

The Distribution of ABO and Rhesus Blood Groups among Residents of Gusau, Zamfara State, North Western Nigeria.

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Research Article

ABSTRACT

The prevalence of ABO and Rhesus blood groups varies from race to race. The study was designed to determine the distribution of ABO and Rhesus (Rh) blood group among residents of Gusau, Zamfara State in North Western, Nigeria. ABO and Rhesus phenotyping was carried out using standard tube techniques using Biorad Seralclone anti-A, anti-B, anti-AB and anti-D reagents (Bio Rad Medical Diagnostics, Germany). Of the 500 subjects screened, 227(55.4%) were of blood group O, 119(23.8%) were blood group B, 88(17.6%) group A and 16(3.2%) group AB. Of the 500 subjects tested, 494 (98.8%) were Rh D positive while 6(1.2%) were Rh D negative. The distribution of ABO blood groups were compared based on gender. Prevalence of ABO blood group was significantly higher among male donors (12.6%, 12.8, 2.0 and 45.4) compared to (5.2%, 11.8, 1.2 and 10.0%) for female donors respectively for ABO blood group A, B, AB and O. Similarly Rhesus blood group distribution was compared based on gender. Men had a higher prevalence of Rh positive and negative groups compared to female (26.20% and 0.40%) versus (72.60% and 0.80%) respectively. The pattern of distribution of ABO blood groups among Gausa residents appeared to be at variant with other populations in Nigeria and other countries. Evidence -based data obtained in this study will facilitate the optimum stocking of blood and blood products in Blood banks in the area as well as facilitate the formulation on relevant transfusion policies.

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INTRODUCTION

The human red blood cell (RBC) membrane is complex and contains a significant number of blood group antigens, the most clinically significant being the ABO and the Rhesus antigens. The ABO blood group system is based on the presence of antigens A and B. Four major groups (A, B, AB and O) exist based on the presence of these antigens either singly (A, B), doubling (AB) or absence of both antigen (O). Individuals who have the antigens A and B on their red cells lack the group specific agglutinins in the serum [1, 2, 3]. The major determinant of the Rhesus blood group is the D antigen. Individuals who have the D antigen on their red cells are known as Rhesus positive while those without antigen D in their RBC's are Rhesus negative [4]. The clinical significance of the ABO and Rh blood group system depends on the ability of agglutinins of both blood group systems to cause haemolytic transfusion reaction and haemolytic disease of the foetus and newborn (HDFN) [5,6,7]. The prevalence of ABO and Rhesus blood groups varies from race to race. The type and stock levels of blood and blood products available in the hospital blood bank in any community should ideally closely correlate with the distribution of the clinically significant red cell antigens in the general population. Although the prevalence of the ABO and Rhesus blood has been reported in some ethnic groups in Nigeria [8,9,10], none has been carried out in Gusau in North Western Nigeria. Knowledge of the distribution of the various blood groups is also important in the formulation of relevant blood transfusion policies. Nigeria is the most populous country in Africa and accounts for approximately one-sixth of Africa's people. The country is diverse and has 389 ethnic groups. This aim of this present study was to

determine the prevalence of ABO and RhD blood group among 500 consecutively recruited subjects of African descent resident in Gusau, Zamfara State in the North West geopolitical zone of Nigeria.

MATERIALS AND METHODS

Study Population

This prospective case study was carried out in the Faculty of Medical Laboratory Science in Usmanu Danfodiyo University in Sokoto, North Western Nigeria. All the participants gave their written, informed consent and were offered pre- and post-test counseling. Ethical approval was obtained from the ethical committee in the Faculty. The aim of this present study was to investigate the prevalence ABO blood and Rh blood groups among 500 consecutively recruited subjects of African descent resident in Gusau, Zamfara State in the North West geopolitical zone of Nigeria.

Study Area

Gusau is a city and local government area located in Northwestern Nigeria. It is the capital of Zamfara State. The LGA has an area of 3,364 km² and a population of 383,162 at the 2006 census. Its population is mostly Hausa with some Fulani, Yoruba and Igbo.

Sample collection and methods

Blood samples were collected by venipuncture into ethylene diamine tetracetic acid (EDTA) anticoagulated tubes and used for the determination of ABO blood and Rh blood groups among 500 consecutively recruited subjects. Red cell phenotyping was carried out using standard tube techniques as described by Judd [11] and Brecher [12]. For ABO blood grouping, a drop of Biorad Seraclone anti-A, anti-B, and anti-AB (Bio Rad Medical Diagnostics, Germany) each was placed in clean test tubes labelled 1, 2, and 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 re-suspended and observed for agglutination. Agglutination of tested red cells constituted positive results and indicates that the red cells contain the group specific antigens. A smooth cell suspension after re-suspension followed by a microscopic confirmation constituted negative test results. For Rhesus D typing, a drop of Seraclone anti-D (RH1) blend serum (Bio Rad Medical Diagnostics, Germany) 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. 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. All negative results were confirmed using the indirect antiglobulin test (IAT) procedure (also for confirmation of weak D).

