DISTRIBUTION OF ABO BLOOD GROUP, RHESUS FACTOR AND HAEMOGLOBIN GENOTYPE IN MAIDUGURI METROPOLIS, NORTH-EASTERN NIGERIA

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ABSTRACT

Objectives: To establish the frequency distribution of ABO, Rhesus (Rh) blood groups and haemoglobin genotype in Maiduguri metropolis. **Methods**: A total of four hundred and seventy subjects consisting of males and females were enrolled into the study. The subjects enrolled were university students and patients coming to the haematology department of the university of Maiduguri teaching hospital they were randomly selected and their ABO blood groups, Rhesus D antigen and genotype were determined. **Results:** The distribution of the blood groups antigen evaluated by our study are as follows; Blood group O were found to be231 (49.1%), blood group B categorized as 104 (22.1%),blood group A91 (19.3%), and blood group AB had the least 46 (9.3%).The Rhesus (Rh D) factor positivity was 399 (85%), and that (Rh D) negativity were71 (15%). The haemoglobin genotype were expressed as HbAA, AS, SS, AC and SC and the study revealed frequencies of AA, 297 (63.2%), AS, 122 (26%), SS,32 (6.8%),AC 12 (2.5%) and SC 07 (1.4%). **Conclusion**: This study showed that blood group O is predominant than the other blood groups and that blood group AB had the least. Rhesus (D) positivity was 85% as compared to Rhesus (D) negativity of 15%. The haemoglobin genotype showed HbAA had the highest occurrence, while SC had the least.

Keywords: ABO, Rhesus blood groups, Haemoglobin genotype, Maiduguri

INTRODUCTION

Blood is a fluid tissue consisting of fluid called plasma with several cells suspended in it. The cells in suspension are the red blood cells, white blood cells and the platelets. Within the cytoplasm of the RBC is found oxygen carrying protein haemoglobin. The ABO Rhesus (Rh) blood groups and haemolobin genotype are all inherited blood characters. These are the antigenic substances present on the red cells of an individual. The genes are made up of deoxyribonucleic acid (DNA) and are organize in linear form, consisting the chromosomes.[1]

The cell membrane of the red blood cell contains a variant of blood group antigen A and B. these are naturally complex oligosaccharides that differ in their terminal sugar on the red blood cell (RBC). They are mostly glycophospholipid, the antibodies against the red cell antigen are called agglutinin[2]*and are* found in plasma. Individuals are categorized into four (4) major blood groups such as A,B, AB and O. Human red cell that contain antigen D is known as Rhesus D (Rh D) positive, while those without antigen D in their blood cell are known as Rhesus D (Rh D) negative.[3]

International Society of Blood Transfusion has recently recognized 33 blood group systems. Apart from ABO and Rhesus system, many other types of antigens have been discovered on the red cell membranes.[4]

ABO and Rhesus blood group are the most common and play an important role in blood group system in humans. Therefore, there is need to always

determine the blood group of patients in order to avoid the risk of transfusion reactions and to prevent haemolytic disease of the newborn.

Haemoglobin is a protein found within the cytoplasm of the RBC as an oxygen carrying protein. Defects in the haemoglobin genes can produce abnormal hemoglobin, known as haemoglobinopathies. Haemoglobin is made up of protein globin and an iron containing pigment known as haem. The globin moiety contains two α subunits and two β subunits. The β subunit is a chain of amino acids arranged in series. The different types haemoglobin are; the foetal haemoglobin (HbF), found in the foetus and infants, the normal adult haemoglobin (HbA), and the sickled haemoglobin HbS. The HbF is made up of two α two γ subunits while the normal haemoblobin is made up of two α subunits and two β subunits. In the sickled Hb, there is a point mutation where valine is replaced by glutamic acid at position 6 of the β subunits,[5] this single amino acid replacement leads to the series of events that occur in SCA.[5] In Maiduguri the north-eastern Nigeria a lot of work has been done on SCA, but there is paucity of report on prevalence of the SCA except the report by Khalil[6]et al. This necessitated the present study in Maiduguri metropolis.

