



A RETROSPECTIVE STUDY OF ABO AND RHESUS BLOOD GROUPS AMONG BLOOD DONORS IN REGIONAL BLOOD TRANSFUSION CENTRE SOUTHWEST DELHI, INDIA

Zoology

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ABSTRACT

Background: The ABO and Rh blood group systems are the most important of all blood groups systems both in blood transfusion and transplant organs. Antigens present on the surface of RBC's membrane are hereditary characters which play an important role in understanding genetics, inheritance pattern, medico-legal issues, disease susceptibility and transfusion safety. Importance of blood group distribution among different populations is highly essential for clinical studies, their relation with disease and environment. The effective management of blood banks and safe transfusion services can be accomplished by understanding the pattern of distribution of ABO and Rh blood groups, as its frequency varies with time, geographical locations and from one population to another. The aim of the present study is to determine the distribution pattern of ABO and Rh blood group among the donors at our hospital so as to assess the preparedness of our blood bank to combat ongoing epidemic and to correlate with other studies carried out in different regions of India.

Methods: This study was conducted in Regional Blood Transfusion Centre Southwest Delhi, during the period of July-August 2021. All relevant data of blood donors were collected from this centre. Blood grouping was done using commercially available standard monoclonal antisera applying test tube and column agglutination techniques.

Results: Total number of donors was 7424, out of which 6894 (92.9 %) were males and 530 (7.1%) were females. The most common blood group was found B (39.2%) and least common being AB (9.2%) among both males and females. The prevalence of Rhesus (Rh) positive and negative distribution in our present study was found 92.1% and 7.9% respectively with pattern B > O > A > AB blood groups. Overall, among males and females ABO blood group, pattern was found B > O > A > AB which was similar among Rh-positive and Rh-negative females individuals, while Rh-positive and Rh-negative males' pattern was found as B > A > O > AB and B = O > A > AB respectively. Maximum blood donors were found in the 18-30 years age group 3949 (53.3%) with aggregate ratio 16:1 (male: female) and ratio of voluntary versus replacement donors was found approximately 5:1.

Conclusion: The knowledge of ABO blood groups is playing a very significant role for blood banks and transfusion service guidelines and the most common blood group found among the Southwest Delhi donors was B positive while the least common was AB negative, which plays a significant contribution for making government policies to develop the National Health Program.

KEYWORDS

ABO and Rh blood group, Blood Donor, Replacement, Voluntary.

INTRODUCTION

In 1901, Karl Landsteiner, an Austrian physician discovered the first human blood group system. The ABO system is the most substantial blood group system of all blood group systems in both blood transfusion and transplant medicine. He discovered A, B, and O blood groups whereas his associates in 1902, Von Descatello and Stule discovered the fourth blood group AB. ABO system is the only system in which individuals without prior exposure through transfusion or pregnancy have antibodies in their serum against the antigen which is absent from their RBC's. The ABO system follows Mendelian genetics, the locus of ABO gene is on chromosome-9 which is occupied by A, B, or O allelic gene, responsible for specificity of ABO blood groups. The nominations group A and B refer to phenotypes, whereas AA, BO, and OO denote genotype. The O gene is an amorph, as no antigen is produced by this gene. Individuals with blood group O have to be homozygous for the O gene, and have the same phenotype and genotype¹. Human ABO blood group antigens exhibit alternative phenotypes and genetically derived glycol conjugate structures that are located on the red cell membrane surface, play an active role in cells' physiology and pathology. The ABO blood group plays a significant role in various human diseases, such as cardiovascular, oncological, some infectious and non-infectious diseases².

The second most important system is the Rh blood group, which is highly complex and very immunogenic. Unlike ABO antibodies, Rh

antibodies are produced only after exposure to Rh antigen positive RBC's causing significant hemolytic disease of the fetus and newborn and severe transfusion reaction. In 1939 Levine and Stetson described hemolytic transfusion in an obstetric patient, subsequently Landsteiner and Wiener in 1940 made antibodies in rabbits when they were transfused with rhesus monkey RBC's. The Rh system gene is present on chromosome-1. There are more than 50 antigens identified, D antigen being most potent³.

