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Haematological parameters of regular and first-time male blood donors in a medium-sized hospital in north central nigeria.

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Abstract

Background: Haemoglobin concentration is the only parameter that is routinely done in order to determine donor fitness. Donors with non-symptomatic derangement in any of the other haematological parameters may therefore be recruited for blood donation. Aims: We determined the haematological parameters of male blood donors and the effect of regular blood donation on these parameters by comparing the parameters of regular and first-time donors. Methods: This was a hospital-based cross-sectional study involving 200 male donors aged 18-59 years. Purposive sampling method was employed to select 100 each of age-matched regular and first-time male blood donors. Only consenting donors who had been found fit to donate with haemoglobin concentration of ≥12.5g/dl and who had been screened negative for HBsAg, HCV and HIV antibodies were recruited for this study. The full blood count (FBC) was determined by haematology analyser; Sysmex KX21 (Sysmex, Kobe, Japan) according to the manufacturer's instructions. Results: There was a significant difference in haemoglobin concentration, MCH and MCHC between the two groups (14.43± 1.26 versus13.92± 1.10; P=0.003, 27.997 ±2.64 versus 27.004± 2.98; P=0.013 and 33.448± 2.72 versus 32.361± 3.08; P=0.009 respectively). Conclusions: Regular donors had a lower mean value of haemoglobin concentration, MCH and MCHC when compared to first-time donors. We, therefore, recommend a yearly full blood count for regular blood donors. Further studies to determine an appropriate donation interval that will not jeopardize the health of our regular donors will also be necessary.

Keywords: *First time, Regular blood donor, Haematological Parameters, Male*

Introduction

Blood is an essential body fluid that is necessary for nutrients and oxygen delivery to the cells and transport of waste products away from cells in human being and other mammals. It is a unique resource for which an artificial substitute is yet to be found, thus blood donation is crucial to meet the enormous demand in medical care. Blood transfusion is an essential part of modern healthcare delivery, which helps save millions of lives that could have been lost due to lack of blood for transfusion. However, donors are occasionally deferred for various reasons, a common reason being low haemoglobin concentration.[1]

In Nigerian blood banks, blood donations are routinely tested for transfusion transmissible infections like Human Immunodeficiency Virus (HIV), hepatitis B and C, and syphilis. At the time of blood donation, the routinely measured haematological parameter is the haemoglobin concentration, which is indirectly measured by copper sulphate specific gravity method as a routine pre-donation assessment procedure. Despite its wide applicability, this is associated with a lot of erroneous results and does not give quantitative result of haemoglobin level in donors.[2,3,4] The effectiveness of transfusion therapy depends on the quality of blood and blood products such as the red cell, granulocyte or platelet concentrates, which depend on the values of all

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haematological parameters, including the levels of haemoglobin, haematocrit, leucocyte and platelet counts of the donors at the time of donation.[5]

The values of haematological parameters are affected by several factors, even in apparently healthy populations. These factors include age, gender, ethnic background, body build, social status, nutritional and environmental factors, especially altitude.[6] It has been demonstrated in several studies that some of the haematological parameters exhibit considerable variations at different periods of life. At birth, the haemoglobin (Hb) concentration, red blood cell (RBC) count and packed cell volume (PCV) are shown to be higher than at any other period of life.[7] The levels of these parameters then decrease during the next few months after birth, some more steeply than others, with the cells becoming hypochromic due to the development of physiological iron deficiency anaemia.[8] The Hb content of red cells then gradually rises to adult levels by the age of puberty.[9] Following the donation of one unit of whole blood (450mls), haematological parameters decrease immediately. Blood withdrawal causes a reduction of plasma volume which is almost completely restored 24–48 hours after donation. Recovery of haematocrit, ferritin, and haemoglobin concentrations takes more time as these parameters have been found to be reduced beyond 4 weeks after donation, which corresponds approximately to the period needed for total haemoglobin mass to return to baseline levels.[10]

In most blood banks in Nigeria, family replacement and commercial donors constitute the largest number of donors, with voluntary donors making up a minority.[11,12] Despite the WHO vision 2020 on blood policy regarding 100% voluntary non-remunerated blood donors,[13] our country is still far from reaching this target. Therefore, strict donor selection criteria should be implemented so that the recipients of blood transfusion can benefit maximally from such a procedure.

Since haemoglobin concentration determination is a routine test to determine donor fitness, it is, possible for a donor with non- symptomatic derangement in any of the other haematological parameters to be recruited for blood donation. The aim of this study was thus to determine the haematological parameters of male blood donors and the effect of regular blood donation on these parameters by comparing the parameters of regular and first -time donors.

