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Haematology Parameters of Apparently Healthy Prospective Whole Blood Donors in a Nigerian Hospital Setting

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Abstract

Background: Adequate selection of a prospective whole blood donor protects his health and safety of the recipient. **Objectives:** The main objective of this study was to determine the haematology parameters of apparently healthy prospective whole blood donors. **Participants and Methods:** This was a hospital based prospective study carried out from August to October 2020 at the blood transfusion unit of the Lagos State University Teaching Hospital (LASUTH), Ikeja, Nigeria. A structured pretested questionnaire was used for data collection. The socio demographic status and the haematology parameters of apparently healthy prospective whole blood donors who tested negative for HIV, hepatitis B and C markers were captured. Obtained data were analysed with the statistical package for the social scientist software version 20. **Results:** One hundred male (97.1%) and three female (2.9%) apparently healthy prospective whole blood donors were studied. The median age of study subjects was 30 years. Obtained median haematology parameter values were 13 g/dl, 40%, 4.9/nl and 203.9/nl for haemoglobin concentration, haematocrit, total white cell and platelet counts respectively. The median values for the mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH) and mean corpuscular volume (MCV) of participants were 32.6 g/dl, 27.7 pg and 85.7 fl respectively. Observed prevalence of subnormal haematology parameters for haemoglobin concentration, total white cells, platelets were 12.6%, 25.2%, and 13.6% respectively. Also subnormal values for MCHC, MCH, MCV were 11.7%, 26.2%, and 16.5% respectively among prospective whole blood donors in this study. No higher than normal haematology parameter values were observed. Median values for erythrocyte sedimentation rate was 8.4 mm/hr. **Conclusion:** A significant

percentage of apparently healthy prospective whole blood donors had subnormal haematology parameters values. Obtained normal values in our study are comparable with local reference range reports from previous studies in Nigeria and other parts of Africa.

Keywords

1. Introduction

Blood transfusion is a lifesaving process and therapy which is required for a wide range of health conditions such as severe anaemia, severe trauma, obstetric complications in pregnancy or parturition and surgical procedures [1]. Blood donor selection is meant to protect the donor health and patient safety by ensuring that blood is collected only from healthy individuals. Prospective whole blood donors are screened to exclude those whose health might be compromised by the donation and to protect blood recipients from transmission of infectious agents [2]. The haemoglobin or packed cell volume estimation is the only routine haematology parameter used for the screening of prospective whole blood donors in transfusion services centres in Nigeria and some other sub-Saharan African countries. The aim of the haemoglobin (Hb) concentration screening among prospective whole blood donors is to safeguard individuals from developing anaemia following a donation exercise. Also to ensure that the haemoglobin content of the donated blood meets the required criteria [3]. This practice also protects returning donors from donation induced iron deficiency and depletion of iron stores from inappropriate repeated donations [4] [5]. The minimum Hb concentration level recommended by international and national guidelines is 12.0 g/dl and 13.5 g/dl for females and males respectively as cut offs for whole blood donor selection [6]. However, in some countries including Nigeria the same haemoglobin concentration level of 13.5 g/dl is used as cut off in the screening of male and female prospective blood donors [7]. In addition to Hb concentration estimation, prospective blood donors are screened for transfusion transmissible infections such as HIV 1 & 2, hepatitis B, C and syphilis in Nigeria [8]. These are parts of measures to ensure blood safety. The red cell indices which include mean cell volume (MCV), mean cell haemoglobin (MCH) and mean cell haemoglobin concentration (MCHC) are haematology parameters useful for predicting subclinical anaemia [9]. The red cell indices, white cell and platelet counts which are components of the complete blood cell count also are not routinely screened for among prospective whole blood donors in Nigeria. Previous researches have documented that Hb concentration estimation alone may be inadequate for the screening of prospective whole blood donors [9] [10]. Erythrocyte Sedimentation Rate (ESR) is an old surrogate marker and haema-

tology screening test. It is widely used in clinical practice for evaluating the inflammatory or acute response, infection, trauma, autoimmune and malignant diseases [11]. The haematology parameters of individuals assess health and disease conditions [12]. The haematology parameters of prospective whole blood donors are therefore required for their adequate screening and selection for donation. In view of this, our study aims to assess the complete blood counts of HIV, Hepatitis B and C negative healthy prospective whole blood donors.