Meanwhile, the system can play a direct role in infection by serving as receptors or co-receptors for microorganisms, parasites, and viruses. Blood group antigens, also named human histo-blood group antigens (HBGAs), are one of the main antigens on the surface of human red blood cells. They represent polymorphic traits inherited among individuals and populations. Differences in blood group antigen expression can increase or decrease host susceptibility to many infections. In addition, many blood group antigens facilitate intracellular uptake, signal transduction, or adhesion through the organization of membrane microdomains and modify the innate immune response to infection. There are more than 40 different kinds of Rh antigens. The most significant Rh antigen is Rh D. When Rh D is present on the red cell surface, then red cells are called Rh D positive. Antibodies to Rh D develop only after an individual is exposed to Rh D antigens via transfusion, pregnancy, or organ transplantation. Anti RhD (or anti-D) antibodies destroy Rh D positive red cells and can lead

to haemolytic transfusion reactions. This is of particular importance in pregnancy where anti-D antibodies can cross the placental barrier from mother to fetus and lead to haemolytic disease of newborn (HDN)⁴.

The ABO blood group has been previously found to contribute to the risk of multiple infectious diseases in a series of studies. Mohammadali et al. reported that the presence of blood group O might significantly decrease the risk of hepatitis B, and the distribution of Rh in HBV-infected individuals was higher between Rh-positive donors⁵. Elnady et al. found that Rota-positive status for rotavirus gastroenteritis was significantly more prevalent among those with blood type A and significantly less prevalent among those with blood type B⁶. Another recent study carried out by Degarege et al. reported that malaria patients with blood group A had a higher risk of anemia than those with O and non-A phenotypes⁷. Among patients infected with the dengue virus, Murugananthan et al. found that patients with AB blood had a risk that was more than 2.5 times higher of developing dengue hemorrhagic fever than did those with other blood types⁸. In addition, a meta-analysis suggested that blood group types A, B, and AB might not affect susceptibility to norovirus infection while blood type O appeared to be more susceptible for infection⁹.

The aim of the present study is to determine the frequency distribution pattern of ABO and Rh blood groups among the donors at our center. To assess the awareness of our blood bank to combat the ongoing epidemic and to correlate our study with other studies, which were carried in different regions/states of India.

MATERIALS AND METHODS

The present retrospective study was carried out at the blood bank of Regional Blood Transfusion Centre Southwest Delhi and data was collected during the period from July 2019 to August 2021. The present study includes state-wise voluntary as belonging to Delhi, Haryana, and others and in-house voluntary and replacement donors. Replacement donors were those who donated for their patients and were close relatives, family members, or friends of the beneficiaries. The donors were first required to fill up a registration form which carried all the information like personal details, demographic details, occupation and medical history, etc. Blood donors were taken using some standard criteria from all individuals between 18 to 60 years of age, with more than 50kg of weight and haemoglobin of more than 12.5 grams%. The donors were then screened by medical officers according to blood donor selection criteria and guidelines from the drug and cosmetics act and NACO. Individuals with good health, mentally alert, and physically fit were selected as blood donors. Proper written consent form was also taken prior to donation regarding their acceptability for donation and for the tests to be carried out for the transfusion-transmitted infections. The blood samples were obtained by venipuncture method, and were collected in a vacutainer containing Ethylene diamine tetra acetic acid (EDTA) and plain vacutainer. Blood grouping ABO and Rhesus was done by antigen antibody micro-agglutination tube test. ABO and Rh blood grouping were done using commercially available monoclonal antisera-A, B, AB, H and Rh D-antisera, monoclonal IgM and monoclonal (IgM + IgG) (Tulip Diagnostic Ltd, India). ABO blood group was determined by forward blood grouping (cell grouping) and reverse blood grouping (serum grouping) by pooled known A, B and O cells that are freshly prepared in the blood bank. Rh negative blood groups were confirmed by indirect antiglobulin test. Weak D- positive results were considered as Rh positive.

STATISTICAL ANALYSIS:

Collected data were entered in Microsoft Excel and were analyzed using the software Statistical Package for Social Sciences (SPSS) version 21.0. Descriptive statistical measures such as percentages, frequencies were applied.

RESULTS

In the present study, the total number of donors was 7424 in which 6894 (92.9%) were male and 530 (7.1%) were female donors. The major donors belonged to the age group between 18-30 years was found 3949 (53.3%) and least were of age group more than 50 years 269 (3.6%) and state-wise donors was maximum found in Delhi 4106 (55.3%) and the minimum belonged to other states (U.P, Rajasthan & Punjab) 138 (1.9%). Voluntary donors 6087 (82%) were much more than replacement donors 1337 (18%) shown in Table-1/ Figure-1.1, 1.2 & 1.3).

