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Levels of Serum Iron, Total Iron Binding Capacity, Transferrin Saturation Fraction and Packed Cell Volume of Blood Donors in Calabar, Cross River State, Nigeria

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Abstract: The purpose of this study was to determine the serum iron and total iron binding capacity, transferrin saturation fraction and packed cell volume of blood donors in University of Calabar Teaching Hospital, Calabar. Serum iron concentration (SI), Total Iron Binding Capacity (TIBC), Transferrin Saturation Fraction (TSF) and Packed Cell Volume (PCV) showed mean values of 16.60±2.93umol/l, 62.20±4.02umol/l, 27.20±3.00% and 0.398±.030l/l respectively for the blood donors. These values were not significantly (p>05) different from that reported for the control subjects (Serum Iron, 17.50±1.80umol/l. Total Iron Binding Capacity, 61.70±3.43umol/l, Transferrin Saturation Fraction, 28.60±3.37% and Pack Cell Volume 0.410±0.37 l/l respectively). However, the SI, 16.60±2.93umol/l, TSF, 27.20±3.00% and PCV 0.398+0.30l/l respectively of blood donors from Calabar in South-Eastern part of Nigeria were significantly (p>0.50) lower than values obtained from Ibadan (SI, 19.06±1.00umol/l, TSF, 35.10±1.90%, PCV, 0.451±.068l/l) in South-Western part of Nigeria. Age did not significantly (p>0.05) influence the levels of SI, TIBC, TSF and PCV of the donors and controls in this study. From this study it is observed that there may be regional differences in the iron parameters suggesting regular nutritional education for the donors on the importance of improving their nutritional status.

Key words: Blood donors, serum iron, total iron binding capacity, transferrin saturation fraction, packed cell volume

Introduction

The voluntary unpaid blood donation is a humanitarian act towards the sick by the healthy (Ali *et al.*, 2001). No blood transfusion service can survive without blood donors. The demand for blood is soaring all over the world and on any given day, approximately 32,000 units of red blood cells are needed for accident victims, people undergoing surgery and patients receiving treatment for leukemia, cancer and other diseases, such as sickle cell disease and thalassaemia (Ranney and Rapaport, 1997). More than 23 million units of blood components have been reported to be transfused every year (Huestis and Busch, 1991). In most countries, strict regulations have been established for the selection of blood donors that incorporate criteria that serve to protect both the donor and recipients (Huestis and Busch, 1991).

A donor donates approximately 450mls of blood at the time of donation (Ranney and Rapaport, 1997) which contains approximately 225mg of iron which will be lost by the donor. Reports have shown that some blood banks in some countries do not care for standards and hence the donors health is jeopardized (Jacobs *et al.*, 1998). Currently the American Association of blood banks has a standard of minimum haemoglobin of 13.5gldl for men and 12.5ldl for women donors (Dacie and Lewis, 2001) that are currently in use worldwide. Iron is a universal cofactor for mitochondrial energy generation and supports the growth and differentiation of all cell types. The regulation of systemic iron is through the proteins 'Transferrin' (iron mobilization) and 'Ferritin' (iron sequestration) (Roskams and Connors, 1994). The physiologic importance of the storage iron is that it provides a rapidly available supply in the event of blood loss (Lipschitz *et al.*, 1995). The iron content of the body is kept constant by maintaining a balance between the amount absorbed and amount lost and this amount also depends upon the interaction of foods, drugs and abnormal components of diet (Jawad, 1996). Iron requirements depend on age, sex, race, pregnancy lactation and attitude (Molla *et al.*, 1992). This work is aimed at assessing the iron status (in terms of Serum iron, Total iron binding capacity, Transferrin saturation fraction and packed cell volume) of male subjects presenting themselves as blood donors at University of Calabar Teaching Hospital, Calabar, Nigeria.

Materials and Methods

A total of eighty five (85) subjects were used for the study. The first group was made up of 52 blood donors attending UCTH blood transfusion bleeding bay. Of this number a few claimed to be relatives of patients while a greater number claimed they were paid to donate blood for their patients in the hospital who required blood transfusion for various reasons. The ages of the donors ranged from 19-40 years. The second group was made

Table 1: Mean Serum Iron, TIBC, PCV and Transferrin Saturation fraction of Blood Donors Compared with Control

Groups	SI (umoll/l)	TIBC (umol/l)	TSF (%)	PCV (I/l)
Blood Donors n = (52)	16.60±2.93	62.20±4.02	27.20±3.00	0.398±030
Control Subjects n = (33)	17.50±1.80	61.70±3.34	28.60±3.37	0.410±037
P Value	>0.05	>0.05	>0.05	>0.05

Result expressed as mean±SD, n= Number of subjects studied

Table 2: Serum Iron, TIBC, PCV and Transferring Saturation fraction of Blood Donors and Controls based on age

	Blood Donors			Control Subjects		
	15-25	26-36	>37	20-30	31-40	>41
Parameters	(n = 14)	(n = 18)	(n = 20)	(n = 21)	(n = 7)	(n = 5)
SI (umol/l	17.40±1.80	17.0±2.40	16.0±3.30	16.40±2.30	16.40±2.0	16.0±2.10
TIBC (umol/l	68.60±2.40	63.50±2.40	58.30±3.0	64.90±2.0	57.20±1.90	54.10±1.90
TSF (%)	27.30±2.30	26.90±3.0	26.0±2.0	25.50±3.0	28.0±3.0	26.40±2.0
PCV L/L	0.360±.019	0.370±.020	0.360±.030	0.445±.025	0.420±.020	0.410±.025

