

Section

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## Distribution of ABO and Rh types in Voluntary Blood Donors in a Tertiary Care Center in a Southern District of Rajasthan

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### ABSTRACT

**Background:** Despite the long list of several other blood groups discovered, the knowledge and distribution of ABO and Rh-D blood group are essential for blood transfusion purposes, population genetic study and healthcare planning. **Aims:** This study is aimed to determine the distribution pattern of the ABO and Rh blood groups among blood donors in Southern Rajasthan and compare it with other data from similar studies within and outside India. The importance of the study lies in maintaining the blood bank inventory so that no patient dies due to the deficient supply of blood.

**Methods:** It is a retrospective study carried out at blood bank, Ananta Institute of Medical Sciences and Research centre, Rajsamand, Rajasthan over a period of 2 years from January 1, 2016, to December 31, 2017. Blood group of the blood donors was determined by commercially available standard monoclonal antisera by test tube agglutination technique accompanied by reverse grouping.

**Results:** Out of 1142 subjects, 1117 (97.81%) were male and 25 (2.19%) were female subjects. 279 (24.43%) donors were voluntary and 863 (75.56%) donors were replacement donors. On studying the ABO blood group system, the most frequent group was B (33.97%) followed by O (31.96%), A (22.06%), and AB (6.91%) in blood donors while in Rh system, 1084 (94.92%) donors were Rh positive and 58 (5.07%) were Rh negative. **Conclusions:** The knowledge of distribution of blood group is very important for blood banks and transfusion services which play an important role in the patient's health care. The study has a significant implication regarding the inventory management of blood bank and transfusion services and will also throw light on the reasons of deficiency of a particular group in a particular area so that deficient group donors may be encouraged to donate more frequently.

**Keywords:** ABO, blood bank, Rhesus, blood donors

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### INTRODUCTION


Blood is a very important and life-saving component of the body and hence its transfusion for various ailments is a landmark for improving health. Timely transfusion of blood saves millions of lives.

In recent times, transfusion medicine has gained immense importance and the use of specific components of blood rather than whole blood has gained importance. But there has been a shortage of sufficient blood units. An increase of 10.7 million blood donations from voluntary unpaid donors has been reported from 2008 to 2013. In total, 74 countries collect over 90% of their blood supply from voluntary unpaid blood donors; however, 71 countries collect more than 50%

of their blood supply from family/replacement or paid donors<sup>[1]</sup>.

Human red blood cells contain on their surface a series of glycoproteins and glycolipids, which constitute blood group antigens. Development of these antigens is genetically controlled, inherited in a mendelian fashion.<sup>[2]</sup> Erythrocyte antigens are organized into more than 30 blood group systems by the International Society of Blood Transfusion.<sup>[3]</sup> The ABO blood group system was the first human blood group system to be discovered by Landsteiner in 1901.<sup>[4]</sup> Later Landsteiner and Wiener defined the Rh blood group in

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1941.<sup>[5]</sup> Together these two systems have proved to be the most important, for blood transfusion purposes.

All human populations share the same blood group systems; although they differ in the frequencies of specific types. The incidence of ABO and Rh groups varies markedly in different races, ethnic groups, and socio-economic groups in different part of the world.<sup>[6]</sup>

Discovery of ABO blood group system opened the way for discoveries in the field of immunohaematology, blood transfusion among humans irrespective of their natives, unmatched pregnancy, legal medicine, anthropology and the discovery of other blood group systems.<sup>[7]</sup>

The ABO blood group system is divided into four blood types on the basis of presence or absence of A and B surface antigens. The blood groups are ABO and AB. ABO blood group system is important because of the fact that A and B are strongly antigenic and anti A and anti B are naturally occurring antibodies present in the serum of persons lacking the corresponding antigen. These antibodies are capable of producing intravascular hemolysis in case of incompatible transfusion.<sup>[8]</sup>

ABO and Rh blood groups are useful in blood transfusion practice, population genetic studies, analyzing population migration patterns as well as resolving certain medicolegal issues, for example, disputed paternity cases.<sup>[9]</sup>

Blood banks usually have a problem of ever-changing stock position and it being very difficult to predict the prevalence of a particular blood group at a particular time hence the knowledge of distribution of ABO and Rh blood group is essential for effective management of inventory, be it a facility of a smaller local transfusion service or a regional or national transfusion service.<sup>[10]</sup>

The present study was done to assess the prevalence of blood groups in the region and to compare the results with other studies conducted in India and elsewhere in the world and its multipurpose future utilities for the health planners.

