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Pattern of Blood Group among Blood Donors in Rural Area of Konkan Region

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Abstract

Background: Nearly 700 erythrocyte antigens are described and organized into 30 blood group systems by the International Society of Blood Transfusion of which ABO and Rh are important. All human populations share the same blood group systems; although they differ in the frequencies of specific types. The prevalence of ABO & Rh groups varies markedly in different races, ethnic groups, and socio-economic groups in different part of the world. The knowledge of distribution of ABO& Rh blood groups at local and regional levels is helpful in effective management of blood banks & safe blood transfusion services. The study was done to assess the prevalence of ABO & Rh blood group among the blood donors in the blood bank centre in Rural Medical College in Konkan region.

Material & Methods: An observational cross-sectional study was conducted in the blood bank of a Rural Medical College, in Konkan region of Maharashtra. Secondary data was collected for the period of two years (from June 2021 to June 2023).

Results: The present study concludes that 'A' blood group is the commonest blood group amongst the blood donors followed by 'B', 'O' and 'AB' blood group respectively. Rh

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positive and negative donors were 91.16% % and 8.84 % respectively in the Rhesus blood group system.

Conclusion: For blood transfusion activities, population genetic study and parental testing, ABO and Rhesus (Rh) blood group system are paramount. Blood groups are hereditary characters and are useful in compatibility test in blood transfusion and organ transplant practices. Inventory management and disease trends in relation to blood groups can be supported by knowledge about distribution of blood.

Keywords- Blood group, ABO system, Rhesus, blood donor

Introduction

Karl Landsteiner discovered the ABO Blood Group System in 1901. Adriano Sturli and Alfred von Decastello who were working under Landsteiner discovered type AB a year later in 1902. Landsteiner was awarded the 1930 Nobel Prize in Physiology or Medicine for his work. The discovery of ABO blood groups by Karl Landsteiner was an important achievement in the history of blood transfusion that was followed by discovery of Rh (D) antigen. Janský is credited with the first classification of blood into the four types (A, B, AB, O) in 1907, which remains in use today.[1,2,3,4] Nearly 700 erythrocyte antigens are described and organized into 30 blood group systems by the International Society of Blood Transfusion of which ABO and Rh are important. Landsteiner law states that if an antigen is present on a patients red blood cells (RBCs) the corresponding antibody will NOT be present in the patients plasma, under 'normal conditions' [5] The ABO gene is located on chromosome 9 and has three alleles, A, B and O. The A allele encodes a glycosyltransferase that adds N-acetylgalactosamine to the glycoprotein H antigen that is expressed on all normal red cells. The B allele encodes a different glycosyltransferase that adds d-galactose. The O allele is a deletion that results in loss of enzyme translation (inactive glycosyltransferase); therefore, resulting in an unmodified H antigen. A and B are co-dominant alleles, as a result, AB individuals express both antigens.

The ABO blood group system has been linked to several diseases, primarily cardiovascular problems. The determination of ABO blood groups could serve in blood group individualized approaches towards health maintenance and prevention of diseases. A study done by Hilde E. et al showed that ABO blood groups were associated with 11 health and disease outcomes. [6] ABO blood groups were primarily associated with cardiovascular outcomes. Individuals with blood group A and B were associated with hyperlipidemia, thrombosis, myocardial infarction

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and heart failure. Whereas, individuals with O blood groups were associated with hypertension.

All human populations share the same blood group systems; although they differ in the frequencies of specific types. The incidence of ABO & Rh groups varies markedly in different races, ethnic groups, and socio-economic groups in different part of the world. The frequencies of ABO and Rh blood groups vary from one population to another and time to time in the same region. The knowledge of distribution of ABO& Rh blood groups at local and regional levels is helpful in effective management of blood banks & safe blood transfusion services. Identification of Rh system is important to prevent the erythroblastosis fetalis; which commonly arises when an Rh negative mother carries an Rh positive fetus. [7]

