

RESEARCH ARTICLE

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Distribution of ABO and Rhesus (RHD) blood groups among blood donors in Republic of Congo

Brunel M Angounda, Serge O Mokono, Geneviève B Boukatou, Boris S Bakoua, Edwige PLC Nanitelamio

ABSTRACT

Aims: The ABO and Rhesus (Rh) blood group systems are most important in population genetic study and for blood transfusion purposes. This study was conducted to determine the distribution of ABO and Rh blood groups among Congolese blood donors.

Methods: A retrospective study was conducted at National Center for Blood Transfusion, over a period of 5 years from January 1, 2011, to December 31, 2015. This study included the blood transfusion centers of Brazzaville, Pointe Noire and other localities grouped together in the North and Southwest coordination. Blood grouping ABO and Rhesus were determined using conventional blood typing procedures based on Beth-Vincent and Simonin-Michon methods.

Results: Out of 266,055 blood donors included, 217,990 (81.9%) were male and 48,065 (18.1%) were female donors. Most donors were young adults, representing the age group of 18–30 (45%). The majority were replacement (62.4%) while the remainder was voluntary donors (37.6%). The most prevalent blood group was O (56.6%), followed by blood groups A (20.3%) and B

(20.1%), whereas the least prevalent blood group was AB (2.9%). The majority 97.6% were Rh D positive, and 2.4% were Rh D negative.

Conclusion: The study has a significant implication regarding the inventory management of blood transfusion center in Republic of Congo.

Keywords: ABO, Congo, Donors, Rh, Transfusion

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INTRODUCTION

Blood group antigens are hereditary determined and play an essential role in the genetic distribution population and the transfusion safety [1, 2]. Blood transfusion can carry immediate or delayed immunological risks, whose most common is the hemolytic transfusion reaction by antibody incompatibility [3]. The discovery of the ABO and Rh blood groups was an important achievement in the history of blood transfusion [4, 5]. The knowledge of the ABO and the Rh blood group distribution in different areas is imperative for the management of the blood transfusion services [2, 6]. The antigens of blood group systems are frequently tested in blood donors and patients because of their clinical relevance. Blood transfusion resulted in high mortality before the

discovery of ABO blood groups because there was no knowledge of the difference in the blood composition among individuals in human population [3]. Indeed, in many studies through the world, the distribution of these blood groups shows considerable variations reflecting the underlying genetic and ethnic diversity of human populations [7, 8]. In United States and Europe, the ethnic and racial differences in distribution of ABO and RhD phenotypes are recognized [7, 8, 9]. In the studies conducted in Guinea, Ivory Coast, Burkina Faso, and Nigeria, the blood group O was the most prevalent and AB the less prevalent blood group [10, 11, 12, 13]. In another study conducted in Pakistan, the B and AB blood groups had the highest and lowest frequency, respectively [14]. Also, in a Morocco study, the A blood group was the most predominant and AB the less prevalent blood group [15]. In Nigerian populations, the frequencies of phenotypes RhD+ and RhD– varied between 94.8–97% and 3–5.2%, respectively [10, 11].

There are few data on blood group systems in republic of Congo and most of them were never published. About, the studies conducted in Brazzaville showed that the predominant blood group to be O and the least prevalent to be AB [16, 17]. In 2009, another study showed that RHD gene deletion is the most prevalent cause of the D phenotype in the Congolese population [18]. But these data were global and did not integrate the pattern of geographical distribution. This study aims to determine the distribution of ABO and Rh blood groups among blood donors in Republic of Congo.

MATERIALS AND METHODS

Design and sample population

A retrospective study was conducted at National Center for Blood Transfusion (NCBT) over a period of 5 years from January 2011 to December 2015. This study has a national distribution and includes the blood transfusion centers of Brazzaville, Pointe Noire and those of several localities grouped in the North (Gamboma, Djambala, Oyo, Owando, Mossaka, Abala, Ewo, Boundji, Ouesso, Sembe, Pokola, Ngombé, Impfondo, Lepionnier, Makoua, Bétou, Okoyo, Mbama, Itoumbi, Kélé and Mbomo) and Southwest (Dolisie, Mossendjo, Sibiti, Nkayi, Mouyondzi, Madingou, and Loutété) coordination. The study population included the blood donors visiting NCBT and donors referring to mobile teams. Samples were analyzed from both voluntary and replacement donors.

Voluntary blood donation involves a donor giving blood of his or her own free will while replacement or family donors are those who give blood when required by a family or community member.

Prior to donating blood, the donors were first assessed for physical and health wellbeing. The assessment criteria required that the donors between the ages of 18 and 70, with a personal weight above 50 kg and a blood pressure

of up to 140/90 mmHg were accepted. Only donors who satisfied these criteria were recruited.