## METHODS

This study was carried out at blood bank, Ananta Institute of Medical Sciences and Research centre, Rajsamand, Rajasthan, during the 2 years period from 1 January 2016 to 31 December 2017. Total 1,142 donors were considered medically fit and accepted for blood donation during the study period.

All were of age between 18 and 60 years. After blood donation, blood group was determined by forward blood grouping (cell grouping) by test tube agglutination method. Commercially available standard antisera A, antisera B, and antisera D were used after validation at blood bank. Reverse blood grouping (serum grouping) was performed by test tube agglutination method with pooled known A, B, and O cell that are being prepared daily at the blood bank. Final blood group is confirmed only if both forward group (cell group) and reverse group (serum group) are identical. The donor blood group data were recorded on specially formed pro forma, tabulated, analyzed, and compared with the similar studies by other authors.

## RESULTS

Total number of donors was 1,142. The voluntary and replacement donors constituted 24.43% and 75.56% respectively. The frequency of ABO and Rh blood groups was compared. In ABO system, our study shows the highest frequency of blood group "B" (35.72%), followed by "O"

(33.8%), "A" (23.38%), and "AB" (7.09%). Incidence of Rh positive and Rh-negative donors was 94.92% and 5.07% respectively. Percentage of male and female donors was 97.81% and 2.18% respectively.

**Table 1. Distribution of different types of blood donors according to sex and donation type (voluntary/replacement).**

Donation type	Male	Female	Total	Percent of Total
Voluntary	261	18	279	24.43%
Replacement	856	7	863	75.56%
Total	1117	25	1142	
Percent of Total	97.81%	2.18%		

**Table 2: Distribution of blood donors according to group.**

	Rh+				Rh-			
	A positive	B positive	O positive	AB positive	A negative	B negative	O negative	AB negative
Number of donors	252	388	365	79	15	20	21	2
Percentage	22.06	33.97	31.96	6.91	1.31	1.75	1.83	0.17

**Table 3: Comparison of frequency percentage of ABO and Rhesus blood groups in various studies of India and with different countries**

Study	A	B	O	AB	Rh+	Rh-
Chandra and Gupta <sup>[11]</sup>	21.73	39.84	29.10	9.33	95.71	4.29
Girish et al <sup>[14]</sup>	24.27	29.43	39.17	7.13	94.93	5.07
Kaur et al <sup>[12]</sup>	18.01	38.06	34.31	9.62	91.28	8.72
Giri et al <sup>[16]</sup>	28.38	31.89	30.99	8.72	95.36	4.64
Periyavan et al <sup>[20]</sup>	23.85	29.95	39.82	6.37	94.20	5.80
Wadhwa et al <sup>[18]</sup>	23.30	35.50	32.50	8.80	94.20	5.80
Nag et al <sup>[19]</sup>	23.90	33.60	34.80	7.70	94.70	5.30
Mallikarjuna et al <sup>[17]</sup>	26.15	29.85	31.76	7.24	94.80	5.20
Khattak et al <sup>[21]</sup>	27.92	32.40	29.10	10.58	90.13	9.87
Patel et al <sup>[15]</sup>	21.94	39.40	30.79	7.86	95.05	4.95
Garg et al <sup>[13]</sup>	28.70	32.07	28.70	10.53	94.49	5.51
Agrawal et al <sup>[23]</sup>	22.88	32.26	37.12	7.74	94.61	5.39
Pramanik and Pramanik <sup>[22]</sup>	34	29	33	4	96.70	3.30
Frances et al <sup>[24]</sup>	42	8	47	3	83	17
Mollison et al <sup>[25]</sup>	41	9	46	4	85	15
Bashwari et al <sup>[26]</sup>	24	17	52	4	93	7
Mwangni J <sup>[28]</sup>	21.60	21.40	54.20	2.80	95.20	4.80
Australian Red Cross Society <sup>[27]</sup>	38	10	49	3	NA	NA
Present Study	22.06	33.97	31.96	6.91	94.92	5.07

## DISCUSSION

Total 1,142 subjects were included in the study. Replacement donors (75.56%) were much more than voluntary donors (24.43%).

