



Frequency and Distribution of ABO and Rhesus (D) Blood group Antigens among Blood Donors at a District Hospital Blood Bank in North Goa

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Abstract

Background: Many blood grouping systems and blood group antigens have been described in the available literature. ABO and Rh grouping systems are the most prevalent amongst these. The prevalence of these varies between different regions and races. The present study was conducted at a District hospital blood centre, to study the frequency and; age and sex distribution of ABO and Rh groups in the study population, in the North District of Goa, to help in managing the blood bank inventory and serve patients better.

Methods: The study population included 5438 blood donors (voluntary and replacement). Blood groups were determined by conventional test tube agglutination methods – forward and reverse grouping, using standard antisera. Data obtained from the blood centre records was reported as numbers and percentages, and findings were compared with the available literature.

Results: Blood group O was the most prevalent in our study population, followed by A, B and AB. Rh positivity was seen in 93.6% blood donors. Rest all donors were Rh negative. Majority donors belonged to the age group 31-40 years, followed by 21-30 years, with majority (88%) being males. 97% donors were voluntary and 3% were replacement donors.

Conclusion: O Positive was the commonest blood group in our study population and AB negative was the least common.

Keywords: blood donors, voluntary, replacement, blood groups, ABO group, Rh group, distribution, age, gender.

Introduction

Sir Karl Landsteiner was the first to describe the human ABO blood grouping system in the year 1900, and it is the most important blood grouping

system in transfusion medicine. Rh blood grouping system is the second most common blood grouping system in transfusion medicine.²

A large number of blood grouping systems have been described in the available literature. However, ABO and Rh (D) grouping systems still remain the most prevalent in the population.²

ABO and Rh blood grouping is important primarily during transfusion of blood and its components, during organ transplantation, for medico legal research, for population genetic studies, to study the association of blood groups with various diseases and for research purposes.¹⁻⁵

The prevalence of different blood groups varies between different regions and races. It is important to have a good knowledge about the distribution of ABO and Rh blood groups in the community, for appropriate planning of the regional blood bank activities, to manage blood bank inventory and to aid in providing safe and appropriate blood to patients, to prevent transfusion reactions in the blood recipients.²

The aim of the present study is to understand the distribution of ABO and Rh groups in the donor population attending our blood centre at the North District Hospital, Goa, India.

No similar published data is available from the state and this is the first of its kind study performed in the North District of Goa.

Materials and Methods

The present study is a retrospective study conducted over a period of three years from October 2020 till September 2023 at the blood centre of the North District Hospital in Goa.

Data Collection

The data was retrieved from the registers from the blood centre records. The study population included all the voluntary and replacement blood donors that donated blood at the blood centre as well as at the voluntary blood donation camps, after taking informed consent for the donation procedure.

Inclusion Criteria

Healthy blood donors were selected based on a tailor-made questionnaire prepared by the blood centre authorities as per the 'guidelines for blood

donor selection and blood donor referral' issued by the National blood transfusion council, National AIDS control Organization, Ministry of Health and Family Welfare, October 2017 and basic medical examination done by the blood centre medical officer. The guidelines are in accordance with the Drugs and Cosmetics Act, 1940 and Rules, 1945.

Testing Methods

Tube agglutination method as per the standard operating procedures of blood centre was used for performing ABO and Rh grouping of the study population. Forward as well as reverse grouping was performed on all blood samples, with positive and negative controls. Bombay blood group was ruled out in all the donors belonging to O blood group by testing with Anti-H reagent. All the Rh negative groups obtained on forward and reverse grouping, were subjected to Du testing as per the departmental standard operating procedures for detecting the weak Rh D antigens. All the Du positive samples were considered to be Rh Positive.

Reagents Used

The reagents used for the blood grouping procedure were standard monoclonal antisera - Anti A, Anti B, Anti AB, Anti-H, Anti-A1 and; monoclonal and Rho Anti D antisera. Validation, lot verification and daily quality control procedures were performed on all these antisera used before performing grouping on donor samples.

