



DISTRIBUTION OF ABO AND RH BLOOD GROUPS IN VOLUNTARY BLOOD DONORS AT A TERTIARY CARE HOSPITAL

Pathology

Dr. Sanjay G. Surase

Professor

Dr. Bharat Ghodke Associate Professor

Dr. Kshitija Jadhav Junior Resident

Dr. Shreya Madankar* Junior Resident *Corresponding Author

Dr. Sumedha Shinde Assistant Professor

ABSTRACT

Introduction: ABO and Rh blood group systems are the most important blood group systems and are genetically inherited. They play very vital role in blood transfusions, parental and genetic testing and addressing medico legal issues. This study was conducted to determine the distribution of ABO and Rh blood groups among voluntary blood donors in Mumbai, India. **Objective:** This study was conducted to determine the distribution of ABO and Rh blood groups among blood donors at tertiary care centre. **Material And Methods:** A retrospective data based study conducted at tertiary care centre over a period of 1 year from 1st January 2023 to 31st December 2023. ABO and Rh typing was done using tube agglutination method with antisera against ABO and Rh and they were further confirmed by reverse grouping method using known pooled A and B cells. **Result:** Out of 6004 donors, 5149 (85.8%) were males and 855 (14.2%) were females. Majority of donors belonged to age group 26-40 years. The commonest ABO blood group among Rhesus positive donors was B (31.5%) followed by O (30.0%), A (25.5%) and AB (8.9%) while in with Rhesus negative donors was O (1.5%) followed by A (1.1%), B (1.1%) and AB (0.4%). **Conclusion:** The knowledge of distribution of blood group is essential for effective inventory management of blood bank and transfusion services. This study throws light on the reasons of deficiency of a particular group and to maintain registry of each blood group so that deficient group donors may be encouraged to donate more frequently and to make available particular group donor when required.

KEYWORDS

ABO blood group, Rh factor, blood donors, blood distribution, voluntary blood donation

INTRODUCTION

Blood group distribution is a vital aspect of transfusion medicine. The ABO and Rh blood group systems are the most significant, influencing transfusion compatibility and frequency of certain medical conditions. Understanding the distribution pattern in a population helps in planning and managing blood bank resources efficiently.

ABO blood group discovered by Karl Landsteiner for which he received Noble prize followed by weiner discovery of Rh (D) antigens. After Von Decastello and Sturli discovered the fourth Type Blood Group AB^[1].

Each individual has different blood groups. The ABO blood group system is divided in to four blood types on the basis of presence or absence of A and B surface antigens determined by ABO genes, located on chromosome 9q with anti-A and anti-B antibodies in serum of individuals lacking the corresponding antigen^[2].

The cause of Haemolytic disease of foetus and Newborn (HDFN) was linked to the Rh Blood group which is very essential in Obstetrics^[3]. Blood groups are genetically determined, inherited in a simple mendelian fashion and are useful in paternity testing, legal medicine, immune haematology, blood transfusions, unmatched pregnancy. Disease such as duodenal ulcer, Diabetes mellitus, urinary tract infection are known to have some association with blood groups^[4].

The prevalence of ABO Blood groups varies from region to region and race to race. Data regarding ABO blood group distribution is very important for effective management of safe blood transfusion services and Blood bank.

This study investigates the distribution of ABO and Rh blood groups among voluntary blood donors at tertiary health care centre, providing insights that could enhance blood donation campaigns and resource allocation.

MATERIALS AND METHOD

Study Type: A retrospective data based study at tertiary health care centre.

Inclusion Criteria: All voluntary blood donors.

Exclusion Criteria: Replacement donors.

Study Period: 1st January 2023 to 31st December 2023.

Data Collection: ABO and Rh typing was done using tube agglutination method with antisera against ABO and Rh and they were further confirmed by reverse typing method.

