Blood Viscosity Among Pregnant Women Attending Antenatal Clinics In A Tertiary Hospital In Abakaliki, Nigeria

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Abstract: Increase in blood viscosity has been associated with certain clinical outcome in pregnancy ranging from pregnancy induced hypertension to cardiovascular complications, both of which on the long run may indirectly affect the fetal performance in utero. In this study, 30 women (20 pregnant and 10 nulliparous controls), and aged between 28 – 35years were recruited from Federal Medical Centre, Abakaliki, Nigeria. The viscosity of their blood samples were indirectly measured using 1ml syringe to note the time taken to dispense. The results of the study (Mean± SD; 21.70 ±1.75 and 17.50 ±1.72 for the pregnant women and the nulliparous controls respectively), showed that it took a significantly longer ($P<0.05$) time for the blood of pregnant women to be dispensed through the syringe than that of nulliparous subjects. This implies that the blood of pregnant women is much more viscous than that of the nulliparous women, hence, the need for the rheological factors to be closely monitored during pregnancy.

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1. Introduction

Blood is viscous and its viscosity decreases as the flow velocity of shear rate increase. Rheological variables affect blood flow in both macrovessels and microvessels. These variables include whole – blood viscosity and its major determinants; plasma viscosity and haemocrit. Plasma viscosity is likewise determined, at least in part, by plasma fibrinogen (Brun, 2002). Viscosity defines the resistance to fluid flow or in a general term, the thickness of a fluid. For blood and other fluids, the viscosity is increased as the thickness increases. Viscosity limits the flow of blood, providing the intrinsic resistance to blood flow in the presence of pressure. It might be accounted for by hemodynamic changes. Haemorheology is concerned with whole blood viscosity and its determinants i.e plasma viscosity, haemocrit and shear-dependent flow behavior of the red cells due to their tendency to aggregate at low and to deform at high shear rates. In pregnancy, measurement of blood viscosity is pivotal as it gives an insight into an underlying hyperviscosity syndrome. In such conditions like Waldenstrom Macroglobulinemia (WM), cryoglobulinemia, and high level of rheumatoid factor activity, the viscosity of blood can also be highly elevated (Gertz et al, 2004).

Very highly viscous maternal blood can lead to restricted fetal growth, resulting in Small for Gestational Age (SGA) babies and low birth weight. Lu et al, (1991) affirmed the importance of adequate plasma volume expansion in allowing adequate fetal growth and showed an increased incidence of low birth weight in association with high haematocrit. Although the mechanism is obscure, it may be related increased blood viscosity. Monitoring blood viscosity could as be indirect approach to monitoring the pressure of blood in a pregnant woman (Brun, 2002).

This study aimed at determining the rheologic properties of whole blood samples from pregnant women and to ascertain the impact of pregnancy on changes in blood viscosity.

2. Materials and Methods

2.1. Study population

A total of 30 women (20 pregnant and 10 nulliparous controls) aged between 28-35 years and all residing in Abakaliki were recruited from the Federal Medical Centre, Abakaliki in October for this study. The consent of the subjects was sort before sample collection while pregnant women having edematous appearance, diabetes mellitus and hypertension were excluded.

2.2. Sample collection

One milliliter (1ml) of blood samples were drawn from the antecubital vein by venipuncture with minimum venous stasis using a syringe. The blood sample was thereafter emptied into a labeled EDTA container.

2.3. Measurement of viscosity

The viscosity of the blood was measured using 1ml syringe, which improvised for a viscometer. One milliliter (1ml) of each of the blood samples collected with the 1ml syringe which was thereafter hung upside down with a retort stand. Then, the time it took for the blood to empty was noted for all the samples.

2.4. Data analysis

The blood viscosity of the 30 subjects was indirectly measured as a function of the time it took the blood to be dispensed through a 1ml syringe. The mean of the data generated were compared using Student t-test at 95% confidence interval of the mean. Data were presented as mean $\pm$ SD.

3. Results

Table 1shows comparison of the mean $\pm$ SD of age and time of blood flow through a viscometer. The mean of the rate of blood flow through a viscometer was compared between pregnant women (n = 20) and nulliparous control (n =10) and aged between 28 – 35 years (Table 1). The results obtained showed 21.70 $\pm$ 1.75 and 17.50 $\pm$ 1.72 for the pregnant women and the nulliparous controls respectively (Table 1).

