



Original Article

## Prevalence of ABO and Rh Blood Group among Blood Donors at the Blood Bank of RMCH, Bareilly, Uttar Pradesh: A Cross-Sectional Study

Dr. Rohit Palta<sup>1</sup>, Dr. Anu Jhanji<sup>2</sup>, Dr. Ajay Kumar Agarwal<sup>3</sup>, Dr. Ghos Ahmed<sup>4</sup>, Dr. Kriti Grover<sup>2</sup>, Dr. Siddharth Arora<sup>5</sup>

<sup>1</sup>Assistant Professor, Department of Medicine, Rohilkhand Medical College & Hospital, Bareilly, Uttar Pradesh, India

<sup>2</sup>Assistant Professor, General Pathology, Rohilkhand Medical College & Hospital, Bareilly, Uttar Pradesh, India.

<sup>3</sup>Professor, Department of Community Medicine, Varun Arjun Medical College & Rohilkhand Hospital, Banthra, Shahjahanpur, Uttar Pradesh, India

<sup>4</sup>Professor, Department of Community Medicine, Rohilkhand Medical College & Hospital, Bareilly, Uttar Pradesh, India

<sup>2</sup>Assistant Professor, General Pathology, Rohilkhand Medical College & Hospital, Bareilly, Uttar Pradesh, India.

ORCID ID: 0009-0008-4653-4418

<sup>5</sup>Assistant Professor, Department of Radiation Oncology, Rohilkhand Medical College & Hospital, Bareilly, Uttar Pradesh, India.

ORCID ID: 0000-0002-4482-9465

OPEN ACCESS

### Corresponding Author:

#### Dr Rohit Palta

Assistant Professor, Department of Medicine, Rohilkhand Medical College & Hospital, Bareilly, Uttar Pradesh, India

Received: 11-03-2026

Accepted: 27-04-2026

Available online: 24-06-2026

Copyright © International Journal of Medical and Pharmaceutical Research

### ABSTRACT

**Background:** The ABO and Rhesus (Rh) blood group systems are clinically important in transfusion medicine. Knowledge regarding their distribution in a population helps in blood bank inventory management, emergency transfusion planning, and public health research. Distribution of blood groups varies according to race, ethnicity, and geographical region.

**Aim:** To determine the prevalence and distribution pattern of ABO and Rh blood groups among blood donors at a tertiary care hospital in Bareilly, Uttar Pradesh.

**Materials and Methods:** This retrospective cross-sectional study was conducted in the Blood Bank of Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, from 18 July 2024 to 27 September 2024. A total of 1454 blood donors were included. Blood group data and donor demographic details were collected from blood bank donor registers. Blood grouping was performed according to standard blood bank protocols using Anti-A, Anti-B and Anti-D antisera. Data were analysed statistically using SPSS version 21.0.

**Results:** Out of 1454 donors, the most common ABO blood group was B (38.58%), followed by O (29.85%), A (21.73%), and AB (9.84%). Rh-positive donors constituted 97.32%, while Rh-negative donors accounted for 2.68%. Maximum donors belonged to the 26–35 years age group (50.07%). Male donors constituted 95.60%, whereas female donors represented 4.40%.

**Conclusion:** Blood group B was the most prevalent blood group among donors in this region, followed by O, A and AB. Rh-positive blood group predominated. Knowledge of regional blood group distribution is useful in maintaining adequate blood bank inventory and improving transfusion services.

**Keywords:** ABO blood group, Rh factor, blood donor, prevalence, blood bank, transfusion medicine.

### INTRODUCTION

Blood group antigens are genetically inherited molecules present on the membrane of red blood cells. These antigens are expressed early in life and remain unchanged throughout life. The ABO blood group system is the most important blood group system in transfusion practice. It was first discovered by Karl Landsteiner in 1900, who identified groups A, B, and O [1]. Later, Von Decastello and Sturli described blood group AB in 1902 [2].

The ABO blood group system holds great clinical significance because antibodies against A and B antigens occur naturally in plasma and may cause severe haemolytic transfusion reactions if incompatible blood is transfused [3]. The Rh blood

group system is considered the second most important blood group system after ABO because of its major role in blood transfusion and haemolytic disease of the newborn [4].

Apart from transfusion medicine, ABO and Rh blood groups are useful in population genetics, anthropological research, medico-legal investigations, migration studies and disease association research [5].

