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Research Article

Spectrum of ABO, D and Secretor Blood groups among residents of Iwollo community, of South Eastern Nigeria.

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Abstract: One thousand, eight hundred and eighty four volunteers who reside in Iwollo community of Ezeagu Local Government Area of Enugu State, South East Nigeria were screened for ABO, Rhesus and Secretor blood groups. Group AB had the least percentage frequency in ABO distribution (2.96%) followed by group B (9.03%) then group A (40.03%) while group O had the highest percentage frequency of 47.98%. Group D +ve were 97.84% while D -ve were 2.16%. Secretors and non-secretors gave percentage frequencies of 78.03 and 21.97% of the subjects respectively.

Key Words: Percentage frequency, blood group, rhesus, secretors.

Introduction

Blood transfusion has been in practice for quite a long time. Infact it had been going on before the eighteenth century. Death of the recipient often ensued without any definite reason. (Okafor *et al*, 2009). Landsteiner (1901) observed that some people's erythrocytes would mix smoothly with the plasma of certain people, while in others, the same erythrocytes would form clumps or agglutinate. By that simple experiment, he discovered that all humans have inherited two blood antigens (called agglutinogens A and B). Those who inherit the A agglutinogen belong to A group; those who inherit B agglutinogen belong to B group, those with both A and B agglutinogens are the AB group, while those who inherit neither of the two agglutinogens are the O group.

Humans have also inherited two types of blood antibodies (or agglutinins) that are known to fight the A and B agglutinogens of any foreign or transfused blood but not their own inherited agglutinogens. These *a* and *b* agglutinins are responsible for death of recipient during transfusion. Group A people have the A agglutinogens in their erythrocytes but have the *b* agglutinins in their plasma. Group B people have the B agglutinogens and the *a* agglutinins. Group AB people have both A and B agglutinogens, but have neither of the *a* and *b* agglutinins. Group O people have no A and B agglutinogens but have both *a* and *b* agglutinins. (Ali and George, 1998).

The four blood groups are not equally distributed in any given population. Amongst the Caucasians of United States, the distribution is Group AB, 3%, Group B, 9%; Group A, 41% while O is 47% (Adeyemo and Soboyejo, 2006). Among African Americans, the distribution is type AB, 7%, type B, 20%, type A, 27% while type O is 46% (Adeyemo and Soboyejo, 2006). Among the Caucasians of Great Britain, the gene frequencies are Group AB, (3%), Group B (8%), Group A (42%) while Group O is (47%) (Petrov, 1987). In Russia it was found that 8% were AB, 23% were B, 33% were O; while 36% were A. (Petrov, 1987).

The Rhesus system was discovered by Landsteiner and Weiner (1940) as the second, most vital blood group system due to the type of babies born by Rh-ve mothers who suffer from haemolytic disease of newborn (HDN).

These Rh-ve mothers who were married to, or were impregnated by Rh +ve men gave births to these HDN babies at second births onwards, after they must had developed rhesus antibodies during first birth, previous abortion or transfusion. People who have inherited the D antigens are Rh +ve, while the other alleles, C, c, d, E, e are all Rh –ve. (Matthew *et al*, 2005).

The incompatibility in transfusion arises when a Rh –ve person receives a second transfusion from a Rh +ve person. The first transfusion would lead to the development of *anti – rhesus* in the blood of the Rh –ve recipient. There is no *anti-rhesus* development when a Rh +ve person receives blood, no matter the number of times, from either a Rh –ve or Rh +ve person. The incompatibility in childbirth ensues when a Rh – ve mother who previously gave birth to a Rh +ve baby becomes pregnant again for another Rh +ve baby. There is no fear of producing HDN baby when a Rh –ve man marries either a Rh –ve or Rh +ve woman. Also there is no fear or worry if the wife is Rh +ve while the husband is either Rh –ve or Rh +ve. The main problem usually arises when a Rh +ve man marries a Rh –ve woman and they wish to have more than a baby (unless it is their wish or agreement not to produce children of their own conception). If the baby happens to be Rh +ve, then it is most likely that there would be the development of *anti – rhesus* after the birth of this baby, which would be destroying all subsequent Rh +ve babies in the uterus of the Rh –ve mother. This is because during delivery, as the placenta is being separated from the uterus, there is some bleeding and the baby's blood carrying the Rh antigens enter the blood stream of the Rh –ve mother so that *anti-rhesus* develops in the mother's blood. It is as if the Rh –

ve mother received transfusion from her Rh +ve baby.

