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Frequency of Kell (K) Blood Group Antigen Amongst Indigenes of Ikwerre Ethnicity in Rivers State, NigeriaSerekara Gideon Christian^{*}, Beauty Eruchi Echonwere-Uwikor, Joy Sira Celestine

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<https://dx.doi.org/10.4314/sokjmls.v10i1.7>**Abstract**

Kell blood group is the third in ranking of clinical significance after the ABO and Rh blood group system. Kell blood group (K) antibodies are clinically significant enough to cause Haemolytic Transfusion Reaction (HTR) and Haemolytic Disease of the Foetus and New-born (HDFN). The aim of the study was to determine the frequency occurrence and percentage distribution of Kell blood group antigens amongst indigenes of Ikwerre ethnicity in Rivers State, Nigeria. This study was a cross-sectional study carried out amongst the Ikwerres whose first generational parental origin is Ikwerre. A total number of two hundred and six (206) subjects consisting of one-hundred males (100) and one-hundred and six females (106) within the age bracket of 18 - 40 years were recruited for the study. Blood samples were collected using standard venipuncture technique into individualized EDTA sample container. Sample analysis was carried out at the Haematology Laboratory of Prof. Nimi Briggs Hospital, Rivers State University, Port Harcourt. All subjects were recruited for three days and their blood samples were taken on their respective days being the 19th, 20th and 25th day of November, 2024 and analysis carried out within 24hours of sample collection. Presence of Kell blood group antigen (K) was carried out using Anti - Kell Monoclonal, Lorne Laboratories Ltd, UK, Lot Number: 760108-B2, Expiry Date: 2026-07-30. Phenotyping was done using the tube technique as described by Lorne Laboratories Ltd, UK. The result showed a total of four (4) positive cases of Kell antigen in only

Females and none in males, as well as a percentage distribution of 1.9 % in Females. This finding therefore revealed the rarity of Kell blood group antigen amongst the Ikwerres.

Keywords: Ikwerre, Kell antigen, Kell antibody, Kell blood group

Introduction

The term "Blood type" refers to a specific pattern of reaction to testing antisera within a given system (Owen, 2000). A blood group system is defined as a group of antigens encoded by alleles at a single gene locus or at gene locus so closely linked that cross over is very rare (Daniel & Reid, 2010).

The International Society of Blood Transfusion recently recognizes thirty-three blood group systems. Apart from ABO and Rh system, other blood group antigens have also been found on the red cell membrane of which Kell blood group antigen is one of them (Mitra *et al.*, 2014). Red blood cells blood group antigens are inherited carbohydrate or protein structures located on the outside surface of the RBC membrane (Logberg *et al.*, 2011). Blood group antigens are surface markers on the outside of the red blood cell (RBC) membrane. They are proteins and carbohydrates attached to lipids or protein (Daniels, 2002). Blood group antibodies in the serum are clinically significant antibodies, which can specially identify their group specific antigens located on the surfaces of red cells, typically for transfusion purposes (East Midlands Regional Transfusion Committee, 2017).

The Kell blood group system was discovered in 1946. It was named for Mrs. Kelleher, a patient in whom anti-Kell antibodies had resulted in haemolytic disease of her newborn child (the child's RBCs expressed K antigen which were bound by anti-K in the mother's serum), her newborn later died of haemolytic disease of the fetus and newborn (Daniels, 2005). Kell blood group has 38 different blood group antigens (Redman, 1995). The ISBT symbol is KEL with ISBT number 006 and gene symbol KEL (Maheshwari *et al.*, 2024).

The Kell blood group system is complex. The Kell locus is highly polymorphic and gives rise to many Kell antigens. There are, however, two major co-dominant allelic genes that produce two important antigens: K and k (previously known as Kell and Cellano, respectively), which differ by a single amino acid. The k antigen is more common than the K antigen in most populations, the K-k+ phenotype is found in 98% of Blacks and 91% of Caucasians (Reid & Lomas-Francis, 2004).

Kell antigens were once thought to be restricted to blood cells of erythroid origin (i.e., RBCs and their precursors), but they have recently been found to be expressed in myeloid tissues (Wagner *et al.*, 2000; Wagner *et al.*, 2004). The Kell antigen is also expressed in a small amount on a number of organs including lymphoid organs, muscle (both cardiac and skeletal), and the nervous system (Reid & Lomas-Francis, 2004).