ANOVA analysis (p>0.05); Result expressed as mean±SD, n = Number of subjects studied

Table 3: Mean Serum Iron, TIBC, PCV and Transferrin Saturation fraction of Blood Donors from Calabar Compared with donors from Ibadan

	Blood Donors		Control Subjects	
	Present	Ibadan work (n = 31)	Present	Ibadan work n = 31)
Parameters work	(n = 52)	(Usanga, 1990)	Work n = 52)	(Usanga, 1990)
SI (umol/l)	16.60+2.93	19.06+1.00	17.50+1.80	21.27+2.00
TSF (%)	27.20+3.00	35.10+1.90	28.60+3.37	35.5+2.31
PCV L/L	0.398+.030	0.451+.068	0.410+.037	0.459+.068

ANOVA analysis (p < 0.05); Result expressed as mean±SD, n = Number of subjects studied

up of thirty-three (33) apparently healthy male adults who served as control. They were all healthy individuals who gave no history of medication at least 3 months preceding the study. The consisted of volunteers who were staff in the hospital and also Medical Laboratory Science Students of University of Calabar Teaching Hospital, Calabar, Nigeria. They were aged 18-41 years. All blood donors fulfilled the criteria for suitability as donors (including packed cell volume concentration of >0.390 l/l). Venous blood samples were collected from the subjects between 9.00am-12noon into sequestrene and dry iron-free bottles. The following investigations were performed on the samples haematocrit, Serum Iron (SI), Total Iron Binding Capacity (TIBC) and Transferring Saturation Fraction (TSF). Standard methods of Dacie and Lewis, 2001 were used for haematocrit determination while the serum iron, TIBC and TSF were determined by the method of the international committee for standardization in haematology (ICSH, 1978). The data were analyzed by student's "t" test and ANOVA. Unless otherwise stated the data were expressed as means±standard deviation. P<0.05 was considered significant in all statistical comparisons.

Results

The results of SI, TIBC, TSF and PCV concentrations for the blood donors and controls are presented in Table 1. The SI, TIBC, TSF and PCV concentrations of male blood donors were observed to fall within the reference range

of Dacie and Lewis, 2001 and reports of Usanga, 1990; Ukaejiofor *et al.*, 1979. Again there were no significant differences when blood donors were compared with controls. The blood donors and controls subjects were compared based on age (Table 2). The numerical differences within and among the age groups shows no significant (p>0.05) change with increase in age. The SI, TIBC, TSF and PCV of the control and blood donors from Calabar were compared with that observed for the same age group from Ibadan (Usanga, 1990) (Table 3). For all the parameters investigated donor's from Calabar recorded significantly (p<0.05) lower values than their counterparts from Ibadan.

Discussion

Haemoglobin level assessed either by packed cell volume or copper sulphate method is one of the criteria used for selection of donors in UCTH. The parameter indicates whether a donor is fit in terms of haemoglobin content (an iron containing protein) or not. A Pack Cell Volume of >0.390L/L was used as inclusion criteria for the participants in the study. The Serum Iron (SI) Total Iron Binding Capacity (TIBC) Transferring Saturation Fraction (TSF) and Packed Cell Volume (PCV) of the male donors were similar to that reported from other parts of Nigeria and other normal population (Usanga, 1990; Ukaejiofor *et al.*, 1979; Dacie and Lewis, 2001; Jacob's *et al.*, 1972). Our present work has shown that SI, TIBC, TSF and PCV of male blood donors in this locality did not differ significantly (p>0.05) from healthy

male non-donors (control) adults. This finding is similar to the earlier reports (Usanga, 1990; Ukaejiofor *et al.*, 1979) that blood donors had similar values of SI, TIBC, TSF and PCV with non-blood donors.

The values of SI, TSF and PVC of our donors were observed to be significantly lower than that reported for donors in Ibadan (Usanga, 1990). Nutritional and economic differences may account for the differences observed. Two decades ago blood donation was largely done by patient's relation and voluntary non-remunerated donors, however, recent trends show that commercially paid donors who donate blood merely for the financial gains to meet up their needs are the bulk providers of blood used for transfusion services in UCTH and perhaps in other centers in Nigeria. These commercial donors who do the donation just for the monetary benefit may not see the essence of proper feeding hence the lower values observed. Furthermore, Usanga, 1990 used Williams and Conrad, 1966 method for the estimation of serum iron, total iron binding capacity and percent saturation of transferrin with iron while in the present study, kit method of International Committee for Standardization in Haematology (ICSH, 1978) was used. The differences in the sample size may also have contributed to the observed significant differences in the parameters of donors in the present studies.

This study has shown regional differences in the iron parameters of blood donors in Nigeria. From this study, it is suggested that there should be increased awareness campaigns through regular education to commercial donors on the need for them to improve their nutritional status as well as reduce the frequency of donation so as to prevent a depletion of their iron stores. It is believed that by so doing maintenance of donors' good health as well as quality safe blood for transfusion will be achieved.

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