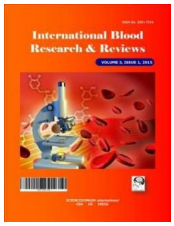

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Blood Group Phenotype Frequencies in Blood Donors in the Northeast of Democratic Republic of Congo

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Authors' contributions

This work was carried out in collaboration between all authors. Author BAS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MMB, BBL, OBJ and KKP managed the analyses of the study. Author KTC managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background and Aims: To know blood group antigen frequencies in a population has various benefits as the assessing risk of alloimmunization, the providing antigen-negative compatible blood to patients with multiples antibodies and the development of a donor data bank for the preparation of indigenous cell panels. The aims of this study is to determine the frequencies of the ABO, Rh and Kell antigens in the blood donors in Kisangani, in the northeast region of Democratic Republic of Congo.

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Materials and Methods: Blood samples from 252 volunteer blood donors coming to the Blood Transfusion Provincial Center at Kisangani in 2015 were typed by serologic test for ABO, Rh (D, C, E, c, e) and K antigens.
Results: For the 252 blood donors, the most frequent phenotype in the ABO blood group, was O (47.6%) followed by A (30.6%), B (17.1%) and AB (4.1%). If combined ABO and Rh blood groups, O positive was most frequent, followed by A positive, B positive, AB positive, O negative and A negative respectively. In the Rh system, the c antigen was the most frequent (98.8%), followed by e antigen (97.6%), D antigens (96.42%), C antigen (15.9%) and E antigen (13.9%). Among ten phenotypes identified in the Rh system, the phenotype R_0r was the most frequently encountered (71.03%). In the Kell system, 100% of donors were K-k+.
Conclusion: Although the Africa specificities for the most immunogenic antigens and the context of limited resources, it is important for better care of patients to improve tests as phenotyping red cells.

Keywords: Blood group; ABO; Rh; Kell; DRC.

1. INTRODUCTION

Blood transfusion is life saving for numerous patients but it is not without risks. There are transfusion transmitted infectious risks and the immediate or delayed immunological risks due to antigen phenotype disparity between donor and recipient [1].

In transfusion medicine, it is helpful to know blood group antigen frequencies in a population. This knowledge has various benefits as the assessing risk of alloimmunization, the providing antigen-negative compatible blood to patients with multiples antibodies, the ethnic distribution of blood group and the development of a donor data bank for the preparation of indigenous cell panels [1,2].

There is thirty-three major blood group system [3]. In the usual situation, it is recommended to perform analyses on ABO, Rh and Kell group systems and to detect red cells antibodies. Many resource limited countries of sub-Saharan Africa as the Democratic Republic of Congo (DRC) select an approach considered as safe and cost-effective for blood grouping: red blood cells for blood transfusion are essentially matched for ABO and D antigens [3,4]. In sometimes or for chronic transfused patients as sickle cell disease patients, if reagents are available, the matching could be extended to the other major Rh system antigens (C, c, E, e) and to Kell system antigens.

Very little data are available regarding the ABO, Rh and Kell blood groups antigens in the Congolese population. From the DRC northeast region, a study was performed on the ABO blood groups by Monteny Va [5] more than 96 years ago.

The purpose of this study is to determine the frequencies of the ABO, Rh and Kell antigens in the blood donors in Kisangani, in the northeast region of Democratic Republic of Congo (DRC).

2. MATERIALS AND METHODS

Blood samples from 252 volunteer blood donors coming to the Blood Transfusion Provincial Center at Kisangani in DRC between 1st January and 31st December 2015 were typed for ABO, D, C, E, c, e and K antigens. There was 10 women and 242 men with age range from 18 to 60 years.

All blood donors had given their consent to the study and the study had been approved by the ethics committee of the University of Kisangani.

To identify ABO, Rh (D, C, E, c and e) and Kell blood groups the traditional techniques were used. ABO grouping was performed by typing the red cells for the presence or absence of A and/or B antigens by antibody agglutination test using antisera anti-A, anti-B, anti-A,B. Results of this forward grouping were correlated with results of the serum/plasma tested for the presence or absence of anti-A and anti-B antibodies. The direct agglutination of antigens with slide technique was used for Rh system and the indirect antiglobulin technique by tube technique for Kell system antigens. To phenotype Rh, five monoclonal monospecific antisera ant-D, anti-E, anti-C, anti-c and anti-e were used. Kell phenotyping was realized with anti-K.

Antigens were determined, according to the manufacter's instructions, by using the kits of Bio-Rad, USA. For direct typing, an antiserum was added to 5% of donor RBC suspensions and an antiglobulin test was used for the indirect typing. Quality controls were done by using

positive and negative control cells and Coombs'control cells in the National Blood Transfusion Center.

3. RESULTS

For the 252 blood donors, the most frequent phenotype in the ABO blood group was O (47.6%), followed by A (30.6%), B (17.1%) and AB (4.1%). If combined ABO and Rh blood groups, O positive was most frequent, followed by A positive, B positive, AB positive, O negative and A negative respectively.

In the Rh system, the frequency of RhD antigen was 96.42%. For the others, the c antigen was the most frequent (98.8%), followed by e antigen (97.6%), C antigen (15.9%) and E antigen (13.9%). Ten phenotypes in the Rh system were identified. The phenotype R_0r was the most frequently encountered (71.03%).

