Nigerian Journal of Physiological Sciences 23 (1-2):5 - 8 ©Physiological Society of Nigeria, 2008.
Available online/abstracted at http://www.bioline.org.br/np; www.ajol.info/journals.nips; www.cas.org

DISTRIBUTION OF ABO, RHESUS BLOOD GROUPS AND HAEMOGLOBIN ELECTROPHORESIS AMONG THE UNDERGRADUATE STUDENTS OF NIGER DELTA UNIVERSITY NIGERIA

U. G. EGESIE, O. J. EGESIE[1], I. USAR[2] AND T. O. JOHNBULL[3]

Departments of Human Physiology, Haematology[1] and Pharmacology[2], University of Jos, Jos, Nigeria
Department of Anatomy[3] Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria

Summary: The distribution of ABO, Rhesus blood groups and haemoglobin electrophoresis among 200 undergraduate students of Niger Delta University, Bayelsa State, Nigeria randomly selected were studied. Blood samples were collected by venepuncture from the antecubital vein. The blood sample were transferred into EDTA bottle and mixed. The determination of the ABO, Rhesus (RhD) blood groups and haemoglobin electrophoresis was done. The results showed that blood group O had the highest percentage distribution of 49% followed by blood groups A and B with 22% respectively and the least percentage distribution was blood group AB which is 7%. Rh-D positive rate was 98% and that of Rh-D negative was found to be 2%. The percentage distribution for the haemoglobin electrophoresis pattern for HbAA, HbAS, HbSS, HbAC and HbSC were 66%, 26%, 2%, 2%, and 4% respectively. HbAA and HbAS occurred more frequently than other haemoglobin variants in this study.
Key words: *ABO and Rhesus blood groups, Haemoglobin electrophoresis.*

Introduction

ABO and Rhesus blood groups are among the most important blood groups clinically (Seeley et al, 1998). 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 transfusion reaction and death (Honig and Bore, 1980). Also, the presence of Rhesus blood group was recognized in 1939 and it was confirmed within few years (Landsteiner and Weiner, 1940). With the ABO blood group individuals are divided into four major blood groups namely, A, B, AB and O, according to the presence of antigens and agglutinins. Group A blood has type A antigens, group B blood has type B antigens and group O blood has neither A nor B antigens. Also plasma from blood group A contains Anti-B antibodies which act against type B antigens, whereas plasma from type B blood contains Anti-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). It is a well known fact that the ABO blood groups are not found in equal numbers. In Caucasians in the United States, the distribution is group O, 47%, group A, 41%, group B, 9%, and AB, 3%. Among the African Americans the distribution is group O, 46%, group A, 27%, group B, 20% and group AB, 7%. In the Orientals the distribution is group O, 36%, group A, 28%, group B, 23%, and group AB, 13% (Pramanik and Pramanik, 2000). In Ogbomosho, Oyo State Nigeria, 50% of the Population are blood group O, 22.9% blood group A, 21.3% group B, and 5.9% group AB (Bakare *et al,* 2006).

One of the antigens on the surface of red blood cells, the Rhesus antigen (named because a related antigen was first discovered in Rhesus monkeys), is found on the red cells of approximately 85% of the people of United States. This is the second most important blood group system due to its immunogenicty in RhD negative individuals in blood transfusion or pregnancy (Dennis *et al* 1998). People are positive if they have RhD antigen on the surface of their red cells and are Rh negative if they do not have this antigen. Rhesus incompatibility can pose a major problem in pregnancies when the mother is Rhesus negative and the foetus is Rhesus positive. If fetal blood leaks through the placenta and mixes with the mother's blood, the mother becomes sensitized to Rhesus antigen. The mother produces Rh antibodies that cross the placenta and cause agglutination and haemolysis of fetal red blood cells. This is called haemolytic disease of the newborn (HDN) and its severity may worsen in subsequent pregnancies if not properly managed (Dennis et al, 1998). RhD antigen distribution varies from one population to the other. RhD negative blood group is documented as 5.5% in South India, 5% in Nairobi, 4.8% in Nigeria, 7.3% in Lahore, 7.7% in Rawalpindi (Bhatti and Amin 1996; Mawuagi, 1999). About 95% of African Americans are RhD positive.

The haemoglobin contained in a quantity of blood accurately reflects the functional competence of the blood to supply oxygen to the tissue (Weatherall,

2000). The structural abnormality may cause premature red blood cell destruction, easily denatured haemoglobin, haemoglobin with abnormal oxygen affinity, altered solubility and in some instances reduced globin synthesis. Sickle haemoglobin (HbS) differ 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 haemoglobin change from round to sickle shaped red cells. The sickle cell homozygote (HbSS) almost always suffers anaemia. The sickle cell trait (HbAS) is immune to malaria (Tamarin, 2002). There are several variants of sickle cell disease. These are called SS (individuals inherit one sickle gene from each parent), SC (the individual inherits one sickle cell gene and another abnormal type of haemoglobin called "C"), and S beta thalassaemia (the individual inherits one sickle cell gene and one gene for beta thalassaemia). The clinical course of sickle cell disease is extremely variable. The World Health Organization estimated that 7% of the world population is carriers of HbS (WHO, 1972). This study, determined the distribution ABO and Rh blood group and the frequency of distribution of haemoglobin electrophoresis among a section of students of Niger Delta University Bayelsa State, Nigeria.

