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Research Article

Expression of Kidd, Rh-C, E, and D Antigen among Indigenes of Bonny Kingdom, Nigeria

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ABSTRACT

Blood group antigens are surface markers on red cell membrane. Routine Laboratory typing for some blood group antigens is not a regular practice for clinical assessment of patients with transfusion related diseases in Nigeria. This cross sectional study was aimed at determining the expression of Jka, Rh-C, E, and D blood group antigens amongst indigenes of Bonny Kingdom, Nigeria. One hundred and twenty (120) apparently healthy subjects consisting of sixty (60) males and sixty (60) females aged between 18-50 years participated in the study. Four millilitres (4 mls) of venous blood was obtained from each participant and dispensed into Ethylene Diamine Tetraacetic Acid (EDTA) bottle from which a 5% cell suspension preparation was made and Tile method/microtitre agglutination technique for determination of blood group antigens was adopted. Data obtained were analysed by simple percentage calculations. The Results obtained showed 116(96.6%) [59 (49.1%) males and 57(47.5%) females] for Rh-D positivity, 31(25.8%) [(13(10.83%) males and 18(15%) females] for Rh-C positivity, 35(29.2%) [21 (17.5%) males and 14(11.66%) females] for Rh-E positivity, and 4(3.32%) were positive of Jka antigen 2(1.66%) each for both sexes. The expression of the studied antigens follows a pattern of Rh-D> Rh-E>Rh-C>Jka in the population. This work has revealed the presence of Jka, Rh-C, Rh-E, and Rh-D with percentage expression as 3.32%, 25.8%, 29.2% and 96.8% in the same order with a pattern of RhD>Rh-E>Rh-C>Jka amongst indigenes of Bonny Kingdom Rivers State Nigeria. It is necessary to take into cognizance the fact that the presence of Rh-C, Rh-E may likely be the cause of some red cell alloimmunization which cannot be explained after a compatible routine ABO/Rh-D cross match amongst indigenes of Bonny Kingdom, while the Kidd antigens and its associated antibody rarely may be implicated. Based on the finding in this study, it is recommended that Rh-E and C grouping be carried out on pregnant mothers, blood donors and recipients before transfusion; while Kidd blood grouping may be subjected to expansive population testing to determine its likely potency in triggering and/or specifying red cell alloimmunization.

Keywords: Kidd antigen; Rh-antigens; Blood group

INTRODUCTION

The presence of un-assayed rare blood group antigens in the blood of donors/recipients constitute a major cause of transfusion related reaction after a compatible ABO/RhD cross match, yet remain one of the less routinely assessed prior to blood donation and transfusion in Nigeria.

Blood group antigens are carbohydrate or protein moieties that constitute allogenic variation determined by the genetic makeup of the alleles of a system inherited and found on the surface of blood cells [1-3]. The blood group antigen is determined by the genetic makeup of the alleles of a system [4-6].

There are about 29 known blood groups with more than 240 antigens including ABO, Rhesus (Rh), Kidd, Kell, MN, Duffy and Lewis blood groups [6]. However, the ABO/Rh system remain as one of the most immunologic and predominant in occurrence [7] and both are routinely typed for in blood transfusion service or blood bank [4], although there are some rare null phenotypes, Bombay phenotype etc

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The ABO and Rh blood group are stable throughout life and they vary widely across races, ethnic groups and geographic boundaries [5,8,9]. The RhD and RhCe genes that encode the Rh proteins (d and cc/ee respectively) are located on the short arm of chromosome one [9,10]. It has 52 well defined antigens and the most complex blood group system with the most immunogenic being D (RhD) [1,11]. The Rh is genetically complex but it can be described simply by the single pair of alleles D and d which can be determined by three genes C, D and E, each has two alleles C, c, D, d, E, e encoded by two genes RHD and RHCE. Rh antibodies are IgG antibodies which are acquired through exposure to Rh-positive blood (generally either through pregnancy or transfusion of blood products) [11].

