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Original Article

DISTRIBUTION OF ABO AND RH BLOOD GROUP SYSTEMS IN THE GENERAL POPULATION OF DHAKA, BANGLADESH: INSIGHT FROM A SINGLE-CENTRE ANALYSIS.

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Abstract:

Objective: *This study aimed to analyze the distribution of ABO and Rh blood groups among the general population of Dhaka city. The findings provide updated insights into local blood group patterns, which can help optimize transfusion services and blood bank management.*

Method: *A retrospective cross-sectional study was conducted at NILMRC, Dhaka. Data were collected from the Laboratory Information System (LIS) of NILMRC. A total of 10,176 individuals were included in the study, regardless of age, sex, or health condition. ABO and Rh blood groups were determined using both automated systems and the manual slide agglutination method.*

Results: *The most common blood group was B (33.48%), followed closely by group O (33.33%), group A (24.12%), and group AB (9.07%). Rh-D positive individuals comprised 96.33% of the total population. Males were predominant in all blood groups, and 58% of participants were within the 18–30 years age group.*

Conclusion: *B-positive was the most prevalent blood group among the population studied. Understanding the distribution of blood groups is essential for improving donor recruitment strategies and ensuring adequate blood availability for transfusion needs in the future.*

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Introduction

Blood grouping is a critical field in both transfusion and transplant medicine,[1] first revolutionized by the pioneering work of Karl Landsteiner in 1901. Landsteiner's discovery of the ABO blood group system revealed the presence of specific antigens on the surface of red blood cells and corresponding antibodies in the plasma. This antigen-antibody interaction determines blood group compatibility, which is an important factor in ensuring safe blood transfusions. ABO blood group system remains of prime importance in transfusion medicine as antigens are the most immunogenic of all the blood groups, and antibodies are naturally occurring, found universally, and are highly reactive. The most common cause of death due to transfusion reaction is ABO incompatibility.[2]

The clinical importance of the Rh blood group system is based on the fact that the antigen D is highly immunogenic. If a D-negative recipient is transfused with D-positive blood, in 90% of cases, the recipient forms anti-D. This is especially crucial in pregnancy, where Rh incompatibility between a Rh-negative mother and a Rh-positive fetus can lead to hemolytic disease of the newborn (HDN).[3]

Blood group distributions vary significantly between populations due to genetic and geographical factors.[4]

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Understanding these variations is vital for effective blood bank management, emergency medical planning, and understanding disease susceptibility. Certain blood types, for example, have been associated with conditions such as cardiovascular diseases, infectious diseases like malaria, and certain types of cancer.[5,6,7]

This research aims to analyze the distribution of ABO and Rh blood groups among the common population of Dhaka city, using data from the Laboratory Information System (LIS) collected over the period from 2020 to 2024. This study will provide updated insights into local blood group patterns, helping optimize transfusion services, improve patient care, and support future epidemiological research.

Materials and Methods

Study Design

This retrospective cross-sectional study aims to determine the distribution of ABO and Rh blood groups among individuals at the National Institute of Laboratory Medicine and Referral Centre (NILMRC), Dhaka, Bangladesh. Data were collected from the Laboratory Information System (LIS) over five years, from 2020 to 2024.

Study Population

The population includes 10,176 individuals who underwent routine blood grouping tests at NILMRC. Participants were selected regardless of age, gender, or health status for broad urban representation. No exclusion criteria based on medical conditions ensure that data reflect the general population served by the center.

Sampling Method

The study used a census approach, including all individuals recorded in the LIS at NILMRC during the specified period.

Data Collection

ABO and Rh blood group data were collected from the LIS at NILMRC, which archives laboratory results. ABO was classified as A, B, AB, or O, while Rh was classified as Rh-positive or Rh-negative.

Ethical Considerations

All data were anonymized to protect confidentiality. Since the study used secondary data from the LIS without direct interaction, informed consent was not required. Ethical approval was obtained from the relevant institutional review board. No: 2024.0203

Statistical Analysis

All the ABO and Rh (D) blood group data were tabulated in Microsoft Excel and analyzed by SPSS 23. Descriptive statistical measures like frequency and percentage were calculated.

