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Characterisation of Rhesus antigens (D, C, c, E, e) among blood donation units and recipients in the Gynaecology, Obstetrics and Paediatrics hospital of Yaoundé and the District Hospital of Obala in the Centre region of Cameroon

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Abstract

Objective: Despite being a life-saving act, blood transfusion can present risks that transfusion safety aims to prevent. The aim of this study was to characterise Rhesus antigens (D, C, c, E, e) in donors and recipients in the Gynaecology, Obstetrics and Paediatrics hospital of Yaoundé and the District Hospital of Obala in the Centre region of Cameroon. Methodology: Rhesus antigens (D, C, c, E, e) were detected by plate agglutination at 37°C, phenotypes were determined and allelic frequencies calculated. Results: Three rhesus antigens were dominant in our study population of 204 pairs. Ag D, Ag c and Ag e had frequencies of 97%, 98% and 99% respectively for donor blood units and 98%, 99% and 100% for recipients. The Dce phenotype was the most represented with 51.5% in donor blood units and 52.9% in recipients. The D allele was widely represented with a frequency of 0.827 for donor blood units and 0.859 for recipients. Conclusion: Ag D, c and e are represented by more than 97%. The Dce phenotype is the most represented. The D allele is dominant. Characterisation of Rhesus antigens highly contributes to transfusion safety.

Keywords: Rhesus antigens, Blood donors, Recipients, Transfusion safety.

INTRODUCTION

Blood transfusion is a life-saving medical procedure. It involves taking blood or blood derivatives from an individual called the donor and infusing them intravenously into a person called the recipient [1]. Blood transfusion can present risks that transfusion safety aims to prevent [2].

Erythrocyte antigens are classified into 3 major groups: blood group antigens which are genetically induced, collections and series for which the genetic classification has not yet been determined [3]. The International Society of Blood Transfusion recognises 346 blood group antigens grouped into 36 blood group systems. The Rhesus system is the 4th (ISBT 004). It is a complex system comprising 54 antigens numbered RH1 to RH61 with 07 unassigned numbers. The antigens most commonly sought in current practice are D (RH1), C (RH2), E (RH3), c (RH4) and e (RH5). There are 18 possible phenotypes when anti-D, C, E, c and e antisera are used. The distribution of Rhesus antigens varies according to race, region, ethnic group and sex [4].

In sub-Saharan countries, the pre-transfusion procedure for determining blood grouping in donors and recipients is often limited to testing for ABO and Rh 1 antigens. Testing for other blood group antigens such as RH2, RH3, RH4 and RH5 is not systematically performed, thereby endangering transfusion safety [5].

MATERIAL AND METHODS

We conducted a descriptive cross-sectional study with data collection from October 2023 to April 2024 in the Gynaecology, Obstetrics and Paediatrics Hospital of Yaoundé and the Obala District Hospital. The tests were carried out at the Yaoundé Central Hospital blood bank. We took pairs of donor blood units and the corresponding recipients. Rhesus D, C, c, E, e antigens were tested by agglutination on a plate at 37°C according to the procedures of the Manuel pratique du laboratoire de Transfusion Sanguine dans les Pays

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en Développement [6] and Modern blood banking & transfusion practices [3]. RH1 and RH-1 allelic frequencies were calculated using the Landsteiner and Weiner formula. Written informed consent was obtained from all recipients.

RESULTS

We selected 204 pairs of blood units from matching donors and recipients. Donor age ranged from 19 to 60 years, with an average of 28.4 years and 68.6% of donors under 30 years of age. The most common age range was [25-30] for both donors and recipients. The age of recipients ranged from 1 day to 85 years, with an average of 28.25 years. Donors were predominantly male (94.6%) and recipients predominantly female (57.8%).

The distribution of Rhesus antigens in our population is shown in Figure 1.

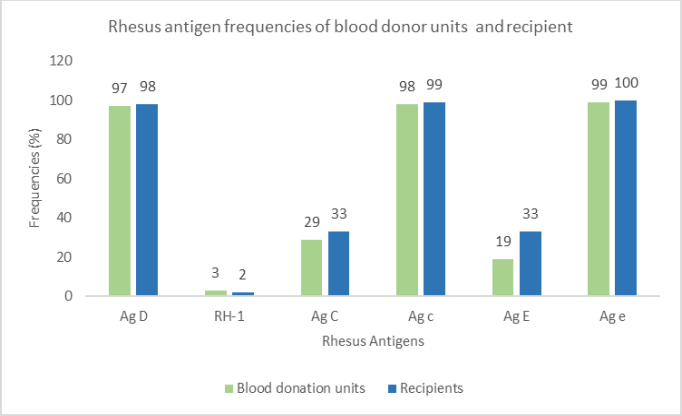

Figure 1: Rhesus antigen frequencies of donor and recipient blood units

In the Rhesus system, 03 antigens were dominant in donors' and recipients' blood units, with frequencies of 97%, 98% and 99% for the former and 98%, 99% an d 100% for the latter in relation to Ag D, Ag c and Age respectively. RH -1 is the least represented, with a frequency of 3% in donor blood units and 2% in recipients.

The Rhesus phenotypic frequencies of our study population are shown in Figure 2.

