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Research Article

Assessment of Some Haematological and Biochemical Parameters of Family Replacement Blood Donors in Gusau, Nigeria

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ABSTRACT

Background: The regular supply of blood is necessary in every health facility in order to treat patients requiring transfusions and save millions of lives through blood transfusions. The aim of this study was to determine the haematological and biochemical parameters of family replacement donors since they are the major source of blood donors in Northern Nigeria.

Materials and methods: Two-hundred and twenty-eight family replacement donors, aged 18-54 years, were recruited from Federal Medical Centre and Yariman Bakura Specialist Hospital, Gusau, Zamfara State for the determination of haematocrit, haemoglobin, RBC count, MCH, MCV, MCHC, serum iron, serum ferritin and TIBC using standard techniques.

Results: The values of haematocrit, haemoglobin, RBC count, MCH, MCV and MCHC were 38.8 ± 3.6%, 12.6±1.3 g / dL, 5.3 ± 0.56 X 10^{12} / L, 23.9±2.0 pg, 73.6±6.2 fl, 32.6±2.5 g / dL, respectively while the levels of serum iron, serum ferritin and TIBC were 15.3±5.2 µmol / L, 69.4±45.1 ng / ml, 45.5±15.4 µmol / L, respectively in family replacement donors. Age had no significant effect on the values of haematocrit, haemoglobin, RBC count, MCH, MCV, MCHC, serum iron, serum ferritin and TIBC *(P > 0.05)*

Conclusion: Family replacement donors should be encouraged for blood donation since they have the values of haematological and biochemical parameters that are within the reference ranges of healthy individuals. By doing this, there will be sufficient units of blood in the blood banks to accommodate unexpected and emergency cases, resulting in reduction in death rate associated with non-availability of blood for transfusion.

INTRODUCTION

Millions of lives are saved each year through blood transfusions and it is therefore important for the regular supply of blood to treat severe anemia in children under five years old, management of pregnancy related complications, massive trauma, cancer among other conditions [1,2].

A blood donor generally donates approximately 450ml of blood, which results in a loss of approximately 225mg of iron with subsequent mobilization of iron from body iron stores. However, if the donor has no iron-deficiency, the erythrocytes and the haemoglobin level will generally return to normal within 3-4 weeks. Therefore, adequate iron stores are very important in the maintenance of the donor [2-4].

The regulation of systemic iron is through the problems "transferrin" (iron mobilization) and "ferritin" (iron sequestration) but the indicator of mobilizable body iron stores is the serum ferritin concentration [5,6].

The American Association of Blood Banks has standard minimum haemoglobin levels of 13.5g / dL and 12.5g / dL for men and women blood donors, respectively [4].

The three main types of blood donors are voluntary unpaid donors, family replacement blood donors and paid blood donors [7]. Family replacement donors and paid donors provide the bulk of blood donations in resource poor countries for cultural and economic reasons [8]. In developing countries like Nigeria, there is dependency on family replacement and remunerated donors [9-12]. A replacement blood donor is a family member or a relative of a patient that donates a unit of blood for a specific patient while a voluntary blood donor donates out of altruism and without any inducement for a donation to unknown patient or recipient [12].

It has been reported that both voluntary and family replacement donors should be encouraged to become repeat donors as their prevalence of viral markers and background safety are similar [13].

In Nigeria, there seems to be less emphasis on the haematological and biochemical parameters of family replacement donors that are predominantly source of blood donors in Northern Nigeria. Therefore, the objective of this study was to determine the values of some haematological and biochemical parameters of family replacement donors in order to guide the blood bank staff in the selection of blood donors in Zamfara, Northern Nigeria.

MATERIALS AND METHODS

A total of two-hundred and twenty-eight (228) family replacement donors, aged 18-65 years, were recruited from Federal Medical Centre and Yariman Bakura Specialist Hospital, Gusau, Zamfara State and studied between January and December, 2015 for their haematological and biochemical parameters.

The blood donors that were sero-negative for human immunodeficiency virus (HIV 1 and 2), hepatitis B and C viruses and syphilis infections were included in the study while the prospective blood donors that were on iron therapy or recently transfused with blood were excluded.

After the written consent from the blood donors and ethical clearance from the ethical committees of Federal Medical Centre and Yariman Bakura Specialist Hospital, Gusau, Zamfara State, five milliliters (5ml) of whole blood was collected from each blood donor asceptically and 2 ml of blood was put into tri-potassium EDTA tube while the remaining 3ml was put in a plan tube.