RESULTS

The study analyzed the distribution of ABO and Rh blood groups among 6004 voluntary blood donors, consisting of 5149 males (85.8%) and 855 females (14.2%). The findings are summarized in the table below:

Table 1. Distribution of ABO and Rh blood group

Type of blood group	Rh Factor	Male	Female	Total (%)	Total (%)
A	Positive	1332	199	1531 (25.5%)	1597
	Negative	62	04	66 (1.1%)	(26.6%)
B	Positive	1628	263	1891 (31.5%)	1957
	Negative	52	14	66 (1.1%)	(32.6%)
O	Positive	1520	281	1801 (30.0%)	1891
	Negative	65	25	90 (1.5%)	(31.5%)
AB	Positive	465	69	534 (8.9%)	559
	Negative	25	00	25 (0.4%)	(9.3%)
TOTAL		5149 (85.8%)	855 (14.2%)	6004 (100%)	6004 (100%)

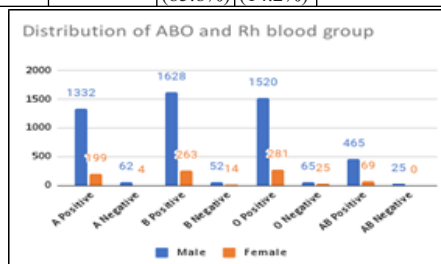


Fig. 1 Distribution of ABO and Rh blood group on the basis of gender

DISCUSSION

The results of this study reveal that the most prevalent blood group among voluntary blood donors is B Positive (32.6%), followed closely by O Positive (31.5%) and A Positive (26.6%). AB Positive is the least common among the positive Rh factor groups, representing 9.3% of the donors.

Regarding the Rh factor distribution, the majority of donors are Rh-positive (94.1%), with Rh-negative donors comprising a smaller portion (5.9%). This trend aligns with other regional studies, where Rh-negative groups are generally less common. The relatively low frequency of Rh-negative individuals highlights the importance of targeted blood donation campaigns to ensure an adequate supply of Rh-negative blood. These findings are crucial for optimizing blood bank inventory and ensuring availability during emergencies.

Gender distribution shows a higher participation of male donors (85.8%) compared to female donors (14.2%), a trend often seen in voluntary blood donation studies.

These findings are crucial for the planning and management of blood banks, as they indicate that blood groups B Positive and O Positive should be prioritized for collection and storage, given their prevalence. The relatively low percentage of Rh-negative donors suggests the need for targeted campaigns to recruit more Rh-negative donors, ensuring an adequate supply of this critical blood type in emergencies.

The distribution of ABO and Rh blood groups varies significantly across different regions of India, reflecting the diverse genetic makeup of the population. In this discussion, we compare the findings of our present study with previous studies conducted in different regions of India, highlighting both similarities and differences.

Table 2. Distribution of ABO and Rh blood groups across different regions of India

Region	Place of study	A	B	O	AB	Positive	Negative
South India	Tirupathi	6.98	42.61	45.59	4.80	95.96	4.03
	Bangalore	23.85	29.95	39.82	6.37	94.2	5.8
North India	Haryana	22.90	38.83	28.70	9.45	90.79	9.28
Central India	Indore	24.15	35.25	31.05	9.01	95.43	4.57
East India	Ranchi	22.09	35.15	34.73	8.03	86.46	3.54
West India	Rajasthan	15.46	39.95	35.68	8.80	91.17	8.82
Present Study	Maharashtra	26.6	32.6	31.5	9.3	94.1	5.9

In South India, the study in Tirupathi (Khader F et al., 2018) found that blood group O was most prevalent (45.59%), followed by B (42.61%), A (6.98%), and AB (4.80%) and in Bangalore (Periyavan et al., 2010), blood group O was also the most common (39.82%), but the prevalence of blood group A was significantly higher (23.85%) compared to Tirupathi^[5]. In our study, blood group B was the most prevalent (32.6%), followed by O (31.5%), A (26.6%), and AB (9.3%). The lower prevalence of blood group A in South India contrasts with our findings, where blood group A is more common, similar to the patterns observed in Bangalore^[6].

In North India, the study in Haryana (Pawan et al., 2015) showed blood group B as the most common (38.83%), followed by O (28.70%), A (22.90%), and AB (9.54%)^[7]. In Present Study, the prevalence of blood group B (32.6%) in our study is slightly lower compared to Haryana but still reflects a common trend in North India where B is typically the most prevalent blood group. Our findings align with the general distribution observed in Haryana.