2. Objectives of the Study

1) To determine the haematology parameters of healthy prospective whole blood donors.

2) To evaluate the adequacy of the haemoglobin concentration alone for the selection of eligible whole blood donors.

3) To make recommendations for improving donor selection criteria based on obtained data.

3. Participants and Methods

This prospective hospital based study was carried out from August to October 2020 at the blood transfusion unit of the Lagos State University Teaching Hospital (LASUTH), Ikeja, Nigeria. This tertiary health institution and referral hospital serves the blood transfusion needs of patients in Lagos and neighbouring states in south west, Nigeria. LASUTH has over one thousand bed spaces and serves an estimated population of about 22 million residents in Lagos which is the commercial capital city of Nigeria. Lagos coordinates are 6.5˚N latitude, 3.4˚E longitude and 41M above sea level. The study protocol was approved by the hospital research and ethics committee. A structured pretested questionnaire for validity and reliability was used to collect sociodemographic data and the haematology parameters of prospective whole blood donors (**Appendix**). Questionnaires were designed by the researchers and filled by experienced study medical laboratory scientists and technicians who worked in the blood bank at this centre. After giving an informed consent, consecutive prospective whole blood donors were recruited into the study. We enrolled male and female participants aged 18 to 65 years. Inclusion criteria for participants for this study were age ≥ 18 to 65 years and a negative HIV, Hepatitis B and C serostatus. The exclusion criteria were age < 18 and >65 years or a positive HIV or Hepatitis B or C serostatus. Five (5) millilitres of venous whole blood was collected from the cubital vein of every participant into a Potassium-ethylenediamine tetra acetic acid (K-EDTA) containing vacutainer collection tube. After a pre- and post-test counselling, HIV antibodies were tested for in the venous blood sample of every consecutive consenting participant using the WHO approved Determine TM HIV-1/2 rapid kits. Hepatitis B surface antigen and hepatitis C antibodies were also tested for in donor plasma using the rapid chromatographic immunoassay kits. Rapid testing was performed in accordance with the product manufactur-

ers' guidelines. Complete blood cell count of participants which included hae-moglobin (Hb) levels, haematocrit (Hct), MCHC, MCH, MCV, total white blood cell (TWBC) and platelet counts were assayed with the Sysmex Kx-2IN, an automated five-part differential haematology analyser (Sysmex Corporation, Japan). Erythrocyte sedimentation rate of each sample was assayed manually using the westergreen method. Sample size was determined by availability of test kits or reagents for viral screening of enrolled participants. Obtained data were analysed with the statistical package for the social scientist software (version 20.0; SPSS, Chicago, IL). The statistical tests used in this current study included the mean and median. Obtained results were presented in simple tables with frequencies, percentages, mean and median values.

4. Results

A total of 110 apparently healthy prospective blood donors aged 18 to 65 years were initially recruited for this study. Of the enrolled 110 participants, 7 tested positive for either HIV or HCV antibodies and were excluded from data analysis. The haematology parameters of 103 eligible participants comprising 100 males and 3 females were statistically analysed. The mean age of the study participants was 31.72 ± 7.9 years with a range of 29 to 59 years. The majority 88 (85.4%) of the prospective whole blood donors were in the age range 18 - 39 years while 15 (14.6%) were in 40 - 59 years as in Table 1. The median Hb value of the prospective blood donors was 13.0 g/dl with a range of 9.4 to 15.8 g/dl. The median total white cell count of donors was 4.9/nl with a range of 2.5 to 7.2 in Table 2. The obtained median value for the platelet count was 203.9/nl with a range of 292.0 to 353.0/nl. The median value for the MCHC was 32.6 g/dl with a range 29.4 to 36.5. The median value for the MCV was 85.7 fl with a range of

Table 1. Age and gender characteristics of studied prospective blood donors.