The blood samples in the EDTA bottles were analyzed for full count using Mythic 18, automated haematology analyzer while the samples in the plain containers were analyzed for serum iron level using iron NP colorimetric test kit with Nitro-PAPS, serum ferritin level using Human Ferritin Elisa Kit and Total Iron Blinding Capacity (TIBC) level using Chemelex Labkit. All these kits were used based on the manufacturers' instructions.

Data were analyzed using SPSS version 20 and the results were expressed as mean ± standard deviation while comparison of haematological and biochemical parameters of family replacement blood donors with age was analyzed using analysis of variance (ANOVA). $P < 0.05$ was considered to be statistically significant.

RESULTS

The red cell parameters of family replacement blood donors in Gusau are shown in Table 1. The mean values for haematocrit, haemoglobin, Red Blood Count (RBC) count, Mean Cell Haemoglobin (MCH), Mean Cell Volume (MCV) and Mean Cell

Haemoglobin Concentration (MCHC) were 38.8 ± 3.6%, 12.56 ± 1.3 g / dL, 5.3 ± 0.56 X 10^{12} / L, 23.9 ± 2.0 pg, 73.6 ± 6.2fl and 32.6 ± 2.5 g / dL, respectively.

Table 2 shows the biochemical parameters of family replacement blood donors in Gusau. The mean values for serum iron, serum ferritin and TIBC were 15.3 ± 5.2 µmol / L, 69.4 ± 45.1 ng / mL and 45.5 ± 15.4 µmol / L.

Comparison of red cell parameters of family replacement blood donors with age is show in Table 3. The age groups of < 24 years, 25-34 years, 35-44 years and 45-54 years had haematocrit levels of 38.4 ± 3.9%, 39.1 ± 3.3%, 37.8 ± 3.0% and 38.4 ± 3.9%, respectively *(P = 0.1608);* haemoglobin values of 12.6 ± 1.4g / dL, 12.7 ± 1.2 g / dL, 12.7 ± 1.1 g / dL and 12.7 ± 1.9 g / dL, respectively *(P = 0.9733);* RBC counts of 5.3 ± 0.6 X10^{12} / L, 5.3 ± 0.5 X 10^{12} / L, 5.3 ± 0.6 X 10^{12} / L and 5.4 ± 0.8 x 10^{12} / L, respectively *(P = 0.9073);* MCH values of 24.2 ± 2.4 pg, 24.0 ± 1.8pg, 23.5 ± 2.0pg and 23.7 ± 1.8 pg, respectively *(P= 0.3047);* MCV values of 74.7 ± 7.1 fl, 74.0 ± 5.9 fl, 72.4 ± 6.1 fl and 72.1 ± 5.5 fl, respectively *(P = 0.17),* and MCHC values of 32.6 ± 3.0 g / dL, 32.7 ± 2.8 g / dL, 32.3 ± 1.5g / dL and 32.6 ± 1.3 g / dL, respectively *(P = 0.7567).*

Table 4 reveals the comparison biochemical parameters of family replacement blood donors with respect to age. The age group of < 24 years, 25-34 years, 35-44 years and 45-54 years had serum iron levels of 14.6 ± 4.2 µmol / L, 15.7 ± 5.6 µmol/ L, 14.8 ± 5.8, µmol / L and 15.7 ± 2.9 µmol / L, respectively *(P= 0.5539);* serum ferritin levels of 58.5 ± 27.5 ng/m, 68.3 ± 42.9 ng/mL, 74.4 ± 49.3 ng/mL and 89.6 ± 70.2ng/mL, respectively *(P= 0.0576);* TIBC values of 43.9 ± 12.4 µmol / L, 46.5 ± 16.5 µmol / L 44.6 ± 17.4 µmol / L, 46.7 ± 8.9 µmol / L, respectively *(P = 0.737).*

Table 1: Red cell parameters of family replacement blood donors in Gusau.

Parameter	Blood donors (n=228)
Haematocrit (%)	38.8±3.6
Haemoglobin (g/dL)	12.6±1.3
RBC count (X 10^{12} / L)	5.3±0.56
MCH (pg)	23.9±2.0
MCV (fl)	73.6±6.2
MCHC (g / dL)	32.6±2.5

Table 2: Biochemical parameters of family replacement donors in Gusau.