Statistical Analysis

For each variable, simple percentages were calculated, tabulated and compared with the available literature.

Results

During the study period, ABO grouping and Rh typing was performed on a total number of 5438 blood donors.

Of these, 5275 (97%) were voluntary donors and 163 (3%) were replacement donors. (Refer to Table no.1)

Sr. No.	Type of donors	Numberof donors	Percentage of donors (%)
1.	Voluntary	5275	97
2.	Replacement	163	3

4758 donors (88 %) were males and 680 (12 %) were females. (Refer to Table no.2)

Sr. No.	Gender	Number of donors	Percentage of donors (%)
1.	Males	4758	88
2.	Females	680	12

During the study period, no Bombay blood group donors were found. However, one Bombay blood group patient’s sample was received at our Blood centre for cross matching.

Age group	Number of donors	Percentage of donors (%)
18-20 yrs	114	2.1
21-30 yrs	2448	45
31-40 yrs	2599	47.8
41-50yrs	261	4.8
51-60yrs	16	0.3

Distribution of ABO Groups in the Study Population

1802 donors were O Positive (33.1%), 107 were O negative (2%), 1516 were A Positive (27.9%), 130

were A Negative (2.4%), 1390 were B Positive (25.6%), 95 were B Negative (1.7%), 380 were AB Positive (7%) and 18 were AB Negative donors (0.3%).

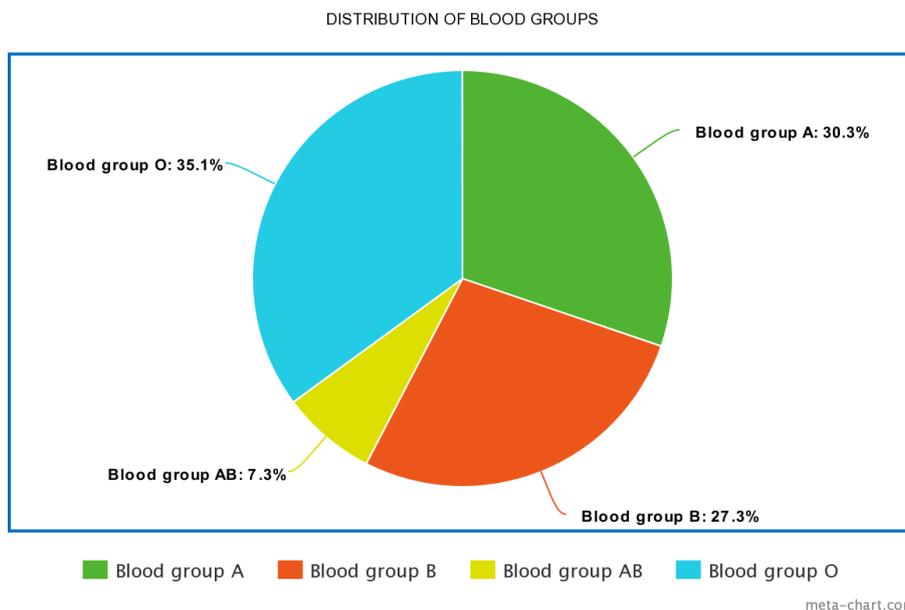


Fig 1: ABO Distribution in Study Population

Amongst the 1646 donors with blood group A, 8 (0.5 %) were A₂ Positive and 1638 (99.5%) were A₁ Positive. (Refer to Table no.4)

Sr. No.	Blood group	Number of blood donors	Percentage of blood donors (%)
1.	A ₁	1638	99.5
2.	A ₂	8	0.5

Amongst the 398 donors with blood group AB, 326 (82 %) were A₁B Positive and 72 (18 %) were A₂B Positive. (Refer to Table no.5)

Sr. No.	Blood group	Number of blood donors	Percentage of blood donors (%)
1.	A ₁ B	326	82
2.	A ₂ B	72	18

Rh Distribution in the Study Population

Rh positive donors constituted (5088 donors) 93.6 % of the study population, whereas Rh Negative constituted (350 donors) 6.4 % of the study population. (Refer to Table no.6)

Weak D Distribution

Out of the 5088 Rh Positive donors, 58 donors had weak D group which made up 1.1 % of the total study population.

