

Distribution of ABO and Rhesus Blood Groups among the Blood Donors in a Teaching Hospital of Hilly Region, Nepal: A Cross-sectional Study

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ABSTRACT

INTRODUCTION: The ABO and Rhesus-D blood group systems are important and widely used in humans for transfusion of blood and blood components for various medical conditions. The purpose of this study was to determine the distribution of ABO and Rhesus D blood groups among blood donors at Karnali Academy of Health Sciences, Teaching Hospital, Jumla, Nepal. **MATERIALS AND METHODS:** From July 2019 to January 2022, a retrospective cross-sectional study among 800 blood donors was conducted using medical records from blood donors who donated blood in a Teaching Hospital of Jumla, Nepal. Microsoft Excel was used to analyze the data, and the results were presented as frequency and percentage. **RESULTS:** The most common blood group was 'A' (30.6%) and the least common was 'AB' (14.5%) with a majority of male blood donors (84.6%). Only 2.2% of blood donors was Rhesus-negative, while 97.7% were Rhesus-positive. Considering ABO and Rhesus blood groups altogether, blood group 'A' Rhesus-positive (30.1%) was the most common and blood group 'AB' Rhesus-negative (0.1%) was the least common. **CONCLUSIONS:** Blood group 'A' was the most common, followed by blood groups 'B', 'O', and 'AB'. The majority of the blood donors were Rhesus-positive, with blood group 'AB' Rhesus-negative being the most uncommon. This information would be helpful to the hospital's blood bank in this rural hilly region, particularly in the hospital's planning for blood transfusion services.

Keywords: ABO Blood Group, Blood Bank, Rhesus Blood Group System.



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INTRODUCTION

The ABO blood groups were the first human blood group system, discovered by Karl Landsteiner in 1900 [1]. Based on the presence of antigens on the surface of RBC, individuals are classified into four major blood groups (A, B, AB, and O) [2]. Additionally, blood groups are classified as positive or negative based on the presence or absence of Rhesus (Rh) or D antigen on the surface of RBC. The detection of an individual's blood group is critical for maintaining blood banking records, safe transfusion and organ transplantation [3]. ABO (with blood types A, B, AB, and O) and Rhesus (with Rh D-positive or Rh D-negative blood types) are clinically significant blood group systems. The distribution of ABO and Rh- D blood groups are

critical for effective blood bank inventory management as well as lowering maternal mortality rates. It is also useful in population genetic studies, researching population migration patterns, and resolving certain medico-legal issues, particularly in paternity testing [4]. There are numerous blood group systems based on various blood group antigens, but understanding the distribution of ABO and Rhesus systems at the local and regional levels aids in the effective management of blood stock inventory in blood banks and safe blood transfusion services [4]. The frequency distribution of ABO and Rhesus blood groups varies by race, ethnicity, and region of the world [1]. A regular update of the hospital's blood bank inventory is critical for

effective management of emergency and routine cases, as well as efficient hospital services [3]. However, there is little information or data available about blood group distribution in general, which could be effective evidence for the providing quality services and managing emergency cases in the hospital. Though, there have been very few studies on the distribution of blood groups in the hilly region of Nepal. Therefore, the researcher felt the necessity to determine the distribution of ABO blood group and Rhesus factor among blood donors visited the tertiary level health care center, Karnali Academy of Health Sciences (KAHS)-Teaching Hospital, Jumla.

MATERIALS AND METHODS

Study design and setting

A retrospective cross-sectional study was conducted at KAHS-Teaching Hospital Jumla, Nepal from July 2019 to January 2022.

Participants and procedure

Donors aged between 18-60 years, weighing more than 50kg, and meeting the hemoglobin cut-off criteria (hemoglobin level of at least 12.0 g/dL for females and 13.0 g/dL for males) were eligible for this study as per world health organization (WHO) standards [5]. All of the blood donors were voluntary and replacement donors who donated the blood in the hospital's laboratory and blood bank. The ABO and Rh-D blood grouping test was performed on each sample using the tile agglutination method and the tube agglutination method based on the departmental standard operating protocol (SOP) method with Tulip Diagnostics anti-A, anti-B, and anti-D (Tulip Diagnostics (P) Ltd, Verna, Goa, India). And, the reverse and forward both blood grouping methods were done for confirmation if the test result showed a low titer or agglutinations.