A regional donor data bank is of utmost importance in maintaining proper availability of specific blood group for required demand and for effective management of blood banks inventory, at a smaller local transfusion service or a regional or national transfusion service.[8,9] Human-to-human blood transfusion was first published by James Blundell in 1818.[10,11] All human populations have same ABO and Rh blood group systems; but they may differ in the frequencies and distributions of specific types in different races, ethnic groups, and socio-economic groups or also amongst the different populations. [12,13] Knowledge of blood group distribution is also important for clinical studies, for reliable geographical information and it will help a lot in reducing the maternal mortality rate, as access to safe and sufficient supply of blood will help significantly in reducing the preventable deaths. ABO and Rhesus (Rh) blood group antigens are hereditary characters and are useful in population genetic studies, researching population migration patterns, as well as resolving certain medicolegal issues, particularly of disputed paternity and more importantly in compatibility test in blood transfusion practice. The need for blood group prevalence studies is multipurpose, as besides their importance in evolution, their relation to disease and environment is being increasingly sought in modern medicine. [14,15,16,17.] The study was done to assess the prevalence of ABO & Rh blood group among the blood donors in the blood bank centre in Rural Medical College in Konkan region.

Material and Methods

This hospital record based cross-sectional study was carried out at the blood centre of a rural medical college. The data was gathered for a period two years (from June 2021 to June 2023). Most of donors at this blood centre were voluntary type. The blood collections were taken

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from the voluntary donors at outdoor blood donation camp and from replacement donors at blood centre.

Total 3372 donors were considered medically fit and accepted for blood donation during the study period. All were of age between 18-60 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. Rh negative blood groups were confirmed by antiglobulin technique. All weak D groups were considered as Rh positive.

Collected data was compiled on Microsoft Office Excel Worksheet 2011 and analysed using frequency, mean, standard deviation, simple proportion and percentages. The study was approved by Institutional Ethical Committee.

Result

Table 1 shows among total 3372 donors, 3186 (94.48 %) were males while 186 (5.52 %) were females. Most common (82.89%) age group of donors was 18-35 years followed by 36-49 years (13.91 %) and 50-60 years (3.20%).

The most common blood group among blood donor was ‘A’ (35.37%) followed by blood group ‘B’ (28.64%), ‘O’ (26.98%), and ‘AB’ (9.01%).

Table 1: Age and Sex wise ABO group distribution of blood donors

Blood groups	Donor Age			Male	Female	Total
	18-35 years	36-49 years	50 -60 years			
A	967	199	27	1142	51	1193 (35.37%)
B	831	105	30	919	47	966 (28.64%)
O	762	124	24	843	67	910 (26.98%)
AB	235	41	27	282	21	303 (9.01%)
Total	2795 (82.89%)	469 (13.91%)	108 (3.20%)	3186 (94.48%)	186 (5.52%)	3372 (100%)

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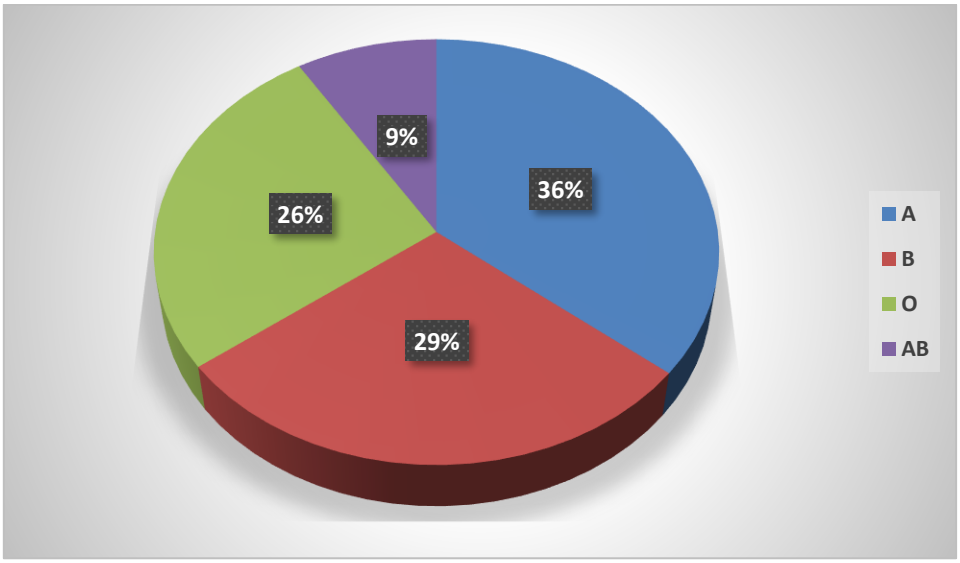