Sr. No.	Rh group	Number of blood donors	Percentage of blood donors (%)
1.	Rh positive	5088	93.6
2.	Rh negative	350	6.4

Discussion

The study included 5438 healthy blood donors who donated blood at our blood centre over a period of three years from October 2020 till September 2023. Data regarding many such studies conducted worldwide is available in the literature. Some of these studies have been referenced below.

Voluntary and replacement blood donors constituted 97% and 3% respectively of our study population. This was comparable to the figures in studies by Garg P et al¹ (99.71% and 0.91%) and Swamy P et al² (93.83% and 6.17%). Voluntary blood donations are encouraged at our blood centre and minimal replacements are requested to

make available safe, non-remunerated blood and to cater to emergencies without wasting time on replacement donations. Our blood centre staff are actively involved in arranging in - house and out-house blood donation camps so as to maintain sufficient blood stock at any point in time. This is the main reason for our replacement donations being low compared to many other studies available in the literature.

88% of our study population were males, whereas 12% were females. This bias could probably be due to less number of female donors volunteering to donate blood, mainly due to fear of donation, lack of motivation, social tabOos, cultural habits and increased vaso-vagal syncopes during

donation and post donation fatigue in female donors compared to male donors. Also deferrals are more in female donors, owing to their low hemoglobin levels, iron deficiency being very common in the females. We must hence focus on maintaining good nutrition of females and providing iron and other supplements to those who are deficient. The other reasons for deferral

in females are low body weight measurements, low blood pressure values, menstruation, pregnancy and lactation period related deferrals. Our figures were comparable to those in studies by kumar S et al³ (92.4% males and 7.6% females) and Singh A et al (91.73% males and 8.27 % females)¹⁹.

Table 7: Comparison of distribution of ABO and Rh groups of present study with other Indian and International studies

Sr. No.	Place of study	Author	Distribution of different ABO groups									RhPos donors	Rh Neg donors	Total donors
			A pos	A neg	B Pos	B Neg	AB Pos	AB Neg	O pos	O neg	Bombay Blood group			
			A		B		AB		O					
1.	North Goa	Mashelkar P et al	27.9	2.4	25.6	1.7	7.0	0.3	33.1	2	-	93.6	6.4	5438
			30.3		27.3		7.3		35.2					
2.	Ethiopia	Debele GJ et al ⁵	27.41	0.94	20.12	1.18	5.47	0.24	41.88	2.76	-	94.8	5.2	1700
			28.4		21.3		5.7		44.6					
3.	Saudi Arabia	Belali TM et al ⁶	24.81	2.59	20.90	0.81	4.72	0.23	38.68	7.22	-	89.12	10.87	4167
			27.40		21.71		5		45.90					
4.	Pakistan	Khattak ID et al ⁷	27.92		32.40		10.58		29.10			90.13	9.87	22897
5.	Oman	Allawati M et al ⁸	24.06		21.63		3.83		50.47			91.65	8.35	3416
6.	Mexico	Adrian CR et al ⁹	26.08	1.35	8.53	0.40	1.71	0.10	59.26	2.56	-	95.58	4.42	271164
			27.44		8.93		1.81		61.82					
7.	Uttarakhand	Garg P et al ¹	26.98	1.72	30.31	1.76	10.05	0.48	27.15	1.55	-	94.49	5.51	12701
			28.70		32.07		10.53		28.70					
8.	Davangere	Swamy M et al ²	24.61	1.54	28.26	1.59	6.94	0.3	34.67	2.09	-	94.48	5.52	19413
			26.25		29.85		7.24		36.76					
9.	Srinagar	Kumar S et al ³	28.4	1.96	29.7	1.93	11.04	0.66	24.30	1.93	-	93.51	6.49	9883
			30.39		31.68		11.70		26.24					
10.	Ranchi	Singh A et al ¹⁹	21.29	0.80	33.88	1.27	7.80	0.23	33.48	1.25	-	96.46	3.54	20455
			22.09		35.15		8.03		34.73					
11.	Ahmedabad	Patel PA ⁴	21.07	0.84	37.70	1.55	7.38	0.45	28.78	1.98	-	95.05	4.95	5316
			21.93		39.46		7.84		30.77					
12.	Vellore	Das PK et al ¹⁰	18.85		32.69		38.75		5.27		0.004	94.53	5.47	150536
13.	Gujarat	Raja KA et al ¹⁸	23.24	1.10	32.65	1.77	8.48	0.45	30.73	1.53	-	95.12	4.87	40732
			24.35		34.43		8.94		32.26					
14.	Haryana	Puri PL et al ¹¹	20.04	2.16	34.5	3.28	8.34	0.82	28.14	2.68	-	91.07	8.93	3202
			22.20		37.82		9.16		30.82					
15.	Rajasthan	Behra R et al ¹³	20.38	1.89	33.52	2.95	8.68	0.8	29.17	2.61	-	91.75	8.25	83631
			22.2		36.4		9.4		31.7					
16.	Bangalore	Periyavan S et al ¹⁵	23.85		29.95		6.37		39.81		0.005	94.20	5.79	36964