OBSERVATIONS AND RESULTS

Of the 500 subjects screened, 227(55.4%) were of blood group O, 119(23.8%) were blood group B, 88(17.6%) group A and 16(3.2%) were group AB. Table 1 show the percentage distribution of ABO blood groups in Gusau metropolis. Of the 500 subjects tested, 494 (98.8%) were Rh D positive while 6(1.2%) were Rh D negative. Table 2 show the percentage distribution of Rh blood groups. The distribution of ABO blood groups were compared based on gender. Prevalence of ABO blood group was significantly higher among male donors (12.6%, 12.8, 2.0 and 45.4) compared to (5.2%, 11.8, 1.2 and 10.0%) for female donors respectively for ABO blood group A, B, AB and O. Table 3 show the percentage of ABO blood groups in Gusau metropolis based on gender. Similarly Rhesus blood group distribution was compared based on gender. Men had a higher prevalence of Rh positive and negative groups compared to female (26.20% and 0.40%) versus (72.60% and 0.80%) respectively. Table 4 show the percentage of Rh blood groups in Gusau metropolis based on gender.

Table 1: Percentage distribution of ABO blood groups in Gusau metropolis

ABO Blood Group	Number (%)
A	88(17.60%)
B	119(23.80%)
AB	16(3.20%)
O	277(55.40%)
Total	500 (100%)

Table 2: Percentage distribution of Rhesus blood groups in Gusau metropolis

Rhesus Group	Number (%)
Rh Positive	494 (98.80%)
Rh Negative	6(1.20%)
Total	500(100%)

Table 3: Percentage of ABO blood groups in Gusau metropolis based on gender

ABO Blood Group	Gender		Total
	Male Number (%)	Female Number (%)	
A	62 (12.60%)	26 (5.20%)	88 (17.60%)
B	64 (12.80%)	55 (11.80%)	119 (23.80%)
AB	10 (2.00%)	6 (1.20%)	16 (3.20%)
O	227 (45.40%)	50 (10.00%)	277 (55.40%)
Total	363 (72.80%)	137 (21.20%)	500 (100%)

Table 4: percentage of Rh blood groups in Gusau metropolis based on gender

Rhesus (Rh) Blood Group	Gender	
	Male Number (%)	Female Number (%)
Rh positive	363(72.60%)	131(26.20%)
Rh negative	4(0.80%)	2(0.40%)
Total	367(73.40%)	133(26.60%)

DISCUSSION

The ABO blood group system is one of the most clinically significant blood group systems because of the regular occurrence of antibodies of the blood group system and ability of antibodies of the system to cause haemolytic transfusion reaction and HDFN. The prevalence of ABO blood groups varies from race to race. In this present study, we observed that 55.4% of subjects were blood group O, 23.8% were blood group B, 17.6% were group A and 3.2% were group AB. Gene frequencies with respect to the ABO system for the present study has shown a general formula $O > B > A > AB$ indicating a preponderance of allele B over allele A. Our finding is consistent with previous report among Guinean population in which the frequencies of the genes A, B and O in the population were 14.70, 15.48, 69.83 respectively [13]. Our finding is however at variance with previous reports in other parts of Nigeria; Erhabor and colleagues [9], Jerimiah [14], Worledge and colleagues [15], Falusi and colleagues [16] and Omotade and colleagues [17] which investigated the prevalence of ABO and Rh blood groups and obtained a prevalence pattern ($O > A > B > AB$) among student of African descent in Port Harcourt, among students in the Niger Delta, among the Yoruba and Hausa ethnic groups, in five zone of Nigeria and in Ibadan respectively.

However, some Eastern Europeans have a higher proportion (up to 40%) of group B blood [18]. Ethnic American Indians belong exclusively to blood group O while American blacks generally demonstrate frequencies of O, A, B, and AB blood groups of 49%, 27%, 20% and 4%, respectively ($O > A > B > AB$)². Also a previous study to determine the frequency of ABO and Rh blood group antigens among 4,656 neonates born at a private hospital in Istanbul indicated that group A blood was detected most frequently followed by group O, group B, and group AB [19]. A study conducted to determine the frequency of ABO and Rhesus (Rh) blood groups in Pakistan indicated that group B was the predominant blood group [20]. The most frequent blood group in Saudis is O-positive. Blood group A is observed at a lower frequency relative to values from Western populations, whereas a significant increase in blood group B combined with a slight increase in blood group AB [21]. The gene frequencies among residents of Bangal, India with respect to ABO systems show a pattern ($O > B > A > AB$). Blood group O was the highest (35.8%) and the least percentage distribution was blood group AB (6.68%). The frequencies of A (+), B (+), AB (+), and O (+) blood in West Bengal, India were 22.44%, 33.61%, 6.58%, and 35.07%, respectively [22]. A study that evaluated the distribution of ABO and Rhesus (Rh) D blood groups in the population of Poonch district in Azad Jammu and Kashmir showed the same trend of prevalence as for the general Indian subcontinent ($B > or = O > A > AB$) [23]. ABO frequencies observed among Mauritanian population in a previous report were of the order of $O > A > B$ [24].