The frequency of ABO and Rh blood groups differs significantly among different populations and geographical regions due to racial and ethnic variation [6]. Therefore, knowledge of regional blood group distribution is essential for proper blood bank inventory management and efficient transfusion services.

This study was undertaken to determine the distribution of ABO and Rh blood groups among blood donors attending a tertiary care hospital in Bareilly, Uttar Pradesh.

## OBJECTIVE

To determine the distribution and prevalence of ABO and Rh blood groups among blood donors in a tertiary care hospital in Bareilly, Uttar Pradesh.

## MATERIALS AND METHODS

This retrospective cross-sectional study was conducted in the Blood Bank of Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, from **18 July 2024 to 27 September 2024**. A total of **1454 blood donors** were included in the study. Data were collected retrospectively from blood donor registers maintained in the blood bank.

The study included both **voluntary blood donors** and **replacement blood donors** who donated blood during the study period. Donors who were found positive for **Hepatitis B, HIV**, or were found **anaemic** during pre-donation screening were excluded from the study.

ABO and Rh blood grouping of all donors was performed according to standard blood bank operating procedures using commercially available **Anti-A, Anti-B and Anti-D antisera** by the agglutination method.

A blood group test determines which antigens are present on the surface of red blood cells. Based on antigen-antibody reactions, the ABO blood group system is classified into four groups:

- **Group A:** Presence of A antigen on red blood cells with anti-B antibody in plasma
- **Group B:** Presence of B antigen on red blood cells with anti-A antibody in plasma
- **Group AB:** Presence of both A and B antigens with no antibodies in plasma
- **Group O:** Absence of A and B antigens with both anti-A and anti-B antibodies in plasma

The **Rh factor**, mainly the D antigen, further classifies blood groups into **Rh-positive** and **Rh-negative**. Based on this, eight blood group types were identified:

**A+, A-, B+, B-, AB+, AB-, O+, O-**

For blood grouping, donor blood was tested with Anti-A, Anti-B and Anti-D antisera, and the reaction was interpreted based on visible agglutination. Agglutination with a specific reagent indicated the presence of the corresponding antigen.

### Blood Group Test Chart

Reagent	Agglutination	Interpretation
Anti-A	Yes	A antigen present
Anti-B	Yes	B antigen present
Anti-D	Yes	Rh positive

### Interpretation of Blood Group by Agglutination Pattern

Anti-A	Anti-B	Anti-D	Blood Group
+	-	+	A+
+	-	-	A-
-	+	+	B+
-	+	-	B-
+	+	+	AB+
+	+	-	AB-
-	-	+	O+
-	-	-	O-

Blood group details were obtained from the **blood group donor register**. Additional donor information including **age, sex, haemoglobin level, body weight, and type of donor (voluntary or replacement)** was collected from blood donor records maintained in the blood bank.

Statistical analysis was performed using **Statistical Package for Social Sciences (SPSS) version 21.0**. Data were analysed in terms of frequency, percentage, mean and standard deviation. Statistical significance was considered at a **p-value <0.05**.

## RESULTS

A total of **1454 blood donors** were included in the study. The distribution of blood groups was analysed according to age, sex, haemoglobin, weight and Rh factor.

**Table 1: Correlation of Blood Group with Age Group among Blood Donors (n = 1454)**

Age Group (Years)	Total Donors	Percentage
18–25	349	24.00%
26–35	728	50.07%
36–45	288	19.81%
46–55	75	5.16%
56–65	14	0.96%
Total	1454	100%

**P-value = 0.042\***

### Observation

The majority of blood donors belonged to the **26–35 years age group (50.07%)**, followed by the **18–25 years age group (24.00%)** and **36–45 years age group (19.81%)**. Minimum donors were in the **56–65 years age group (0.96%)**. Among blood groups, **B positive (37.55%)** was the most frequent, followed by **O positive (28.95%)**, whereas **AB negative (0.28%)** was the least common. The association between age group and blood group distribution was statistically significant (**p = 0.042**).

**Table 2: Correlation of Blood Group with Sex among Blood Donors (n = 1454)**

Sex	Number	Percentage
Male	1390	95.60%
Female	64	4.40%
Total	1454	100%

**P-value = 0.727**

### Observation

Out of 1454 blood donors, **1390 (95.60%) were males** and **64 (4.40%) were females**. Male donors were significantly higher compared to female donors. In both sexes, **B positive blood group** was the most common. The difference in blood group distribution between males and females was not statistically significant (**p = 0.727**).

