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Distribution of Abo, Rhesus Blood Groups and Haemoglobin Variants among Residents of Yenagoa and Environs, Bayelsa State, Nigeria

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Background: ABO, Rhesus blood groups and Haemoglobin variants are known to vary from one population to another. This study therefore sought to study the frequency of these indices among residents of Yenagoa and Environ, Bayelsa State, Nigeria**.**
Objectives: The study was designed for the purpose of updating information on the prevalence of abnormal haemoglobin variants, ABO, Rh blood groups and serve as a platform for instituting genetic counseling services with a view to reducing haemoglobinopathies.
Methods: Standard electrophoretic and haemagglutination techniques were employed in testing the blood samples.
Results: Of the 5,183 residents screened, 73.32% were HbAA, 25.03% HbAS, 0.28% AC, 1.3% SS, 0.06% SC. 20.30% were of blood group A, 22.70% group B, 3.0% group AB and 54% group O. 95.5% were Rh.D positive while 4.5% were Rh D negative. Analysis of the residents population revealed that 2702(52.1%) were females while 2481 (48.9%) were males. The age range is between 1–60 years.
Conclusion: Knowledge of the distribution of ABO, Rh blood groups and haemoglobin variants in any population is useful in health care planning, medical diagnosis and targeting the population that need counseling. If such information is well managed it can make a difference in the quality of decisions that individuals will make especially as it concerns marriage, blood transfusion and other medical demands.
Keywords: haemoglobin variants, ABO, Rhesus blood group, Yenagoa, Nigeria.

Background
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INTRODUCTION

The ABO and Rh blood groups are among the most important blood groups (Seeley *et al.*, 1998). Karl Landsteiner first described the ABO blood group in 1900, and it served the beginning of blood banking and transfusion medicine (Ali *et al*., 2005). Even after 100years, the single most important test performed in blood banking services is determination of ABO blood groups to avoid morbidity and mortality (Honig and Bore, 1980).

In the ABO blood group, individuals are divided into four major blood groups, A, B, AB and O, according to the presence of the antigens and agglutinins. Type A blood has type A antigens, type B blood has type B antigens, type AB blood has both types of antigens, and type O blood has neither A nor B antigens.

In addittion, plasma from type A blood contains type B antibodies, which act against type B antigens, whereas plasma from type B blood contains type A antibodies, which act against type A antigens. Type AB has neither type of antibody and type O blood has both A and B antibodies (Seeley et al*.,* 1998).

Furthermore, the presence of Rhesus system was recognized in 1939 and it was confirmed within few years (Landesteiner and Weiner, 1940). Rh system emerged as second most important blood group system due to haemolytic disease of newborn and its importance in RhD negative individuals in subsequent transfusions once they develop Rh antibodies (Dennis et al., 1998). People are positive if they have a certain Rh antigen (the D antigen) on the surface of their erythrocytes, and people are Rh–negative if they do not have this Rh antigen.

Rh incompatibility can pose a major problem in some pregnancies when the mother is Rh –negative and the foetus is Rh – positive (Avent, 1999). If foetal blood leaks through the placenta and mixes with the

mother's blood, the mother becomes sensitized to the Rh antigen. The mother produces Rh antibodies that cross the placenta and cause agglutination and haemolysis of foetal erythrocytes. This disorder is called Haemolytic disease of the newborn (HDN), or erythroblastosis foetalis, and it may be fatal to the foetus (Dennis et al., 1998).

Sickle cell haemoglobin (HbS) differs from normal haemoglobin (HbA) because it has a valine in place of a glutamic acid in position number six of the beta chain of the globin molecule. When the availability of oxygen is reduced, the erythrocytes containing sickle cell haemoglobin change from round to sickle-shaped cells. (Tamarin, 2002). There are several common forms of sickle cell disease. These are called SS (individuals inherit one sickle cell gene from each parent), SC (the child inherits one sickle cell gene and one gene for another abnormal type of haemoglobin called "C"). The clinical course of sickle cell disease is extremely variable (Platt etal., 1991). Some patients have nearly no symptoms. Others are severely incapacitated (Bray et al., 1994).

