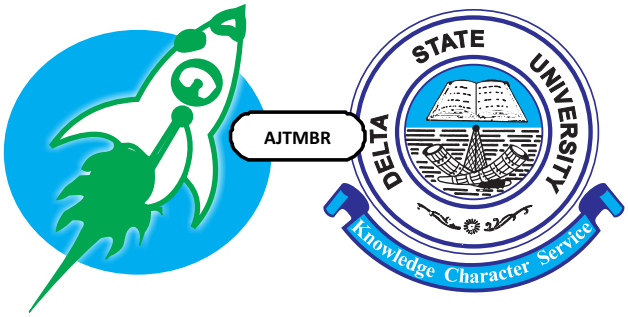
African Journal of Tropical Medicine and Biomedical Research (AJTMBR)



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Focus and Scope

The African Journal of Tropical Medicine and Biomedical Research is a multidisciplinary and international journal published by the College of Health Sciences, Delta State University of Abraka, Nigeria. It provides a forum for Authors working in Africa to share their research findings on all aspects of Tropical Medicine and Biomedical Sciences and to disseminate innovative, relevant and useful information on tropical medicine and biomedical sciences throughout the continent. The journal will publish original research articles, reviews, editorials, commentaries, short reports, case reports and letters to the editor. Articles are welcome in all branches of medicine and dentistry including basic sciences (Anatomy, Biochemistry, Physiology, Pharmacology, Psychology, Nursing etc) and clinical sciences (Internal Medicine, Surgery, Obstetrics and Gynaecology, Dental surgery, Child Health, Laboratory Sciences, Radiology, Community Medicine, etc). Articles are also welcome from social science researchers that document the intermediating and background social factors influencing health in countries of Africa. Priority will be given to publication of articles that describe the application of the principles of primary health care in the prevention and treatment of diseases.

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Acknowledgments

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Distribution and frequency of blood groups and haemoglobin genotype pattern among blood donors in a tertiary hospital in southern Nigeria

Dirisu, IM[1] & Okuonghae, EM[2]

Abstract

Introduction: The ABO is a blood group system that is responsible for most blood transfusion reactions, transplant rejections and determining some forensic cases. The ABO and Rh blood group systems have been shown to show variations in different parts of the world and race. Haemoglobin is an intracellular protein found in red blood cells. Qualitative and quantitative abnormalities in this protein manifest as haemoglobinopathy.

The study is to show the frequency and distribution of ABO, Rh blood groups and haemoglobin phenotype of eligible blood donors in Delta state University Teaching Hospital (DELSUTH), Nigeria

Materials and Methods: This is a cross-sectional study of all blood donors attending the blood bank in DELSUTH from November 2022 to April 2003. Consecutive sampling technique was used and samples for blood group and haemoglobin genotype was collected from eligible donors. Data from the blood ban analysed using SPSS version 23.

Results: A total of 95 donors were involved in the study. Analysis of the ABO blood group showed that the frequency blood group O,A,B and AB, were 83.2%,7.4%,7.4% and 2.2% respectively. RhD positive donors accounted for 93.7% of donors and RhD negative were 6.3%. 83.2% of donors had genotype AA while16.8% were genotype AS.

Conclusion: Blood group O and RhD positive were the commonest blood group while genotype AA was the commonest genotype among blood donors in the facility.

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Introduction

Human red blood cells contain a series of glycoproteins and glycolipids on their surfaces which constitute blood group antigens.[1] These antigens are genetically controlled and are inherited in the Mendelian manner. Approximately 400 red blood cell group antigens have been described in literature.[1] These different blood group antigens vary greatly in their clinical significance, with ABO and Rh groups being the most important in view of the safety of blood or blood products transfusion till date.[2]

The ABO blood group system was the first human blood group system to be discovered by Landsteiner in 1901 and later on, Landsteiner and Wiener defined the Rh blood group in 1941. The protein that defines the ABO antigens is a glycosyl transferase that is encoded from a single gene for which there are three major alleles A, B, O.[1] The A and B alleles catalyze the addition of different carbohydrates residues (N-acetyl galactosamine for group A and galactose for group B) to a basic antigenic glycoprotein or glycolipid with a terminal sugar on the red cell, known as the H substance.[1] The O allele is non-

functional and so does not modify the H substance. Apart from their expression on the red blood cells (RBC), ABO antigens are also highly expressed on the surface of a variety of human cells and tissues, including the epithelium, sensory neurons, platelets and the vascular endothelium.[3] Antibodies of the ABO system are naturally occurring antibodies as they arise without immune stimulation by relevant blood group antigens.[1] They are not detectable in the blood until 3 to 6 months of life.