Parameter	Blood donors (n=228)
Serum iron (µmol / L)	15.3±5.2
Serum ferritin (ng / mL)	69.4±45.1
TIBC (µmol / L)	45.5±15.4

Table 3: Comparison of red cell parameters of family replacement donors with age.

Parameter	< 24years (n = 48)	25-34years (n = 109)	35-44years (n = 51)	45-54years (n = 20)	P-value
Haematocrit (%)	38.7±3.8	39.1±3.3	37.8±3.0	38.4±3.9	0.1608
Haemoglobin (g / dL)	12.6±1.4	12.7±1.2	12.7±1.1	12.7±1.9	0.9733
RBC count (X 10^{12} / L)	5.3±0.6	5.3±0.5	5.3±0.6	5.4±0.8	0.9073
MCH (pg)	24.2±2.4	24.0±1.8	23.5±2.0	23.7±1.8	0.3047
MCV (fl)	74.7±7.1	74.0±5.9	72.4±6.1	72.1±5.5	0.17
MCHC (g / dL)	32.8±3.0	32.7±2.8	32.3±1.5	32.6±1.3	0.7567

Table 4: Comparison of biochemical parameters of family replacement donors with age.

Parameter	< 24years (n = 48)	25-34years (n = 109)	35-44years (n = 51)	45-54years (n = 20)	P-value
Serum iron (µmol / L)	14.6±4.2	15.7±5.6	14.8±5.8	15.7±2.9	0.5539
Serum ferritin (ng / mL)	58.5±27.5	68.3±42.9	74.4±49.3	89.6±70.2	0.0576
TIBC (µmol/L)	43.9±12.4	46.5±16.5	44.6±17.4	46.7±8.9	0.737

DISCUSSION

The importance of haematological and biochemical parameters of family replacement donors in Nigeria cannot be overemphasized since they are predominantly the source of blood donors in northern Nigerian and Nigeria as a whole.

The values of haematocrit, haemoglobin and RBC count of family replacement donors in this study are consistent with the findings of previous researchers on apparently healthy donors, first-time donors, voluntary donors and samples from prospective blood donors at Kenyan regional blood transfusion centres [2, 7-10]. This shows that the values of haemotocrit, haemoglobin and RBC count are comparable to that of voluntary donors and therefore, family replacement donors should be encouraged for blood donation in Northern Nigeria provided the donors are free from transfusion transmissible infections in addition to satisfying all other requirements for blood donation. This will further boost the units of blood in our blood banks in Nigeria since some of the units of blood donated for the patients by the relatives or friends may not be utilized by them.

In this study, there were no statistically significant differences in the values of haematocrit, haemoglobin and RBC count of family replacement blood donors with respect to age and these are in line with the earlier report [11].

The study has further revealed the lower values of 23.9 ± 2.0pg and 73.6 ± 6.2 fl for MCH and MCV, respectively compared to the previous studies on voluntary donors, first time donors and apparently healthy donors [2,9,12]. The differences might be associated with mild lower values of haemoglobin and haematocrit in this study. However, the value of MCHC observed in this study is in line with the earlier findings [2,9,12].

The values of MCHC, MCV and MCHC among the family replacement donors did not differ with age and these are in support of previous study on healthy Chinese adults [13].

Divergent views have been expressed on the serum iron and ferritin levels of blood donors. This study has revealed that serum iron and ferritin levels are in agreement with some of the previous authors, especially on first-time donors but at variance with the reports from other studies [2,14-16,8,10]. The different values from various authors could be associated with the dietary habits of blood donors, sensitivities of serum iron and ferritin kits utilized, and techniques among other factors. However, the serum iron and ferritin levels are within the reference ranges [17].

Total Iron Binding Capacity (TIBC) level in this study is lower than the reported TIBC values on first-time blood donors [2, 8,14]. However, the reported values from all authors are within the documented wide reference range but the different values for TIBC may be associated with the techniques employed and sensitivity of kits [18-25].

The mean values of serum iron, ferritin and TIBC did not differ significantly with respect to age in this study.

In conclusion, since there are no adequate voluntary donors to donate sufficient blood for most of our patients in Nigeria, family replacement donors that are usually non-remunerated donors, should be encouraged for donation based on comparable or similar haematological and biochemical parameters to the voluntary and first-time donors. By doing so, units of blood in our blood banks will be boosted to accommodate unexpected and emergency cases associated with massive blood loss and thereby reducing deaths significantly.

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