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RESEARCH ARTICLE

Kell Blood Group Antigen: Rare Amongst Igbo Descents in Nigeria

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Abstract

Kell blood group system is recognized by the International Society of Blood Transfusion (ISBT), and is characterized by its complexity and clinical significance. Kell blood group (K) antibodies can cause medical anomalies like Haemolytic Transfusion Reaction (HTR) and Haemolytic Disease of Foetus and New-born (HDFN). The study aimed at determining the presence of Kell blood group antigen(s) amongst some Igbos residing in Port Harcourt, Nigeria. This study was a cross-sectional study carried out among Igbo indigenes of the five Igbo speaking states whose origin of their first-generation parents are Igbos. A total number of two hundred and four (204) subjects (seventy-four (74) males and one hundred and thirty (130) females) within the ages of 15 to 47years were recruited for the study. Blood samples were collected using standard venepucture technique. Sample analysis was carried out at the Medical Laboratory Unit of Professor Nimi Briggs Hospital, Rivers State University, Nkpolu-Oroworkwu, Port Harcourt, Nigeria. All subjects were recruited within three days and their blood samples collected on their respective days being the 19th, 20th and 25th day of November, 2024 and testing done within 24hours of sample collection. Determination of the presence of Kell blood group antigen (K) was carried out using Anti - Kell monoclonal reagents; Lot Number: 760108-B2, Expiry Date: 2026-07-30 (Lorne Laboratories Ltd, UK). Phenotyping was done using standard tube technique as described by Lorne Laboratories Ltd, UK. The result showed zero frequency occurrence and percentage distribution of Kell blood group antigen in the studied population. This implies that Kell blood group is rare amongst the Igbos.

Keyword: Kell Blood Group, Igbo Descent, Nigeria, Kell Antigen, Kell Antibody.

1. Introduction

The International Society of Blood Transfusion has officially recognised 33 human erythrocyte blood group systems, which include over 300 inheritable blood group antigens [1]. The Kell blood group system is one of the major human blood group systems, characterized by its complexity and clinical significance. The Kell blood group system is complex and contains many antigens that are highly immunogenic. These antigens are the third most potent, after those of the ABO and Rh blood groups, at triggering an immune reaction[2].

The term “blood group” refers to the entire blood group system comprising red blood cell (RBC) antigens whose specificity is controlled by a series of genes which can be allelic or linked very closely on the same chromosome [3]. A blood group system can be defined as group of antigens that are encoded by specific alleles at a specific single locus of a gene or at the loci of a gene that is closely linked in such a way that crossing over cannot occur or may rarely occur [4]. “Blood type” refers to the outcome of a specific agglutination pattern of reaction to a testing antiserum within a given blood group system.

The Kell group was named after the first patient described with antibodies to K1, a pregnant woman named Mrs. Kelleher in 1945 and in another woman Mrs. Cellano in which antibodies to K2 was observed

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[5].Kell blood group system classifies human blood based on the presence on the surfaces of red blood cells of various antigens encoded by the KEL gene. The system, is characterized by a high degree of polymorphism (genetic variation), and thus studies of the Kell antigens have provided insight into the development of polymorphic traits in the context of human evolution. Antibodies generated against antigens in the Kell system can cause transfusion reactions and erythroblastosis fetalis; after the Rh and ABO systems, the Kell system is the third most common blood group to cause these reactions (transfusion reactions and erythroblastosis fetalis) [6].

According to Reid *et al.,* [7], the nomenclature of KELL blood group is as follows: Number of KELL antigens: 25; ISBT symbol: KEL; ISBT number: 006; Gene symbol: KEL; Gene name: KELL blood group.

Kell blood group is ranked the third number of all blood group systems discovered, owing to its involvement in immunological reactions. it consists of a single 93KDa red-cell transmembrane protein that usually carries 36 antigens[8]. The Kell protein consists of 732 amino acids that are glycosylated at five different locations and pass through the membrane of RBC. This protein is associated with another transmembrane protein XK, which anchors it to the RBC surface by a disulfide linkage[9]. The gene of this protein is found at chromosome 7q33 and have19 exons encompassing more than 20kb of genomic DNA[10].