The Rhesus (Rh) blood group locus is composed of two related structural genes, RhD and RhCE which encode the membrane protein that carry D, Cc and Ee antigens. The RhD gene may be either present or absent, giving the RhD+ or RhD- phenotype respectively. Rh antigens are expressed only on red cells and are fully expressed before birth. Rh antibodies are generally immune antibodies and can cause hemolytic transfusion reaction.

Distribution of ABO and Rh D blood groups varies between populations and races reflecting the underlying genetic and ethnic diversity of human populations.[3] The studies on blood groups are important parameters in various genetic studies for reliable geographical information, researching population migration patterns and in blood transfusion process. The knowledge of the distribution of ABO and Rh blood groups is essential for effective management of blood banks inventory, be it a facility of a smaller local transfusion service or a regional or national transfusion service. Apart from the above, these blood groups can be used in resolving certain medico-legal issues, particularly of disputed parentage. In addition, there are accumulating evidence that the ABO blood group plays a key role in various human diseases such as diabetes, cardiovascular, neoplastic, carcinoma and infectious disorders.

The intracellular protein found in RBC called haemoglobin (Hb) is made up of four polypeptide globin chains that are folded around heme molecules. The globin chains are known to have many alleles and are encoded by the relevant genes on chromosomes 11 and 16. Normal adult blood contains three types of haemoglobin ; Hb A (96-98%), Hb F (0.5-0.8%) and Hb A_2 (1.5-3.2%).Haemoglobin abnormalities could result from synthesis of abnormal Hb with altered amino acid sequence of from reduced synthesis of normal alpha or beta globin chains.

Nigeria is a large nation with diverse ethnic groups and a population of about 200million. As with many other genetic traits, haemoglobin genotype and the gene frequency of ABO and rhesus blood group varies significantly within the six geopolitical zones in Nigeria. Despite the numerous studies carried out on the distribution of haemoglobin genotypes, ABO and rhesus blood groups in Nigeria, to the best of my knowledge, no study has been carried out among residents blood donors in Oghara, Delta state, South-South Nigeria.

This study was therefore carried out to determine the distribution of haemoglobin genotypes, ABO and rhesus blood groups among eligible blood donors in Delta state university teaching hospital (DELSUTH), Oghara, Delta state.

MATERIALS AND METHODS

The study was a cross-sectional study.

Samples were collected at the donor Clinic of the Delta state University Teaching Hospital (DELSUTH), Oghara, Delta state, Nigeria. DELSUTH is a state government owned teaching hospital with over 300 bed capacity, located in Ethiope-west local government area of Delta state. It is affiliated to Delta state university,

Abraka and it boast of over 20 different medical disciplines.

Study Population
The study population comprised of apparently healthy voluntary and eligible blood donors who would gave written consent to participate in the study. We excluded blood eligible donors that were not willing to participate in the study.

Sample Size Estimation
Minimum sample size was determined using the formula: n = N/1+N (e)2 with 95% confidence interval level.

Where:
n= minimum required sample size
N = number of blood donors per month (estimated to be 126)
e = allowable error (%) which was set as 0.05.
Substituting in the formula:
n = 126/1+126(0.05)2 = 95.8.

Thus, a minimum of 96 blood donors were be required to be enrolled in the study.

Sampling Technique
A consecutive sampling procedure was used in this study.

Approximately 2milliliters (mls) of venous blood was drawn aseptically from the antecubital vein of each subject with minimal stasis and dispensed into commercially prepared ethylene di-amine tetra-acetic acid (EDTA) bottle for blood group and genotype.. The sample was mixed gently but thoroughly to prevent cell lysis and ensure adequate anticoagulation. All specimens was labelled with personally generated identification numbers and analysed within one hour of collection. The ABO and Rh blood group were determined using tile method and the haemoglobin genotype was determined using haemoglobin electrophoresis. Blood group was done using the cell (forward) grouping method using monoclonal Anti-A, Anti-B and Anti-D sera with LOT number-224037. Reagent storage and labeling of samples were managed properly according to the kit manufacturer (Immucor, Inc, Germany) standards.