The KEL gene is found on chromosome 7, at 7q33, and contains 19 exons that span more than 21 kbp of genomic DNA. The KEL gene is highly polymorphic, with different alleles at this locus encoding the 25 antigens that define the Kell blood group. The K/k blood group polymorphism represents a point mutation resulting in an amino acid switch from threonine 193 (in the k antigen) to methionine 193 (in the K antigen) in the Kell glycoprotein. The K antigen is more potent at triggering an immune reaction than the k antigen. Its higher level of antigenicity may be because, unlike other Kell antigens, it is not glycosylated at residue 191 (Daniels, 2005).

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. The K1 antibody (antiK1) is responsible for severe anaemia in 10% of cases (Kausar *et al.*, 2022). The lesser number of cases are caused by anti-K2, anti-K3, anti-K6, and anti-K7 which have been associated with HDFN (Kausar *et al.*, 2022).

Kell antibodies are a significant cause of haemolytic disease in foetuses and newborns, second only to Rhesus alloimmunization (Koumoutsea *et al.*, 2019). Early detection and management are crucial, with an anti-Kell titer 4 indicating increased risk and necessitating intensive monitoring (Slootweg *et al.*, 2018).

The splenic marginal zone B cells play a key role in initiating anti-KEL antibody formation following transfusion (Patel *et al.*, 2018). In thalassaemia patients, who require frequent transfusions, anti-K was found to be the most common alloantibody (38.2%) in one study (Foomani *et al.*, 2023). The mechanism of fetal anaemia in Kell alloimmunization differs from Rh-D, involving suppression of foetal erythropoiesis in addition to haemolysis (Koumoutsea *et al.*, 2019). Regular monitoring of anti-K titers is recommended for predicting disease severity and guiding management, with a critical titer of 1:32 suggested for increased foetal risk (Koumoutsea *et al.*, 2019).

The people of Ikwerre are among one the minority tribes in the South-South geopolitical zone (Niger Delta) of Nigeria. The Ikwerre (natively known as Iwhuruohna) is one of the ethnic groups in Rivers State, Nigeria. The Ikwerre People in Rivers State, spans over four Local Government Areas; Port Harcourt, Obio Akpor, Ikwerre, and Emohua. The Ikwerre tribe are approximately two hundred and seventy thousand in population which represents 0.27% of about one hundred and thirty million Nigerians. This region has a population density of 407.1/km square. There is no published research information on the percentage distribution and frequency occurrence of Kell blood group antigens amongst the Ikwerres. It is therefore necessary to conduct this study to

identify how dominant these antigens are (Akani, 2022).

Scientific information and research about the Kell blood group amongst the Ikwerres is scarce. However, the presence of Kell antigens in blood meant for transfusion, even though from a single blood donor in a population, is of clinical consequence in terms of severe blood transfusion and haemolytic disease of the Newborn, when transfused to an individual who is negative for Kell (K) antigen. Unlike the extensively researched ABO and Rh blood group systems that have been well-studied, there is paucity of scientific research of Kell(K) antigen amongst the Ikwerres. This study will reveal the percentage distribution and frequency occurrence of K antigens amongst descents of Ikwerre.

Materials and Methods

Study Design

This study is a cross-sectional study carried out among natives of Port Harcourt City, Obio-Akpor, Ikwerre and Emohua Local Government Area whose origin of their first-generation parents are Ikwerres.

Study Area

Sampling was done in Port Harcourt metropolis amongst indigenes of Ikwerre Ethnic Nationality. The laboratory analysis was conducted at Prof. Nimi Briggs Hospital, Rivers State University, Nkpolu-Oroworukwu, Port Harcourt, Rivers State, 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.

Study Population

A total of two hundred and six (206) human subjects consisting of one hundred males and one hundred and six females of Ikwerre ethnicity from Obio-Akpor, Emohua, Ikwerre and Port Harcourt Local Government Area, Rivers State were recruited for the study. The study subjects were adults varying between 18 - 40 years of age.

Informed consent and Eligibility of Subjects

Informed consent was obtained from the subjects before their blood samples were collected. Non-

indigenes of Ikwerre and non-consenting indigenes of Ikwerre ethnicity were excluded from the study.

Sample Collection, Storage and Transportation

After pre-test counseling, venous blood sample was collected with the use of conventional needle and syringe for each subject, as described by Cheesebrough (2010). Two (2) milliliters of venous blood from the subjects was added into individualized tube containing 0.5mL of 1.2mg/mL ethylene diamine tetra-acetic acid (EDTA). The blood samples were 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° and transported from the site of collection to Prof. Nimi Briggs Hospital, Rivers State University, Port Harcourt, where they were analyzed for the presence of Kell blood group antigen. Blood samples collected in Ethylene Diamine Tetra-acetic Acid were analyzed within 24 hours of collection.

