Section: Miscellaneous

Original Research Article

COMPREHENSIVE ANALYSIS OF ABO AND RH BLOOD GROUP DISTRIBUTION AMONG BLOOD DONORS: A THREE-YEAR RETROSPECTIVE STUDY IN SAMBALPUR, ODISHA

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Abstract

Background: The ABO blood grouping system, introduced by Sir Karl Landsteiner in 1900, plays a crucial role in transfusion medicine, with the Rh blood grouping system being the second most prevalent. Despite various blood grouping systems described in the literature, ABO and Rh (D) remain pivotal for transfusions, organ transplants, and research. This study aims to investigate the distribution of ABO and Rh groups among blood donors at VIMSAR Medical College and Hospital, Sambalpur, Odisha, providing valuable insights into regional blood group patterns. The objective is to comprehend the distribution of ABO and Rh groups among the donor population attending VIMSAR Medical College and Hospital blood centre in Sambalpur, Odisha, over a three-year period. **Materials and Methods:** A retrospective study covering November 2020 to October 2023 was conducted at the VIMSAR Medical College and Hospital blood centre. Data were collected from registers, including voluntary and replacement blood donors. Inclusion criteria followed National Blood Transfusion Council guidelines, and ABO and Rh grouping used the tube agglutination method with standard operating procedures. Statistical analysis involved calculating simple percentages. **Result:** The study included 5,000 blood donors, comprising 97% voluntary and 5% replacement donors. Males constituted 86%, and females 14% of the study population. ABO distribution showed O Rh positive as the most common (35.1%), followed by A Rh positive (27.9%) and B Rh positive (25.6%). Among A donors, 99.6% were A1, and among AB donors, 81.7% were A1B. Rh-positive donors were 93.6%, Rh-negative 6.4%, with 1.1% having a weak D group. The study's findings align with existing literature, emphasizing the importance of voluntary blood donations. Gender bias and age distribution reflect patterns observed in comparable studies. Blood group prevalence corresponds to regional and international trends, contributing to the broader understanding of blood group variations. **Conclusion:** This study provides unique insights into ABO and Rh blood group distribution in Sambalpur, Odisha, highlighting the need for regional studies to inform transfusion medicine policies and emergency responses. Limitations include the exclusion of patient cross-matching data.

INTRODUCTION

The human ABO blood grouping system, initially described by Sir Karl Landsteiner in 1900, stands as a pivotal component in transfusion medicine. Subsequently, the Rh blood grouping system emerged as the second most prevalent system within this field. Although numerous blood grouping systems have been documented in the literature, ABO and Rh (D) remain predominant, essential for transfusions, organ transplants, medico-legal research, population genetics, disease association studies, and general research. The distribution of ABO and Rh blood groups varies across regions and

races, necessitating comprehensive knowledge for appropriate planning in regional blood banks, inventory management, and ensuring the safe provision of blood to patients while preventing transfusion reactions.[1-5]

This study aims to comprehend the distribution of ABO and Rh groups among the donor population attending the VIMSAR Medical College and Hospital blood centre in Sambalpur, Odisha. It is the first of its kind conducted in the state, providing unique insights into the blood group distribution in this specific region.

MATERIALS AND METHODS

A retrospective study spanning three years (November 2020 to October 2023) was conducted at the blood centre of VIMSAR Medical College and Hospital, Sambalpur, Odisha.

Data Collection:

Registers from the blood centre records were utilized for data retrieval. The study encompassed voluntary and replacement blood donors who donated blood at the blood centre and voluntary blood donation camps, following informed consent.

Inclusion Criteria

Healthy blood donors meeting the criteria outlined by the National Blood Transfusion Council guidelines and undergoing basic medical examinations were included in the study. The guidelines adhere to the Drugs and Cosmetics Act, 1940, and Rules, 1945.

Testing Methods:

The ABO and Rh grouping of the study population was conducted using the tube agglutination method, following standard operating procedures. Both forward and reverse grouping, including positive and negative controls, were performed. Bombay blood group was ruled out in O blood group donors using Anti-H reagent. Rh-negative groups underwent Du testing to detect weak Rh D antigens.

Reagents Used:

Standard monoclonal antisera for A, B, AB, H, A1, and Rho D, as well as monoclonal and Rho Anti D antisera, were employed for blood grouping. Validation, lot verification, and daily quality control procedures were implemented for all antisera before donor sample grouping.

Statistical Analysis:

Simple percentages were calculated for each variable and compared with existing literature to provide a comprehensive overview.

RESULTS

The study encompassed a total of 5,000 blood donors during the specified period, with 97% being voluntary donors and 5% replacement donors [Table 1].

The gender distribution revealed that 86% of donors were male, and 14% were female [Table 2].