Previous reports [14,15,16,17] are however in agreement with the frequencies obtained in this study and confirm that group O is the predominant ABO blood group among Nigerians. There is however an exception to this rule. Previous report [25] among the Gwari tribe of Abuja and the Rubuka tribe of the Plateau state in Northern Nigeria has shown that blood group B was the predominant ABO blood group. The reason for this exception may be due to high rate of intra-tribal marriages prevalent among the Gwari and Rubuka tribe. The high prevalence of group

O observed in this present study among the people of Gusau in North Western Nigeria seems an advantage particularly in terms of optimizing the use of scarce blood resource by potentially utilizing the blood group O stock against ABO blood group barriers for patients of other blood groups (A, B and AB) particularly in emergency situations. Blood group O individuals lack ABO blood group antigens on their red cell and thus are termed universal donors. Such blood can potentially be transfused to patients of blood groups A, B and AB. However, there is a caveat to this rule and some level of caution need to be exercised. This is particularly true because the plasma of some blood group O blood individuals has been shown to contain high titer of potent A and B immune haemolytic antibodies (haemolysins) that can potentially cause the haemolysis of red cells containing antigen A and B. Evidence –based best practice in the developed world advocate for the routine testing of all blood group O donor blood for the presence of these α and β haemolysin and that those containing high titer haemolysin should be reserved specifically for group O patients only. Those samples which are negative for high titer haemolysin could be given to groups A, B, and AB individuals in emergency situations, when ABO group specific units are not immediately available.

The Rhesus blood group system is the second most clinically significant red cell antigen system after the ABO blood group system. Rh incompatible transfusions are also potentially fatal to health [26]. In this study, we observed the prevalence of Rhesus positive and negative among 98.8% and 1.2% respectively. Our finding is consistent with previous reports obtained among non-Caucasians. Erhabor and colleagues [9] in the Niger Delta of Nigeria observed that 93% of their subjects were Rhesus positive while the remaining 7% of the study population were negative. Egesie and co-workers [27] observed Rh-D positive and negative rates of 98% and 2% respectively among their cohort of undergraduate students in the Niger Delta of Nigeria. Similarly, 96.7% positive rate was recorded among the Ibos ethnic group of Eastern Nigeria by Ukaejiofor et al [28]. Other documented Rh-D positive rates includes; 95% by Jeremiah and coworkers [29] in Port Harcourt, 96.6% by Pramanik et al [48] in Nepal, 94% by Mwangi in Kenya [30], 93% by Bashwari et al [24] in the Eastern region of Saudi Arabia, 97.7% in West Bengal India [22], 95.94% in Guinea [43] and 92.8% by Sarhan et al [31] in Southwest of Saudi Arabia.

This percentage of Rh (D) negative observed in our study (1.2%) is significantly lower than the prevalence rate of >14% Rh (D) negative phenotype observed in studies among Caucasians [32,33]. There are several obstetric advantages associated with the low prevalence of D-negative in Gusau. The risk of Rh (D) alloimmunization will be of a much smaller magnitude than it is in most western countries where a significant proportion of the population lacks the major Rh (D) antigen. In such individuals, the chances of becoming sensitized to the D antigen following exposure either by transfusion of Rh(D) positive red cells or during pregnancy involving a Rhesus positive foetus is very high. Alloantibody D produced as a result of such immunization has serious clinical significance including haemolytic disease in the newborn and/or transfusion reactions. Despite the fact that the prevalence of Rh-negative phenotype is significantly lower among Africans compared to Caucasians, Rh alloimmunization remains a major factor responsible for perinatal morbidity in most developing countries for several reasons; lack of universal access and unaffordability of anti-D immunoglobulin, lack of anti-D prophylaxis in Rhesus negative women who have a potentially sensitizing events during pregnancy (amniocentesis, cordocentesis, antepartum haemorrhage, vaginal bleeding during pregnancy, external cephalic version, abdominal trauma, intrauterine death and stillbirth, in utero therapeutic interventions, miscarriage, and therapeutic termination of pregnancy), unavailability of prophylactic immunoglobulin D follow termination of pregnancy among Rhesus negative women and unavailability of FMH measurements following potentially sensitizing events during pregnancy.

In this present study we observed a higher prevalence of group O, A, B, AB and Rhesus positive among male donors compared to females. This male gender associated higher prevalence may be due to the fact that the number of male subjects in this study was significantly higher compared to female subjects. Most studies in Africa report a male dominance in blood donation program (61% in Togo), (71.2% in Burkina Faso) and (90% in Ghana) [34,35,36]. A recent study in 7 countries in central, western and eastern francophone Africa regions reported less than 30% females in their donor population [37]. Reports from Anglophone East and Southern African countries have also shown a male dominance in blood donation program. The reason for this male gender predisposition to blood donation in the African population is based on the erroneous belief that men are healthier than women [38] coupled with the general belief that women make monthly blood donations to nature through their menstrual cycle. Other factors such as pregnancy and breastfeeding further restrict many women from donating blood in SSA. Interestingly, this pattern seems to differ significantly from what obtains in some European countries. In 2003, female blood donors represented 40% in Austria, 49.7% in France, 50% in Norway and 55% in Great-Britain blood donor populations.

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