Fig 1: Pattern of blood group among males

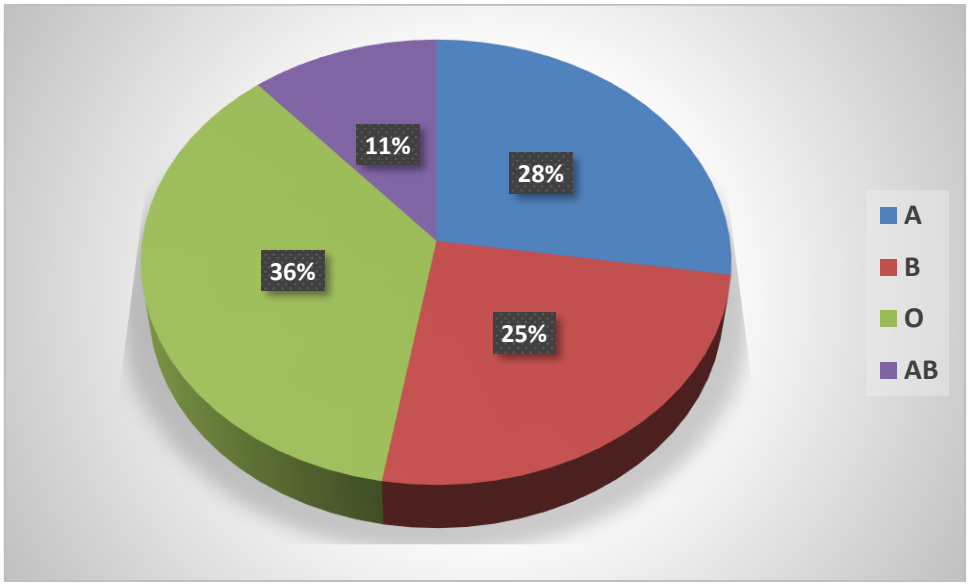

Fig 2: Pattern of blood group among females

Table 2 displays blood donor distribution as per Rhesus phenotype. 3074 (91.16%) donors were Rh +ve while 298 (8.84%) were Rh-ve. Amongst ABO donors, Rh + ve donors were in close percentage, ranging from 88.25% to 93.90%.

Table 2: Age and Sex wise Rh group distribution of blood donors

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Blood groups	No. of donors according to Rhesus phenotype (%)		Total
	Rh+ve (%)	Rh-ve (%)	
A	1082 (90.70%)	111 (9.30%)	1193
B	907 (93.90%)	59 (6.10%)	966
O	803 (88.25%)	107 (11.75%)	910
AB	282 (93.06%)	21 (6.94%)	303
Total	3074 (91.16%)	298 (8.84%)	3372

Discussion

Piyush patel et al [18] study shows Shimoga, Davangere, Bangalore and Chittoor studies has decreasing sequence for group O, B, A and AB (most prevalent was o group and least prevalent group was AB). The same study concluded that Eastern Ahmadabad study has decreasing sequence for group B, O, A and AB while and Punjab study has the same as group B, A and AB/O. Pakistan, Nepal, Australia, UK, USA and Niger had group B, A and O has highest prevalence while least prevalence is for group AB. Our findings are like those of studies conducted in southern Indian studies except Bangalore. Rh positivity prevalence is more than 94 % in all studies in the table except Chittoor study which has 90.6%. Present study shows 91.16 % are Rh + ve while 8.84 % are Rh -ve.

