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## Occurrence of kell blood group among individuals with ABO and Rh (D) blood groups in Awka and Asaba, Nigeria

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### ABSTRACT

Antigens on the surface of the red blood cells are used to determine their blood group. The major blood groups in Nigeria are ABO and Rh (D). Globalization and trans-continental marriages might have thrown up some other blood group in Nigeria. This study identified the occurrence of kell blood group among individuals with ABO and Rh (D) blood groups in Awka and Asaba, Nigeria. One hundred and forty-two participants were recruited randomly for the study. A ml of blood sample collected from each participant was washed in phosphate buffered saline (PBS) thrice and a 3% red cell suspension of each participant's blood was used to determine their blood groups by their agglutination reactions with anti-A, anti-B, Anti-D and anti-K antibodies. The presence or absence of agglutination in any or combinations of the reactions was used to identify the blood groups. The agglutination reactions showed that 106 (74.6%) were O Rh (D) positive; 2 (2.8%) were O Rh (D) Negative; 18 (12.7%) were A Rh (D) positive, 2 (1.4%) were A Rh (D) Negative; 12 (8.5%) were B Rh (D) Positive; none was B Rh (D) Negative while 3(2.1%) were kell blood group. Two individuals with expression of kell antigen on their red cell were of O Rh (D) positive blood while the third individual was of A Rh (D) positive. The finding that 2.1% of the studied population are kell blood group was an indication that individuals with expression of kell antigen on their red cells resides in Nigeria.

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**Keywords:** ABO, Rh (D), kell antigen, blood group system.

## INTRODUCTION

About 44 human blood group systems are recognised and are determined by 49 genes (ISBT WP, 2022). Blood types of offspring are inherited from both parents. The most important blood group systems are ABO and Rhesus. Other blood groups with significant clinical importance are kell system, MNS system, Lewis system and Duffy system (Castilho et al., 2000; Dean, 2005, Owaidah et al., 2020). Apart from the transfusion reactions that could be life threatening, ABO and Rh (D) blood system has been identified to influence susceptibility to some diseases. One of such disease that has been linked with Rh (D) positive blood is viral Hepatitis (Adulrazeez et al., 2014).

In Nigeria the predominant blood group in decreasing order of frequencies was the O Rh D positive > A Rh D positive > B Rh D positive and AB Rh D positive (Akinuga et al., 2011; Anifowoshe et al., 2017). More than 50% of the population are blood group O Rhesus (D) positive. While less than 5% of the population are Rh D negative about 95% of the population are Rhesus D positive. In Nigeria before any unit of blood or blood product is transfused, ABO Rh (D) compatibility testing must be carried out (Akinuga et al., 2011; Anifowoshe et al., 2017; Osaro et al., 2019). The purpose of the compatibility testing is to prevent transfusion reactions which could be life threatening (Goldman et al., 2015; Anifowoshe et al., 2017; Liu et al., 2017). Similarly, the other blood group systems such as kell system which is fully developed in birth can induce transfusion reactions and haemolytic disease of the Newborn (HDN) because the kell antigens are highly immunogenic and highly polymorphic (Mabroo et al., 2013; Prinja and Narain 2020); if compatibility screening is not performed on them to rule out their existence. In Nigeria screening for kell blood system is not common. Although the kell antigen is highly polymorphic, the two major co-dominant alleles of kell red cell antigen are k and K, both antigens differing by a single amino acid change (Dean, 2005; Westhoff et al., 2004). This finding predisposes that those individuals

who are kell blood group must not receive blood transfusion from donors that have anti-k or anti-K antibodies. The present study was designed to screen for kell blood group among ABO and Rh (D) blood group individuals resident in Awka and Asaba towns of Nigeria.

## MATERIALS AND METHODS

One hundred and forty-two individuals (females =104; male = 38) participated in the study. They were randomly recruited amongst the blood donors at Regina Ceali Specialist Hospital Awka and Federal Medical Centre Asaba. They were aged between 20 and 30 years. Three (3) ml of Blood sample was collected from each of the participant and dispensed into EDTA anticoagulant tube of which 1ml was washed in 4 ml of phosphate buffered saline by centrifugation at 1000 g for 20 seconds. This process was repeated thrice and thereafter 3% suspension of red cells in PBS was prepared for each participant and labelled accordingly. The tube technique for blood grouping was used to determine the ABO, Rh (D) and kell blood group status of the participants. The procedure was as described by the manufacturer of the anti-A, Anti-B, Anti-D and anti-K reagents (Lorne Laboratories LTD, Great Britain). One volume of monoclonal Anti-A or Anti-B or Anti-D or anti-K reagent was added to one volume of 3% red cell suspension in a properly labelled test tube corresponding to each participants. The reaction mixture was mixed thoroughly and centrifuged at 1000 g for 20 seconds. After which the red cells were gently re-suspended and viewed macroscopically for agglutination. The test tubes with positive agglutination test were recorded while those with negative agglutination test were incubated for 15minutes at room temperature 20°C and the reaction mixture centrifuged at 1000 g for 20 second and viewed for agglutination again. No evidence of agglutination hereafter was recorded as negative for the antigen of choice. Agglutination of red cells constitute a positive test result which indicates the presence of antigen-A, or antigen-B or Rh (d) antigen or K-antigen on the red cells. While red cells that did not agglutinate with anti-A and Anti-B were

