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ABO, Rh D blood groupand genotype profileof clinical students in Bingham University Teaching Hospital

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Abstract:
Background*: There is an ethnic disparity in the prevalence of ABO and Rhesus D blood groups and genotypes. The aim of this present study is to determine the ABO and Rhesus D blood group as well as the genotypeprofileof the clinical students of African descent attending Bingham University Teaching Hospital Jos Plateau State Nigeria.*
MaterialsandMethods*: ABO and Rhesus D phenotype of 110 consecutively-recruited medical students of Bingham University in Jos Plateau State, Nigeria were determined with the monoclonal anti-A, anti-B, and anti-D antisera using the forward cell grouping method to observe for agglutinations. The Hemoglobin electrophoresis machine using tris buffer of PH 8.6 was used to determine various genotypes. Each subject was also asked to state his/her known blood group and genotype prior to the study.*
Results*: Our study shows the following characteristic features of the study population of110 apparently healthy clinical students: Those of age 18-30 years made up Males 39 (35.5%) and 71females (64.5%) constituted the subjects in this case study. The profile of the ABO bloodgroup and Rhesus D revealed that 69 (62.7%) were group O, 20 (18.2%) were group B, 20 (25.6%) were group A and1 (18.2%) were group AB. Furthermore, 106 (96.4%) were Rhesus positive and 4 (3.6%) were Rhesus D negative. Our findings on the genotype profile shows that 76 subjects claimed they had pre-knowledge of their genotypes prior to this study out of which 40 (52.6%)were incorrect having experimentally tested.*
Conclusion*: The ABO blood group profile of the 400 level clinical students in BhUTH, is O > B ≥ A >AB, thus a potential rich blood bank for donors. Advocacy and awareness on the need to stock blood products in Blood banks and the advantages surrounding blood donation.*
Key Word*: ABO; Rhesus; Blood groups; Prior knowledge of blood group and genotype; BhUTH*

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I. Introduction

Landsteiner discovered the ABO blood groups in 1901, followed by Rh blood group in 1941.The International Society of Blood Transfusion describes more than 30 blood groups of which only ABO and Rh blood groups remain clinically most important. The ABO blood grouping system consists of the A, B, and H carbohydrate antigens and antibodies, while that of Rh is composed of D antigen. Therefore, ABO blood grouping is based on the presence or absence of A and B antigens on the surface of red blood cells (RBCs) and Rh grouping is based on the D antigen presence or absence on the RBC surface. All blood groups are inherited but its profiles or frequencies varies. This variation depends on the allele's distributions, ethnic groups, race [1]. Blood and blood component transfusion have been used to correct severe anemia, clotting factors, thrombocytopenia, immunodeficiency states, hypoalbuminaemia, and problems related to electrolytes. Since the Second World War, blood and blood component transfusion have been used to correct severe anemia, deficiency of plasma clotting factors, thrombocytopenia, immunodeficiency states, hypoalbuminaemia, and problems related to electrolytes [2,3]. Transfusion of compatible blood at Least for ABO and Rh antigens reduces transfusion reaction in recipients. The ABO and Rh blood groups are also useful in clinical studies, population genetic

studies, and researching population migration patterns as well as resolving certain Medico legal issues, particularly of disputed paternity cases [4]. Therefore, knowledge of the ABO and Rh blood group distribution in specific population has paramount importance in the context of transfusion medicine. Many previous studies in sub-Saharan Africa reported that blood group O and Rh+ are the most frequent ABO and Rh blood groups, respectively, but the proportion varies by location.[5,6,7,8]. Many other coexisting factors made the study of relationship between malaria and ABO/Rh blood groups difficult that varying findings are reported. Complexity of the interaction between the parasites and host immune responses as well as impact of other RBC polymorphisms may be responsible for such differences.[9-15]. The fact that blood is not always available in blood banks calls for systematic and effective profiling in our institutions. The need to carry out a study on the ABO and Rh D blood group and genotype profile of clinical students of Bingham University Teaching Hospital (BhUTH) was conceived for the purpose of free will blood donations and to consolidate on validity test (screening) on every blood sample brought to the Laboratory as a standard practice in BhUTH, Jos-Nigeria.