Research by Mais in 2018 revealed that approximately 80% of individuals who are D-negative and exposed to a single D-positive unit will produce an anti-D antibody. However, the percentage of alloimmunization is significantly reduced in patients who are actively exsanguinating [12]. Detection of anti-E suggests the presence of anti-c due to combine genetic inheritance, implying that E and c antigens are likely to be inherited together, based on Rh haplotypes [12]. Also detecting anti-E raises suspicion for formation of anti-c, as seen in most cases that patients sometimes form both.

The Kidd antigen system (Jk antigen) is found on the gene encoding a protein on chromosome 18 responsible for the transportation of urea in the red blood cells and the kidney [13-15]. The Kidd gene has 11 exons with exons 4-11 encoding the mature protein. The Kidd gene (SLC14A1) is on chromosome 18q12.3. Jka and Jkb have similar prevalence in White and Asian populations but Jka is more common in Black populations than Jkb [13,14,16].

It is established that the Kidd blood group system is a transporter for urea and thus the possibility that the erythrocyte urea transporter and the kidney urea transporter are encoded by a single gene (detected by the mutational loss of the Kidd antigen). Lack of facilitated urea transport impairs urea recycling in the kidney and, hence, maximal urinary concentrating ability. Research on this has shown that individuals who lack the Jk antigen (Jk null) are unable to maximally concentrate their urine [17].

Individuals with two Jka antigens, for instance, may form antibodies against donated blood containing two Jkb antigens (and thus no Jka antigens) (i.e anti-Jka against either a homozygous or heterozygous Jka positive RBC transfusion). This can lead to haemolytic anaemia, in which the body destroys the transfused blood, leading to low red blood cell counts. Disease also associated with the Jk antigen is haemolytic disease of the newborn, in which a pregnant woman's body creates antibodies against the blood of her fetus, leading to destruction of the fetal blood cells. Haemolytic disease of the newborn associated with Jk antibodies is typically mild, though fatal cases have been reported [18].

The Kingdom of Bonny, otherwise known as Grand Bonny is a traditional state in the town of Bonny, located in Bonny Local Government Area of Rivers State, Nigeria. In the pre-colonial period, it was an important slave trading port and later was a key location for trading palm oil products. During the 19th century the British became increasingly involved in the internal affairs of the kingdom, and in 1886 assumed control under a protectorate treaty [19].

In our earlier research work on Bonny indigenes, we found out a total absence (0%) of blood group M antigens in the study population. 112 (93.3%) of indigenes were positive for Rh-c antigens. 12 (10%) for Lewis A antigen and these antigens are associated with haemolytic disease of the Newborn, haemolytic transfusion reactions and Helicobacter infection [19].

Following incidence of increase in transfusion related reactions in indigenes of Bonny kingdom coupled with the fact that routine laboratory typing for some uncommon blood group antigens is not a regular practice for clinical assessment of patients with transfusion related diseases in Nigeria. There is paucity of information on expression of Kidd, Rh-C, Rh-E and Rh-D blood group antigens amongst decent of Bonny Kingdom; it is therefore necessary to synthesize information on the expression of Kidd, Rh-C, Rh-E and Rh-D blood group antigens amongst decent of Bonny Kingdom Rivers State, Nigeria. Thus this research work is aimed at determining the expression of Kidd, Rh-C, Rh-E and Rh-D antigens in indigenes of bonny kingdom, Nigeria.

MATERIALS AND METHODS

Study design and population

This cross-sectional study involved one hundred and twenty (120) apparently healthy subjects consisting of sixty (60) females and sixty (60) males aged between 18-50 years all indigenes of Bonny Kingdom were recruited by structured questionnaire for the study. Inform consent of participants were gotten *via* the use of the structured questionnaire.