Materials and method

Collection of Blood Sample:

A total of 200 students aged 16 – 26 years, were randomly selected from among registered students of the Niger Delta University, Bayelsa State Nigeria. Blood samples were collected by venepuncture from the antecubital vein. The blood was transferred into prepared ethylenediamine tetracetic acid (EDTA) anticoagulant bottle.

ABO and Rh Blood Group Tests:

The ABO and Rhesus blood grouping were done using the tile method. A drop of blood from each student was placed on a clean white tile in three places. A drop of each of the antisera, anti A, and anti B and anti D was added and mixed with each blood sample with the aid of glass rods. Blood groups were determined on the basis of agglutination.

Haemoglobin Electrophoresis:

Haemoglobin electrophoresis was determined using cellulose acetate electrophoresis technique was used. A small quantity of venous blood was placed on a tile and mixed with three drops of water to lyse the red cells. With the aid of an applicator, the haemolysate was placed on the cellulose acetate paper. Electrophoresis in Tris buffer solution was for 15 – 20 minutes at e.m.f. 250v. Haemolysates from blood samples of known Hb AS and AC were run as control.

Statistical analysis

Statistical analysis was done using Chi-Square to determine statistical significance at P- value of < 0.05.

Results

Two hundred students were randomly selected from among registered students of Niger Delta University Bayelsa State, Nigeria. This consisted of 124 males and 76 females between the ages 16 and 26. The distribution of the blood groups A, B, and O is shown on Table 1. There is significant difference in the distribution of blood groups between the male and female students. The distribution of RhD positive and RhD negative varies among the ABO blood groups. There are significant differences in the distribution of RhD positive and negative among the groups as own in Table 2.

The distribution of the various haemoglobin electrophoresis obtained in this study are shown in table 3. There is significant difference in the distribution of haemoglobin electrophoresis among the male and female students. The highest percentages are among students with haemoglobin HbSS, HbAA, and HbSC. The percentage of males that are HbAA and HbAS are more than the corresponding females.

Table 1: ABO Blood Group Distribution among the Students (n = 200).

Sex	*A*	*B*	*AB*	*0*	*TOTAL*
Male	26 (13%)	28 (14%)	8 (4%)	62 (31%)	124
Female	18 (9%)	16 (8%)	6 (3%)	36 (18%)	76
Total	44 (22%)	44 (22%)	14 (7%)	98 (49%)	200

There is no significant relationship between male and female students in their blood group. Chi-square value = 0.415 and P-value = 0.9372 which is greater than 0.05.

Table 2: RhD blood group distribution among the Students (n = 200).

ABO Blood Group	**RhD Positive*	** RhD Negative*
A	42 (21%)	2 (1%)
B	44 (22%)	0
AB	14 (7%)	0
O	96 (48%)	2 (1%)
Total	196 (98%)	4 (2%)

* There is no significant difference between Rhesus positive and Rhesus negative students.

Table 3: Haemoglobin electrophoresis pattern among the Students (n = 200).

Sex	*HbAA*	*HbAS*	*HbSS*	*HbAC*	*HbSC*
Male	80	28	2	0	4
	(14%)	(14%)	(1%)	(0%)	(2%)
Female	52	24	2	4	4
	(26%)	(12%)	(1%)	(6%)	(2%)
Total	132	52	4	4	8
	(66%)	(26%)	(2%)	(2%)	(4%)

There is no significant difference between Male and Female in haemoglobin electrophoresis pattern

Discussion

From this study, the distribution of blood group O was the highest with percentage frequency of 49%, followed by blood group A and B with percentage frequency of 22% respectively and the least percentage frequency is that of blood group AB which is 7%. Normally, 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 group O, 47%, group A, 41%, group B, 9% and group AB, 3% (Seeley et al, 1998). Among Western Europeans 42% are group A, 9% group B, 3% group AB and the remaining 46% group O. For blacks in United States, the distribution is group O, 46%, group A, 27%, group B, 2%, and group AB, 7%. (Seeley et al, 1998). Similarly, in Pakistan, blood group O is the most common (35%), blood group A is 24%, blood group B is 33% and blood group AB is 8%. In Lagos Nigeria, blood group O is 55.3%, blood group A, 25.3%, blood group B, 16.7% and blood group AB, 2.7% (Adeyemo et al, 2006). Thus, the segregation of the genes responsible for the ABO blood groups has always taken a particular pattern for its distribution. In this study, it can be seen that blood group AB has the least percentage; which is most of the time very rare and also the case in other previous studies.

