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Full Length Research Paper

Frequency distribution 0f ABO, RH blood groups and blood genotypes among the cell biology and genetics students of University of Lagos, Nigeria

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One hundred and fifty students (150) were randomly selected from the Department of Cell Biology and Genetics of University of Lagos, Akoka, Nigeria for ABO, RH blood groups and 6 haemoglobin genotypes studies. Blood group O was the highest with the percentage frequency of 55.3%, followed by blood group A (25.3%), B (16.7%) and the least percentage frequency was blood group AB which is 2.7%. The RhD distribution also varies among the four (4) ABO blood groups. The total percentage of RhD positive was 94% and that of RhD negative was found to be 6%. When the students were screened for haemoglobin genotypes the percentage frequency for the haemoglobin genotypes for HbAA, HbAS, HbSS, HbAC, HbSC were 70%, 26%, 1.3%, and 0.7%, respectively.

Key words: Rhesus factors, haemoglobin, genotype, blood groups.

INTROODUCTION

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 100 years, 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). Furthermore, the presence of Rhesus system was recognized in 1939 and it was confirmed within few years (Landesteiner and Weiner, 1940).

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 addition, 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).

The ABO blood types are not found in equal numbers. In caucasians in the United States, the distribution is type O, 47%; type A, 41%; type B, 9%; and type AB, 3%. Among African American, the distribution is type O, 46%; type A, 27%; type B, 20%; and type AB; 7%. Among Western Europeans, 42% have group A, 9% group B, 3% group AB and the remaining 46% group O (Pramanik and Pramanik, 2000). Also among 7653 individuals in Ogbomoso, Oyo State, Nigeria, 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).

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

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Table 1. ABO blood group distribution among the 150 male and female students of Department Cell Biology and Genetics of University of Lagos, Nigeria.

SEX	A	B	AB	O	TOTAL
Male	17 (11.3%)	4 (2.7%)	1 (0.7%)	31 (20.6%)	53
Female	21 (14%)	2 1(14%)	3 (2%)	52 (34.7%)	97
Total	38 (25.3%)	25 (16.7%)	4 (2.7%)	83 (55.3%)	150

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). Rh – D distribution also varies worldwide. Rh-D 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 (Mwangi, 1999; Omotade et al., 1999; Bhatti and Amin, 1996). About 95% of African – Americans are Rh-positive whereas indigenous Africans are virtually 100% Rh-positive.

Sickle cell haemoglobin (Hb^S) differs from normal haemoglobin (Hb^A) 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. The sickle cell homozygote (Hb^SHb^S) almost always dies of anaemia. The sickle cell heterozygote (Hb^AHb^S) is only slightly anaemic and has resistance to malaria (Tamarin, 2002). The normal homozygote (Hb^AHb^A) is not anaemic and has no resistance to malaria. Thus, in areas where malaria is common, the fit genotype of the three appears to be the sickle cell heterozygote, which has resistance to malaria and only a minor anaemia.

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"), and S-beta thalassemia (the child inherits one sickle cell gene and one gene for beta thalassemia, another inherited anaemia). The clinical course of sickle cell disease is extremely variable (Platt et al., 1991). Some patients have nearly no symptoms. Others are severely incapacitated (Bray et al., 1994). This paper presents the frequency distribution of ABO and Rh blood groups and the frequency distribution of blood genotypes among a section of students of University of Lagos, Nigeria.

MATERIALS AND METHOD

Collection of blood samples

A total of 150 students were selected randomly from among registered students of the Department of Cell Biology and Genetics, University of Lagos, Akoka, Lagos, Nigeria. Blood samples were collected by venopuncture method. The blood was transferred into the prepared ethylenediaminetetriacetic acid (EDTA) anticoagulant bottle.

ABO and Rh blood groups tests

For the ABO and Rh tests, 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, anti B and anti D obtained from Helena laboratories, Beaumont, Texas was added and mixed with each blood sample, with the aid of glass rods. Blood groups were determined on the basis of agglutination.

Blood genotype test

For the study of the blood genotype, cellulose acetate electrophoresis technique was used to determine haemoglobin genotype. A small quantity of venous blood was placed on a tile and mixed with three drops of water to lyse. With the aid of an applicator, the haemolysate was placed on the cellulose acetate paper. Electrophoresis in Tris buffer solution was for 15-20 min at an e.m.f of 230V. Haemolysates from blood samples of known genotypes were run as control.

RESULTS

One hundred and fifty students (150) were randomly selected among the students of Department of Cell Biology and Genetics and tested. This consisted of 97 females and 53 males between ages 16 and 25. The frequency distribution of the blood groups A, B, AB, and O is shown in the Table 1. There are significant differences in the distribution of blood groups between the male and female students.

The frequencies of RhD groups are shown in Table 2. The RhD^+ and RhD^- distribution varies among the four (4) ABO blood groups. The percentages of the various haemoglobin genotypes obtained in this study are shown in Table 3. The percentages vary significantly. The high-est percentage was found with genotype Hb AA (70%) and the lowest frequencies occurring with the haemo-globin genotypes HbAC, HbSS, HbSC and HbCC. Table 3 also indicates the frequency of haemoglobin genotypes in

Table 2. RhD distribution among the students of Department Of Cell Biology and Genetics, University Of Lagos, Nigeria based on ABO blood group (n= 150).

ABO blood group	Rh D positive	RhD negative
A	35 (23.3%)	3
B	22 (14.6%)	3
AB	4 (2.6%)	-
O	80 (53.3%)	3
TOTAL	141 (94%)	9 (6%)

Table 3. Six (6) haemoglobin genotypes distribution among the male and female students of Department of Cell Biology and Genetics University of Lagos, NIgeria (n = 150).

SEX	HbAA	HbAS	HbAC	HbSS	HbSC	HbCC
Male	37 (24.7%)	11 (7.3%)	2 (1.3%)	1 (0.7%)	1 (0.7%)	1 (0.7%)
Female	68 (45.3%)	28 (18.7%)	- -	1 (0.7%)	- -	- -
Total	105 (70%)	39 (26%)	2 (1.3%)	2 (1.3%)	1 (0.7%)	1 (0.7%)

in males and females. The percentage of females that are HbAA and HbAS are more than corresponding percentage of males.

DISCUSSION

From this study, the frequency of blood group O was the highest with percentage frequency of 53.3%, followed by blood group A with the percentage frequency of 25.3%, blood group B with the percentage of 16.7% and the least percentage frequency is that of blood group AB which is 2.7%. 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 addition, it can be seen from the study that blood group AB has the least percentage; AB has the least percentage which is most of the time very rare and also similarly the case in other previous studies.

Rh-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 frequency of 53.3% which is followed by group A Rh-D positive with the percentage frequency of 23.3%, blood groups B Rh-D positive is 14.6% and AB. Rh-D positive 2.6% (Table 2). In overall, the total percentage of RhD positive was 94% and that of RhD negative was found to be 6%.Over the years, the Rh blood group systems has been distributed among any population to keep the frequency 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).

From the 150 students screened for this study, the percentage frequency for the haemoglobin genotypes for HbAA, HbAS, HbSS, HbAC, HbSC were 70%, 26%, 1.3%, and 0.7% respectively (Table 3).The ratio of HbAA to HbAS was 5:2, HbAA to HbSS, 50:1 and HbAA to HbAC; 50:1, the ratio of HbAS to HbCC, 2:1 and HbSS to HbSC was 2:1. Moreover, the observed high incidence of HbAA and HbAS in this study, though the frequency 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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