Table 1. Demographical parameters of blood donor's distribution with Gender

Parameters	Male (%)	Female (%)	Total (%)
Age Group			
Less than 30	3714 (50.1%)	235 (3.2%)	3949 (53.3%)
31-40	2130 (28.7%)	137 (1.8%)	2267 (30.5%)
41-50	840 (11.3%)	99 (1.3%)	939 (12.6%)
More than 50	210 (2.8%)	59 (0.8%)	269 (3.6%)
Region wise distribution			
New Delhi	3729 (50.2%)	377 (5.1%)	4106 (55.3%)
Haryana	3031 (40.8%)	149 (2%)	3180 (42.8%)
Other	134 (1.8%)	4 (0.1%)	138 (1.9%)
Types of blood donors			
Replacement	1317 (17.7%)	20 (.3%)	1337 (18.0%)
Voluntary	5577 (75.1%)	510 (6.9%)	6087 (82.0%)

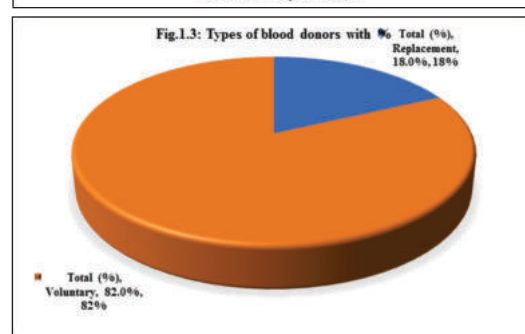
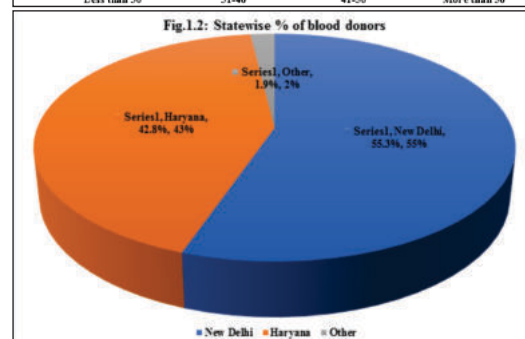
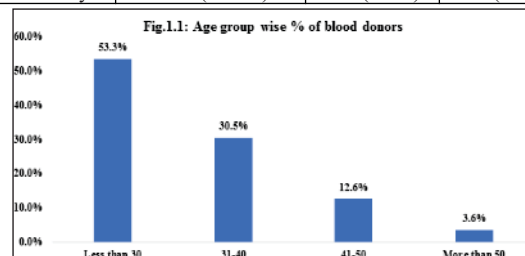


Table 2 showed that the most common blood group was B (39.2%) and the least common being AB (9.3%) with an overall pattern of ABO was found B > O > A > AB in both (male and female) donors, which was the same pattern in male and female donors separately (Figure-2). Table-3 showed that Rh positive was found 92.1% and Rh-negative donors were found 7.9% with the same pattern B > O > A > AB in both (male and female) donors. Blood group frequency with respect to ABO and Rhesus positive was found to be shown by formula B > O > A > AB, which is in accordance with other studies in different regions in India [1,3 - 11] from Table-5, while Table-4 shows that Rh-positive and Rh-negative male donors with ABO patterns were found as B > A > O > AB and B = O > A > AB and Rh-positive and Rh-negative in female donors with ABO pattern were found the same as B > A > O > AB.

Table 2: Distribution of blood donors according to ABO blood group with Gender

Blood Group	Male (%)	Female (%)	Total (%)
A	1546 (20.8%)	105 (1.4%)	1651 (22.2%)
B	2707 (36.5%)	205 (2.8%)	2912 (39.2%)
O	1996 (26.9%)	175 (2.4%)	2171 (29.3%)
AB	645 (8.7%)	45 (.6%)	690 (9.3%)
Total	6894 (92.9%)	530 (7.1%)	7424 (100%)

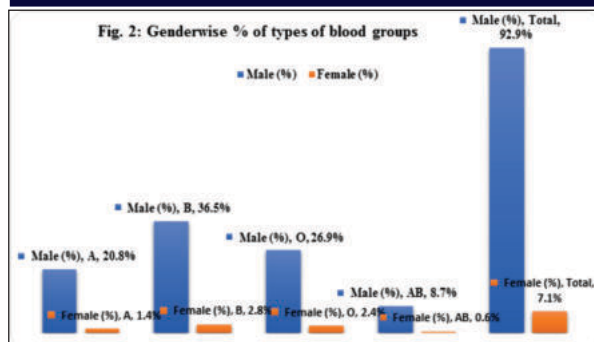


Table 3: Distribution of blood donors according to Rhesus Phenotype

Blood Group	Rh Positive (%)	Rh Negative (%)	Total (%)
A	1515 (20.4%)	136 (1.8%)	1651 (22.2%)
B	2712 (36.5%)	200 (2.7%)	2912 (39.2%)
O	1982 (26.7%)	189 (2.5%)	2171 (29.2%)
AB	628 (8.5%)	62 (0.8%)	690 (9.3%)
Total	6837 (92.1%)	587 (7.9%)	7424 (100%)