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 a percentage frequency of 48%, which is followed by group B RhD positive with the percentage frequency of 22%, blood groups A RhD positive is 21% and AB RhD positive 7%. This study showed a total percentage of RhD positive distribution of 98% and RhD negative distribution to be 2%. Similar pattern of distribution is also observed in other studies. RhD negative blood group is documented as 5.5% in south India, 5% in Nairobi Kenya, 4.5% in Nigeria, 7.5% in Lahore, 7.7% in Ralwalpindi studies (Das *et al*, 2001; Mawuagi, 1999; Omatade *et al*, 1999; Majeed and Hayee, 2002; Bhatti and Amin, 1996).

In this study, the percentage distribution for HbAA, HbAS, HbSS, HbAC and HbSC were 66%, 26%, 2%, 2% and 4% respectively. The observed frequency of HbAA and HbAS being significantly higher than other haemoglobin variants in this study is in agreement with previous reports that the normal haemoglobin (Hb AA), ranges from 55 to 75% (Nwafor and Banigo, 2001; Egesie *et al*, 2003). The distribution of sickle cell trait (HbAS) is 20 - 30% in Nigeria (Reid and Famodu, 1988; Egesie et al, 2003; Adeyemo, *et al,* 2005). Knowledge of the distribution of ABO, Rh blood groups and haemoglobin electrophoresis among any population is useful in health care planning and appropriate allocation of resources, while counselling targeted at appropriate persons ensures the general well being of the individuals or people.

References

Adeyemo OA, Soboye JO, Omolade B, (2006). Frequency distribution of ABO, RH blood groups and blood genotype among cell biology and genetics students of University Lagos, Nigeria. *African J. Biotech.* 5: (22) 2062 – 2065.

Ali N, Anwar M, Bhalti FA, Nadeem A, Ali M, (2005). Frequency of ABO and Rh blood groups in major ethnic groups and casts of Pakistan. *Pakistan J. Med Sci.* 21 :26 – 29.

Advert ND (1999). The Rhesus blood group system:, insight from recent advances in molecular biology. *Transfusion medicine Rev*. 13:245 – 266.

Bakare AA, Azeez MA, Agbolade JO (2006). Gene freqencies of ABO and rhesus blood groups and haemoglobin variants in Ogbomoso, South-West Nigeria. *Afr. J. Biotechnol*. 5(3):224 – 229.

Bhalti FA, Amin A, (1996). Spectrum of ABO and D blood groups of donors at Rawalpindi/IsIamabad. *Pakistan J. Pathol*. 7(2):26 – 28.

Dennis YM, Hylem NM, Fidler C, Sargent IL, Murphy MF, Chamberlain PF,(1998). Prenatal diagnosis of fetal RhD status by molecular analysis of maternal plasma. *New Engl. J. Med*. 337:1734 – 1738.

Egesie UG, Aji, JP, Egesie OJ, (2003) Prevalence of Haemoglobin S on the Jos Plateau. *J Med in the Tropic*s 5: (2); 41 – 44.

Honig CL, Bore JR (1980). Transfusion associated fatalities: A review of Bureau of Biologic

reports 1976 – 1978. *Transfusion.* 20:653 – 661.

Landsteiner K, Weiner AS (1940). An agglutinable factor in human blood recognized by immune sera for rhesus blood. *Proc. Soc. Exp. Biol. Med*. 43:223 -224.

Mawuagi J (1999). Blood group distribution in an urban population of patient targeted blood donors. *East Afr. Med. J.* 76(11):615 -618.

Nwafor A, Banigo BM (2001). A comparison of measured and predicted State. *Nig. J. Appl. Sci. Environ Mangt.* 5(1):79 -81.

Omotade OO, Adeyemo AA, Kayode CM, Falade SL, Ikpeme S (1999). Gene frequencies of ABO and Rh (D) blood group alleles in a healthy infant population in Ibadan, Nigeria. *West Afr. J. Med.* 18:294-297.

Pramanik T, Pramanik S (2000). Distribution of ABO and Rh blood groups in Nepalese students: a report. *Eastern Mediterranean Health J.* 6(1):156 –158.

Seeley RR, Stephens TD, Tate P (1998). *Anatomy and Physiology*. 4th edition. The McGraw Hill Companies, Inc. USA p. 1098.

Tamarin RH (2002). *Principles of Genetics*. 7th edition. The McGraw Hall Companies, Inc., U.S.A. p. 609.

Weatherall D J (2000). Genetic disorders of Haemoglobin In: *Post graduate Haematology*. 4th Edition. Hoffbrand, V. A. Lewis, S.M. Tuddenham E.G.D(eds). Arnold London. P 91 – 119.

WHO (1972). Nutritional anaemia. WHO Tech. Rep Ser. 503.