In total, there are 25 Kell antigens, all of which are encoded by the KEL gene. The two primary, codominant alleles of the KEL gene include K and k, which encode the K (Kell) and k (Cellano) antigens, respectively. The k antigen is common, occurring in more than 90 percent of blacks and whites. Polymorphisms in the KEL gene give rise to different antigens, including the Jsa and Jsb antigens. The Jsb antigen is found in 100 percent of whites and 80 percent of blacks. Examples of other Kell antigens include Kpa (Penney) and Kpb (Rautenberg). Kell antigens normally associate with a protein called Kx on the surfaces of red blood cells. In some people, the Kx protein is absent, resulting in McLeod syndrome. Characteristics of this syndrome include acanthocytosis (thorny projections on red blood cells) and reduced Kell antigen expression. These abnormalities often lead to defects in muscle and nerve function that manifest as disordered movement, psychological disturbance, and loss of reflexes [6].

Antibodies that target Kell antigens can cause transfusion reactions and haemolytic disease of the newborn (HDN). The infrequent cases of HDN caused by Kell immunization tend to result in severe fetal anemia because maternal anti-Kell target fetal red blood cell (RBC) precursors, suppressing the fetal production of RBCs [2]. Antibodies that target Kell antigens are commonly IgG that are anti-K1, anti-K2, anti-K3, and anti-K7 that become the cause of haemolytic disease in newborns and transfusion reaction [9]. Anti-K is the next most common immune red cell antibody after those in the ABO and Rh system. Anti-K typically presents as IgG class alloantibody. Individuals lacking a specific Kell antigen may develop antibodies against Kell antigens when transfused with blood containing that antigen. This is particularly true for the “K” antigen which shows a relatively high antigenicity and moderately low frequency (approximately 9%) in Caucasian populations. Anti-K can also occur following transplacental haemorrhage (TPH) associated with childbirth making Kell an important concern for hemolytic disease of the newborn[11].

The Igbo, sometimes referred to as Ibo, are one of the largest single ethnic groups in Africa. Most Igbo speakers are based in southeast Nigeria, where they make up almost 17 % of the population; they can also be found in significant numbers in Cameroon and Equatorial Guinea. Their language is also called Igbo. The primary Igbo states in Nigeria are Anambra, Abia, Imo, Ebonyi, and Enugu States. The Igbos also are more than 25% of the population in some Nigerian States like Delta State and Rivers State. Traces of the Igbo Culture and language could be found in Cross River, Akwa Ibom and Bayelsa States. Igbo language is predominant in such cities like Onitsha, Aba, Owerri, Enugu, Nnewi, Nsukka, Awka, Umuahia, and Asaba, among others.The arrival of the British in the 1870s and increased encounters between theIgbo and other Nigerians led to a deepening sense of a distinct Igbo ethnic identity. Under British colonial rule, the diversity within each of Nigeria’s major ethnic groups slowly decreased and distinctionsbetween the Igbo and other large ethnic groups, such as the Hausa and the Yorubabecame sharper[12].

Kell antigenic profile on Igbo indigenes is rare and less studied. Kell blood group is associated with haemolytic transfusion reactions and haemolytic disease of the new born hence the need for proper screening to identify this blood group in patients. There is a dearth on research on Kell blood group system in Nigerian ethnic groups. This study is therefore important as it reveals evidence-based findings on distribution of Kell blood group antigens amongst Igbo descents.

2. Materials and Method

2.1 Study Design

The study is a cross-sectional study carried out among Igbo indigenes of the five Igbo speaking states whose origin of their first-generation parents are Igbos.

2.2 Study Area

The Igbo subjects recruited for the study were those who are residents of Port Harcourt. The laboratory analysis was carried out in Nimi Briggs Hospital Laboratory, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Nigeria. Port Harcourt, the capital of Rivers State is located on latitude 4.75°N and longitude 7.00°E and lies along Bonny River in the Niger Delta.

2.3 Study Population

Based on convenient random sampling, a total number of two hundred and four (204) human subjects consisting of seventy-four males and one hundred and thirty females who were apparently healthy across the five Igbo speaking states were recruited for the study. The subjects were adults varying between 15-47 years of age.