Analysis

During blood donation process, 5 mL of blood sample was taken in EDTA tube from each blood donor for blood groups typing. Blood grouping ABO and Rhesus was done by antigen–antibody agglutination test using at least two batches of commercially standard anti-sera and cells test prepared and validated locally in our blood services. Blood group antigens were determined by double determination from two different technicians realizing forward blood typing procedures based on Beth-Vincent and Simonin-Michon methods. Presence of agglutination indicates the presence of the corresponding blood group and vice versa. Negative samples for Rh D were confirmed by antiglobulin technique (“weak D test”). The antigen–antibody agglutination reaction was observed visually. Approval of the national blood transfusion center was obtained for this study. Data have been used anonymously. The confidentiality of donors has been preserved. Descriptive statistics was used whereby data were summarized using frequency and percentages.

RESULTS

A total of 266,055 participants were included. The majority of study population were from Brazzaville (41.8%, n=111,181) and Pointe Noire (38%, n=101,044) blood transfusion centers and the lowest frequencies were observed at the North (10.6%, n=25,544) and South-West (9.6%, n=28,286) coordination. As shown in Table 1, there were more male participants (81.9%, n=217,990) as compared with female participants (18.1%, n=480,665). The age distribution of the participants was 45% (n=119,767), 41.4% (n=110,090), and 13.6% (n=36,198) for the age groups of 18–30, 31–45, and 46–60, respectively. Replacement donors (81.9%) were much more than voluntary donors (37.6%).

The study revealed that blood group O was the commonest (56.6%) closely followed by A at 20.3%, followed by B at 20.1% and AB was the least prevalent group at 2.9%. Out of the total donor population, 97.6% were RhD positive (RhD+) and 2.4% were RhD negative (RhD–) (Table 1).

In all the centers, the highest prevalence of blood groups was related to O and the lowest prevalence to the AB blood group (Table 2). The prevalence of blood group A was higher in all centers than B except for Southwest coordination. Rhesus D positive prevalence showed the highest difference in Pointe Noire center and the lowest in North coordination. The prevalence of Rh-negative groups was the highest in North coordination and the lowest in Pointe Noire center (Table 2).

Table 1: Characteristics and blood group distribution among Congolese blood donors

Characteristics	Frequency	%
Gender		
Male	217,990	81.9
Female	48,065	18.1
Age (years)		
18–30	119,767	45.0
31–45	110,090	41.4
46–60	36,198	13.6
Donors types		
Voluntary	99,991	37.6
Replacement	166,064	62.4
Centers		
Brazzaville	111,181	41.8
Pointe Noire	101,044	38.0
Southwest coordination	28,286	10.6
North coordination	25,544	9.6
Blood group		
O	150,637	56.6
A	54,118	20.3
B	53,478	20.1
AB	7822	2.9
Rh antigens		
RhD positive	259,569	97.6
RhD negative	6486	2.4

Table 2: Distribution of blood group systems in all blood transfusion centers

Centers	Blood group					
	A%	B%	AB%	O%	RhD+%	RhD–%
Brazzaville	21.08	21.05	3.21	54.66	97.64	2.36
Pointe Noire	21.02	20.85	3.02	55.11	98.36	1.64
Southwest coordination	16.84	17.44	2.06	63.66	98.31	1.69
North coordination	18.28	15.98	2.46	63.28	93.25	6.75

DISCUSSION

The ABO and the Rh blood group system is the most important system in the transfusion and the organ transplants [2]. The current study showed that the majority of donors were male, which is consistent with other studies in Africa and in most regions globally [19, 20]. In fact, several factors for women including menstruation, pregnancy and breastfeeding excluding them from the blood donation [21, 22].

In this study, the most common age range for blood donation is 18–30 years with 45%. This is consistent with studies in Tanzania and Madagascar, which also showed the blood donors were essentially young with majority of them aged <40 years old [19, 23]. The

improved interest and ability among younger adults to donate may be related to awareness, better physical health, and greater mobility. Older individuals may suffer from medical conditions such as ischemic heart disease, diabetes mellitus, malignancy, and hypertension, hence, negatively impacting their ability to be well enough to donate blood [24, 25].

The majority of donors in our study were replacement (62.4%) while the minorities were voluntary (37.6%). This is consistent with other studies and global trends [19]. The donation of blood by voluntary non-remunerated blood donors is critical for the safety and sustainability of national blood supplies. National blood donation systems in which replacement donors dominate are typically unable to meet clinical demands for blood while paid

family members contributing often poses serious threats to the health and safety of the recipients and the donors. World Health Organization (WHO) recommendations are therefore to create health systems based 100% on voluntary donation [20].

In this study, the blood group O was found to be the most common (56.6%) among ABO blood groups, followed by blood group A (20.3%), blood group B (20.1%), and blood group AB (2.9%). These findings are consistent with studies done elsewhere in Africa [12, 26, 27]. A similar distribution of ABO blood groups has been seen in studies conducted among blood donors in Ghana, Uganda, Tanzania, Burkina Faso, and Cameroon, which also showed the predominant group to be O and the least common to be AB [12, 19, 26, 27, 28].

However, in contrast to our study, Lialiaris in Greece and Wagner in Germany found the commonest blood group as group A, followed by blood group O, B, and AB [29, 30]. While other studies conducted in India and Pakistan showed blood group B was the most predominant, followed by blood group O, A, and AB [14, 31]. In all the studies cited and including our study, blood group AB is the least distributed among the population of the world [7].