regarded as Blood group O. Negative control was also used as quality control measure. The frequency of occurrence of agglutination or lack of agglutination was expressed in percentages.

**Ethical clearance and informed consent.**

The Ethics Committee of Federal Medical Centre Asaba approved the study design (Ref.FMCASB/A&I VOL.XII/305). The participants after being dully informed of the purpose of the study gave informed consent to participate in the study. There was no form of inducement for the participants.

**RESULTS**

The blood group screening of the participants showed that 106 (74.6%) were

blood group O Rh(D) positive, 4 (2.8%) were blood group O Rh (D) Negative, 18 (12.7%) were blood group A Rh (D) Positive, 2 (1.4%) were A Rh (D) Negative, 12 (8.5%) were B Rh (D) Positive, none had B Rh(d) negative while Kell blood group was detected in 3 (2.11%) of the participants (Table 1). Amongst the 3 participants with Kell blood group, two being O Rh (D) positive individuals and one being an A Rh (D) Positive individual as shown in Table 2. The ratio of mutual occurrence of O Rh (D) positive with Kell blood group was 53:1 while the ratio of mutual occurrence of A Rh (D) positive with kell blood group was 18:1 as shown in Table 2. Kell blood group was not observed in the other blood groups.

**Table 1:** Prevalence of kell, ABO and Rh (D) blood group among blood donors and recipients.

Blood group status	Frequency (%)
O Rh (D) Positive	106(74.6%)
O Rh (D) Negative	4(2.8%)
A Rh (D) Positive	18(12.7%)
A Rh (D) Negative	2(1.4%)
B Rh (D) Positive	12(8.5%)
B Rh (D) Negative	0(0%)
Kell Rh (D) Positive	3(2.1%)
Kell Rh (D) Negative	0(0%)

Table showing the frequency of the various blood groups indicated in percentage.

**Table 2:** Mutual occurrence of kell antigen with ABO and Rh (D) blood groups in donors and recipients.

Blood group status	Frequency (%)	Ratio of incidence of ABO Rh (D) to kell group
O Rh (D) Positive and kell antigen	2(1.9%)	53:1
O Rh (D) Negative	0(0%)	-
A Rh (D) Positive	1(5.6%)	18:1
A Rh (D) Negative	0(0%)	-
B Rh (D) Positive	0(0%)	-
B Rh (D) Negative	0(0%)	-

Table showed where kell blood group was observed among the ABO Rh (D) blood. Kell blood group was observed in participants with O Rh (D) positive in the ratio of 1:53 while it was observed in A Rh (D) positive in the ratio of 1:18. Kell blood group was not observed in the other blood groups in the present study.

## DISCUSSION

In the present study, the most predominant blood group in decreasing frequencies are blood group O Rh (D) positive, blood group A Rh (D) positive, Blood group B Rh (D) positive, blood group O Rh (D) negative, blood group K Rh (D) positive and blood group A Rh (D) negative. The pattern of frequency observed in this study was similar to the pattern reported among Medical Students of Madonna University Teaching Hospital, Elele (Akinnuga et al., 2011). It was also similar to the pattern reported among Nigerian population in the Northern, Eastern and Western parts of Nigeria (Anifowoshe et al., 2017; Osaro et al., 2019). It is a well-known fact that ABO Rh (D) blood group of individuals do not change in the course of their life time. This is also true for Kell blood group.

The most predominant blood group in this study was O Rh (D) positive. Individuals of this blood group do not have A or B antigen expressed on their red cells surface. This finding is consistent with other reports from Elele in Nigeria (Akinnuga et al., 2011), Northern, Eastern and Western parts of Nigeria (Anifowoshe et al., 2017; Osaro et al.; 2019), Port Harcourt (Jeremiah et al., 2011) and other countries like; Mauritania (Hamed et al., 2012), Khuzestan (Toabizadde et al., 2016), Ethiopia (Tesfaye et al., 2015) but not in others like; Southern Bangladeshi (Dewan, 2015) and Northern India (Chandra and Gupta, 2012) were blood group B Rh (D) was the most predominant blood group..