MATERIALS AND METHOD

SETTING

This study was conducted at the Gloryland Medical Centre and Federal Medical Centre both in Yenagoa, Bayelsa State, from January 2009 to May, 2011, age ranges from 1 to 60years. Health care services in Bayelsa state are poorly provided and absence of basic primary health care facilities in the rural areas has created a situation where those who could afford, normally seek medical attention at Yenagoa where these hospitals are situated. This is the reason for the choice of these two hospitals as the research base for the study

Collection of blood samples

Blood samples were collected using standard venipuncture techniques. Approximately 3ml of blood was collected from each subject and transferred into the prepared ethylenediaminetetraacetic acid (EDTA) anticoagulant bottle. The institutional Ethical committee approved the study. All the participants gave their informed written consents and willingly presented themselves at the Medical Laboratory for sample collection.

ABO and Rh blood groups tests

Red cell phenotyping was carried out with standard tube techniques as described by Judd and Brecher . For ABO blood grouping, a drop of anti-A, anti-B, and anti-AB (Atlas Medical, Cambridge, UK) each was placed in clean test tubes labelled 1,2,3. To each tube was added a drop of 5% red blood cell suspension in saline. The contents were gently mixed together and centrifuged for 30 seconds at 1000g. The cell buttons were resuspended and observed for agglutination. Agglutination of tested red cells constituted positive results. A smooth cell suspension after resuspension followed by a microscopic confirmation constituted negative test results.

Blood genotype test

For the study of the blood genotype, cellulose acetate electrophoresis technique was used to determine haemoglobin genotype. The method described by Brown was used for haemoglobin electrophoresis. A small quantity of haemolysate of venous blood from each of the subjects was placed on the cellulose acetate membrane and carefully introduced into the electrophoretic tank containing Tris - EDTA - Borate buffer at pH 8.6. The electrophoresis was then allowed to run for 15 – 20 minutes at an electro motive force (emf) of 160 V. The results were read immediately. Haemolysates from blood samples of known haemoglobin (i.e. AA, AS, AC) were run as controls.

For Rhesus D typing, a drop of anti-D serum (Atlas Medical , Cambridge, UK) was placed in a clean labelled test tube and a drop of control placed in a second tube. 1 drop of 5% RBC suspension in saline was then added and incubated at 37°C for 30mins. At the end of the incubation period, the contents of the tube were mixed gently and centrifuged for 30 seconds at 1000g. Agglutination was read macroscopically and microscopically in doubtful cases. All negative results were confirmed using the indirect antiglobulin test (IAT) procedure (also for confirmation of weak D

Statistical analysis

Statistical analysis was analyzed using computer database software from the Statistical Package for Social Sciences (version 17; SPSS Inc., Chicago, IL) to generate frequency distribution and percentage prevalence scores of the various parameters. Descriptive analysis of the percentages
of continuous variables was reported. Comparisons were assessed using mean and chi-square tests. A P-value of 0.05 was considered statistically significant in all clinical comparisons.

RESULTS

Of five thousand one hundred and eighty-three residents (5183) of Yenagoa and environ were selected and tested. Analysis of the residents population revealed that 2702 (52.1%) were females while 2481 (48.9%) were males. The age range is between 1–60 years. The distribution of the blood groups A, B, AB, O and Rhesus D is

shown in the Table 1 and 2 respectively. There were no significant differences in the distribution of blood groups between the male and female. The Rhesus D positive and Rhesus D negative distribution varies among the four (4) ABO blood groups as shown Table 2.
The percentages of the various haemoglobin genotypes obtained in this study are shown in Table 3. The percentages vary significantly. The highest percentage was found with genotype Hb AA (73.31%) and the lowest distribution occurring with the haemoglobin Genotypes HbSC, HbAC and HbSS.

Table 1. Frequency distribution of ABO blood group systems for the years 2009– 2011 in Yenagoa, Nigeria.(N=5183)

Study sites/yr	Sex	A	B	AB	O	TOTAL
Federal Medical Centre(2010-2011), Yenagoa	M	132(5.6%)	161(6.8%)	19(0.8%)	401(16.9%)	713
	F	306(12.8%)	376(15.8%)	44(1.9%)	936(39.4%)	1662
Total						2375
Gloryland Medical Centre(2009-2011), Yenagoa.	M	406(14.5%)	404(14.4%)	53(1.9%)	905(32.2%)	1768
	F	205(7.3%)	233(8.3%)	40(1.4%)	562(20.0%)	1040
Total						2808
Gross Total		1049(20.3%)	1174(22.7%)	156(3.0%)	2804(54%)	5183