Materials and Methods

This research was a hospital-based cross-sectional study conducted at the blood bankunit of the Department of Haematology and Blood Transfusion, University of Ilorin Teaching Hospital, Ilorin, North Central geo-political zone of Nigeria. The hospital located in the State capital, is at latitude 8^0 30'N and longitude 4^0 35 E'. The State comprises 16 Local government areas and 3 Senatorial districts. The State population, as of the 2006 National Population Census, has a population of 2.37million people with agriculture as the main source of economy. The teaching hospital serves as a referral centre for the people of the State and other neighbouring states of Ekiti, Osun, Niger and Kogi. This study was conducted over four months in the blood bank. Ethical clearance was obtained from the Ethics and Research Committee of the University of Ilorin. (Approval number: ERC/PAN/2016/07/1578) Written permission was also obtained from the Head of the Department of Haematology and Blood Transfusion. Informed consent was also obtained from the prospective blood donors after explaining the procedure involved in this research before being recruited.

A total of 200 consenting male donors between the ages of 18 and 59 years were recruited to participate in this study. A Purposive sampling method was employed to select 100 each of age-matched regular and first- time male blood donors into the two categories. The definition of regular donors in this study was those who donated at least 2 times in the previous year.

A brief biodata including age, tribe, level of education, occupation and social habits, like smoking, drinking alcohol, extra-marital affairs, and sharing of sharp objects, was inquired and documented for each donor, after which a thorough physical examination (checking for pallor, jaundice, blood pressure, pulse, weight and height) were done. Haemoglobin concentration was determined using a portable DiaSpect Haemoglobinometer (a product of DiaSpect Medical GmbH, Sailauf, Germany, EKF Diagnostics, GmbH, Barleben, Germany) according to the manufacturer's instructionto check for donor fitness. The haemoglobin concentration of 12.5g/dl and above was considered adequate and fit for blood donation. The consenting donors were also screened for Hepatitis B surface antigen using Enzyme-Linked Immunosorbent Assay (ELISA) and HCV and HIV antibodies using third-

generation ELISA kits. Only donors screened negative for HBsAg, HCV and HIV antibodies were recruited for this study. Three milliliters (3ml) of whole venous blood were collected immediately after donation in a vacutainer tube containing tripotassium ethylene diamine tetra acetic acid as an anticoagulant. The sample was gently mixed and sent immediately to haematology laboratory for full blood count (FBC) within two hours of sample collection. The full blood count was determined using a haematology auto analyzer, Sysmex KX 21N (Sysmex, Kobe, Japan), according to the manufacturer's instructions.

Data analysis was done using Statistical Package for Social Sciences (SPSS) software package version20 (International Business Machine Inc Chicago, Illinois, USA). Data were expressed as mean and standard deviation. Independent sample t-test was used to compare the mean of the haematological parameters between the first-time and regular donors. P value ≤0.05 was considered significant.

Results

Two hundred consented male blood donors were recruited for this study. The donors comprised 100 first-time and 100 regular family replacement and voluntary blood donors. The Majority of the blood donors were family replacements 186 (93.0%) in this study. The mean age of the regular and first-time donors was 29.63± 6.90 years and 29.06 ±8.70 years respectively (*P= 0.607*). The majority of the respondents were artisans (59.0 %) and 41.0% were civil servants. Many were married and attained secondary school education. Greater numbers were Muslims and of Yoruba ethnic group, while very few of them were from Nupe and Hausa ethnic origins. (Table 1)

The mean values of haemoglobin concentration(g/dl) of first-time donors and regular donors were 14.43± 1.26 and 13.92± 1.10 respectively. One donor (0.5%) had polycythaemia with haemoglobin of 17.8g/dl. The mean values of haematocrit in the first-time donors were higher than those of the regular donors (43.89±3.34 vs 42.00± 3.11 p-value 0.809), although the difference was not statistically significant. There were significant differences in the mean values of Haemoglobin concentration, Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC), which were higher among first time compared with regular donors (14.43± 1.26 versus13.92± 1.10; p=0.003, 27.997 ±2.64 versus 27.004± 2.98; p=0.013 and 33.448± 2.72 versus 32.361± 3.08; p=0.009 respectively). There was no statistically significant difference in the mean corpuscular volume in the two groups (83.965±6.2366 vs 83.640±6.4621, p=0.724). Table 2.