From the point of view of transfusion, rhesus blood group system is the second most important blood group [2]. The identification of Rhesus blood system is important to prevent erythroblastosis fetalis, which commonly arises when a Rhesus negative mother carries Rhesus positive fetus. This study reveals that Rhesus (D) positivity has the highest distribution among the donors which is similar to other studies conducted on other countries. In the studies performed at Ivory Coast (92.93%), Madagascar (98.9), Tanzania (97.7%), Uganda (98%), and Cameroon [19, 23, 26, 28, 32].

The frequency of Rh negativity is less in Congolese blood donors. This observation is in agreement with several studies that show a low frequency of Rh negativity in Africans, Asians, and American blacks compared to Caucasians [11, 23, 26]. About 2–8% of donors all over the world are detected as Rhesus (D) negative except in Britain and Germany, where the distribution of Rhesus (D) negative is 15% and 17.29% respectively [30, 33].

CONCLUSION

Our study shows that the most frequent blood group is O and least common is AB among the Congolese blood donors. More than 97% of the study population were Rh D positive. These findings may be important for blood donor recruitment strategies in NBTC. They could be used to sensitize blood prescribers to avoid wastage of rare blood group phenotypes, while respecting the indications of blood transfusion. Future studies must also include serological and genetic investigation of the prevailing ABO blood group antigens/Rhesus factor in the population, using cross-sectional design.

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Author Contributions

Brunel M Angounda – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Serge O Mokono – Conception of the work, Design of the work, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Geneviève B Boukatou – Design of the work, Acquisition of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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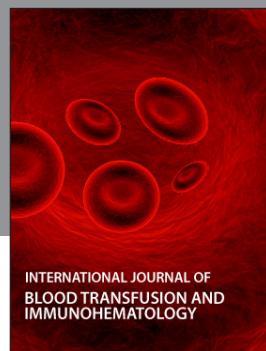
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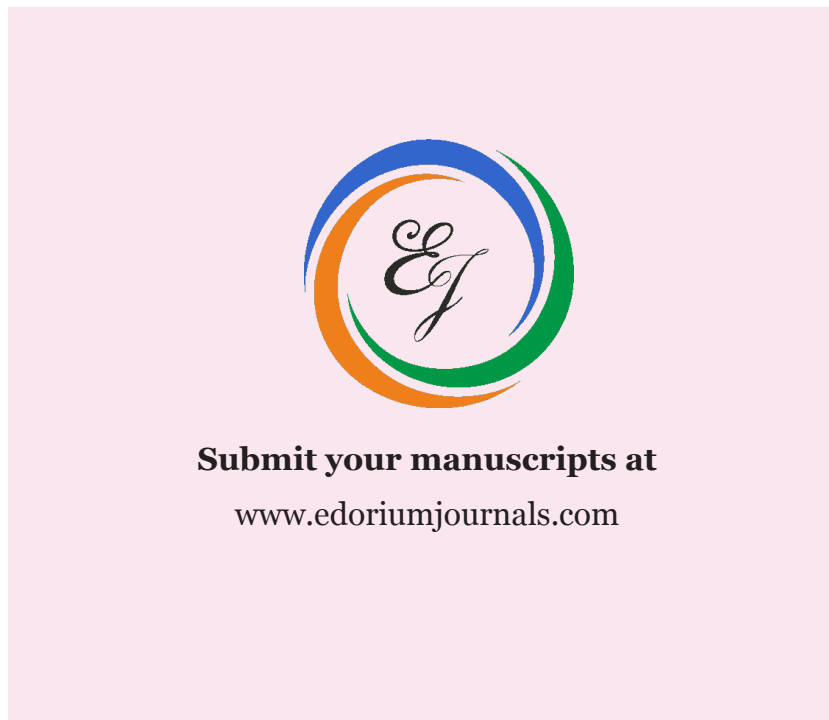
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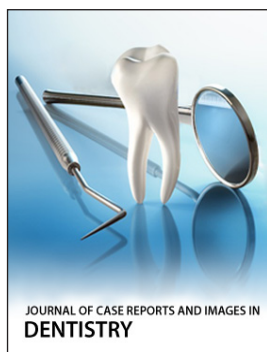
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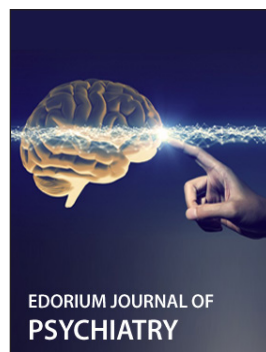
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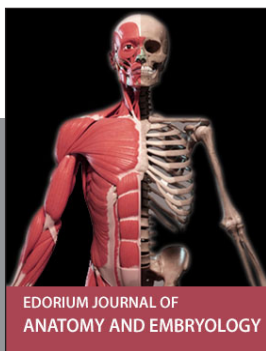
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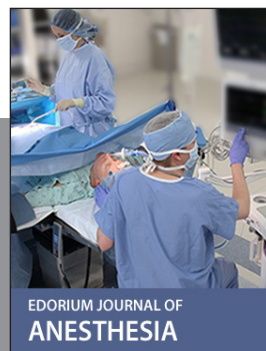
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