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LIPIDS AND RHEOLOGIC INDICES AMONG BLOOD DONORS IN ILE-IFE METROPOLY NIGERIA

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ABSTRACT
In this study a total of eight (8) male none remunerated donors were recruited. A validated questionnaire was administered to collect data pertaining to their life styles. None of them was found to be cigarette smoker nor drink alcohol and the standard criteria for blood donor fitness were met by all of them and instruction to have their last meal two hours before donation were also adhere strictly. A pre and post donation samples were collected 1, 24, 48, 72 and 120 hours were collected. Among the parameters analysed were;- Packed cell volume (PCV), Relative plasma viscosity (RPV), Relative whole blood viscosity (RWBV), Plasma fibrinogen concentration (PFC), Cholesterol (CHOL), Triglyceride (TG), Sodium (Na^+) and Potassium (K^+). The experimental differences seen in pre and 1hr post samples were not statistically significant ($p>0.05$). When the result of 24hrs post donation samples were compared to pre samples, there were no significant difference ($p>0.05$). Statistically significant differences were seen in RWBV and Na^+ only when 48 and 72 hrs post samples were compared to pre-samples ($p<0.05$). In the 120hs post samples significant difference was seen only in sodium ($p<0.05$), relative stable haematocrit was observed throughout the period of this study. In conclusion bloodletting is capable of inducing quick and significant hypolipidemic effect which could predetermine improved haemorheology and overall microcirculatory efficiency. This procedure could be therapeutic for dyslipidemic and hyperviscosity patients and myocardial protection and prevention.

INTRODUCTION

Blood has anomalous rheological properties particularly in certain disease condition. It has been established that an increase in blood viscosity and red blood cell aggregation and a decrease in red blood cell deformity are all strong risk factors for the development of cardiovascular disease [1]. Cardiovascular disease (CVD) is a leading cause of death worldwide. The latest statistics (2009) for the United States show that CVD is the leading cause of death for persons age 65 years and above [2]. Interventions that reduce the incidence of CVD are therefore of profound importance. Blood viscosity and aggregation are major factors in hypertension and other cardiovascular pathologies, including myocardial infarction. Blood saves lives were the WHO theme for 2000AD. There is a considerable shortage of blood even in large metropolises with the supply being less than50% of requirement [3]. Also studies in the past have shown a lowered risk of cardiovascular morbidity and mortality among regular blood donors [4,5]. This effect was shown to last at least for a period of 3 years from the last donation [6]. Report had it also that among 2682 middle-aged men

who were followed for about 5 years, the risk of heart attack was 86% lower among blood donors [7]. Another epidemiological study performed on nearly 4,000 people found that the non-smoking men who had donated blood in the previous three years were at half the risk to have a heart attack or stroke as were those who had never donated blood [8]).

A significant number of experimental and statistical studies show that high levels of haematocrit and blood viscosity, a decrease in the RBC deformability and increase in the ability of RBCs to aggregate are all important risk factors for cardiovascular disease along with other risk factors such as increased concentration of low density lipoproteins and fibrinogen, obesity, smoking etc [9,10]

Most blood donors suffer no significant after effect, occasionally, however, donors feel faint or dizzy, nauseous, and/or have pain, redness or a bruise when the blood was taken. More serious complications, which rarely occur, include fainting, muscles spams and nerve damage [11]. Repeated blood donation/bleeding change most haemorheological variables, by decreasing cytocrit and viscosity, reduced agreeability and increasing blood cell deformity, and optimal milieu to help prevent thrombosis is artificially created [12]. Blood donors are persons who give blood for the purpose of transfusion. These individuals are usually unpaid volunteers, but they may also be paid by commercial enterprises to give blood for transfusion purposes. Blood donation involves the process of testing collecting, preparing and storing of blood and blood components. In general, blood donors must be at least 17 years, must weigh at least 110 pounds (50kilogram) and must be in good health [13]. Many factors can temporary or permanently disqualify potential donors. Most of them have to do with having engaged in behaviors that put them at risk of infection or having spent time in certain certified areas. Among these factors are haven had a tattoo, haven had sex with people in high-risk groups, had certain diseases and have been raped [13].

The Federal Ministry of Health in 2005 estimated that Nigeria collects about 500,000 units of blood annually [14]. This is grossly inadequate for a country with a population of over 150 million people whose annual transfusion requirements will be about 2% of its population [3]. To ensure adequacy and availability, this estimated requirement of about three million units of blood annually can be made possible if the concept of regular voluntary blood donation is imbibed in the culture [3]. Regular blood donation has been found to be beneficial in many ways. It challenges the bone marrow to increase its red marrow, producing more blood for the donor. It also prevents the accumulation of body iron which can cause free radical formation in the body [3]

MATERIALS AND METHODS

A total of 8 voluntary non remunerated donors were studied longitudinally at Obafemi Awolowo University Teaching Hospital complex, Ile-Ife Osun State Nigeria. Verbal consent of participation in this exercise was obtained from each of them. A pre-donation blood samples were collected from all of them and post donation samples of 1, 24, 48, 72 and 120 hours after donation was also collected. Standard criteria for blood donor's fitness were met and specific instructions to have their last meal at least two hours before donation were strictly adhere to.