Table 1: Socio – Demographic Characteristics of First and Regular Blood Donors

	First time donors	Regular donors
Age		
18-27	38 (38.0)	37 (37.0)
28-37	42 (42.0)	39 (39.0)
38-47	16 (16.0)	19 (19.0)
> 48	4 (4.0)	5 (5.0)
Total	100 (100.0)	100 (100.0)
Mean Age±SD	29.63±6.90	29.06±8.70
Marital Status		
Married	68 (68.0)	66 (65.0)
Single	32 (32.0)	34 (34.0)
Total	100 (100.0)	100 (100.0)
Education Qualification		
Primary	12 (12.0)	15 (15.0)
Secondary	61 (61.0)	58 (58.0)
Tertiary	16 (16.0)	18 (18.0)
None	11 (11.0)	9 (9.0)
Total	100 (100.0)	100 (100.0)
Religion		
Islam	64 (64.0)	67 (67.0)
Christianity	36 (36.0)	33 (33.0)
Total	100 (100.0)	100 (100.0)
Employment Status		
Civil Servant	41 (41.0)	40 (40.0)
Artisan	59 (59.0)	60 (60.0)
Total	100 (100.0)	100 (100.0)
Tribe		
Yoruba	62 (62.0)	59 (59.
Nupe	18 (18.0)	24 (24.0)
Hausa	20 (20.0)	17 (17.0)
Total	100 (100.0)	100 (100.0)

Twenty- four (12%) of the total number of donors had low MCV, while five (2.5%) had high MCV. Eighty-two (41%) had low MCH, and 83 (41.5%) had low MCHC. The proportion of donors with low MCH was

significantly higher among regular donors than first-time donors (50% versus 32%; P value= 0.032). There were no significant differences between regular and first- time donors in the number with low MCV (13% versus 11%; P value = 0.830) and those with low MCHC (47% versus 36%; p value = 0.114). Table 2

Table 2: The mean Haematological Parameters among first and regular Blood Donors

Parameter (mean±SD)	**First time donors**	**Regular donors**	**P- value**
*RBC count ($x10^{12}$/l)	5.1788± 0.49569	5.1386± 0.58174	0.609
Haemoglobin conc. (g/dl)	14.43± 1.26	13.92± 1.10	0.003
¥ HCT(%)	43.886± 3.3403	42.000± 3.1186	0.809
∞MCV(fl)	83.965± 6.2366	83.640± 6.4621	0.724
€MCH(pg)	27.997 ±2.64	27.004± 2.98	0.013
Ω MCHC(g/dl)	33.448± 2.72	32.361± 3.08	0.009
π WBC count($x10^9$/l)	5.346± 1.5845	5.173± 1.1989	0.395
Absolute neutrophil ($x10^9$/l)	2.1892± 1.35089	2.1134± 0.79502	0.638
Absolute lymphocyte ($x10^9$/l)	2.5134± 0.70691	2.4841± 0.64500	0.765
Platelet count	190.64± 54.631	193.65± 50.762	0.694

*RBC (Red Cell Count), ¥ HCT (Haematocrit) , ∞MCV (Mean Corpuscular Volume),
€MCH (Mean Corpuscular Haemoglobin), ΩMCHC (Mean Corpuscular Haemoglobin Concentration), π White Blood Cell (WBC)

The mean White Blood Cell count of first and regular donors was within normal range 5.346±1.58 versus 5.173±1.198 p= 0.395. Forty-four (22%) of the total number of donors had neutropaenia (absolute neutrophil count<1.5 $x10^9$/l), and one donor (0.5%) had neutrophilia. The Platelet count was 190.64±54.631 versus 193.65±50.762 for the two categories of the subjects. Four (2%) of the total number of donors had thrombocytopaenia (platelet count < 90 x 10^9/l) and 7 (3.5%) had thrombocytosis (platelet count>300 x 10^9/l). There were no significant differences between regular and first -time donors in the mean values of total leucocytes and platelet counts (p= 0.395, 0.694).