Sample collection

4 mls of Venepuncture blood sample was obtained aseptically from the antecubital fossa of each participant with the use of vacutainer containing 0.5 mL of 1.2 mg/mL of dipotassium Ethylene Diamine Tetra-Acetic Acid (EDTA), it was well mixed and for the serological determination of Kidd, Rh-C, Rh-E and Rh-D blood group antigens respectively.

Determination of kidd, Rh-C, Rh-D and Rh-E blood group antigen using anti-jka, anti Rh-C, anti Rh-D and anti-Rh-E monoclonal, lorne laboratories microtitre agglutination techniques

Phenotyping of red cells was done using Micro-titre Agglutination technique as describe by Lorne laboratory Ltd. A 5% suspension of red blood cell was prepared using normal saline. 20 µl of anti-

Rh-D, anti-Rh-E, anti-Rh-C and anti-Jka antibodies were added unto separate micro-titre plate, and 20 µl washed red cell was added into the micro-titre plate containing the anti-Rh-D, anti-Rh-E, anti-Rh-C and anti-Jka antibodies. The sample was incubated for 15 minutes with intermittent rocking and observation for agglutination every 30 seconds. If no agglutination found after 30 miutes, 20 µl of LISS antibody was added and observed for 15-30 minutes. Confirmation of agglutination and no agglutination was done by placing the sample on a slide and viewed microscopically. Presence of agglutination indicates a positive result and absence of agglutination indicates negative result.

Data analysis

Data obtained were statistically analysed by simple percentage calculation and data presented in Tables.

RESULTS

Demographic data of participant

The study population consisted of a total of 120 apparently healthy Bonny indigenes, 60 males and 60 females aged between 18-50 years as shown in Table 1.

Table 1: Demographic data of study population.

Gender	Frequency (%)
Male	60 (50%)
Female	60 (50%)
Total	120 (100%)

Percentage expression of Rh-C, Rh-D and Rh-E antigen in the study population

Table 2 shows a percentage expression of Rh-C, Rh-D and Rh-E antigen amongst study population. Results obtained showed 116(96.6%) [59 (49.1%) male and 57(47.5%) females], 31(25.8%) [(male 13(10.83%) and 18(15%) females] 35(29.2%) [male 21(17.5%) and 14(11.66%) female] positivity rate for Rh-D, Rh-C and Rh-E respectively.

Table 2: Percentage expression of Rh-C, Rh-D and Rh-E antigen in the study population.

Blood antigen/ gender	Population (N)	Rh-C (%)	Rh-D (%)	Rh-E (%)
Males	60	13 (10.8)	59 (49.1)	21 (17.5)
Females	60	18 (15.0)	57 (47.5)	14 (11.7)
Total	120	31 (25.8)	116 (96.6)	35 (29.2)

Percentage expression of kidd antigen in the study population

Table 3 shows a percentage expression of Kidd (Jka) antigen amongst study population. A total of 4 (3.32%) of the population were positive for Kidd blood group antigen 2 (1.66%) male and 2 (1.66%) female.

Table 3: Percentage expression of Kidd (Jka) antigen in the study population.

Subjects/Gender	Population (N)	Frequency (%)
Male	60	2(1.66)
Female	60	2(1.66)
Total	120	4 (3.32)

DISCUSSION

Although there are few alternatives to blood transfusion such as the bovine haemoglobin generally only used for compassionate use or possibly in Jehovah's Witnesses, Iron, erythropoietin to stimulate the body's own production of RBCs but are not a substitute, the human blood remain a major source of blood for transfusion and thus there is the need to transfuse compatible, safe and less risk associated blood in clinical and therapeutic medicine. The incidence of a group of antigen in a race determines the rate of expression of the corresponding antibody in that population.

Once an uncommon antibody is found in a population, there is the tendency that the occurrence will increase with time as exposure occur either through pregnancy or blood transfusion. This cross-sectional study carried out among indigenes of Bonny kingdom in Rivers State, Nigeria to assess kidd, Rh-C, Rh-D and Rh-E blood group antigens expression amongst Bonny indigenes in River State Nigeria.