Statistical analysis and data management

Data were entered into Microsoft excel, and analysis was carried out. Descriptive statistical analysis was performed to show the frequency distribution of the ABO and Rh-D blood group among blood donors.

Ethical considerations

The study was approved by the Karnali Academy of Health Sciences' Institutional Review Committee (Reference no. 2078/2079/37).

RESULTS

ABO grouping and Rh-D typing were performed on 800 donor samples in total, of which 677 (84.6%) were

from male blood donors and 123 (15.4%) were from female blood donors, with a mean age of 27.49±6.64 years. The majority of the donors were found under the age group of 18-27 years followed by 28-37 years, 38-47 years and 48-57 years, with frequency distributions of 435 (54.4%), 308(38.5%), 45(5.6%) and 12 (1.5%) respectively. The ethnic groups included in the study were Brahmin, Chhetri, Janajati, Thakuri, Dalit and others, with Chhetri having the highest frequency of 394 (49.3%) followed by Brahmin 133 (16.6%), Thakuri 97 (12.1%), Dalit 96 (12.0%), Janajati 79 (9.9%), and others 1 (0.1%) respectively (**Table 1**).

The distribution of ABO blood groups among donors was 245 (30.6%), 233 (29.1%), 206 (25.7%) and 116 (14.5%) were A, B, O and AB blood groups respectively. Rh-D positivity was 782 (97.7%) and Rh-D negativity was 18 (2.2%) in the Rh-D blood group (**Table 2**).

Characteristics	Frequency (n)	Percentage (%)
Age (Years)		
18-27	435	54.4
28-37	308	38.5
38-47	45	5.6
48-57	12	1.5
Range	18-54	
Mean ± SD	27.49±6.64	
Sex		
Male	677	84.6
Female	123	15.4
Ethnicity		
Brahmin	133	16.6
Chhetri	394	49.3
Janajati	79	9.9
Thakuri	97	12.1
Dalit	96	12.0
Others	1	0.1

Blood groups	Frequency (n)	Percentage
A	245	30.6
B	233	29.1
O	206	25.7
AB	116	14.5
Rh positive	782	97.7
Rh negative	18	2.2

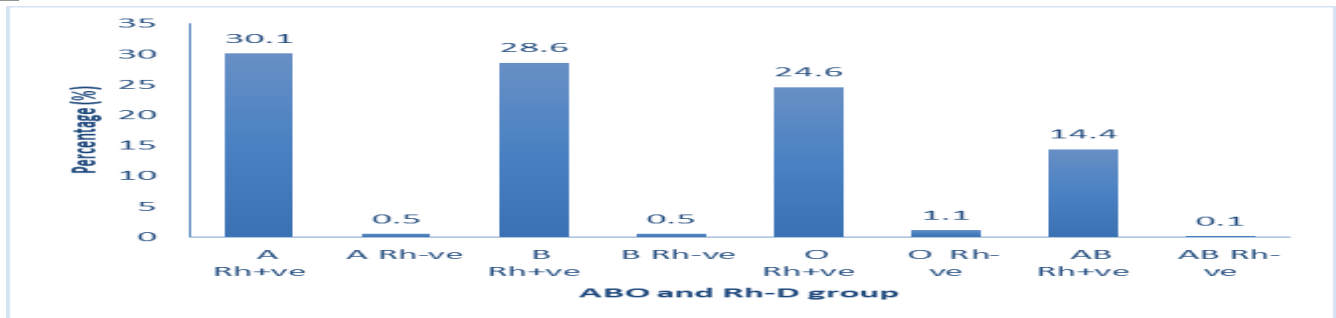


Figure 1 | ABO and Rh-D blood group distribution among study participants

Considering ABO and Rh blood groups altogether, the most common blood group was 'A' Rh-positive, accounting for 241 (30.1%) while 'AB' Rh negative accounted for only 1 (0.1%) (Figure 1).