**Table 3: Average Haemoglobin, Weight and Age among Blood Donors**

Parameter	Female (Mean ± SD)	Male (Mean ± SD)	P-value
Haemoglobin (g/dL)	14.62 ± 6.04	13.48 ± 0.75	0.135
Weight (kg)	66.28 ± 13.20	61.85 ± 10.76	0.008*
Age (years)	31.53 ± 8.12	32.33 ± 7.95	0.440

### Observation

The mean haemoglobin among female donors was **14.62 ± 6.04 g/dL**, while in male donors it was **13.48 ± 0.75 g/dL**. Mean body weight among females was **66.28 ± 13.20 kg**, compared to **61.85 ± 10.76 kg** among males, and this difference was statistically significant (**p = 0.008**). Mean age of female donors was **31.53 ± 8.12 years**, whereas mean age of male donors was **32.33 ± 7.95 years**, with no statistically significant difference.

### Overall Distribution of ABO Blood Groups

**Table 4: Distribution of ABO Blood Groups among Blood Donors**

Correct Table 4 should read:

Blood Group	Number	Percentage
A	316	21.73%
B	561	38.58%
AB	143	9.84%
O	434	29.85%
Total	1454	100%

## Observation

Among all donors, **blood group B was the most common (38.58%)**, followed by **blood group O (29.85%)**, **blood group A (21.73%)**, and **blood group AB (9.84%)**. Thus, blood group B was the predominant ABO blood group in the studied donor population, while AB was the least common.

**Table 5: Distribution of Rh Blood Group among Blood Donors**

Rh Type	Number	Percentage
Rh Positive	1415	97.32%
Rh Negative	39	2.68%
Total	1454	100%

## Observation

Rh-positive blood group was observed in **97.32%** of donors, while only **2.68%** donors were Rh-negative. This indicates a clear predominance of **Rh-positive blood group** among blood donors in this region.

Overall, the study demonstrates that **blood group B positive was the most prevalent blood group, Rh-positive phenotype predominated**, and most donors belonged to the **26–35 years age group**, with male donors contributing the majority of blood donations.

## DISCUSSION

The present study was conducted to evaluate the prevalence and distribution of ABO and Rh blood groups among blood donors at Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh. Knowledge of regional blood group distribution is important for maintaining adequate blood bank inventory, planning transfusion services, and ensuring availability of compatible blood during emergency situations.

In the present study, **blood group B (38.58%)** was found to be the most common blood group, followed by **O (29.95%)**, **A (21.73%)**, and **AB (9.84%)**. Similar findings were observed by **Sidhu and Sidhu [6]**, who also reported predominance of blood group B in the North Indian population. **Girish et al. [8]** reported comparable findings in blood donors from the Malnad region. **Patel et al. [9]** also found blood group B to be the most common among blood donors in Western Ahmedabad. Similar results were further reported by **Simon et al. [10]**, **Banerjee et al. [11]**, **Meena et al. [12]**, **Raja et al. [13]**, **Chandra and Gupta [14]**, and **Wadhwa et al. [15]**. These findings suggest that blood group B is predominantly distributed in North Indian donor populations.

However, variation in blood group distribution has been reported in other parts of India. **Das et al. [16]** and **Mallikarjuna [17]** observed that **blood group O** was the most common blood group among blood donors in South India. This variation may be due to differences in genetic background, ethnicity, racial variation, and geographical distribution.

In the present study, **Rh-positive blood group (97.32%)** was significantly more common than **Rh-negative blood group (2.68%)**. Similar findings were reported by **Sidhu and Sidhu [6]**, and this pattern is consistent with observations in most Indian studies, indicating a predominance of Rh-positive blood group in the Indian population.

Age-wise analysis in the present study showed that the majority of donors belonged to the **26–35 years age group (50.07%)**, followed by the **18–25 years age group (24.00%)**, while the minimum number of donors belonged to the **56–65 years age group (0.96%)**. Similar findings were observed by **Girish et al. [8]**, **Patel et al. [9]**, and **Simon et al. [10]**, all of whom reported greater blood donation among younger age groups. This may be because younger adults are generally healthier, more physically active, and more likely to fulfil blood donation eligibility criteria.

Sex-wise distribution in the present study showed that **95.60%** of donors were male, whereas only **4.40%** were female. Similar findings were reported by **Simon et al. [10]**, **Banerjee et al. [11]**, and **Meena et al. [12]**. The lower participation of females in blood donation may be due to anaemia, lower haemoglobin levels, nutritional deficiencies, lower body weight, menstrual blood loss, social hesitation, and lack of awareness regarding voluntary blood donation.