Daily quality control of selected red blood cells and antiserum was performed to confirm the reactivity and specificity of the reagent. These reagents were tested with the corresponding antigen-positive and antigen-negative red blood cells. The reagents were considered appropriate for use if only antigen-positive red blood cells demonstrate a positive result.

Study Duration
The study was carried out within a period of six months (November 2022- April 2003)

Data Analysis
Data obtained was analysed using Statistical Package for the social sciences (SPSS) version 23. Probability values less than 0.05 ($p < 0.05$) were considered as significant. Results were presented in tables and percentages.

RESULTS

Sociodemographic Distribution
A total of 95 blood donors were recruited in this study comprising of 10 voluntary donors, 16 family replacement donors and 69 professional donors.

Most donors were below 30 years old (70.5%) and the fewest were above 40years of age (3.2%). Most donors below 30 years and between 30- 39 were professional donors (84.1% and 11% respectively). The only group of donors above 40 years were family replacement donors (3 donors).

The difference in age group amongst the three groups of patient was statistically significant ($p < 0.001$).

Eight- nine (93.7%) donors were males and six (6.7%) were females. All professional donors (100%) were males, while 12 males and 8 males were family replacement and voluntary donors respectively. There was a significant difference between the sex groups in the study ($p < 0.001$). Thirty-eight (40%) of the donors had tertiary level of education, thirty-two (33.7%) had secondary levels and twenty- five (26.3%) had primary education. Neither voluntary nor family replacement donor had primary level of education but 2(20%) and 3(18.8%) reached secondary level of education respectively. Most professional donors (39.1%) had secondary level of education, closely followed by (36.2%) and (24.6%) with primary and tertiary education respectively. The difference in level of education reached statistical significance ($p<0.001$).

Seventy- four (77.8%) of donors were single and twenty-one (22.1%) were married. Most family replacement donors were married (62.5%) while most of the voluntary and professional donors were single (70% and 88.4%) respectively. The difference in marital status was statistically significant ($p<0.001$).

Table 1: Demographic pattern of blood donors

	FR n = 16	**PD n = 69**	**VD n = 10**	**Total n = 95**	**P-value**
Age group					
<30	4 (25.0)	58 (84.1)	5 (50.0)	67 (70.5)	
30 – 39	9 (56.3)	11 (15.9)	5 (50.0)	25 (26.3)	<0.001
40 – 49	3 (18.8)	0 (0.0)	0 (0.0)	3 (3.2)	
Sex					
Male	12(75.0)	69(100)	8(80)	89(93.7)	<0.001
Female	4(25.0)	0(0.0)	2(20)	6(6.3)	
Education					
Pry	0 (0.0)	25(36.2)	0(0.0)	25(26.3)	
Sec	3 (18.8)	27(39.1)	2(20)	32(33.7)	<0.001
Tertiary	13 (81.2)	17(24.6)	8(80)	38(40)	
Marital status					
Single	6 (37.5)	61 (88.4)	7 (70.0)	74(77.8)	,<0.001
Married	10 (62.5)	8 (11.6)	3 (30.0)	21(22.1)	
Religion					
Christians	16(100.0)	69(100.0)	10(100.0)	95(100.0)	

FR (Family replacement), VD (Voluntary donor and PD (Professional donor)

Haemoglobin genotype and blood group of blood donors

Seventy-nine (83.2 %.) donors were genotype AA and sixteen (16.8%) had genotype AS. Amongst the genotype AA donors, majority were professional donors (56 donors) while voluntary donors accounted for the fewest number (9

donors). A similar trend was noticed in donors with haemoglobin genotype AS.

Seventy-nine (83.2%) donors had blood group O, seven each had blood group A and B while two had AB. Fifty-seven professional donors had blood group O, while family replacement and voluntary donors had fourteen and eight persons with blood group O respectively. Seven donors (7.4%) had blood group A and six of them were professional donors. Seven donors (7.4%) had blood group B, five of them were professional donors and the remaining were voluntary donors. Two persons (2.2%) had blood group AB and were family replacement and professional donors.