In ABO system, our study shows the highest frequency of blood group "B" (33.97%), followed by "O" (31.96%), "A" (22.06%), and "AB" (6.91%) (Table 3). Blood group frequency with respect to ABO with Rh positive was found to be in sequence of B > O > A > AB (Table 2) which is in accordance with other studies.<sup>[11,12]</sup> The frequency for ABO with Rhesus negative comes out to be in sequence of O > B > A > AB (Table 2) which matches with study done by Kaur et al<sup>[12]</sup> but is in contrast with study done by Garg et al<sup>[13]</sup>

where the sequence of B > A > O > AB was given. As observed in Table 3, these figures are similar to the other studies carried out in India.<sup>[11-21,23]</sup>

Many studies have suggested that outside India, "A" group is much more common than "B". The most common blood group in the studies conducted in Britain, the USA, Australia, Nigeria, and Saudi Arabia is "O" group followed by "A," "B," and "AB".<sup>[24-28]</sup> In a study from Nepal, "A" group was the most common followed by B, O, and AB.<sup>[22]</sup>

Rh negativity status was found to be 5.07% in our study (Table 4) which is in accordance with the studies conducted at other places in India and is in contrast with western studies<sup>[24,25]</sup> where it was reported to be as high as 15-17%.

**Table 4: Percentage of male and female donors in and outside India**

	Male donors (%)	Female donors (%)
<b>Inside India</b>		
Present Study	97.81	2.18
Garg et al <sup>[13]</sup>	99.71	0.23
Patel et al <sup>[29]</sup>	99.05	4.95
Agarwal et al <sup>[30]</sup>	87.4	12.6
Giri et al <sup>[16]</sup>	95.75	4.25
Bala et al <sup>[31]</sup>	94.79	5.21
Koram et al <sup>[32]</sup>	97.73	2.27
Singh et al <sup>[10]</sup>	91.73	8.27
<b>Outside India</b>		
Nigeria <sup>[33]</sup>	90.1	9.9
Iran <sup>[34]</sup>	95	5
Italy <sup>[35]</sup>	67	33
Spain <sup>[36]</sup>	50.3	49.7
Great Britain <sup>[34]</sup>	45	55
USA <sup>[37]</sup>	54.5	45.5

It has been observed that female donors (2.18%) are very less compared to male donors (97.81%) (Table 1, 4). Similar results have been seen in many studies conducted in India <sup>[10,13,16,29,30,31,32]</sup> and some developing countries for example in Iran <sup>[34]</sup> and Nigeria <sup>[33]</sup>. This may be attributed to taboos related to blood and its loss, fear of blood donation, low level of awareness regarding the importance of blood donation, lack of motivation and increased deferral in female donors which are obviously accentuated in developing countries. In contrast, female donors show significant participation in developed countries.<sup>[34,35,36,37]</sup>

The significance of such studies which analyze the prevalence of blood groups is manifold. The group-wise availability of blood will eventually reflect the prevalence of blood group in the general population in that territory. It helps the doctor to plan the treatment of patients in a better way, for example, at the time of emergencies such as trauma, Rh incompatibility, and postoperative care.

This type of studies also allows blood banks to identify and maintain records of donors of blood groups which are rare in that particular area. In case of any unavailability during any emergency, the donor could be contacted and requested if he/she would like to donate in a good cause.

The data generated can be useful in population genetic studies giving useful information for instance, about

population migration patterns. It may also prove important for other studies of various geographical regions of India which will be useful to health planners while making efforts to face the future health challenges in the particular region.

## CONCLUSION

In conclusion, blood group 'B' was most common in the study followed by 'O', 'A' and 'AB'. Proportion of Rh positive donors was 94.92% while Rh negative was 5.07%. Blood donation by females was very low (2.18%) compared to males (97.81%) and it needs to be increased by improving health status of females and generating awareness about importance of blood donation.

These studies generate a database of blood groups at local and regional level. It is important to conduct similar studies in other regions in order to present a broader picture which can have significant implications for doctors, patients, transfusion services and health planners.

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