A Rh+ve person could be either RR or Rr (where R is dominant to r) while a Rh-ve person is rr. If the husband is Rr while the wife is rr, then, there is the probability that some of the kids could be Rh+ve while some are Rh-ve. If the husband is RR and the wife is Rh negative (rr)all the offspring would be Rh+ve. If the Rh-ve mother gave birth to as Rh+ve baby and anti rhesus developed, but the subsequent baby happens to be Rh-ve, the *anti rhesus* would not fight it.

However, the drug called RhoGam (Rh immune globulin) which was discovered about 50 years ago is now given to Rh-ve mothers that gave birth to Rh+ve babies (or Rh-ve persons who received transfusion from Rh+ve persons)within less than 72 hours after the delivery or transfusion. This drug binds the rhesus antigens that entered the blood of Rh-ve mothers (or Rh-ve blood recipients) and thereby prevents the development of *anti-rhesus*

The distribution of Rhesus antigens also varies amongst races. The Caucasians are 85% Rhesus +ve and 15% Rhesus –ve (Guyton and Hall, 2011). The Blacks in Kenya are 95% Rhesus +ve and 5% Rh -ve (Mawuagi, 1999).

The saliva, semen, gastric juice, eye secretions and other body secretions of secretors (SeSe or Sese) contain the H substance as well as the A and B agglutinogens. One allele, Se codes for the synthesis of the enzyme, **fucosyl transferase**. (Tamarin, 2002). Non secretors (sese) do not synthesize fucosyl transferase and consequently do not secrete either the H substance or the A and B agglutinogens in their body secretions.

The frequency distribution of secretors/non-secretors also varies. About 80% of Caucasians are secretors while 20% are non-secretors (Walter and Israel, 1987).

There are a few studies that had been carried out on frequency distribution of ABO blood groups and Rhesus antigens in some communities in Nigeria and other African countries (Mawuagi, 1999; Okafor *et al*, 2009). However, studies on the frequency distribution of secretors and non-secretors status in African communities are very scanty indeed.

The present report therefore determines more precisely the frequency distribution of ABO, rhesus antigens and secretors status amongst residents of Iwollo/Oghe community in Ezeagu Local Government Area of Enugu State, Nigeria. The information obtained would be of great value to biologists, anthropologists, clinicians, marriage counsellors, population studies and to the society in general.

MATERIALS AND METHODS

One thousand, eight hundred and eighty four volunteers, who were residents of Iwollo/Oghe community in Ezeagu Local Government Area of Enugu State, Nigeria were used for the survey. After ethical clearance from relevant authorities, their blood samples were tested.

Tests for A, B, AB, O and D blood groups

Three anti-sera, a, b, and D were obtained from the Physiology Laboratory in the Department of Zoology and Environment Biology of Abia State University, Uturu Campus. Two drops of each of the three anti-sera were placed on three separate glass slides. A drop of blood of each subject was placed on top of each antiserum on a slide and mixed with a separate glass rod.

Visible agglutination with *anti – a*, but not with *anti-b*, is an indication of A blood group. Agglutination with *anti-b*, but not with *anti-a*, is an indication of B blood group. Agglutination with both *anti-a* and *anti-b* respectively is an indication of blood group AB. Non-agglutination with each of *anti-a* and *anti-b* is an indication of blood group O.

Agglutination with anti-D when viewed under a light microscope is an indication of Rh +ve, (D+ve) while non-agglutination indicates Rh-ve (D-ve).

Test for Secretors

Type A secretors were identified by mixing two drops of *anti-a* serum with two drops of the subject's saliva before adding two drops of the subject's blood sample. Agglutination was an indication of non-secretor, while non-agglutination, a secretor.

Similarly, type B secretors were identified by mixing two drops of *anti-b* serum with two drops of the person's saliva, before the addition of two drops of the person's blood sample. Agglutination indicates a non-secretor, while non-agglutination, a secretor.