In Central India, the study in Indore (Gupta NK et al., 2012) reported blood group B as the most prevalent (35.25%), followed by O (31.05%), A (24.15%), and AB (9.01%)^[8]. In present Study, the findings are consistent with the Indore study, where blood group B is also the most prevalent. However, our study shows a slightly lower prevalence of blood group B and a higher prevalence of blood group O, indicating regional variations even within Central India.

In East India, the study in Ranchi (Singh A et al., 2016) reported blood group B as the most common (35.15%), followed by O (34.73%), A (22.09%), and AB (8.03%)^[9]. While our study shows a similar distribution, with blood group B being common, the higher prevalence

of blood group O in Ranchi closely aligns with our findings. The slight variations may be attributed to demographic differences.

In West India, the study in Rajasthan (Manish K et al., 2018) showed blood group B (39.95%) as the most prevalent, followed by O (35.68%), A (15.46%), and AB (8.80%)^[10]. Compared to Rajasthan, our study shows a higher prevalence of blood group A and a lower prevalence of blood group B. This difference may reflect the unique genetic influences in the West Indian population compared to our study population.

Overall, the blood group O tends to be predominant in South India (Tirupathi and Bangalore) where it ranges from 39.82% to 45.59%. Blood group B shows a higher prevalence in West, North and Central India, especially in Rajasthan, Haryana and Indore, where it reaches upto 39.95%, 38.83% and 35.25%, respectively. Rh-positive individuals dominate across all regions, with frequencies ranging from 86.46% to 95.96%.

Table 3. Distribution Of Abo And Rh Blood Groups Outside India

Region	Place of study	ABO Blood group				Rhesus Group	
		A	B	O	AB	Positive	Negative
Outside India	Pakistan ^[11]	27.90	32.40	29.10	10.58	90.13	9.87
	Nepal ^[12]	34	29	33	4.0	96.7	3.30
	Britain ^[13]	42	8.0	47.10	3.0	83.0	17.0
	USA ^[14]	41	9.0	46	4.0	85.0	15.0
	Nigeria ^[15]	21.60	21.40	54.20	2.8	95.2	4.80
	Saudi Arabia ^[16]	24	17	52	4.0	93.0	7.00
	Iran ^[17]	45	11	40	4.0	92.4	7.60

Outside India, Blood group O is also the most common in several countries outside India, such as in Nigeria (54.20%), Saudi Arabia (52.0%), and the USA (46.0%). In contrast, Britain and Iran show a higher prevalence of blood group A. The Rh-positive factor remains predominant in most countries, although there is a higher frequency of Rh-negative individuals in countries like Britain (17.0%) and the USA (15.0%) compared to India.

These variations have implications for transfusion services and blood bank management in different regions. The higher prevalence of Rh-positive individuals suggests that blood banks should focus on maintaining adequate supplies of Rh-negative blood, especially in regions or countries where this blood type is less common. The observed differences in ABO group distribution also emphasize the need for region-specific blood donation campaigns and awareness programs.^[18]

CONCLUSION

Our study aligns with several regional studies, particularly in the prevalence of blood group B as the most common type across many parts of India. The predominance of B Positive and O Positive blood groups, along with the high prevalence of Rh-positive donors, aligns with the general trends observed in other parts of India. The relatively low percentage of female donors underscores the need for targeted efforts to encourage female participation in blood donation, particularly through public health initiatives aimed at improving awareness and addressing gender-specific barriers.

The data generated from this study is valuable for the strategic management of blood bank inventories, ensuring that the most common blood types are sufficiently stocked while also maintaining a registry for rarer blood groups. These efforts are critical to responding effectively to the demands of emergency situations and routine transfusion needs. By understanding the local blood group distribution, healthcare providers can better plan for and meet the transfusion needs of the population, thereby improving patient outcomes and contributing to the overall efficiency of the healthcare system.