The other blood group with second predominant frequency in this study was A Rh (D) Positive. Individuals with this blood group usually donate blood to recipients with A Rh (D) blood group or AB Rh (D) positive blood group. However, in a population based cross sectional study from China blood group A Rh (D) positive was the most predominant blood group (Liu et al., 2017). Also a report from Turkey indicated that blood group A Rh (D) positive was the most predominant (Kayiran et al., 2012).

The third blood group in terms of frequency of occurrence was B Rh (D) Positive

blood group. Similarly, individuals with this blood group usually donate blood to recipients with B Rh (D) positive blood group or AB Rh (D) positive blood group. However, report from India and Bangladesh showed that blood group B Rh (D) positive was the most predominant blood group in their respective countries (Chandra and Gupta, 2012; Dewan 2015). Other blood groups encountered in this study were O Rh (D) Negative and A Rh (D) Negative which usually have low frequency in communities.

In Nigeria blood donors and blood recipients are not usually screened for Kell blood group and as such blood transfusion reactions arising from k-antigen or K-antigen are not documented. In this study, 3 participants had Kell blood group and that represents 2.1% of the sample population. All the participants with Kell blood group in this study were females. We could not definitely attribute the incidence of Kell blood group in this study to be gender influenced.

The prevalence of Kell blood group in this study of 2.1% was similar to the prevalence of 2% reported from a study in Port Harcourt (Ugboma and Nwauche, 2009) and Sokoto (Osaro et al., 2015). However, ethnic variations have been observed in the prevalence of Kell blood group in Nigeria (Adedoyin et al., 2018) while a higher prevalence of 21.7% Kell blood has been reported in northern Nigeria among blood donors in Kano (Gwaram and Yusuf, 2020). The finding of this study and those of other studies in Nigeria is compelling enough for a review of the cross match panel in Nigeria.

Further analysis showed that mutual occurrence of both O Rh (D) positive and Kell blood group was observed in two donors, indicating a ratio of 53:1. The finding of some individuals possessing Kell antigen thus negates the concept ABO and Rh (D) blood compatibility testing before blood is cleared for transfusion. Anti-k and anti-K antibodies have been implicated as one of the major cause of post transfusion reaction apart from the ABO and Rhesus (D) antigen (Goldman et al., 2015, Dean 2005). This ratio probably shows that Kell

blood antigen may be concurrently expressed in addition to O Rh (D) blood group in one out of every 53 blood group O Rh (D) positive individuals. This has a far reaching consequences in a country where kell blood antigens are not screened.

Further analysis showed that mutual occurrence of both A Rh (D) positive and kell blood group indicated a ratio of 18:1 and was observed in one recipient. This is a significant finding considering that A Rh (D) positive blood are used predominantly for A Rh (D) or AB Rh (D) blood groups.

The present result has thrown up the fact that we have individuals of kell blood group in Awka and Asaba. Indicating the likelihood there may be individuals with anti-k and anti-K antibodies in the community of study. For instance, the O Rh (D) Positive donor with kell blood group is not suitable to donate blood to O Rh (D) positive recipient that is negative for kell blood group. Such blood if transfused will cause the generation of anti-k antibody in the recipient (Dean, 2005; Prinja and Narain, 2020).

The social and emotional impact in cases of blood transfusion reactions are part of negative influence that creates resistance to receiving blood as a means of treatment or management. The development of anti-k or anti-K after transfusion of kell blood to a pregnant woman who is kell negative can portend grave consequences such as haemolytic disease of the new-born which may lead to death in-utero. The magnitude of such emotional pain may be difficult to assume. Therefore, from the social and emotional aspect of human activity, it is proper that any fear factor and reservation be cleared. One of such way to forestall the fear and reservation is for proper screening of the blood to ensure compatibility and zero transfusion reaction.

## Conclusion

The finding of this study strongly suggests that screening for kell blood antigen be included in cross match panel in Nigeria to accommodate significant individuals with kell blood antigens and to avert any possible

dangers should such individuals require blood transfusion. Although, the present study observed that the most predominant blood group in Nigeria was O Rh (D) Positive, the observation of kell blood group in the study participants justifies a call for review of cross match panel of antigens in Nigeria.

## COMPETING INTERESTS

The authors declare that there is no competing interests concerning this work.

## AUTHORS' CONTRIBUTIONS

Conception and design: CCO, ONO, FAE, NOO. Acquisition of data, analysis and data interpretation, drafting /revising of article, final approval of the version to be published: CCO, ONO, FAE, NOO, UME, SIO, NEO, AA, SEE and IJE.

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