Methodology

Determination of Kell Blood Group

Kell blood group antigen status of subjects was determined 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) indicates the absence of the Kell antigen.

Procedure: A 3% suspension of red cells was prepared in normal saline. In a labeled test tube, one volume of Lorne reagent and one volume of red cell suspension was added in each individual tube and mixed thoroughly. All the tubes were centrifuged for 20 seconds at 1000 revolution per minute (RPM). The red cell button was gently resuspended and read macroscopically for agglutination. Tubes with negative results were incubated for 15minutes at room temperature. After incubation, the tubes were mixed

thoroughly and centrifuged for 20 seconds at 1000 revolution per minute and the red cell button was gently resuspended and read macroscopically for agglutination.

Interpretation of Results: Positive: Agglutination of red cells is indicative of a positive test result. Negative: No Agglutination of red cells is indicative of a negative test result.

Data analysis

Data collected was statistically analyzed by percentage calculation and represented in Tables.

Results

Demographic Details of the Studied Population

A total number of 206 subjects consisting of one hundred (100) males and one-hundred and six (106) females, within the age of 18 and 40 years were recruited for the study. Details are shown in Table 1.

Table 1 Demographic Details of Studied Population

Parameters	Frequency	Percentage (%)
Total number of Subjects	206	100
Total number of males	100	48.5
Total number of females	106	51.5

The frequency and percentage distribution of Kell blood group system amongst indigenes of Ikwerre were analyzed and recorded. Details are shown in Table 2.

Table 2: Frequency and Percentage Distribution of Kell Blood Group Antigen amongst the Studied Population.

Tribe	Frequency of Occurrence	Percentage Distribution (%)
Ikwerre	4	1.9

Frequency and Percentage Distribution of the Studied Blood Group Based on Gender

The frequency and percentage distribution of Kell blood group system based on gender was analyzed and recorded. Details are shown in Table 3.

Table 3: Frequency and Percentage Distribution of the Studied Blood Group Based on Gender

Blood Group	Frequency Occurrence	Percentage Distribution (%)
Kell	Males = 0	Males = 0
	Females = 4	Females = 1.9

Discussion

The present study comprises of 206 human subjects, 100(48.5%) males and 106(51.5%) females. All participants were native of Ikwerre ethnic group, Rivers State, Nigeria. The prevalence of Kell antigens in the present study was 1.9%. The finding agrees with Ugboma et al. (2009), who reported a Kell antigen prevalence of 2% in Port Harcourt. Our observed Kell antigen prevalence of 1.9% is consistent with a 2% prevalence observed by Erhabor et al. (2015) among pregnant women attending antenatal clinic in Usmanu Danfodiyo University

Teaching Hospital (UDUTH) in Sokoto in North- Western Nigeria. Similarly, a previous report by Buhari et al. (2023) observed a Kell prevalence of 2.4% among 1,250 consecutively recruited pregnant women in Sokoto. Also, this study shows a near outcome to the findings from an African Country (Cote d'Ivoire) where a low percentage distribution of 0.77% was reported (Siransy et al., 2014). Kell antigen expression in descents of Ikwerre is at variance with the study by Adewoyin et al. (2018), who reported that the prevalence of Kell antigen among a multi-ethnic cohort of 302 healthy Nigerian individuals

indicated a zero prevalence of K antigen; and also, with the findings done on descents of Ogoni, where Kell antigen was null (Christian *et al.*, 2020).

Interestingly, based on ethnic specificities, the findings from the study is at variance with what reported by Adewoyin *et al.* (2018), in Benin (27.5%), Igbo (23.2%), Esan (12.3%), Yoruba (8.3%) and Urhobo (6%). These dissimilarities are noteworthy, although there are geographical variations and ethnic backgrounds differences.

Based on gender differences, the study also revealed that Kell blood antigens were found in female subjects only. This is of advantage when considering the challenge of Haemolytic Disease of the Foetus and Newborn (HDFN), as Kell antigens were absent in Ikwerre Men. In a population of Kell-positive males as against Kell negative females. The possibility of HDFN in pregnant Kell negative women will be likely, as the mother's immune cells would treat the Kell-positive antigen as a foreign body and develop anti-Kell that would attack and destroy the red blood cells of the foetus.

Conclusion

Kell blood group is rare amongst the study subjects with total absence in Males. The prevalence of Kell blood group was not significant and as such cannot be concluded if individuals with Kell blood group can be at risk to certain diseases. In addition, haemolytic disease of foetus and newborn and haemolytic transfusion reactions will rarely occur as a result of Kell blood group antigen-antibody reactions amongst indigenes of Ikwerre.

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