The Rh-D had the highest number with 116 positives making a percentage expression of 96.6% out of which 49.1% were male and 47.5% were females in the study population. This is closely related and in partial agreement with a study by Egesie et al. [20] who in their study recorded a 98% positivity rate for Rh-D blood group antigen amongst students of Niger Delta University. Lower than the value reported by Christian et al. [21] who reported a 92% positivity rate amongst indigenes of Ogoni Rivers State Nigeria. This study have gone further to confirm that the Rh-D remain the most prevalent vis a vis immunogenic of the Rh blood group system.

Result obtained showed that 4(3.32%) of the population were positive for Kidd antigen with equal distribution amongst the sexes. This is in slight agreement with a study by Osaro et al. who reported 2.1% for Jka amongst 200 pregnant women in Sokoto, North West Nigeria. The Kidd blood group system are well developed at birth and low in immunogenicity and can completely disappear from circulation rapidly and may produce violent delayed haemolytic transfusion reaction. This can lead to acute or delay haemolysis, causing the body to destroy the transfused blood. The slightly elevated percentage might be due to the fact that in our study, freshly collected samples were analysed with potentiating medium that enhance the detection of

the antigens. Typically mild haemolytic disease of the foetus and newborn is another disease associated with Kidd system in which the pregnant mother creates antibodies against the blood of the foetus resulting in the destruction of fetal red blood cells [18,22].

In this study, the results for Rh-E antigen showed that 35(29.2%) of the study population had Rh-E antigens with male having the highest percentage (17.5%) and females (11.7%). This result is higher than that reported by Christian et al. [21] in their study carried out amongst one hundred and one (101) Ogoni indigenes and found out a percentage distribution of 25.74% amongst Ogoni indigenes of River State Nigeria. It is also not in tandern with the findings of Reid et al. [23] who reported 21% for Rhesus E amongst Indians population.

Anti-E is found to react optimally with protease modified erythrocytes and their development may probably result from an exposure to anti-c as well as anti-E either by pregnancy or blood transfusion. A review book by Mais (2018) confirms that detection of anti-E suggests the presence of anti-c due to combine genetic inheritance and the implication is that people who form anti-E are more likely to have inherited the DCe/DCe (R1R1) Rh phenotype and therefore have susceptibility to forming anti-c upon transfusion or pregnancy because they lack this antigen [12].

There was a 25.8% percentage expression for Rh-C from the results obtained in the study out of which 10.8% are male and 15.0% females. This result is in contrast to the findings of Joyce et al. who in their study observed that rhesus antigen "C" was the most prevalent antigen with a prevalence of 98.5% amongst blood donors in Calabar, Nigeria. Also, finding from this study is in contrast to the report of Jeremiah and Buseri [24,25] and Jeremiah and Odumody, [26] who reported the same antigen as most prevalent (99.8% and 100%, respectively) in their studies done amongst subjects in Port Harcourt and the Ibibio, Efik, and Ibo ethnic nationalities in Calabar, Nigeria [27].

CONCLUSION

This work has revealed the presence of Kidd, Rh-C, Rh-E, and Rh-D with percentage expression as 3.32%, 25.8%, 29.2% and 96.8% in the same order with a pattern of RhD>Rh-E>Rh-C>Jka amongst indigenes of Bonny Kingdom Rivers State Nigeria. It is necessary to take into cognizance the fact that the presence of Rh-C, Rh-E may likely be the cause of some red cell alloimmunization which cannot be explained after a compatible routine ABO/Rh-D cross match amongst indigenes of Bonny Kingdom, while the Kidd antigens and its associated antibody rarely may be implicated. Based on the finding in this study, it is recommended that Rh-E and C grouping be carried out on pregnant mothers, blood donors and recipients before transfusion; while Kidd blood grouping may be subjected to expansive population testing to determine its likely potency in triggering and specifying red cell alloimmunization.

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