Age group (years)	Frequency (n)	Percentage %
18 - 28	41	39.8
29 - 39	47	45.6
40 - 49	11	10.7
50 - 59	4	3.9
Total	103	100
Mean age 31.72 ±	7.9 years	
Median age 30 years		
Minimum age	20	
Maximum age	59	
Gender		
Male	100	97.1
Female	3	2.9

70.7 to 178.0. The median value for the MCH of studied prospective whole blood donors was 27.7 pg with a range of 21.1 to 33.1. The median ESR was 8.4 mm/hr with a range of 1 to 57 as in Table 2. The prevalence of subnormal values of haematology parameters in this study for Hb concentration, white cells and platelets counts were 12.6%, 25.2%, 13.6% respectively. Also subnormal values obtained for the MCHC, MCH, MCV were 11.7%, 26.2%, 16.5% respectively among prospective whole blood donors. This is presented in Table 3.

5. Discussion

In our current study, we assessed the haematology parameters of healthy prospective whole blood donors who were HIV antibodies, hepatitis B surface antigen and hepatitis C antibodies negative. Assayed parameters were the Haemoglothbin (Hb) concentration levels, the haematocrit (Hct), the total white cell and

Table 2. Median haematology variables and CD4 counts of prospective blood donors.

Haematology variables	Obtained value	Maximum	Minimum	X^2
HB g/dl	13.0	15.8	9.4	1.2
HCT %	40	50.7	31.2	3.3
TWCC nl	4.9	7.2	2.500	2.56
PLT count nl	203.9	353.0	292.000	55275.9
MCHC g/dl	32.6	36.5	29.4	1.33
MCH pg	27.7	33.1	21.1	2.29
MCV fl	85.7	178.0	70.7	10.79
ESR mm/hr	8.4	57.0	1.0	8.87

HCT: Haematocrit; HGB: Haemoglobin; TWBCC: Total white blood cell count; PLT: platelets; MCHC: Mean corpuscular haemoglobin concentration; MCH: Mean corpuscular haemoglobin; MCV: Mean corpuscular volume; ESR: Erythrocyte sedimentation rate.

Table 3. Sub normal haematology parameters values among prospective whole blood donors.

Haematology parameters (normal values)	Frequency of below normal values among blood donors N = 103	Percentages %
HCT (36% - 52%)	13	12.6
HB (12 - 18 g/dl)	13	12.6
TWCC (4.0 - 11 nl)	26	25.2
PLT (150 - 450 nl)	14	13.6
MCHC (32 - 34 g/dl)	12	11.7
MCH (27 - 32 pg)	27	26.2
MCV (80 - 100 fl)	17	16.5

HCT: Haematocrit; HGB: Haemoglobin; TWBCC: Total white blood cell count; PLT: platelets; MCHC: Mean corpuscular haemoglobin concentration; MCH: Mean corpuscular haemoglobin; MCV: Mean corpuscular volume.

platelet counts, also erythrocyte sedimentation rates (ESR). In transfusion medical practice, the suitability of the prospective whole blood donor is determined by a pre-donation assessment of his or her health status [13]. The mean and median ages of studied prospective blood donors were 31.72 ± 7.9 years and 30 years respectively. The majority (85.4%) of the subjects were between ages18 and 39 years old. The demographic findings in this study were comparable with reports from previous studies among prospective whole blood donors in Nigeria [9] [14] [15]. The predominance of the younger people in the blood donor pool may be explained by the fact that the youth have a better knowledge about blood donation, through being vast in digital technology. The majority (97%) of the whole blood donors enrolled in our study were males. This concurs with previous research findings that donor pools in Nigeria and other countries in the sub Saharan Africa are male dominated [16] [17] [18] [19] [20]. This pattern may be explained by some myths that give wrong impressions and give misinformation concerning the participation of women in blood donation exercises in these parts of the world.