Type AB secretors were identified by mixing two drops of both *anti-a* and *anti-b* sera with two drops of the subject's saliva and then two drops of the subject's blood. Agglutination indicates a non-secretor, while non-agglutination, a secretor.

Type O secretors were detected by mixing two drops of *anti-h* extract (prepared from the plant, *Lotus tetragonolubus* that grew in Iwollo/Oghe bush) with two drops of the person's saliva, before the addition of two drops of the person's blood. Agglutination indicates non-secretor, while non-agglutination, a secretor.

Results

The gene frequencies of the ABO blood groups, D antigens and secretor status are shown in Table 1. Blood group AB had the least frequency (2.9%) followed by B (9.03%) A (40.03%) and 0 (47.98%). Subjects with D +ve antigens were 97.84% while D –ve were 2.16%. Secretors and non-secretors constituted 78.03 and 21.97% of the subjects respectively.

Table 1

The distribution of ABO Blood types, D antigens and Secretor status amongst 1884 Iwollo/Oghe residents of South East, Nigeria

SEX	GROUP A	GROUP B	GROUP AB	GROUP O	D+ve	D –ve	Secretors	Non-Secretors
Males	278	62	18	336	658	16	532	148
Females	476	108	38	568	1186	24	938	266
Total	754	170	56	904	1844	40	1470	414

DISCUSSION

In this study, the frequency of blood types in ascending order was found to be: AB < B < A < O. The same order of frequency had been reported by Guyton and Hall (2011) for the Caucacoid race of the United States and Western Europe respectively. In Pakistan, the order of frequency was AB < A < B < O. (Ali *et al*, 2005). In many other races and ethnic groups, AB is usually the least encountered ABO blood group, followed by B, then A and finally type O blood which is always the most commonly encountered. (Guyton and Hall, 2011).

In Nepal, however, blood group A is most commonly encountered. (Pramanik and Pramanik, 2000). In a survey carried out in Nigeria by Alimba *et al* (2010) the ascending order of blood group frequency was AB < B < A < O. In India, the general trend was found to be AB < A < O < B (Khan *et al*, 2004). Bhatti and Shiekh (1999) reported a trend of AB < O < A < B. In some other studies carried out in Nigeria, the general trend is AB < B < A < O. (Bakare *et al*, 2006; Adeyemo and Soboyejo, 2006). The present data, however, is in accordance with most available data that majority of Nigerians belong to type O.

The high frequency of type O in most populations could be partly attributed to the fact that a reasonable percentage of A and B persons are heterozygotes, existing as AO and BO respectively. In a survey carried out on over two hundred A and B phenotypic Nigerian subjects, it was revealed that over 75% of them were positive for H substance (their blood samples resulted in visible agglutination with *anti-h*; showing that they were heterozygotes, AO and BO (Maduka, 2016). It is therefore expected that heterozygote type B parents, for instance, have the probability of producing B or O offspring. This is also applicable to heterozygote A parents. In addition, some people are born as "Bombay phenotypes" The latter are phenotypically group O persons, since their blood samples do not agglutinate with each of *anti-a* and *anti-b* sera respectively. They are homozygous recessives (hh) for the H gene, the precursor of A and B agglutinogens. Even though 'Bombay phenotypes' could be produced by A v/s AB, AB v/s AB, AB v/s B, or AB v/s O parents, which under normal circumstances are not supposed to produce O offspring, but since they fail to produce the dominant H gene responsible for the production of H substance, such individuals are phenotypically O.

The 'Bombay phenotype' persons produce iso-antibodies to H substance as well as to A and B agglutinogens. If they receive blood from O people, the anti-H antibodies will bind to H antigens on the erythrocytes of O donor causing agglutination by complement – mediated lysis. Therefore 'Bombay phenotypes' can receive blood only from other Bombay phenotypes (hh) donors, but they can donate blood to other O individuals as well as to A, B, and AB just like all O –ve persons in general (Carelli *et al*, 2004).