Table 2. Rhesus D Blood group system distribution among residents of Yenagoa and environ, Bayelsa State, Nigeria for the years 2009– 2011**.** (n = 5183)

ABO	**Rh D Positive**	**Rh D Negative**
A	1007(19.5%)	42(0.8%)
B	1121(21.6%)	53(1.0%)
AB	141(2.7%)	15(0.3%)
O	2680(51.7%)	124(2.4%)
Gross Total	4949(95.5%)	234(4.5%)

Table 3:Five (5) haemoglobin genotypes distribution among among residents of Yenagoa and environ, Bayelsa State, Nigeria**.** (n = 5183

Study sites/yr	**Sex**	AA	AS	SS	AC	SC	TOTAL
Federal Medical Centre(2010-2011)	Male	493(20.8)	201(8.5)	16(0.7)	3(0.1)	-	713
	Female	1150(48.4)	469(19.8)	36(1.5)	6(0.25)	1(0.04)	1662
Total							2375
Gloryland Medical Centre(2009-2011)	Male	1379(49.1)	381(13.6)	5(0.2)	1(0.04)	2(0.1)	1768
Total	Female	779(27.7)	245(8.7)	12(0.4)	3(0.1)	1(0.04)	1040
Gross Total							2808
		3801(73.31	1296(25.03)	69(1.3)	13(0.28)	4(0.08	5183

DISCUSSION
From this study, the distribution of blood group O was the highest with percentage distribution of 54%, followed by blood group B with the percentage distribution of 22.7%, blood group A with the percentage of 20.3% and

the least percentage distribution is that of blood group AB which is 3.0%.

Usually, the distribution of ABO blood group varies from one population to another. In many other studies, blood group O has been found to be the most common blood group. In the Caucasians in the United States, the distribution is type O, 47%, type A, 41%; type B, 9% and type AB; 3% and for the blacks in the United States, the distribution is type O, 46%; type A, 27%; type B, 2% and AB, 7% (Seeley et al., 1998). Among Western Europeans 42% have group A, 9% group B, 3% group AB and the remaining 46% group O.

Similarly, in Pakistan, blood group O is the most common (35%), blood group A is 23.5%, blood group B is 33% and blood group AB is 8%. Thus, the segregation of the genes responsible for the ABO blood systems has always taken a particular pattern for its distribution with exceptional cases. For instance, in Nepal, where 'A' is the most common (34%) and 'O' is 1.5% (Pramanik, and Pramanik, 2000).

In Nigeria, among 7653 individuals in Ogbomoso, Oyo State, 50% had blood group O;22.9% blood group A; 21.3% blood group B and 5.9% blood group AB (Bakare *et al*., 2006).

In Department of Cell Biology and Genetics of University of Lagos, Akoka, Nigeria for ABO blood groups, Blood group O was the highest with the percentage distribution of 55.3%, followed by blood group A (25.3%), B (16.7%) and the least percentage distribution was blood group AB which is 2.7% (Adeyemo *et al*.,2006).

In Niger Delta region, in River State University of Science and Technology, Port Harcourt, Nigeria the distribution of the various blood groups indicated that 46% were blood group O, 26.6% were group A, 23.6% were group B while 3.8% were group AB (Erhabor1 *et al.,* 2010) and college students in Port Harcourt, River state, 22.9% were of blood group A, 17.10% group B, 4.84% group AB and 55.16% group O (Jeremiah, 2006). Undergraduate students of Niger Delta University, Welberforce Island, Amassoma, Bayelsa State have the following distribution with group O 49%, group A and B 22% respectively and the least percentage distribution was blood AB which is 7%(Egesie *et al*.,2008).

In addition, it can be seen from the study that blood group AB has the least percentage which is found in previous studies. Furthermore, it was discovered that blood group B(22.7%) is higher than blood group A(20.3%) which varies with the previous studies except the studies carried out in Niger Delta University, Welberforce Island, Amassoma, Bayelsa State which has the same percentage. It can be due to the crude oil spillage, fishes and environment of Bayelsa State. Further research can be carried out in this aspect.

Rhesus-D distribution also varies within any group of human population. In this study, it was observed that blood group O RhD-positive is the highest with percentage distribution of 51.7% which is followed by group B Rh-D positive with the percentage distribution of 21.6%, blood groups A Rh-D positive is 19.5% and AB Rh-D positive 2.7% (Table 2). In overall, the total percentage of RhD positive was 95.5% and that of RhD negative was found to be 4.5%.