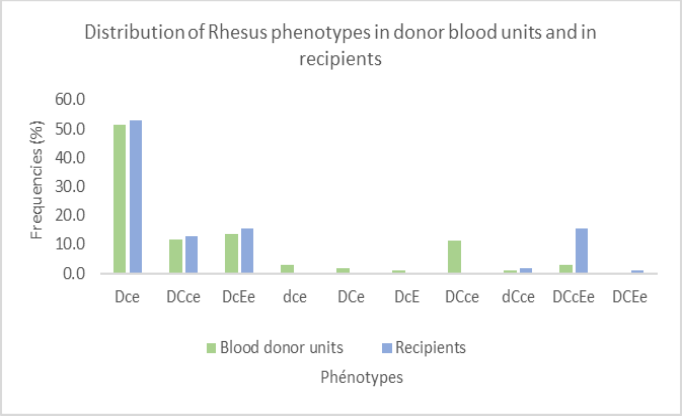

Figure 2: Distribution of Rhesus phenotypes in donor blood units and recipients

The Dce phenotype was the most represented in our study population: 51.5% in donor blood units and 52.9% in recipients. The DcEe phenotype ranked 2nd and DCce 3rd. The frequencies were, respectively, 13.7% and 11.8% in donor blood units and 15.7% and 12.7% in recipients. The phenotypes poorly represented in all subjects were dce, DCe, DcE and dCce.

The allelic frequencies of RH1 and RH-1 in our study population are shown in Table 1.

Table 1: Allelic frequencies of the D antigen

	Allelic frequencies RH1	
	Donor blood units	**Recepients**
RH 1	0,827	0,859
Rh-1	0,173	0,141

The D allele is dominant in donor and recipient blood units with frequencies of 0.827 and 0.859 respectively.

DISCUSSION

The age of the donors ranged from 19 to 60 years, with an average of 27.70 years. The most common age range was [25-30], and 79% were under 30. These results are similar to those of blood donors in Libreville, Gabon, who reported an average age of 29.9 ± 7.0 (17 to 61 years) [7]. The age distribution of blood donors in our study is different from that of French donors. The average age of French donors is 38.3, with 35% under 30 and 37% over 40, including 8% over 60 [8]. Among recipients, the [25-30] age group accounted for 18.1%. Our result was similar to that found in Egyptian recipients, who had a mean age of 32 years [4]. In contrast, at the Yaoundé University Teaching Hospital, recipients over 55 years of age were the most frequently transfused. This age group represented 25% of all recipients [9].

The male gender was predominant among donors, with a percentage of over 94%. These results are similar to those of donors in Libreville, Gabon, who reported 83% male donors [7]. Our results differ from those in France. In France, a trend towards more female blood donors has been observed: 51% in 2007, 52% in 2019 [10] and 47% in 2022 [11]. The majority of recipients in our study population were female (57.8%). Our results were in line with those of recipients at the Fako District Hospital in Cameroon. They reported 57% female recipients [12]. In comparison, Egyptian recipients were less likely to be female, at 47% [4].

Among donors, Ag D, c, e, C and E had frequencies of 97%, 98%, 99%, 29% and 19% respectively. Antigens D, c, e were dominant. Our results are similar to those of blood donors in Libreville, Gabon, who reported frequencies of Ag D (98%), Ag c (100%), Ag e (99), Ag C (16%) and Ag E (18%) [7]. However, our results differ, for Ag C and Ag E, from those of volunteer blood donors in Douala, Cameroon, who reported Ag C and Ag E frequencies of 90% [13]. In recipients, the antigen frequencies were: Ag D (98%), Ag c (99%), Ag e (100%), Ag C (33%) and Ag E (33 %). Our results corroborate those of the HCY, which reported frequencies of 94%, 99%, 95%, 14% and 32% for antigens D, c, e, C and E respectively [14].

RH-1 had the lowest frequency with 3% in donor blood units and 2% in recipients. These results are similar to those of blood donors in Côte d'Ivoire and the general population in Nigeria. They recorded RH-1 frequencies of 7% (5) and 5% [15] respectively. The very low representation of RH-1 found in our study does not corroborate the result of the study on the Ethiopian population which found a frequency of 19% for Ag D [16].

The Dce phenotype was the most represented in our study population: 51.5% in donor blood units and 52.9% in recipients. The DcEe phenotype occupied 2nd place, followed by DCce. The phenotypes that were poorly represented were dce, DCe, DcE and dCce in all subjects. The dominant representation of the Dce phenotype was found among blood donors in Côte d'Ivoire (65%) [5]. However, this is different from the study carried out in the Egyptian population at the Suez Canal University Hospital blood bank. The authors estimated the frequency of the Dce phenotype at 9% and DCce as the most represented phenotype with 33% [4].

The RH1 and RH-1 allelic frequencies of the donor blood units in our study were 0.827 and 0.173 respectively. Our results were similar to

those of donors in Burkina Faso with 0.721 for RH1 and 0.279 for RH-1 [17]. In recipients, the RH1 and RH-1 allelic frequencies were for RH1 (0.859) and RH-1 (0.141). Our results are similar to those found in the Nigerian population in Lagos, who reported allelic frequencies of 0.830 for RH1 and 0.170 for RH-1 [18]. However, a difference was noted between our results and those of the Ethiopian highlanders. The RH1 allele frequency of the latter was 0.538 and that of RH-1 0.462.

CONCLUSION

This study showed that the donors were young and predominantly male. Three Rhesus antigens were dominant: Ag D, Ag c and Ag e with frequencies above 95% for all subjects (blood donation units and recipients). The Dce phenotype was the most represented. The D allele was widely represented in the study population.

Conflict of Interest

The authors declare no conflicts of interest.

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