Table 4: Gender wise distribution of ABO and Rh blood group in blood donors

Blood Group	Male (%)			Female (%)		
	Rh Positive (%)	Rh Negative (%)	Total (%)	Rh Positive (%)	Rh Negative (%)	Total (%)
A	1419 (20.6%)	127 (1.8%)	1546 (22.4%)	96 (1.8%)	9 (1.7%)	105 (1.9%)
B	2525 (36.6%)	182 (2.6%)	2707 (39.3%)	187 (3.5%)	18 (3.4%)	205 (3.7%)
O	1819 (26.4%)	177 (2.6%)	1996 (29.0%)	163 (30.8%)	12 (2.3%)	175 (33.0%)
AB	585 (8.5%)	60 (0.9%)	645 (9.4%)	43 (8.1%)	02 (0.4%)	45 (8.5%)
Total	6348 (92.1%)	546 (7.9%)	6894 (100%)	489 (92.3%)	41 (7.7%)	530 (100%)

Table 5: Comparison of present study with various region in Indian studies.

Study in India	A (%)	B (%)	O (%)	AB (%)	Rh Positive (%)	Rh Negative (%)
Northern Region						
Present study	22.2	39.2	29.2	9.3	92.1	7.9
New Delhi ¹⁰	24.0	35.3	31.0	9.7	95.6	4.4
Srinagar, U.K ¹¹	30.4	31.7	26.2	11.7	93.5	6.5
Jharkhand ¹²	22.1	35.1	34.7	8.1	96.5	3.5
Lucknow, U.P ¹³	21.7	39.8	29.2	9.3	95.7	4.3
Amritsar, Punjab ¹⁴	18.5	38.6	34.3	9.6	91.3	8.7
Western Region						
Ahmadabad ¹⁵	21.8	36.0	33.8	8.4	93.4	6.6
Western Ahmedabad ¹⁶	21.9	39.4	37.7	7.8	95.1	4.9
Eastern Ahmedabad ¹⁷	23.3	35.5	32.5	8.7	92.2	5.8
Central Region						
Kolhapur-Maharashtra ¹⁸	29.1	32.6	28.1	10.2	93.3	6.7
Maharashtra ¹⁹	28.4	31.9	30.9	8.8	95.4	4.6
Madhya Pradesh ²⁰	25.6	39.3	28.6	6.5	94.9	5.1
Eastern Region						
Tezpur Assam ²¹	24.8	32.0	37.6	5.6	96.9	3.1
Durgapur ²²	23.9	33.6	34.8	7.7	94.7	5.3
Assam ²³	21.6	29.3	44.3	4.8	98.5	1.5
Southern Region						
Bangalore ²⁴	21.1	35.2	35.2	8.4	90.8	9.2
Davangere ²⁵	26.2	29.9	34.6	9.3	94.9	5.1
Shimoga, Malnad ²⁶	24.3	33.3	34.7	7.7	94.7	5.3

DISCUSSION

There are a large number of male donors compared to female donors which has been observed in most of the studies in India being a developing nation. The main reasons behind it were lack of education, social taboo, cultural habits, lack of motivation, and fear of blood

donation²⁷. A large section of females from the menstruating age groups were occasionally found anaemic with low body weight, so they are considered unfit for donating blood and usually eliminated during the pre-donation screening and counselling. In this regard, the general health status of the female needs to be improved by providing proper nutritional diet and iron supplements. The fear regarding blood donation among Indian females needs to be driven out by educating them with the advantages of blood donations. Most of the older people suffer from hypertension, diabetes mellitus, low haemoglobin, and ischemic heart diseases and found unfit during pre donation counseling²⁸.

CONCLUSION

The data generated in the present study and several other studies of different geographical regions of India will be useful for health developers to face the future health challenges in the region. The blood group of every individual must be indicated on national identity cards, driving licenses and school/office identity cards. This will be of incredible useful in case of emergencies when urgent transfusion is necessary rather yet to be cross matched blood is required. It is necessary to conduct similar well-designed studies in different regions of other states within India in order to determine the blood group frequencies in them.

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