Table 1: Comparison of the Mean $\pm$ SD of Age and Time of blood flow through a viscometer

VARIABLES	PREGNANT WOMEN	NULLIPAROUS	*P-value
NUMBER (n)	20	10	-
AGE (yrs)	32. 17$\pm$1.20	30.70$\pm$1.89	P > 0.05
PARITY	2.0$\pm$1.20	-	-
TIME (s)	21.70$\pm$1.75	17.5 $\pm$1.72	P < 0.05
**P-value obtained by student t-test. Significant at* P < 0.05			

Figure 1 showed the relationship between age and time of blood flow through a Viscometer in pregnant women while figure 2 showed the relationship between Age and Time of blood flow through a Viscometer in nulliparous control. It showed that it took a significantly longer (P < 0.05) time for the blood of pregnant women to be dispensed through a tube than that of nulliparous subjects.

4. DISCUSSION

The mean of the rate of blood flow through a viscometer was compared between pregnant women and nulliparous control aged between 28 – 35 years attending the Federal Medical Center Abakaliki . The results of which is 21.70 $\pm$ 1.75 and 17.50 $\pm$ 1.72 for the pregnant women and the nulliparous controls respectively, showed that it took a significantly longer (P < 0.05) time for the blood of pregnant women to be dispensed through a tube than that of nulliparous subjects. This implied that the blood of pregnant women is much more viscous than that of the nulliparous women. According to Dintenfass (1974), hyper viscosity syndrome results from plasma abnormality, increased cellularity, and decreased deformability all of which has different rheological mechanisms. Plasma viscosity is determined mainly by the concentration of electrically weight proteins. These proteins including fibrinogen, 2-macroglobulin, and immunoglobulins all contribute to the viscosity of blood due to their interactions with the red cells.

Researcher has generally accepted that there is increased rheology activity in pregnancy, especially those complicated by pregnancy induced hypertension (Dintenfass, 1974, Heilmann and Sekmann, 1989; Gamzu et al, 2001). Huisman and his colleagues had earlier reported that red cell aggregation considerably increases during normal pregnancy inspite of the physiologic hemodilution, mainly because of the increased fibrinogen concentrations. It is also worthy to state that there is increased cellularity in pregnancy. This could be attributed to their increased vulnerability to infection.

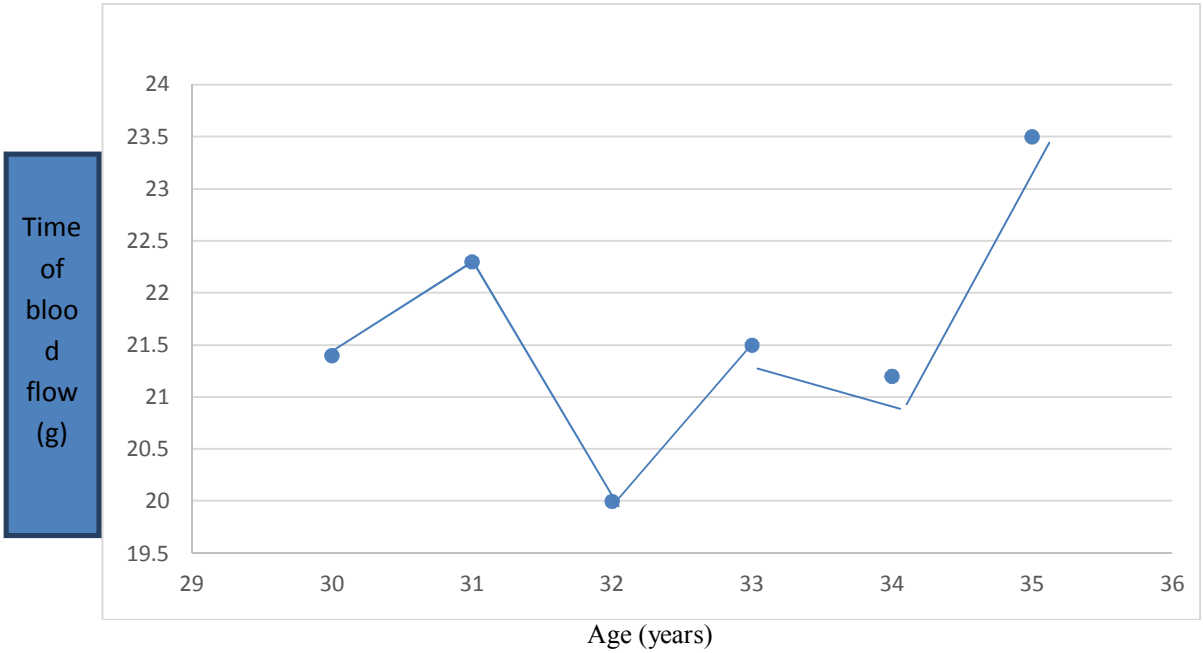

Figure 1: Relationship between Age and Time of blood flow through a Viscometer in pregnant women