Overall, the present study provides useful data regarding ABO and Rh blood group distribution among blood donors in Bareilly, Uttar Pradesh. These findings are helpful in blood bank inventory planning, donor recruitment strategies, and improving transfusion services. Increased awareness programmes, especially targeting female participation in blood donation, may further strengthen the donor pool and improve blood availability in the region.

## CONCLUSION

The present study demonstrates that **blood group B is the most prevalent ABO blood group among blood donors in Bareilly, Uttar Pradesh**, followed by O, A and AB. Rh-positive blood group was overwhelmingly predominant, while Rh-negative blood group was uncommon.

Most donors were young adults in the 26–35 year age group, and male donors formed the majority of the donor population. Female participation in blood donation was comparatively low and needs improvement through awareness programmes and counselling.

Understanding the local distribution of ABO and Rh blood groups is extremely useful for blood bank inventory planning, transfusion management, and emergency preparedness. These data can help ensure timely availability of blood components and strengthen transfusion services in the region.

## REFERENCES

1. Dennis LY, Hjlem NM, Fidler C. Prenatal diagnosis of fetal RhD status by molecular analysis of maternal plasma. *N Engl J Med.* 1998;339:1734–1738.
2. Giangrande PLF. The history of blood transfusion. *Br J Haematol.* 2000;110:758–767.
3. Roback JD, editor. *Technical Manual.* 17th ed. USA: American Association of Blood Banks; 2011.
4. Mollison PL. *Blood Transfusion in Clinical Medicine.* 6th ed. Oxford, UK: Blackwell Scientific Publications; 1979. p. 239–666.
5. Khan MS, Subhan F, Tahir F, Kazi BM, Dil AS, Sultan S. Prevalence of blood groups and Rh factor in Bannu region NWFP, Pakistan. *Pak J Med Res.* 2004;43(1):8–10.
6. Sidhu S, Sidhu LS. ABO blood group frequencies among the Sansis of Punjab. *Coll Antropol.* 1980;4:55–58.
7. Blood group testing. [Vedantu Biology – Blood Group Test](#) Accessed January 13, 2026.
8. Girish CJ, Chandrashekar TN, Ramesh Babu K, Kantikar SM. ABO and Rhesus blood group distribution among Malnad region blood donors. *Res Rev Biomed Biotechnol.* 2011;2(3):25–30.
9. Patel PA, Patel SP, Shah JV, Oza HV. Frequency and distribution of blood groups in blood donors in Western Ahmedabad: a hospital-based study. *Natl J Med Res.* 2012;2:207–210.
10. Simon K, Jain RS, Manjunesha S. Prevalence of ABO and Rhesus blood groups in blood donors: a retrospective study from a tertiary care blood bank in Pondicherry. *medRxiv.* 2024. doi:10.1101/2024.05.14.24306971
11. Banerjee S, Devi AMS, Subramanian S. Prevalence of ABO, Rh (D, C, c, E and e), and Kell (K) antigens in blood donors: a single-centre study from South India. *Asian J Transfus Sci.* 2024;18(2):219–224.
12. Meena H, Kumar R, Vasistha S, Sharma J. Prevalence of ABO-Rh (D) blood group amongst blood donors at a tertiary care centre in Kota, Rajasthan. *Eur J Cardiovasc Med.* 2023;13(1):895–899.
13. Raja KA, Dobariya GH, Unagar CA, Pandya AN, Patel JN, Wadhvani SJ. Frequency and distribution of ABO and Rh blood groups among blood donors in a tertiary care hospital of South Gujarat, India. *Int J Res Med Sci.* 2016;4(12):5377–5381.
14. Chandra T, Gupta A. Frequency of ABO and Rhesus blood groups in blood donors. *Asian J Transfus Sci.* 2012;6:52–53.
15. Wadhwa MK, Patel SM, Kothari DC, Pandey M, Patel DD. Distribution of ABO and Rhesus-D groups in Gujarat, India: a hospital-based study. *Indian J Pediatr Oncol.* 1998;19:137–141.
16. Das PK, Nair SC, Harris VK, Rose D, Mammen JJ, Bose YN, et al. Distribution of ABO and Rh-D blood groups among blood donors in a tertiary care centre in South India. *Trop Doct.* 2001;31:47–48.
17. Mallikarjuna S. Prevalence of ABO and Rhesus blood group among blood donors. *Indian J Public Health Res Dev.* 2012;3(2):106–109.