The aim of this study is to determine the various profiles of ABO and Rh D blood groups and genotypes of clinical students in BhUTH, Jos-Nigeria.

II. Material and Methods

This prospective study was carried out on 400level clinical students of Bingham university Jos campus of its teaching hospital.

Study Design: Prospective open label observational study

Study Location and Duration: This research was carried out in the Multipurpose laboratory of Bingham University Medical College located in BhUTH Jos, North-Central Nigeria for the period of 6 weeks between May 18th– June30th.2022.

Sample Size:A total of 110 male and female 400 Level clinical students in the Bingham University Medical College were recruited for the study

Sample Size Calculations

The sample in this research was calculated using Taro Yamane (1973) formula with 95% confidence level (according to 134 medical students 400 level, 2021). The calculation formula is shown below:

$$n = \frac{N}{1+N(e)^2}$$

$n = 134/1+134(0.05)^2$

$n = 134/1.335$

$n = 100.37$ ˜101 blood samples.

Final sample size was 110 minimum, after adding 10% to compensate for non-respondent. Blood samples was collected from 400 level clinical students in Bingham University, College of Medicine and Health Sciences who were the source population.

Subjects, selection and data collection

The study population was drawn from consented clinical students during their practical classes at the Multipurpose Laboratory of the Medical College in BhUTH.Well-structured questionnaires were administered to thestudents in order to obtain relevant information.

Consent form

Consent forms was administered to the students in order to recruit subjects for the study.

Clear statements on study

Consent of the subjects of study was adequately sorted with assurance of optimal privacy and confidentiality.

Incentives and benefits

There was no form of incentives, but the study enabled the subjects to know their genotype and blood groups.

Inclusion criteria

All consenting, consecutively recruited legal adults (≥ 18 years), confirmed clinical students of Bingham University and students withouta recent history of red cell transfusion were recruitedinto this study.

Exclusion criteria

The clinical students of Bingham University Medical College who did not meet theinclusion criteria were excluded from the study (non-adult students < 18 years, non -consenting students and students who have had a red cell transfusion in the last 4 months.

Procedure methodology

Venous blood (3mls) was collected from each study participant for ABO/Rh blood grouping and genotype. ABO and Rh blood grouping was carried out using monoclonal anti-A, anti-B, and anti-D antisera using the forward cell grouping method, using tiles. For the genotype, hemoglobin electrophoresis machine with tris buffer($_P$H 8.6) was used.A drop of anti-sera A, B, AB and O each was put in the appropriate compartments of a clean and dried tile, then a drop of red cells was placed on the appropriate row of the compartment containingthe antisera and then mix appropriately using an applicator stick provided for each compartment. After this processes the tile was then rocked gently to watch for agglutination.

Electrophoresis procedure:

A cellulose acetate strip was soaked in a buffer for 5 minutes, then using a Pasteur pipette a drop of haemolysed patient sample and controls were placed on the electrophoretic plate.

The cellulose acetate strip was blotted twice between two layers of blotting paper. The applicator tips of the electrophoretic comb were used to place the samples on the electrophoretic plate using applicator tip onto the cellulose acetate strip approximately 3cm from the cathode end. An equal amount of TEB buffer into 2 outer compartments of the electrophoresis tank. An acetate cellulose strip was then placed between the two shoulder pads of the electrophoresis tank, ensuring the side with the applied sample faces upwards. The ends of the strips were pressed firmly against the pads to ensure proper contact. From the power source, a 450v was applied for 20 minutes.The strip was then transferred into a stain for 3-5 minutes and washed in acetic acid to remove excess stain and allow the strip to dry.

Statistical Analysis

Collecteddata was entered and analyzed using statistical package for social sciences (SPSS) version 20.0. Descriptive statistics (frequency, median, and percentage) was used to describe the study population characteristics while variables were considered statistically significant only for *P* value $\leq$ 0.05 at 95% confidence level.

III. Result

Demographic representation of the studied subject was 71 (64.5% females and 39(35.5) males.

Table no 1: ABO blood profile.