In the Kell group system, all of donors were K-k+ (100%).

4. DISCUSSION AND CONCLUSION

The frequency of ABO, Rh and Kell blood groups varies in different races, between ethnic groups, in different part of the world and both within and between geographical areas [6-8].

The ABO system is the most important of all blood group systems in transfusion medicine because agglutinins in the ABO system are normally present in the absence of the corresponding antigen and ABO group mistyping can cause intravascular hemolysis, renal failure and death. Consequently, transfuse safe blood of the compatible ABO group is the cornerstone of safe blood transfusion practice [6].

In this study (Table 1), the most frequent phenotype in the ABO blood group was O followed by A, B and AB, giving the order O > A > B > AB. If combined ABO and Rh blood groups, O positive was most frequent, followed by A positive, B positive, AB positive, O negative and A negative respectively. This finding is similar with studies from other African countries as in Nigeria [9], Guinea [10], Cameroun [7] and Mauritania [11].

Nevertheless these frequencies are in contrast with those from other part of the world. In India, the most common blood group was B [1,12-14] followed by the group O [1,13,14] and least common being AB. In this area, ABO blood group frequency was shown by formula B > O > A > AB [12-14].

The Rh system is, after ABO blood group, the most clinically important in transfusion medicine and the most polymorphic one. In DRC, the blood transfusion are done only regarding ABO and RhD antigens. This situation exposed recipients to alloimmunization. In Kisangani, the alloimmunisation against RBC was found to have a prevalence of approximately 10% in the sickle cell disease patients who had been multitransfused. Specific alloantibodies founded were anti-C-D, anti-E and anti-C-D-E [4].

In this study (Table 2), the frequency of RhD antigen was 96.42%. This result, comparable with the findings in Cameroun (96.32%) [7], is nevertheless higher than those founded in other sub-Saharan countries as Côte d'Ivoire (92.93%) [3], Guinea (95,9%) [10] and Nigeria (81.5%) [15]. The frequency of the RhD negative was 3.58%. This finding is lower than the 6% founded in Cameroun [16] and the 18.5% in Nigeria [15] but higher than the 1% reported in Madagascar [17]. The D antigen is the most highly immunogenic of the Rh antigens. It plays a significant role in the haemolytic disease of the fetus and newborn and the transfusion of D+ blood to D – recipients should be avoided.

Table 1. ABO and Rh blood group distribution among 252 blood donors

Blood group (N=252)	n	%	Total
ABO group			
A-	2	0,8	
A+	75	29,8	30,6
B-	1	0,4	
B+	42	16,7	17,1
AB+	12	4,8	4,8
O-	6	2,4	
O+	114	45,2	47,6
Rh group			
D+	243	96,4	
C+	40	15,9	
E+	35	13,9	
c+	249	98,8	
e+	246	97,6	

Table 2. Rh and Kell phenotypes frequencies in north-east Congolese donors (n=252)

Antigens					Phenotype	n	%
Anti-D	**Anti-C**	**Anti-E**	**Anti-c**	**Anti-e**			
Rh positive							
+	0	+	+	0	DcE	1	0,40
+	0	0	+	+	Dce	179	71,03
+	0	+	+	+	DcEe	26	10,32
+	+	0	+	+	DCce	30	11,90
+	+	+	+	+	DCcEe	5	1,98
+	+	0	0	+	DCe	1	0,40
+	+	+	0	+	DCEe	1	0,40
Rh negative							
0	0	0	+	+	ce	7	2,78
0	+	+	+	+	CcEe	1	0,40
0	+	0	+	+	Cce	1	0,40
Kell							
K - k +						252	100.0

"Rh-positive" refer to presence of the D antigen and "Rh-negative" to his absence. However by the mid-1940s, four other antigens, responsible for the majority of clinically significant antibodies, had been recognized: the antithetical C and c, and E and e antigens. Therefore the five principal Rh antigens are D, C, c, E and e even if over 50 different Rh antigens had been characterized later [18].

For the Rh system (Table 1), the c antigen was the most frequent in our study, followed by e antigen, C antigen and E antigen. In the context of DRC, there is a risk that a patient without the C, E, c or e antigens to be transfused with blood containing these antigens. Certainly these antigens are less immunogenic than D antigen but such as exposition can lead to the production of the corresponding antibodies that can cause a haemolytic reaction if they are not detected during crossmatching, particularly in multi-transfused patients as those with sickle cell disease.

Ten phenotypes in the Rh system were identified in our study. It is characteristic of the black population. The phenotype Dce was the most frequently encountered (71.03%) contrarily of the DCce phenotype that is the most popular in white population [6].

After the ABO and the Rh antigens, the K antigen in the Kell blood group system is strongly immunogenic [6]. All of donors in this study were K-k+ (100%). Matching the blood for K antigen in the Kell blood group system is not necessary, although antibodies produced to this antigen can cause severe haemolytic reaction in future transfusions or haemolytic disease of the fetus and newborn in future pregnancies.

Despite some limitations of this study, related to the shortage of antisera, such as the small sample size and the collection of data from a single existing center, sub-Saharan Africa specificities are important to be documented by providing immunohematology data on blood donors. Although the context of limited resources, it is important for better care of patients to improve tests as phenotyping red cells, screening and identifying red cells antibodies.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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