Results:

Graph 1 shows the blood group distribution of participants. Blood Group B was the most prevalent, representing 33.48% of the sample population. Blood Group O accounted for 33.33%. Blood Group A was 24.12%, while Blood Group AB was the least common at 9.07%. The distribution indicates a dominance of blood groups B and O, suggesting regional or genetic influences specific to the population served by this tertiary care center. A Chi-square test on the data demonstrated a statistically significant non-uniformity ($\chi^2 = 1593.61$, $p < 0.001$). This confirms that certain blood groups are inherently more prevalent in this population.

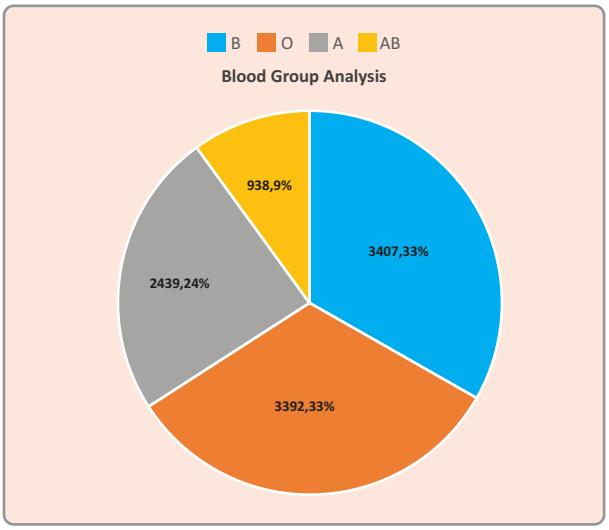

Figure 1: *Blood Group Analysis*

Figure 2 shows that Rh-D Positive individuals formed a significant majority, accounting for 96.33 % of the sample. Rh-D-negative individuals represented only 3.67% of the population.

Figure 3 shows the gender distribution of participants: Group A, females are 45.83% and males are 54.16%. Group B has 54.12% males and 45.88% females. Group O consists of 53.18% males and 46.82% females. Group AB features 47.54% females and 52.45% males. Overall, males exceed females slightly across all groups with minimal differences.