Majority donors belonged to the age group 31-40 years (47.8%) followed by 21-30 years (45%).

These figures were comparable to those in study by Patel PA et al⁴(51.99% in the age group 31-40

years and 42.98% in the age group 21-30 years). This is because 21-40 years age group is the main work force of our society. The low number of donors beyond the age of 40 years could probably be due to increased deferrals owing to diabetes, hypertension, other lifestyle diseases and medication intake, or they themselves abstain from donating blood. The low number of donors below the age of 20 years is mainly due to lack of awareness ABO donation and also the minimum age limit to donate blood being 18 years.

Blood group O Rh positive (35.1%) was found to be the most frequent blood group in our study population, followed by A Rh positive (27.9%), A Rh positive (25.6%), AB Rh positive (7.3%). These were followed by the Rh Negative blood groups, A negative being the most frequent amongst these (2.4 %), followed by O negative (2%), B negative (1.7%), AB negative (0.3%). This was comparable to studies by Debele GJ et al⁵, Belali TM et al⁶, Khattak ID et al⁷, Allawati M et al⁸ and Adrian CR et al⁹.

Amongst those with blood group A, majority were A1 (99.5%). This was comparable to the findings in study by Das PK et al¹⁰ (98.57%) and Raja KA et al¹⁸(100%).

Amongst those with blood group AB, majority were A1B (82%). This figure was lower than the figure by Das PK et al (98.57%)¹⁰ and Raja KA et al (99.95%)¹⁸.

93.6% of our study population were Rh Positive and 6.4% were Rh Negative. 1.1% of the donors had a weak D group. This was comparable to the figures in studies by Puri PL et al¹¹, Behra R et al¹², Bala SS et al¹³, Tyagi MS et al¹⁴, Kumar S et al³, Periyavan S et al¹⁵, Garg P et al¹, Das PK et al¹⁰, Swamy M et al¹⁶ and Nag I et al¹⁷. Most studies conducted across the country showed Rh positivity in their study population ranging from 91 to 97%.

This study is the first of its kind conducted in the North District of Goa and no comparative data is available of the state. Our study results were comparable to similar studies conducted across the world, described in the literature previously.

Conclusion

The present study helped us understand the frequency Variations are known to be present between different regions and races. It is advisable to conduct and publish similar studies across the country. This will help in understanding the blood group distribution across different regions in the country and aid the health planners in drafting national policies in transfusion medicine. It will also create a database that would help in catering to emergency situations in the country and manage the ever increasing demand for blood better.

Limitations

The study included data from only voluntary and replacement blood donors who donated blood at the in-house and out-house blood donation camps. It does not include blood grouping data of patient cross matching samples received at the blood centre.

There are no conflicts of interest involved.

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Ethical clearance has been taken for the present study.

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