The sickle cell gene is fairly evenly distributed throughout Nigeria, with heterozygous (AS) carrier rates of about 25% in the south and 18-32.6% in the North. The highest frequencies of Hb AS have been recorded among the Kanuri's (27.9%) of Borno state, Bades (32.67%) of Yobe state and the Garki's (28.9%) in Kano state. The Ibos (24.3%) in the east and the Yorubas (23.7%) in the West, having the lowest frequencies.[6,7,8]

MATERIALS AND METHOD

This is a cross sectional study carried out at University of Maiduguri and University of Maiduguri Teaching Hospital (UMTH).The subjects comprised of students of the University and patients referred to the haematology department of the UMTH. The ABO blood group, Rhesus antigen and haemoglobin genotype were determined using anti-sera(tiles method) and haemoglobin electrophoresis as described by Dacie.[9]

Maiduguri, the state capital of Borno State is the largest of the six states in North-eastern Nigeria. It lies on latitude 115°N and longitude 135°E, and occupies an area of 50,778 square kilometers. Borno State is bordered by the Republic of Niger to the North, Chad to the North-east and Cameroon to the East. The climate of Maiduguri is favorable, with a mean annual maximum temperature of 34.8°C. The estimated population of Borno State according to 2006 population census report is 4,098,391. The state is dominated by the Kanuri. Other smaller ethnic groups such as Babur and Marghi are also found in the southern part of the state. Shuwa Arabs are mainly the descendants of Arab people.[10]

Informed consent of the studied subject was sorted for before sample collection, demographic information was obtained. A total of four hundred and seventy subjects consisting of males and females were enrolled into the study. The hematological procedure was carried out in hematology department, University of Maiduguri Teaching Hospital (UMTH), and Physiology laboratory of University of Maiduguri.

The subjects were randomly selected. Samples were collected using disposable Syringe and needles, 2ml of blood was collected from each patient by aseptic technique of venipuncture and transferred into an ethylene-diamine tetra-acetic acid (EDTA) containing container. Ethical clearance was obtained from the UMTH, ethical committee.

ABO, Rhesus blood group were determined using the anti-sera as the reagent, manufactured by (Biotech Laboratories Monoclonal UK) which are anti-A, Anti-B, anti-AB and anti-D, to differentiate and classify the ABO, Rhesus blood group of an individual, using tile method[9].

For the ABO and Rh blood group determination, a drop of blood from each subject was dropped on a clean white tile in 4 places in a row, a drop of anti-A, Anti-B, Anti-AB and Anti-D (from Biotech Laboratories Monoclonal UK) was added respectively and mixed with each blood sample using glass rods, blood groups were determined on the basis of agglutination of test serum by respective antiserum.

Haemoglobin electrophoresis was carried out using the lactate cellulose method(Dacie and Lewis), at the UMTH haematology laboratory for the determination of haemoglobin genotype.

The data collected were analyzed using the Statistical Package for Social Science (SPSS version 16.0) software with frequency and percentages were obtained. Results are presented in the form of table, pie chart and histogram.

RESULTS

Four hundred and seventy (470) subjects were studied for ABO and Rhesus blood groups and various distributions of blood groups were obtained. The distribution of the blood groups were blood group O with 231 (49.1%), blood group B was 104 (22.1%), A 91 (19.4%), and blood group AB was44 (9.4%).

The Rhesus factor showed D positivity to be 399 (85%), D negativity71 (15%).

The haemoglobin genotype obtained were AA 297 (63.2%), AS 122 (26%), SS 32 (6.8%), AC 12 (2.5%) and SC 07 (1.5%).