Notably, no Bombay blood group donors were identified within the study period. However, a single Bombay blood group patient's sample was received at the Blood Centre for cross-matching. [Table 3]

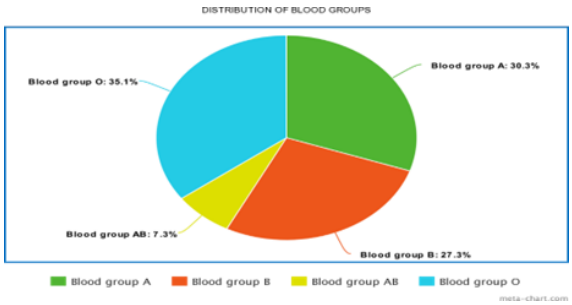

Figure 1 Distribution of ABO Groups in the Study Population

Among the 1,646 donors with blood group A, 6 (0.4%) were A2 Positive, and 1,354 (99.6%) were A1 Positive [Table 4].

Among the 366 donors with blood group AB, 299 (81.7%) were A1B Positive, and 67 (18.3%) were A2B Positive [Table 5].

Rh Distribution in the Study Population: Rh-positive donors constituted 93.6% (4,680 donors) of the study population, while Rh-negative donors constituted 6.4% (320 donors) (Table no.6). Out of the 5,000 Rh-positive donors, 55 had the weak D group, accounting for 1.1% of the total study population. [Table 6]

Table 1: Type of study population

Sr. No.	Type of donors	Number of donors	Percentage of donors (%)
1.	Voluntary	4750	95
2.	Replacement	250	5

Table 2: Sex distribution of study population

Sr. No.	Gender	Number of donors	Percentage of donors (%)
1.	Males	4300	86
2.	Females	700	14

Table 3: Age distribution of blood donors

Age group	Number of donors	Percentage of donors (%)
18-20 yrs	104	2.1
21-30 yrs	2244	44.9
31-40 yrs	2392	47.8
41-50yrs	247	4.9

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51-60yrs	13	0.3

Table 4: Distribution of Blood group A in study population

Sr. No.	Blood group	Number of blood donors	Percentage of blood donors (%)
1.	A1	1354	99.6
2.	A2	6	0.4

Table 5: Distribution of Blood group AB in study population

Sr. No.	Blood group	Number of blood donors	Percentage of blood donors (%)
1.	A1B	299	81.7
2.	A2B	67	18.3

Table 6: Rh distribution of study population

Sr. No.	Rh group	Number of blood donors	Percentage of blood donors (%)
1.	Rh positive	4680	93.6
2.	Rh negative	320	6.4

DISCUSSION

The study comprised 5,000 healthy blood donors who contributed over three years from November 2020 to October 2023. While data on such studies worldwide is available, the focus here is on comparing the study's findings with existing literature. In our study, voluntary and replacement donors accounted for 97% and 3%, respectively, similar to Garg P et al,[1] (99.71% and 0.91%) and Swamy P et al,[2] (93.83% and 6.17%). The blood centre actively promotes voluntary donations, minimizing replacements to ensure a safe, non-remunerated blood supply.

Males dominated the study population at 88%, with females at 12%. This gender bias could stem from factors such as female donors' reluctance due to fear, cultural norms, and vaso-vagal syncopes during donation, resulting in post-donation fatigue. Comparable figures were observed in studies by Kumar S et al,[3] (92.4% males and 7.6% females) and Singh A et al (91.73% males and 8.27% females).[3]

Table 7 presents a comparison of ABO and Rh group distributions with other Indian and international studies. The study's age distribution showed a majority in the 31-40 years age group (47.8%), followed by 21-30 years (45%). This aligns with Patel PA et al,[4] who reported 51.99% in the 31-40 age group and 42.98% in the 21-30 age group. The scarcity of donors beyond 40 years may result from deferrals due to health conditions, lifestyle diseases, or personal choices.

Blood group O Rh positive (35.1%) was the most common, followed by A Rh positive (27.9%) and B Rh positive (25.6%). This pattern mirrored studies by Debele GJ et al,[5] Belali TM et al,[6] Khattak ID et al,[7] Allawati M et al,[8] and Adrian CR et al.[9] Among blood group A individuals, A1 constituted the majority (99.5%), consistent with Das PK et al,[10] (98.57%) and Raja KA et al,[11] (100%). However, among blood group AB individuals, A1B prevalence (82%) was lower than Das PK et al,[10] (98.57%) and Raja KA et al,[11] (99.95%).

Rh positivity in the study was 93.6%, Rh negativity was 6.4%, and 1.1% had a weak D group. These figures were consistent with various studies conducted across India. The study contributes to understanding blood group variations and emphasizes the need for similar studies across regions to aid health planning and emergency response.[12-19]

CONCLUSION

The study sheds light on blood group frequency variations and emphasizes the importance of conducting similar studies across different regions and races. This could inform national policies in transfusion medicine, establish databases for emergency responses, and manage the growing demand for blood effectively. The study's limitations include its focus on voluntary and replacement donors, excluding patient cross-matching data received at the blood centre.

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