediran IA, Durosinmi MA, Ogunniyi SO, Akinola NO, Akanmu, AS (1999). Haemostatic parameters in normal pregnant Nigerians and Nigerians with hypertensive disorders of pregnancy. The Nigerian Postgraduate Med. J. 6(2): 49-52.
Akinsete I, Uyanwah PO (1989). The fibrinolytic enzyme system in pregnancy in Nigerians. Afr. J. Med. Med. Sci. 18(2): 89-93.
Kametas N, Krampl E, Mcauliffe F, Rampling MW, Nicolaides KH (2001). Haemorrheological adaptation during Pregnancy in a Latin American Population, Eur. J. Haematol. 66(5): 305-311.
Harkness J, Whittington RB (1971). The viscosity of human blood plasma and its change in disease and on the exhibition of drugs. Rheologica Acta 10 (1): 1435-1528.
Bain BJ, Bates I (2002). Basic haematological techniques. In S.M Lewis, B.J. Bain and I. Bates (Eds), Dacie and Lewis Practical haematology, 9th edition. London : Churchill Livingstone pp. 19-46.
Reid HL, Ugwu AC (1987). A simple technique of rapid determination of plasma viscosity. Nigerian J. Physiol. Sci. 3: 43-48.
Ingram GIC (1961). A suggested schedule for the rapid investigation of acute haemostatic failure. J. Clinical Pathol. 14, 156-160.
Haugie C (1986). Euglobulin lysis time (method). In William JW, Benller E, Ersley AJ, Lichman N (Eds.), Haematology, 3rd edition. Singapore; M.C Graw Hill Books pp. 1670-1678.
Wright JG, Cooper P, Astedt B, Lecander I Wilde JT, Preston FE, Greaves M (1988). Fibrinolysis during normal human pregnancy: complex inter-relationships between plasma levels of tissue plasminogen activator and inhibitors and the euglobulin clot lysis time. British J. Haematol. 69(2): 253-258
Usanga, E.A., Chilaka, M. and Archibong, E.I. (1994). Prevalence of iron deficiency anaemia in Nigerian pregnant women. J. Med. Laboratory Sci. 4,107-113.
Salawu, L. and Durosinmi, M.A. (2001). Erythrocyte rate and plasma viscosity in health and diseases. Nigeria Journal of Medicine, 10 (1): 11 – 13.
Choi JW, Pai SH (2002). Tissue plasminogen activator levels change with plasma fibrinogen concentrations during pregnancy. Annals of Haematol. 81 (11): 611 -615.