Fig 1.Frequency Distribution of ABO Blood Groups in Maiduguri Metropolis

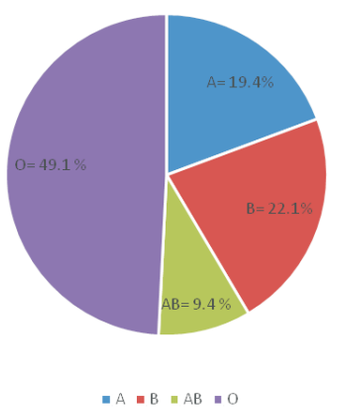
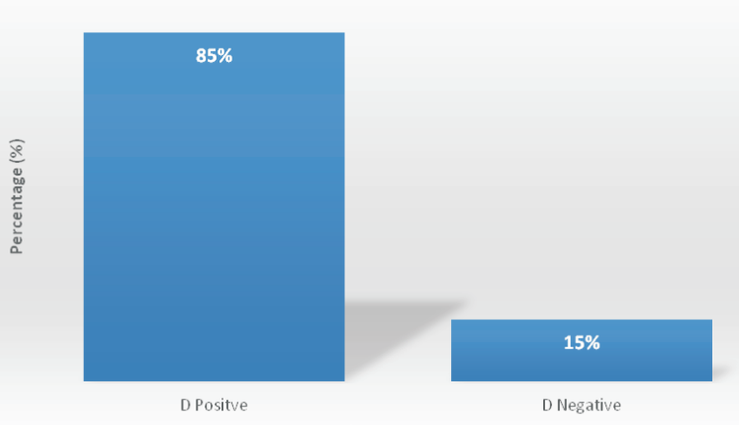


Fig. 2. Frequency distribution of Rhesus Factor in North Eastern Nigeria



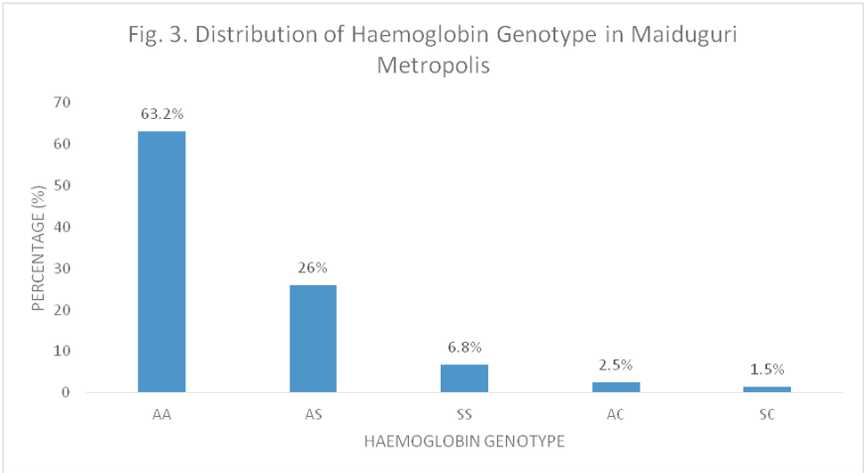


Table 1: Frequency Distribution of ABO Blood Group and Rh Among Healthy Subjects in North Eastern Nigeria Compared to that of North West and a Region in Southern Nigeria.

Blood group	North East	North West	South-South
O	49.1	49	56.1
A	19.3	21.3	25.07
B	22.1	24.3	16.39
AB	9.3	5.2	2.45

Table 2: Frequency Distribution of ABO Blood Group in North Eastern Nigeria in 2017 Compared to Results obtained in 1998

Blood group	North East 1998 Ahmed*et al*	North East 2017
O	52.0%	49.1%
A	27.1%	19.3%
B	17.7%	22.1%
AB	3.1%	9.3%

DISCUSSION

Two common most important blood groups ABO and Rhesus (Rh) antigens which play a definitive role in blood transfusion were studied. These ABO and Rh blood group systems are the most commonly utilized grouping systems in blood transfusion in our practice. These systems and other blood group system play an important role determining the success or otherwise in transplantation, hereditary diseases, genetics and determining migration of races.[11]

The association between different blood groups with diseases have been documented, as some of the blood groups are associated with definitive diseases.[12] The frequency of ABO and Rh blood group varies in different populations throughout the world.[13] Typically, varied studies from Nigeria described the frequency and distribution of ABO and Rh blood groups in different regions (Tables 1 and 2).