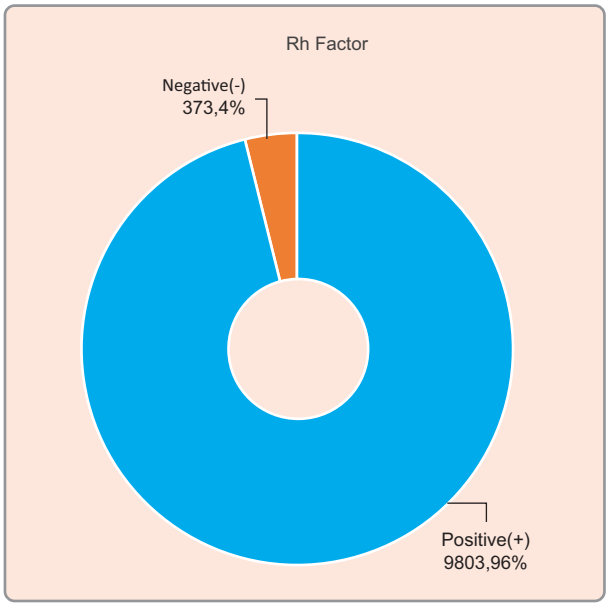

Figure 2: *Distribution of Rh D Factor*

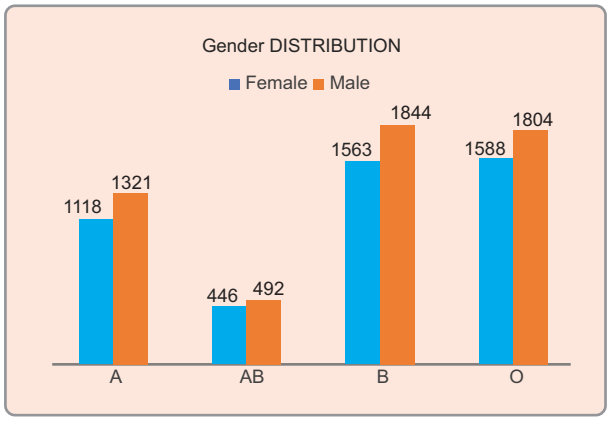

Figure 3: *Gender distribution*

Table 2 shows age group distribution: 58% (5,891 individuals) are aged 18 to 30, followed by 20% (2,033) for ages 30 to 50, 14% (1,466) for ages 0 to 18, and 8% (786) for 50+. This highlights a predominantly young population, with over half in the 18 to 30 range.

Table-I

Age group distribution

Age Group	Count	Percentage
0 to 18	1466	14%
18 to 30	5891	58%
30 to 50	2033	20%
50+	786	8%

Discussion

This study, conducted on a total of 10,176 individuals, provides valuable insights into the distribution of blood groups within the Bangladeshi population. Our findings indicate that blood group B is the most prevalent, accounting for 33.48% of the population, followed closely by blood group O at 33.33%, blood group A at 24.12%, and blood group AB at 9.07%.

These findings are consistent with earlier research. In 1975, Rahman M. studied ABO and Rhesus blood groups in the central region of Bangladesh and similarly reported that blood group B was the most common. His study found the frequencies of B, O, A, and AB to be 34.5%, 33.4%, 22.9%, and 9.2%, respectively.[8] A study by Sultana et al. also confirmed the predominance of blood group B in Dhaka city.[9]

Most studies across Bangladesh consistently report blood group B as the most prevalent. However, there are some regional variations. For instance, a study by Dewan found that among the Bengali population in the Rangamati district, blood group O is more common. Among tribal populations, blood group B remains the predominant type, while in the Tripura community, blood group A is more frequently observed.[4]

Studies from Pakistan show that blood group B[10] is the most prevalent, particularly in regions such as Punjab,[11] Sindh,[12] and Multan.[13] Another study by Ghafoor et al. found that blood group O is the most prominent in Lahore.[14] In Dir Lower, a study by Sana Ullah reported that Blood group A is more common.[15] In India, blood group O is the most common [16] followed by B, A, and AB. There is some regional variation. Among the people of Gwalior and Haryana, blood group B is reported to be the most prevalent. [17,18] In Nepal, several studies suggest that blood group O is most common, followed by B, A, and AB.[19-21] In Australia, USA, China group O is the most common, followed by A, B, and AB.[22-24]

Our study observed that 96.33% of individuals were Rh-positive, while 3.67% were Rh-negative, consistent with findings from previous studies conducted in Bangladesh, which also reported a similar trend.[8,9] Globally, the frequency of Rh-D positive individuals varies significantly by ethnicity: approximately 85% in Caucasians, 92% in Black populations, and 99% in Asian populations (Dean, 2005).[25] In Asian countries such as Bangladesh, India, [16] Nepal,[19] studies consistently show a lower frequency of Rh-D negative

individuals, a pattern that was also observed in our current study. In contrast, countries like the United States [23] and Australia [22] report a comparatively higher prevalence of Rh-D negative individuals.

Furthermore, the analysis of blood group distribution across genders revealed no significant differences. The proportions of ABO and Rh-D blood groups were consistent between males and females, suggesting that gender does not substantially influence blood type prevalence in this sample. This finding is important for blood banks and healthcare providers, as it allows for inventory strategies that do not need to account for gender-specific differences in blood type distribution.

Conclusion

This updated assessment of blood group distribution in Dhaka reveals a predominance of group B, followed by groups O, A, and AB. Rh-positive phenotypes are significantly more common than Rh-negative phenotypes. These insights are crucial for optimizing donor recruitment strategies, ensuring blood availability, and enhancing the infrastructure of transfusion services across the region.

Conflict of interest: None to declare.

Ethical approval: Approved from IRB, NILMRC, No: 2024.0203.

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