Discussion

The effectiveness of transfusion therapy depends on the quality of blood and blood products such as the red cell, granulocyte or platelet concentrates, which in turn depend on the values of all haematological parameters, including the levels of haemoglobin, haematocrit, leucocyte and platelet counts of the donors at the time of donation. Before a blood transfusion is given, many steps are taken to ensure that quality blood and blood products are available for the recipient. The majority of the donors in this study were family replacement (93.0%) donors, which is similar to what was reported by Okocha *et al*[12]in Southeast Nigeria in which 99.0% of their blood donors were family replacement donors, but relatively higher than what was reported in Enugu in which 59.2% and 22.1% of their donors were family replacement and paid donors.[11] The higher number could also be because some of the donors may be paid but pretended to be family members of the blood recipients as we do not allow paid blood donors in our centre. The mean age of both groups was less than 30 years in this study, similar to what was reported in other studies in the country.[6,11,12] This could be because of the increasing population of youths in Nigeria and Africa. It was also reported that this age bracket constituted ~15% of the nation's population.[14] This was expected, as most people within the age group are strong and healthy. The young population structure in Nigeria provides a window of opportunity for youths to serve as change agents in blood donation drives. Furthermore, younger people, being relatively more educated, are more amenable to donor recruitment campaigns. Most subjects were family replacement (93.0%) donors with few being voluntary (7.0%) blood donors. This shows that Nigeria has a long way to go in achieving vision 2020 toward 100% voluntary blood donation.[14] There was a significant difference between the mean haemoglobin concentration of the first-time donors compared with the regular donors 14.43± 1.26 and 13.92± 1.10 p=0.013. This could be due to some levels of iron deficiency among regular blood donors who may not have replenished their iron stores before another donation. Although the haemoglobin concentration of both groups was above the WHO-recommended level for donor selection, there is still a need to encourage iron supplements and a balanced diet among regular blood donors. Although the mean values of haemoglobin concentration of both groups were normal for blood donation and similar to what was reported by Garba *et al.*[15,16,17] in North West

Nigeria and some other parts of Africa but, relatively lower than values among people in the western world in which their mean haemoglobin was as high as 15.50.[8] The reason for the lower haemoglobin level in our subjects in comparison to the western world could be due to lower socio-economic factors, poor nutrition, chronic malaria and helminthic infestations that are predominant in some developing countries which could all result in iron deficiency.[15]

The mean haematocrit values were 43.89±3.34 and 42.00± 3.11 for the first time and regular blood donors. This is similar to what was reported in Enugu, Kaduna, Jos and among two regions in Kenya.[6,15,16,17] The mean values of Haemoglobin concentration, MCH and MCHC were significantly higher among first-time than regular donors (p-value 0.003, 0.013 and 0.009), and this is comparable to what was reported in Jos and Port Harcourt,[18,19] but at variance to the report from Thailand in which there was no significant difference in those parameters despite some level of iron deficiency among the regular donors.[20]

The mean WBC of first and regular donors were within the normal range of 5.346 ± 1.585 versus 5.173±1.199 p= 0.395. The WBC is similar to the findings of Nubila in Enugu, South East Nigeria and what was reported in North West Nigeria by Garba *et al*.[6,15] There was no statistically significant difference in the absolute neutrophil count between the two categories of blood donors. However, a significant proportion (22%) of the blood donors in this study had neutropaenia (absolute neutrophil count <1.5 x109/l), and one donor (0.5%) had neutrophilia. The platelet counts among the first-time and regular blood donors were within normal limits of 190.64±54.631 and 193.65±50.762; this finding though falling within the normal value for our population, is lower than what was reported in Jos,[16] Sudan,[21] Pakistan [22.] This signifies that there is no significant iron deficient state among the blood donors in this present study. In another study in the USA,[23] among blood donors in which the effect of iron balance on platelet counts was studied, it was discovered that 55% (619 of 1128) of the women and 70% (102 of 145) of the men were iron-depleted. Iron-depleted donors had higher platelet counts compared with donors who had normal ferritin levels (women: 286 vs. 268 × 10^3 /μL; $p < 0.0001$; men: 246 vs. 222 × 10^3 /μL; $p = 0.0454$) and only 4.4% of iron-depleted donors had thrombocytosis (> 400 × 10^3 /μL) compared with 2.0% of donors who had normal ferritin levels ($p = 0.017$). Iron replacement therefore decreased platelet counts in iron-depleted female donors, but not in donors who had normal or stable ferritin levels. The same trends were also observed in male donors.[23]

Limitations of this study

The study was limited to male donors because a very small proportion of our donors are females. A future multicentre study targeting female donors will therefore complement our findings in this study.

Conclusion

This study shows that the majority of blood donors in our centre are of family replacement donors and many of them were below 30 years of age. Low red cell indices and neutropaenia were the most common haematological abnormalities obtained among the male blood donors in this study. Regular donors had a lower mean value of haemoglobin concentration, MCH and MCHC and a significantly higher proportion of them had low MCH when compared to first-time donors. We, therefore, recommend a yearly full blood count for regular blood donors. Further studies to determine an appropriate donation interval that will not jeopardize the health of our regular donors will also be necessary.

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