Blood Collection

Twelve ml of blood was taken from each donor from their ante-cubital vein with minimum stasis. 5ml was dispensed into an accurately labeled lithium Heparin bottle and 4.5ml added into another container with 0.5ml sodium citrate in it. The remaining 2.5ml was added into an K_2EDTA container. Samples were mixed and the plasma separated for immediate analysis. The follow investigations were carried out on each sample: plasma fibrinogen concentration (PFC) by clot weight method [15], packed cell volume (PCV) [16], Relative Whole blood and Plasma Viscosity (RWBV and RPV) [17], standard Enzymatic methods were used for total Cholesterol and Triglycerides while the method of Schaff et al was used for Sodium and Potassium estimation [18].

RESULTS

The pre and post samples of first time blood donor were taken at different time and analysed. Among the parameters analysed are packed cell volume (PCV), Relative plasma viscosity (RPV), Relative whole blood viscosity (RWBV), Plasma fibrinogen concentration (PFC), Cholesterol (CHOL), Triglyceride (TG), Sodium (Na^+), and Potassium (K^+).

The result of samples collected in the voluntary first blood donor and one hour post samples collection is shown in table 1. Experimental significant differences were noticed in all the results but they were not statistically significant ($p>0.05$). In table 2, the same observation seen in table one was also seen.

In tables 3 and 4 statistically significant differences were observed in RWBV and Na^+ only ($p<0.05$), the differences observed in other parameters were not statistically significant ($p>0.05$).Relative stable haematocrit was recorded throughout the experimental period. In table 5, statistically significant difference was observed only in the sodium ($p<0.05$), while other values were not statistically significant ($p<0.05$). Significant reductions in electrolytes were not very pronounced, in this study.

DISCUSSION

We have studied rheological and lipid changes in voluntary blood donors, donating blood for the first time ever in order to propose a possible advantageous effect that blood donation might have on lowering lipids in hyperlipidemic patients especially in a resource poor setting environment like our in Nigeria.

Table 1. Pre-sample parameters of donor and 1hr after donation

	PCV	RPV	RWBV	PFC	CHOL	TG	Na^+	K^+
PRE	45.88± 2.85	1.85± 0.14	5.81± 0.95	3.86± 0.83	3.63± 0.84	1.10± 0.52	133.88± 4.45	3.54± 0.27
1 Hr after	44.75± 2.60	1.78± 0.11	5.33± 1.23	3.50± 0.93	3.63± 0.70	1.10± 0.45	133.38± 12.40	3.53± 0.37
P value	>0.05	>0.05	>0.05	>0.05	>0.05	>o.05	>0.05	>0.05

Table 2. 24hrs post samples and pre-samples of blood donors

	PCV	RPV	RWBV	PFC	CHOL	TG	Na^+	K^+
PRE	45.88± 2.85	1.85± 0.14	5.81± 0.95	3.86± 0.83	3.63± 0.84	1.10± 0.52	133.88± 4.45	3.54± 0.27
24 Hr after	44.00± 2.93	1.77± 0.14	5.03± 0.88	3.88± 0.99	3.29± 1.14	1.19± 0.66	136.38± 5.29	3.89± 0.57
P valu	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Table 3. Pre-samples and 48hrs post samples of blood donors

	PCV	RPV	RWBV	PFC	CHOL	TG	Na^+	K^+
PRE	45.88± 2.85	1.85± 0.14	5.81± 0.95	3.86± 0.83	3.63± 0.84	1.10± 0.52	133.88± 4.45	3.54± 0.27
48 Hr after	45.13± 2.64	1.82± 0.12	4.85± 0.71	3.63± 0.52	3.76± 0.86	1.04± 0.74	131.75± 11.09	3.60± 0.57
P valu	>0.05	>0.05	<0.05	>0.05	<0.05	>o.05	<0.05	>0.05

Table 4. 72 hrs post samples of blood donor and their pre-samples

	PCV	RPV	RWBV	PFC	CHOL	TG	Na^+	K^+
PRE	45.88± 2.85	1.85± 0.14	5.81± 0.95	3.86± 0.83	3.63± 0.84	1.10± 0.52	133.88± 4.45	3.54± 0.27
72 Hr after	45.63± 2.97	1.86± 0.27	4.84± 0.70	3.56± 0.62	3.56± 0.62	0.85± 0.38	134.25± 5.06	3.61± 0.49
P valu	>0.05	>0.05	<0.05	>0.05	<0.05	<o.05	>0.05	>0.05