Blood groups	A	B	O	AB
	20	20	69	1

Group O, 69 (62,7%), Group B, 20 (18.2%),Group A, 20(18.2%) and Group AB, 1 (0.9%) – *Tableno1*.

Table no 2: Blood group profile of respondents based on gender and age ranges.

Age ranges	Blood grouping profile									
	0+		A+		B+		AB+		Total	
	F	M	F	M	F	M	F	M	F	M
< 19 – 24 yrs	42	24	14	3	10	6	0	1	66	34
25 – 29 yrs	0	3	3	0	1	1	0	0	4	4
30 > yrs	0	0	0	0	1	1	0	0	1	1
	42	27	17	3	12	8	0	1	71	39
Total	56	29	0	1	15	9	0	0	71	39

Blood group O is more predominant and between the age range of < 19 – 24 years for both male and female (Table no2).

Table no3: Genotype profile of respondents based on gender and age ranges

Age ranges	Genotype profile of respondents									
	AA		AC		AS		SS		Total	
	F	M	F	M	F	M	F	M	F	M
< 19 – 24 yrs	53	27	0	1	13	6	0	0	66	34
25 – 29 yrs	2	2	0	0	2	2	0	0	4	4
30 > yrs	1	0	0	0	0	1	0	0	1	1
Total	56	29	0	1	15	9	0	0	71	39

Genotype AA is more predominant amongst the female with a value of 56 and 39 for male, followed by genotype AS of value 15 for female and 9 for male, no sickle cell amongst our subjects However 1 genotype AC was discovered amongst the male subject (Table no3)

Table no4: Frequency of different blood group among respondents according to gender

Blood group	Female	Male	Total
0+	40 (56.3)	26 (66.7)	66 (41.8)
A+	17 (23.9)	2 (5.1)	19 (17.3)
B+	12 (16.9)	8 (20.5)	20 (18.2)
AB+	0 (0.0)	1 (2.6)	1 (0.9)
0-	2 (2.8)	1 (2.6)	3 (2.7)
A-	0 (0.0)	1 (2.6)	1 (0.9)
Total	71	39	110

Out of 110 subjects investigated, 106 were Rhesus D positive and 4 were Rhesus D negative. Of the 106 Rhesus D^+, 37 were male while 69 females and 2 each Rhesus D^- for both sex.
Rhesus D phenotypes distributions indicated that 37 male were Rh D positive and 2 were Rh D negative, similarly 69 female student were Rh D positive while 2 were Rh D negative (Table no4).

Table no5: Table 5 Rhesus D blood group profile among students based on gender

Gender	Rh D positive N (%)	Rh D negative N (%)	Total
Male	37(33.6)	2 (1.8)	39
Female	69 (62.7)	2 (1.8)	71

Table 5:Rhesus D blood group profile among student based on gender. Rh D positive was predominant amongst our subjects 106 (69 females, 37 male) while 4 of the subjects are Rh D negative (2 females, 2 male) – *Tableno5*.

Figure no1: Pre-knowledge of blood group by respondents

Figure 1: Eighty-six (86) claimed pre knowledge of their blood groups (O = 54, A = 15, B =15, AB = 2), while 24 do not have the pre knowledge of their blood groups. The study confirmed 72 out of the 86 claims. (O =46, A=12, B=13, AB=1).14 subjects were proofed wrong.