We observed that the mean Hb concentration and Hct of the participants were 13.0 g/dl and 40% respectively in our study. This corroborates previous research findings among blood donors [21], but lower than reported by Ayemoba *et al.* [15]. Our study recorded a median total white cell count of 4.9/nl among studied subjects. This is comparable with previous reports [12] [15] and at variance with another with subclinical leucopenia among whole blood donors [22]. The median platelet count of our subjects was 203.9 nl which is comparable with reports of previous studies [12] [15] [17]. Obtained median values among the participants, for the MCH, the MCHC, and the MCV in our study were 27.7 pg, 32.6 g/dl and 85 fl respectively. Red cell indices in the studied subjects were comparable with some previous research reports [12] [15] [17]. The red cell indices are capable of detecting donation induced iron deficiency in repeat blood donors just as some previous studies have documented [12]. Considering that our participants were healthy, obtained normal haematology parameters in this study could be useful as reference values for decision making in clinical practice and research among adult patients. However, we observed some subnormal values for haematology parameters; the Hb concentration (12.6%), the total white cell counts (25.2%) and the platelet counts (13.6%). Also the obtained prevalence of subnormal red cell indices were MCHC (11.7%), MCH (26.2%) and MCV (16.5%) among studied prospective whole blood donors. The findings of subnormal haematology parameters among blood donors in our study corroborates some previous findings in Nigeria [10] [22] [23]. We cannot explain the aetiology of the subnormal blood cell counts as this would require further tests to detect underlying pathology. However, previous studies found out that some viral infections such as HIV, hepatitis B and C which we have excluded among our participants may be responsible for these subnormal parameters recorded [24] [25] [26]. We suggest a larger sample size for repeat studies among the first time and regular whole blood donors. Also, assessment of nutritional status, the mor-

phology of blood cells and further virology screening may be required. The mean ESR of studied prospective whole blood donors was 8.4 mm/hr. Previous studies in Nigeria have reported the upper limit of normal ESR in healthy individuals as 5.0 and 12 mm/hr among adult males and females respectively [27] [28] [29]. ESR may not be required for decision making about eligibility for blood donation but was included in this study because it is usually a part of the complete blood count. It assesses the health and disease conditions in clinical practice. The normal haematology parameters of healthy individuals differ in various populations based on age, gender, race, ethnicity, dietary patterns, altitudes, environmental and genetic background factors [30]. The small sample size in our study was as a result of limited resources at our disposal at that time. A larger sample size is recommended for repeat studies as this enhance a more robust research and improved findings.

6. In Conclusion

Some subnormal haematology parameters were observed in this study among apparently healthy prospective whole blood donors. Haemoglobin concentration only is therefore inadequate as the screening predonation haematology parameter for eligibility decision. We recommend the use of the complete blood count as the haematology parameter for predonation screening of prospective blood donors in Nigeria and other African countries. Obtained normal blood cell values in our study are comparable with reports of local reference ranges in our communities and other parts of sub Saharan Africa. Also, there was a male predominance among studied participants. A health education and awareness program about the harmless nature of blood donation exercises for the females is critical and should be encouraged and emphasised.

Acknowledgements

Conflicts of Interest

The authors declare that they have no competing interests.

Authors' Contributions

All authors contributed to the paper. All authors helped to conceptualise ideas and interpret the findings.

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Appendix

Questionnaire for the prospective whole blood donor demographics and data capture in LASUTH

Date…………………

Serial No…………….

Telephone Number……………………….

Section A: socio-demographic variables

1) Age at last birthday………………..

2) Religion: christianity [ ] islam [ ] traditional religion [ ]

3) Gender: male [ ] female [ ]

4) Marital status: single [ ] married [ ]

Section B: for official use only

HIV status　　　Neg [ ]　　Pos [ ]

HBsAg status　　Neg [ ]　　Pos [ ]

HCV Ab status　Neg [ ]　　Pos [ ]

Hb concentration……………mg/dl

HCT………………………….%

Total WBC count……………nl

PLT count…………………….nl

MCH………………………….pg

MCV………………………….fl

MCHC……………………….g/dl

ESR…………………………..mm/hr

………………………………………………………………………………………

Name and signature of the laboratory scientist in charge/date