Table 3: ABO & Rh phenotype frequencies in different studies (in%) [18]

Sr No	Study	ABO phenotype				Rh phenotype	
		A (%)	B (%)	AB (%)	O (%)	Rh+ve (%)	Rh-ve (%)
Within India							
1	Shimoga	24.27	29.43	7.13	39.17	94.93	5.07
2	Davanagere	26.15	29.85	7.24	36.76	94.8	5.52
3	Eastern Ahmedbad	23.3	35.5	8.8	32.5	94.2	5.8
4	Punjab	21.9	37.6	9.3	9.3	97.3	2.7
5	Bangalore	23.85	29.95	6.37	39.82	94.2	5.79
6	Chittoor	18.95	25.79	7.89	47.37	90.6	8.42
7	Vellore	18.85	32.69	5.27	38.75	94.5	5.47
	Present study	35.37	28.64	9.01	26.98	91.16	8.84
Outside India							
1	Pakistan	23.8	38	10	10	89.1	10.9

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2	Nepal	34	29	4	33	96.7	3.33
3	Australia	38	10	3	49	NA	NA
4	UK	41.7	8.6	3	46.7	83	17
5	USA	41	9	4	46	85	15
6	Niger	23.8	20.7	2.8	52.7	93.9	6.12

Mallikarjuna Swamy et al [19] study shows the most prevalent blood group was O (36.76%), followed by group B (29.85%) and group A (26.15%) and the prevalence of Rh positive and negative distribution was 94.48 and 5.52% respectively. Pranab Choudhury et al [20] study concludes B (33.7%) group is in maximum numbers followed by O (30.3%) and A (24.2%) groups; whereas minimum is from AB group (11.8%). The study also said that Rh-positive donors were 94.5% and Rh negative were 5.5%.

Gopal Patidar et al [21] study remarks that overall distribution of the A, B, O and AB blood groups in India is 23·16%, 34·10%, 34·56% and 8·18%, respectively and Rh(D)-positive and Rh(D)-negative population are 94·13% and 5·87%, respectively

Patel Piyush et al [22] study shows the commonest ABO blood group present was B (39.40 %) followed by O (30.79 %), A (21.94 %) and AB (7.86 %) in blood donors; while in Rhesus system, 5053(95.05%) donors were Rh-positive and 263(4.95%) donors were Rh-negative.

Suraj Jain et al [23] study concludes that the most common ABO blood group type was Group B (36.6%) followed by group O (32.1%), group A (22.8%) and group AB (8.5%) respectively and the distribution of Rh(D) blood group type revealed 93.5% as Rh-positive and 6.5% as Rh-negative. Dharmakanta Kumbhakar et al [24] study revealed blood group O to be the commonest at 37.65% followed by blood group B at 32.0%, blood group A at 24.80% and blood group AB at 5.55%. The Rh-D positive phenotype was 96.86% and remaining 3.14% was Rh- D negative.

Sunita Mistry et al [25] study concluded that The blood group frequencies positions in the descending order were ‘O’, ‘B’, ‘A’ and ‘AB’ respectively. Rh positive donors were 97.54% and Rh negative were 2.45%. Pandu Sanagapati et al [26] study revealed that the most frequent blood group positions in the descending order are ‘O’, ‘A’, ‘B’ and ‘AB’ respectively, Rh+ is the most frequent group than Rh- in the Rh system and blood donations by females are very low.

In summary**,** ‘O’ is the most common and AB is the least common blood group in the 15 Indian studies discussed earlier. In our study, A is the most common and AB is the least common blood group. This may be explained based on different local tribal populations as

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well as migratory coastal population. The later could be because of occupational migration or more likely based on historical coastal war related repeated onslaughts. These 15 studies also conclude that they have Rh phenotype >90% donors which is like our study.

Conclusion

The present study concludes that 'A' blood group is the commonest blood group amongst the blood donors in the blood bank centre in the Rural Medical College, of this Konkan region followed by 'B', 'O' and 'AB' blood group respectively. Rh positive and negative donors were 91.16% % and 8.84 % respectively in the Rhesus blood group system. Female donors contribution was low which is to be escalated by improving health status and awareness about blood donation.

For population genetic study, legal medicine, parental testing and blood transfusion activities, ABO and Rhesus (Rh) blood group system are paramount. Effective delivery of blood banking services can be tackled by cognizance of the blood group distribution pattern. Blood groups are hereditary characters and are useful in compatibility test in blood transfusion and organ transplant practices. They show a wide geographical and racial variation. Different ethnic groups and geographical populations have variable distribution of ABO blood group. Inventory management and disease trends in relation to blood groups can be supported by knowledge about distribution of blood groups.

Conflict of interest- None

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