DISCUSSION

This study determined the distribution of ABO and Rh-D factor among voluntary blood donors in a tertiary care hospital, KAHS-Teaching hospital, Jumla, Nepal where data on this subject is lacking. This study showed the majority of donors were male, which is consistent with other studies in Africa, India, and most other parts of the world [2, 6-9]. The reason behind the less participation of females might be due to low hemoglobin levels, low body weight, pregnancy, breastfeeding, and also a cultural perspective of that region [1, 5]. This study was conducted in a rural region of Nepal, where the majorities of people are uneducated or have little knowledge of the benefits of blood donation. People might not afford a nutritional diet daily. Of the total blood donors, young participants between ages of 18-27 years were the most common blood donors. The active participation of the young may be related to awareness, better physical health, greater mobility, and are more easily persuaded [5]. The most common blood group in the study was 'A' (30.6%) and the least common was 'AB' (14.5%), which is consistent with studies done among Nepalese and Indian medical students [10] where they reported the most prevalent blood group as 'A' (29%). Similarly, a study conducted in Nepal's small Kirat tribe found blood group 'A' to be the most prevalent (55%), with blood group 'O' being the least prevalent (8%) among Jirel [11]. A recent study in Ethiopia [12] revealed that blood group 'A' was the most common. In contrast, according to a study conducted in a teaching hospital in Kathmandu, Nepal, blood group 'O' was the most common blood group (35.1%), followed by blood groups A (29.0%), B (27.0%), and

'AB' (8.2%) [13]. These findings may imply that blood group 'AB' is the least prevalent while blood group 'A' is the most prevalent across the country. These disparities in results may be explained by the differences in sample size, sampling technique, genetic mapping and the diverse ethnic group's origins [1, 5, 14]. According to our findings, the Rh-positive blood group accounted for 97.7% of all cases. Rh-negative was only 2.2% in contrast to other studies which showed a range between 5-17%, except in Britain and United States of America, where data showed 15-17% Rh-D negative [15]. However, the findings are consistent with previous research from Tanzania and India, where the incidence of Rh-D negative blood group was 2.3% and 2-6%, respectively [5]. This study reveals that Rh-D negativity has the lowest distribution among the donors. These findings confirm a low incidence of Rh-D negative among the Nepalese population. The distribution of ABO and Rh blood groups among study participants was as follows: 'A' Rh +ve, 'A' Rh -ve, 'B' Rh +ve, 'B' Rh -ve, 'O' Rh+ve, 'O' Rh-ve, 'AB' Rh +ve and 'AB' Rh-ve were 30.1%, 0.5%, 28.6%, 0.5%, 24.6%, 1.1%, 14.4% and 0.1% respectively. These findings showed that 'A' Rh+ve, 'B' Rh+ve and 'O' Rh+ve were the leading blood group types, while 'AB' Rh-ve and 'O' Rh-ve blood groups were the least common. Other studies conducted in different parts of Nepal, India, Ethiopia and Uganda revealed that 'AB' Rh negative is the rarest blood group [1, 3, 16-19]. However, the universal donor blood group is 'O' Rh negative, which can help many patients during emergency transfusion, but only 1.1% of total donors were 'O' Rh negatives, so the hospital blood bank should be aware of this and concerned about wisely use of blood. Knowing the distribution pattern of the ABO and Rh-D groups will be helpful in the future for the arrangement of blood stock in the blood bank, and might help for the blood arrangement

during surgical procedures or any emergencies. The study is conducted in a single centre of hilly region so the results might not be generalized to the whole population.

CONCLUSIONS

The study concludes that blood group 'A' was the predominant followed by 'B', 'O', and 'AB'. The

ADDITIONAL INFORMATION AND DECLARATIONS

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