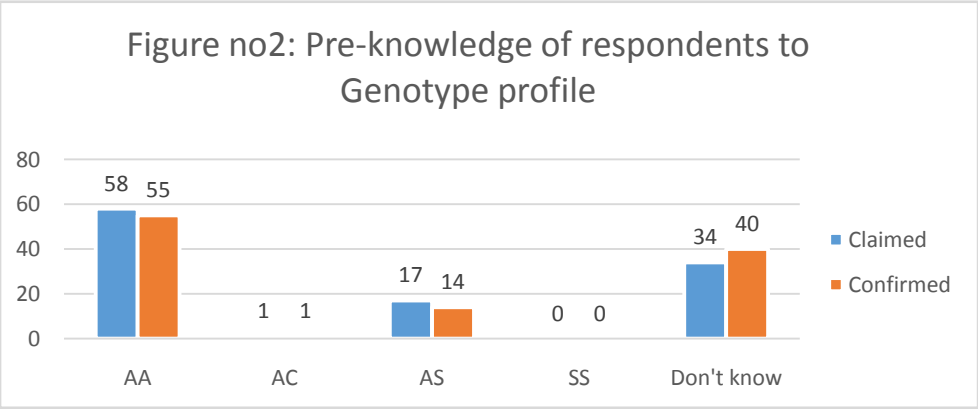

Figure no 2: A total of 76 subjects claimed to know their genotypes (AA= 58, AC=1, AS=17, SS= 0), while 34 subjects do not have pre knowledge of their genotypes. The study confirmed 70 out of the 76 claims (AA=55, AC=1, AS=14, SS=0), 6 subjects were proofed wrong. Forty(40) subjects do not know their genotypes out of the 110 clinical students that participated in the study.

IV. Discussion

The ABO blood group system is the most clinicallysignificant human blood group system. From our findings, the blood group profile of the study isGroup O (69) >Group B (20) ≥ Group A (20)> Group AB (1) thuspresents as the pattern: O > B ≥ A >AB. This is in consonance with the general formula O > B ≥ A >AB. It is also in line with the previous reports by Erhabor *etal*, (2013) among blood donors in Gusau Zamfara State [16], Akhigbe*etal*, (2009) among students of Ladoke AkintolaUniversity of Technology in Ogbomoso[17] and Pennap*etal*.(2011) and among students of Nasarawa StateUniversity[18].

In this present study we observed a higher prevalence of group O and A and Rhesus D positivity among female donors compared to males. This female gender associated higher prevalence may be due to the fact that the number of female subjects71 (64.5%) in this study was significantly higher compared to male subjects 39 (35.5%) similar to the report by Pennap *etal*. (2011)[18].Furthermore, this study observed the predominant blood group as O-positive 66 (41.8%) unlike previous reportson same among the Gwari tribeof Abuja and the Rukuba tribe of Plateau state inNorth- central, Nigeria where blood group B was thepredominant blood groupOnwukeme [19]. Predominance of group Oobserved in our study among the student of Bingham University Jos (BHUTH) provides an advantage in terms of availability of blood for transfusions,especially in emergencies. Blood group O individual lacks ABO blood group antigens on their red cell making them potential donors to individuals of blood groups A, B andAB, though with some level of clinical/ethical caution as the plasma of some group O blood individuals are known to have high titer of potent A and B immunehaemolytic antibodies (haemolysins). The Rhesus blood group system is the second mostclinically significant red cell antigen system after the ABO blood group system. The Rhesus D antigen is the mostimmunogenic of all the Rhesus blood group antigens.Rhesus incompatible transfusions can have a negativeimplication on health [20]. In this study, we observed the prevalence of Rhesus D positive and negative of 96.3%and 3.7% respectively among our cohort of clinical students ofAfrican descent in Jos Bingham teaching hospital.Our finding is consistent with previous report obtained among non-Caucasians byErhabor*etal*, (2010) [21] in the Niger Delta ofNigeria who observed that 93% of their subjects were93:7 percent Rhesus D positive to negative.

There are several implications in not knowing one's blood group or genotype, in an emergency situation where blood transfusion is required. A compatible blood donor is imperative without compromise. In order to avoid this and other associated clinical problems, utmost care should be taken, including not working with a disclosed blood group and genotype of a donor as well as that of the victim and amongst other reasons including disease. Medically, the ABO blood group system has been of great importance in different disease studies[22]. This study shows that depending on blood group and genotype claims could be highly misleading as 72 out of the 86 subjects that claimed to know their blood group were found to be wrong –*Tableno1*. This however upholds the fact that blood screening before donation and clinical diagnosis should not be compromised.

Another assertion is that, ABO blood types were shown to have some associations with various infectious and noninfectious diseases [23].

V. Conclusion

The ABO blood group profile of the 400 level clinical students in BhUTHis O > B ≥ A >AB, thus a potential rich blood bank for donors. Advocacy and awareness on the need to stock blood products in Blood banks and the advantages surrounding the forgoing.

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