2.4 Eligibility of Subjects and Informed Consent

Non-Igbo indigenes were excluded from the study and only willing Igbo indigenes were enrolled for the study. Informed consent was obtained from apparently healthy human subjects prior to enrolment.

2.5 Sample Collection

After counselling and explanations, venous blood was drawn from the antecubital fossa of the subject with the use of conventional needle and syringe for each subject as described by Cheesebrough [13], of which 2.0 ml of collected blood from each subject was added into individualized tube containing 0.5mL of 1.2mg/mL ethylene diamine tetra-acetic acid (EDTA). It was properly mixed to obtain homogeneity between the blood and anticoagulant. The samples were preserved using ice pack in an airtight thermo cool container at temperature of 2-8^{o}C and then transported from the site of sample collection to Prof. Nimi Briggs Hospital Laboratory, Rivers State University, where they were analyzed for presence of Kell blood group antigen. Blood samples collected were analyzed within 24 hours of collection.

2.6 Methodology

2.6.1 Determination of Kell Blood Group Using Anti-Kell Monoclonal, Lorne Laboratories Ltd, UK. Lot Number: 760108-B2, Expiry Date: 2026-07-30

Method

Tube method

Principle

The reagent contains antibodies to the K antigen on human red cells and causes direct agglutination (clumping) of human red cells that carry the Kell antigen. No agglutination (no clumping) generally indicates the absence of the Kell antigen.

Procedure

A 2-3% suspension of red cells was made in isotonic saline. In a labeled test tube, 1 volume of Lorne reagent and 1 volume of 3 % red cell suspension was added. It was mixed thoroughly and all tubes were centrifuged for 20 seconds at 1000 revolutions per minute (rpm). The red cell button was gently resuspended and read macroscopically for agglutination. Tubes which showed negative or questionable results were incubated for 15 minutes at room temperature after which it was observed macroscopically and microscopically for agglutination.

Interpretation of Results

Agglutination of red cells is indicative of a positive test result. No agglutination of red cells is indicative of a negative result.

2.7 Data Analysis

Data collected was statistically analyzed using percentage calculation and the outcomes were represented in Tables.

3. Results

3.1 Demographic Details of Studied Population

A total number of 204 subjects (74 males and 130 females), within the ages of 15-47years were recruited for the study. Details are shown in Table 3.1

Table 3.1 *Demographic Details of Studied Population*

Parameters	Frequency	Percentage (%)
Total number of subjects	204	100%
Total number of males	74	36.3%
Total number of females	130	63.7%

3.2 Frequency and Percentage Distribution of the Studied Blood Group

The frequency and percentage distribution of Kell blood group system was analyzed and recorded. Details are shown in Table 3.2

Table 3.2 *Frequency and Percentage Distribution of the Studied Blood Group*

Blood Group System	Frequency	Percentage (%)
Kell	Males = 0	0
	Female = 0	0

4. Discussion

From the study, it was observed that the presence of Kell blood group antigen in subjects recruited for the study were rare which by implication means that Kell blood group and its associated antigens were not found amongst the study population.

The frequency occurrence of Kell blood group amongst the Igbos and the percentage distribution of Kell blood group antigen was zero. This finding is consistent with that of Christian *et al.,* [14], who reported absence of Kell blood group antigens in their study population - the Ogoni tribe in Rivers State, Nigeria. The findings of this study differ from that of Buhari *et al.,* [15];in their study of red cell phenotypes among pregnant women of Sokoto, Northwestern Nigeria, where they reported that 2.4% of the pregnant women were Kell positive. Also, the finding of this study is not in tandem with that of Adewoyin *et al.,* [16], where they reported in their findings based on ethnic distribution, the following: 27.5% among the Benin tribe, 23.2% among the Igbos, 12.3% among the Esan tribe, 8.3% among the Yorubas and 6% among the Urhobo tribe.

5. Conclusion

The study revealed the absence of Kell blood group antigens amongst the Igbos residing in Port Harcourt, Nigeria.

6. References

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