In this study, the frequency of ABO and Rh blood group was sort out in students of the University of Maiduguri (pre-primary, primary, secondary, and undergraduate) and UMTH. Blood group O was found to be the most prevalent group (231 (49.1%)) followed by group A(91 (19.3%)), group B (104 (22.1%)) and blood group AB(44 (9.3%).

The findings from this study is in agreement with the study[1] from Ogbomosho, whereby it was reported group O as the most prevalent and group AB as the least. In Ogbomosho, (group O has prevalence to be 50% and AB as 5.9%),[1] while in Abeokuta, it was reported that blood group O 53% and AB in 3.9% in their study.[14] Group O prevalence of 55% and AB of 2.7% was reported in Lagos.[15] Recently, studies from other parts of Nigeria still reported the predominance of group O over the other blood groups and with group AB being the least prevalent.[11, 16-19] Surprisingly, a study among people living with HIV and AIDS, reveals blood group O to be 50.6% and AB to be 11.7% which consistently remained to be the most and least prevalent blood groups, respectively.[13]

The high prevalence of group O individuals in nature is of great advantage because of their status as presumed "universal" donors. However, those that express α and β haemoglobins are tagged dangerous donor.[18,21] With respect to this, it is thus evident that they came up to be leading in the blood group distribution. It is pertinent to note that there has been an increase in the level of demand for blood transfusion in our health institution in many parts of sub-Saharan Africa.[20]

The frequency of the Rhesus positive blood grouping antigen in this study was found in 85% of the study population while the remaining 15% were Rhesus negative. This finding tallies with studies done earlier[16] in Maiduguri, but from other parts of Nigeria reports show a positivity of 96.7%,[21] 94%,[15] 97.7%,[1] 93.2%[11] and 93%.[18] The prevalence of Rh negative in this study was relatively high compared to most studies reported Nigerian 3.2% - 7%.[11,15,18,21]

From this study, it is observed that determination of ABO blood grouping systems should be reviewed from time to time to ascertain if there are changes. The Rh (D) negative blood has increased to 15% and hence, the possibility of securing Rh (D) negative blood units has increased.[16]

The haemohglobin electrophoresis is important in planning public health pre-marital enlightenment for the prevention of having HbSS. Out of the 470 subjects recruited into the present study conducted in Maiduguri 63.1% were found to be AA which is lower than the results obtained[6] (79.5%), this may be attributed to the inter marriages between the same family in this part of the country. In the north central and south east the pattern is similar[12,22] it was 78.5%, and 77.5% respectively. HbAS was found to be 26% which is lower than the previous workers, reported the frequencies of Hb AS recorded against the, Kanuri's, (27.9%) Borno state and Bades (32.67%) of Yobe state and the Garkis (28.9%) in Kano state. The Ibos (24.3%) in the east and the Yorubas (23.7%) in the West, having the lowest frequencies.[6-8] On the other hand those with HbSS was found to be 6.8%, which is higher than the reports by Khalil et al 1992 (0.4%), which might also be due to the inter marriages between the families. The report from the north west was (17.1%),[22] which is higher than our present study of 6.8% while the north central and south east showed 0%.[12, 23]

On the other hand, if a patient who desires blood transfusion and he/she happens to be HbSS, there is always the need to subject the blood for haemoglobin electrophoresis to exclude HbS given to them.

CONCLUSION

This study revealed that blood group O has highest frequency and blood group AB has the least. The Rhesus (D) positive has a frequency of 85% as compared to Rhesus (D) negative of only 15%.The haemoglobin genotype showed that HbSS prevalence has increased from 0.40% - 6.8%, HbAS has also raised from 20.1% to 26%. Hence, the need for screening the blood units for Hb electrophoresis to forestall transfusing HbS patients with additional HbS concentrate blood to avert crisis.

RECOMMENDATIONS

Larger survey involving other local Governments should be considered. ABO and Rhesus blood groups are the common blood group system in humans, there is need to always determine the blood group of patients in order to avoid the risk of transfusion reactions and to prevent haemolytic disease of the newborn. Determination of haemoglobin genotype will help in reducing cases of sickle cell anaemia in the society by counselling couples before marriage.

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