Over the years, the Rh blood group systems has been distributed among any population to keep the distribution of RhD negative very low since clinical situations could arise through Rh blood incompatibility. Similar pattern of distribution is also observed in other studies. Rh-D negative blood group is documented as 5.5% in South India, 5% in Nairobi, 4.5% in Nigeria, 7.3% in Lahore, 7.7% in Ralwalpindi studies (Das *et al*., 2001; Mwangi, 1999; Omotade *et al.,* 1999; Majeed and Hayee, 2002; Bhalti and Amin,1996).

In Nigeria, Rh-D negative blood group was found to be 6% in Lagos and 3.3% in Ogbomoso, Oyo state, western region of Nigeria while the Niger Delta region was found to be 7%, 3.23%, 2% among college students in Port Harcourt, River state and Niger Delta University, Welberforce Island, Amassoma, Bayelsa State respectively. Hence, we have average of 95.5% Rh-D positive in these regions in Nigeria.

From the 5183 residents of Yenagoa and environ screened for this study, the percentage distribution for the haemoglobin genotypes for HbAA, HbAS, HbSS, HbAC, HbSC were 73.31%, 25.03%,1.3%, 0.28% and 0.08% respectively (Table 3).

By comparison, the distribution of HbSS was given as follows: 3%–9% for black Americans, 1%–8% for white Americans, 3%–7% for Europeans (United Kingdom among Pakistanis and blacks), 2%–8% for other European countries (Mediterranean), 1%–3% for Caribbeans, 1%–3% for Middle East, 1%–10% for Africans.

In Nigeria, the distribution of HbSS was given as follows: 1.3% Lagos, 3.0% Ogbomoso, Oyo State, 1.5% University students, Port Harcourt, River State, 1.3% Niger Delta University students, Welberforce Island, Amassoma, Bayelsa State (Adeyemo *et al*.,2006 and Bakare *et al*., 2006 Erhabor1 *et al.,* 2010., Egesie *et al*.,2008)

The distribution of (AS) was reported as follows: 8%–16% for black Americans, 8%–10% for white Americans, 6%–15% for Europeans (United Kingdom, Pakistanis and blacks) 1%–15% for Europeans (Mediterranean), 3%–8% for Caribbeans, 7%–8% for Middle Easterns, 15%–30.5% for Africans, and 40.5% for West Africans,

In Nigerians 26% Lagos, 21.0% Ogbomoso, Oyo State, 29.4% University students, Port Harcourt, River State, 26.0% Niger Delta University students Welberforce Island, Amassoma, Bayelsa State.(Adeyemo *et al*.,2006 and Bakare *et al*., 2006 Erhabor1 *et al.,* 2010., Egesie *et al*.,2008).

Our finding of a distribution of 25.03% HbAS and 1.3% HbSS is consistent with previous reports among undergraduate students in Bayelsa state and Rivers state, both in the South-South of Nigeria where distribution rates for HbSS of 1.3% and 1.5%, respectively, were observed.

The number of people with homozygous SS in Nigeria is still high. This is thought to be due to the absence of carrier testing programs or premarital counseling/testing for prospective couples prior to marriage in a bid to reduce the prevalence of haemoglobin disorders. The universal neonatal screening program is an effective way to diagnosis the presence of haemoglobinopathy. Experience in Belgium has shown universal neonatal screening to be an excellent health education tool. Countries in Africa can benefit by implementing similar programs, as their development is pivotal to improving the health care of those affected by haemoglobin disorders.

However, such program requires major economic and organizational resources, which must be taken into account and balanced against other local health priorities.

Moreover, the observed high incidence of HbAA and HbAS in this study, though the distribution of HbAA being significantly higher than that of HbAS, is in agreement with previous reports that the normal haemoglobin (HbAA), range from 55 to 75% (Nwanfor and Banigo, 2001), and the sickle cell trait (HbAS) 20 to 30% in Nigeria (Reid and Famodu, 1988).The importance of the knowledge of the blood groups and genotypes in regards to the health of an individual is enormous. The different types of information are useful for medical diagnosis, genetic information, genetic counseling and also for the general wellbeing of individuals.

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