Eighty-nine (93.7%) donors were Rh D positive and six negative (6.3%). Sixty-five of those who were Rh D positive were professional donors, while fifteen and nine of them were family replacement and voluntary donors respectively. Four donors with Rh D negative were professional donors.

Table 2: Haemoglobin genotype and blood group pattern amongst donors

Genotype	FR	PD	VD		
AA	14 (87.5)	56 (81.2)	9 (90.0)	79 (83.2)	0.001
AS	2 (12.5)	13 (18.8)	1 (10.0)	16 (16.8)	
Blood group					
O	14(87.5)	57(82.6)	8 (80.0)	79 (83.2)	
A	1(6.3)	6(8.7)	0(0.0)	7 (7.4)	0.928
B	0 (0.0)	5 (7.2)	2(20.0)	7 (7.4)	
AB	1(6.3)	1 (1.4)	0 (0.0)	2 (2.2)	
Rhesus					
Pos.	15 (93.8)	65(67.7)	9(90.0)	89 (93.7)	0.793
Neg.	1 (6.3)	4 (5.8)	1(10.0)	6 (6.3)	

Key: FR (Family replacement), VD (Voluntary donor and PD (Professional donor)

DISCUSSION

In studies of the human population, helpful genetic markers such as the ABO and rhesus blood groups are important.[4] They are the most often used and important blood types as regards blood transfusion. Haemoglobin (Hb) genotype is an important blood component that determines haemoglobinopathies. Haemoglobinopathies are among the most frequently inherited genetic disorders in the world and they are inherited from healthy carrier/disease parents.

In this study, the distribution of the ABO blood phenotype showed that blood group O was the most common blood group (83.2%), followed by blood group A and B with 7.4% each and the least blood group was AB (2.2%). The result of this study on the ABO blood group phenotype frequency distribution is similar with the pattern seen in previous studies that reported high frequencies of group O and low prevalence of AB.

Similar distribution of the ABO blood group amongst donors and residents were reported by *Faduyile et al.*, *Enosolease et al.* and *Onuoha et al.* in

Lagos, Adamawa, Edo and Bayelsa states of Nigeria respectively.[2,5,6] Although the studies had similar pattern, the prevalence of each blood group varied from region to region. The slight discrepancy between our findings and that reported in other studies may be attributed to the ethnic difference among the population of Nigeria or it could be due to the smaller sample size in the present study.

The index study showed that professional donors had the highest prevalence for each blood group type and the trend is depicted as 82.6% for O, 8.7% for A, 7.2% for B and 1.4% for AB (O>A>B>AB). This is in concordance to a previous study that have reported the high prevalence of professional donors in Nigeria and in the locality.[7]

The high predominance of blood group O individuals in Nigeria, as seen in this study and previous studies, is advantageous since it indicates that there will always be blood available in an emergency situation.

In this study the distribution of rhesus positive (Rh+) blood group (93.7%) was more predominant than rhesus negative (Rh-) blood group (6.3%). While we reported a value of 6.3% prevalence for Rh- in our study, other studies reported values as low as 1.2% in Gusau and 2.9% in Yola, Nigeria.[8,9] A similar prevalence of 6.03% was reported in Benin by *Enosolease et al.*[2]

The low frequency of the Rh- blood type in the study are advantageous for blood banking and the prevalence of diseases like hemolytic disease of the newborn (HDN). It reduces the need for Rh-blood for transfusions, which is good news for blood bank management and vendors who often have a monumental task in procuring suitable donors. In terms of Rhesus alloimmunization and attendant HDN, it also gives the population certain obstetric advantages as HDN contributes to perinatal morbidity and mortality.

We identified two haemoglobin combinations among our donors (AA and AS). The result of this study showed that 83.2% of blood donors had haemoglobin phenotype AA and 16.8% AS. The prevalence of haemoglobin AA was similar to studies by *Damulak et al.* in Jos (77.7%), *Jeremiah et al.* in Port-Harcourt (80.32%) and *Umoh et al.* in Uyo (78%).[10-12] No sickle cell disease electrophoretic pattern was reported in this study. This was possible due to deferral during screening and also the small sample size.

In conclusion, the prevalent blood group in the study area is blood group O and the least is AB. RhD positive antigen and haemoglobin phenotype AA had the highest prevalence.

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