Almost always an individuals has the same blood group for life, but occasionally an individual's blood type can change through addition or suppression of an infection, malignancy or autoimmune disease (Kremer *et al*, 2007). Another common cause in blood type change is a bone marrow transplant which is performed for leukemia among other diseases. If a person receives a bone marrow from someone who is of different ABO type (e.g a type A patient receives a type O bone marrow) the recipient's "A" blood type would eventually convert to the O blood type of the donor.

There are some advantages of belonging to O blood type which is common in Nigeria as this study has shown. For instance, during an emergency when blood is urgently needed for transfusion, the O donor may be the easiest to get, and the blood is universally donatable. The disadvantage which an O person has, includes a higher risk of contacting cholera, plague, and suffering from peptic ulcers (Davey and Elebute, 1963). Group O persons are also more susceptible to *Plasmodium falciparum* malaria because their blood tastes so sweet to female *Anopheles* mosquitoes (Garrantty, 2005). The second commonest blood group in this study (type A) has its disadvantage of being mostly associated with stomach cancer (Arid *et al*, 1954).

The study also revealed that 97% of the subjects are D +ve. The white race in the United States, have D +ve: D –ve ratio of 17:3 (Guyton and Hall, 2011). The Caucasians of Europe have D+ve: D-ve ratio of 13:7 (Mollinson, *et al*, 1997) D-ve has a 5.5% frequency in South India, 5% in Nairobi – Kenya, 7.3% in Lahore and 7.7% in Ralwalpindi (Bhalti and Amin, 1996). In Asia D-ve is 1% (Avent, 1999). So the case of HDN was more common among the Caucasians than in Blacks or Mongoloids before the discovery of the drug, *Rh immune globulin*.

Since in the study, 2.16% of the subjects were D-ve while the rest were D+ve, it is advisable for intending couples at Iwollo/Oghe community and in Nigeria in general to seek the advice of genetic counsellors before or even after marriage in order to prevent the occurrence of antibody mediated cytotoxic disorder. The major importance of the Rh system to humans is in the avoidance of danger of Rhesus incompatibility between mother and foetus. This incompatibility called HDN is an antibody mediated cytotoxic disorder.

In this study also, the ratio of secretors: non-secretors status is 4:1. Secretors are known to have higher levels of 1gG and 1gA antibodies than non-secretors. This perhaps, explains the link between non-secretor status and an increased susceptibility to bacterial infections (Lomberg *et al*, 2006). Non-secretors are at a greater risk for recurrent UTIs (Urinary Tract Infections) as well as increased inflammation (Morgan and Watkins, 2004). As a general rule, a higher intensity of oral disease and dyeplasia cavities, digestive problems, peptic ulcers and low resistance to infections are found to be more common amongst non-secretors (Lomberg *et al*, 2006). Several workers have suggested that a non-secretor is predisposed to damaging effects of the heart and lungs, while a secretor has some protection against harmful environmental hazards on the heart and lungs. (Haton *et al*, 2009). Secretors appear to have a certain degree of protection against some of the deleterious effects of cigarette smoking (Haton *et al*, 2009). Many coal miners who suffer asthma are non-secretors (Korge *et al*, 2007). Non-secretors are at greater risk of developing diabetes, especially the maturity-onset insulin independent type. (Mehta *et al*, 2006). Non-secretors are also at a greater risk of developing complications due to diabetes (Mehta *et al*, 2006). Alcoholism has been associated with non-secretor blood groups. (Cruz, 2000) The key principle with the use of alcohol is for non-secretors, and every other person is moderation (Cruz, 2000). Non-secretors are much more likely to be carriers of *Candida* species, and to have problems with persistent infections. Blood group O, non-secretors might be the most affected of the non-secretor blood types since *Candida* species appear to find it easier attaching to the skin of type O persons especially the type O, non secretors (Glass *et al*, 2005).

Since about eighty percent of Iwollo/Oghe residents were detected to be secretors, rapists and other people with criminal tendencies could be detected in forensic laboratories through their saliva, semen, sweat, dandruff etc.

The essence of knowledge of blood groups and their frequency distribution in a known locality would serve as valuable information in transfusion, medical diagnosis and treatment, medical statistics, settling of paternal disputes, genetic counselling and forensic medicine.

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