REFERENCES:

1. Md Khader Faheem. Demographic Distribution and Prevalence of ABO and Rhesus Blood Groups in Blood Donors: Study from a Tertiary Care Centre in Southern Region of Andhra Pradesh. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 7, 2018, pp 01-05.
2. Soonam John. Prevalence of ABO and rhesus blood groups in blood donors: a study from a tertiary care centre in South Kerala. International Journal of Contemporary Medical Research 2017;4(11):2314-2316.
3. Raja KA, Dobariya GH, Unagar CA, Pandya AN, Patel JN, Wadhvani SN. Frequency and distribution of ABO and Rh blood groups among blood donors in tertiary care

- hospital of South Gujarat, India. *Int J Res Med Sci* 2016;4:5377-81.
4. Badge SA, Ovhal AG, Azad K, Meshram AT. Distribution of blood groups in blood donors in the blood bank of Jagdalpur, Bastar district, Chhattisgarh. *Med J DY Patil Univ* 2017;10:32-5.
 5. Md Khader Faheem. Demographic Distribution and Prevalence of ABO and Rhesus Blood Groups in Blood Donors: Study from a Tertiary Care Centre in Southern Region of Andhra Pradesh. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 17, no. 7, 2018, pp 01-05.
 6. Periyavan S, Sangeetha SK, Marimuthu P, et al. Distribution of ABO and Rhesus-D blood groups in and around Bangalore. *Asian J Transfus Sci*. 2010 Jan;4(1): 41. doi: 10.4103/0973-6247.59391.
 7. Pawan Singh Puja Sharma, Shivani Kalhan, Rahul Satarkar, Sheetal Gole and Neha Garg. Distribution of ABO blood group and Rh (D) factor among blood donors in Haryana. *Int J Biomed Adv Res* 2015;6:249-52
 8. Gupta Narendra Kumar, Dadwal S. Distribution of ABO and Rhesus-D Blood groups. *Asian J. Trans. Sci*. 2012.V6;1:73.
 9. Singh A, Srivastava RK, Deogharia KS, et al. Distribution of ABO and Rh types in voluntary Blood donors in Jharkhand area as a study conducted by RIMS, Ranchi. *J Family Med Prim Care*. 2016 Jul-Sep;5(3):631-636. doi: 10.4103/2249-4863.197319.
 10. Manish Kumar. Distribution of Blood Groups in Blood Donors in The Blood Bank, Jhalawar Hospital & Medical College Society, Jhalawar, Rajasthan. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 17, no. 8, 2018, pp 29-33
 11. Khattak ID, Khan TM, Khan P, et al. Frequency of ABO and Rhesus blood groups in District Swat, Pakistan. *J Ayub Med Coll Abbottabad*. 2008 Oct-Dec; 20 (4):127-9.
 12. Pramanik T, Pramanik S. Distribution of ABO and Rh blood groups in Nepalese medical students: a report. *East Mediterr Health J*. 2000 Jan;6(1):156-8.
 13. Rao C, Shetty J. Frequency of abo and rhesus (D) blood groups in dakshina Kannada district of Karnataka - A study from rural tertiary care teaching hospital in south India. *Nitte Univ J Health Sci* 2014;4:3-4.
 14. Mollison PL, Engelfriet CP, Conteras M. The Rh blood group system. In: *Blood Transfusion in Clinical Medicine*. 9th ed. Oxford: Black Well Scientific Publication; 1993. p. 2008-9.
 15. Mwangi J. Blood group distribution in an urban population of patient targeted blood donors. *East Afr Med J*. 1999 Nov;76(11):615-8.
 16. Bashwari LA, Al-Mulhim AA, Ahmad MS, et al. Frequency of ABO blood groups in the Eastern region of Saudi Arabia. *Saudi Med J*. 2001 Nov;22(11):1008-12
 17. Torabizade Maatoghia J, Paridara M, Mahmodian Shoushtaria M, Kianib B, Noric B, Shahjahanib M, et al. Distribution of ABO blood groups and rhesus factor in a large scale study of different cities and ethnicities in Khuzestan province. *Iran. Egypt J Med Hum Genet* 2016;17:105-9.
 18. Reddy M.K, K. Raja Kumar, Reddy D.S. ABO and Rhesus Types of Blood Group Distribution in Blood Donors in Blood Bank, Government Medical College and Hospital-Suryapet, Telangana: A Tertiary Care Centre Study. *Trop J Path Micro* 2019;5(3):126-131.