Table 5. 5days post samples of blood donor and their pre-samples

	PCV	RPV	RWBV	PFC	CHOL	TG	Na^+	K^+
PRE	45.88± 2.85	1.85± 0.14	5.81± 0.95	3.86± 0.83	3.63± 0.84	1.10± 0.52	133.88± 4.45	3.54± 0.27
5days after	45.63± 3.78	1.78± 0.11	5.08± 1.30	3.38± 0.74	3.55± 0.76	0.85± 0.47	133.75± 6.36	3.81± 0.65
P valu	>0.05	>0.05	>0.05	0.05	0.05	<o.05	>0.05	>0.05

The beneficial effect of blood donation on cardiovascular disease is caused by a reduction in haematocrit and blood viscosity. Haematocrit was shown to be a risk factor for atherosclerosis in the Framingham study. [19]. Haematocrit is also a very powerful determinant of blood viscosity [20]. In this work, a stable haematocrits throughout the experimental period was recorded. Though there were experimental decreases in all the mean values but were not statistically significant. This negates the observation of [1] and [21] where they reported decreases in haematocrit in autologous blood donors. We observed that repeated blood donations could be the determinant for lowered haematocrit in donors and that the first time blood donation might not be critical enough to cause significant reduction in haematocrit.

Blood has a normal viscosity dependent on adequate hydration and the absence of any illness that could affect normal electrolytes balance in the body. As the blood thickens, it becomes harder for blood vessels to return the blood through the venous and arterial blood vessels. This increases the work of the heart, as a pump, to move the thickened blood to the brain and vital organs out to the limbs and have it return again for oxygenation and the process continues again.

Increased blood viscosity is thought to accelerate atherogenesis by per-petuating areas of low shear in the vascular tree, prolonging the residence time of athero-genic particles, such as platelets and lipoproteins, on the endothelium [22,6] reported that among 2,682 middle-aged men who were followed for about 5 years, the risk of heart attack was 86 percent lower among blood donors. Another epidemiological study performed on nearly 4000 people, found that the non-smoking men who had donated blood in the previous three years were at half the risk to have a heart attack or stroke as were those who had never donated blood [8]. In this study, Whole blood and plasma viscosity equally remain relatively stable all through the period of study except a transient reductions in whole blood viscosity between 48^{th} and 72^{nd} hours ($p<0.05$). This reduction is thought to be due to haemodilution effect after blood loss via donation which probably is at its peak during this period.

The plasma viscosity was relatively unchanged throughout the period of samples collection; this

observation is in line with [1] who demonstrated a decrease in whole blood viscosity in blood donors. The homeostatic mechanism involve in this could not be fully explained but the unchanged haematocrit could have contributed to its stability.

The plasma fibrinogen concentration also remains relatively unchanged. This could be a compensated mechanism to prevent further blood loss as an acute phase reaction. There is paucity of literature in this aspect and the exact mechanism is doubtful but it could be reasoned that donating a unit of blood for the first time might not have immediate significant reduction in the plasma levels of fibrinogen. Ajayi et al, reported a significant decrease in commercial blood donors who donates about five times in a year on average, from their 48th hour post donation, thought with acute rise within the first 24hours [23]. Our observation with PFC could have pre-determined the stability of plasma viscosity while the whole blood viscosity could be linked with stable haematocrit. Also increase in red cell rigidity has been reported after high volume plasmapheresis. Despite stabilities in PFC, gradual reduction in total cholesterol and triglycerides were recorded. Significant reduction in total cholesterol was observed from the first hour after donation while Triglycerides only became significant from the 5th day and reduction levels maintained throughout the duration of the experiment. High volume plasmapheresis has been associated with lowering effect on hypercholesterolemia [24] and this agrees with our observation while the significant decrease in triglycerides could be regarded as a signal for reducing hyperlipidemia.

Statistically significant reductions in electrolytes were not very pronounced in this study. However, a transient significant decrease in sodium ion concentration was noticed at the 48th hour which returned to almost the pre-donation level at 72 hours. The electrolyte were relatively stable, although experimental reductions were noticed these indicate no acute reflections on both cations after bleeding and could also be advantageous to maintain plasma osmolalities after bleeding to forestall dangerous consequences of hypotonicity resulting from excessive depletion of cations especially sodium.

CONCLUSION

Our findings have shown that bloodletting is capable of inducing quick and significant hypolipidemic effect which could predetermine improved haemorheology and overall microcirculatory efficiency. This procedure could be therapeutic for dyslipidemic and hyperviscosity patients and myocardial protection and prevention.

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