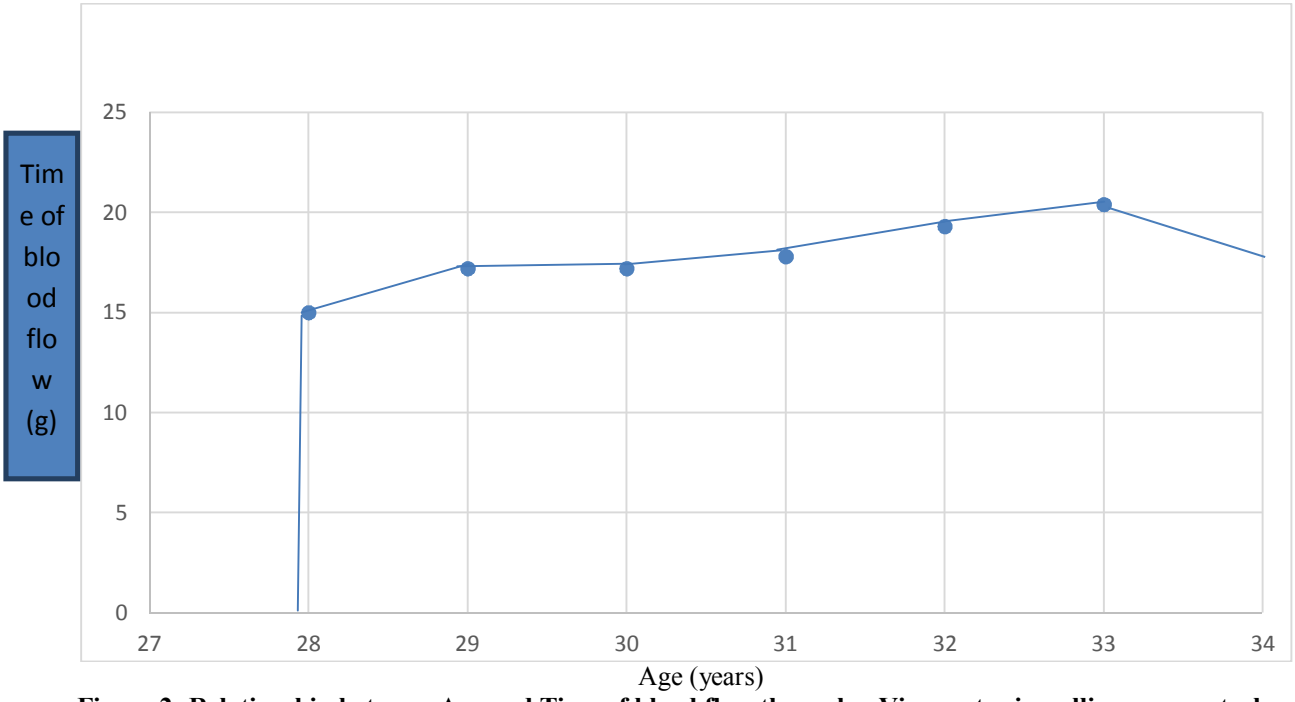

Figure 2: Relationship between Age and Time of blood flow through a Viscometer in nulliparous control

The result obtained from this study is of immense concern for certain classical reasons. First, increase in blood rheology has been associated with certain clinical outcome in pregnancy ranging from pregnancy induced hypertension to cardiovascular complications, both of which on the long run may indirectly affect the fetal performance in utero. Secondly, hyperviscosity slows down circulation and reduces oxygenation of tissues, thus increasing the chances of red cell aggregation and a further

tendency to maternal organ distortion (Dintenfass, 1974).

It is worthy to conclude that blood viscosity increases in pregnancy, hence, blood viscosity when continually evaluated in pregnant women could serve as an early warning for pre-eclamsia since literatures have independently linked the former with pressure. On this note, it is recommended that the concept of evaluating the blood viscosity of pregnant women should be adopted during their antenatal visitation. Since maternal outcome like pregnancy induced hypertension is a concern after the 20th week of gestation (mostly in pregnant women who have a previous history of hypertension), the investigation of the parameter should also be taken more seriously at that time.

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