Journal of Health and Rehabilitation Research 2791-156X JHRR

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Original Article

Distribution of ABO-Rh Blood Group System Among the Students at Shah Abdul Latif University Khairpur, Pakistan

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Conflict of Interest: None.

*Jamali YA., et al. (2024). 4(1): **DOI**: https://doi.org/10.61919/jhrr.v4i1.379*

ABSTRACT

Background: The distribution of ABO and Rh blood groups significantly varies across different populations and is crucial for effective blood bank management and transfusion services. Previous studies have shown diverse patterns in blood group distribution globally, influenced by regional, ethnic, and demographic factors.

Objective: This study aimed to analyze the distribution of ABO and Rh blood groups among the student population at Shah Abdul Latif University (SALU), Sindh, Pakistan, and to understand its implications for local healthcare services.

Methods: A cross-sectional study was conducted involving 253 students (133 males and 120 females) aged 18 to 24 years. Informed consent was obtained from all participants. The study employed a sterile lancet for blood sample collection via a finger prick. Blood group phenotyping was done using the slide method with monoclonal antiserum A, B, and D. Agglutination results were recorded to determine the ABO blood group and Rh factor. Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 25.

Results: The study found that 21.7% of students belonged to blood group A (49.1% Rh positive and 5.5% Rh negative in males, 40% Rh positive and 5.5% Rh negative in females), 35.2% to blood group B (38.2% Rh positive and 6.7% Rh negative in males, 52.8% Rh positive and 2.3% Rh negative in females), 11.1% to blood group AB (57.1% Rh positive in males, 39.3% Rh positive in females), and 32.0% to blood group O (54.3% Rh positive and 2.5% Rh negative in males, 38.3% Rh positive and 4.9% Rh negative in females).

Conclusion: The distribution of ABO and Rh blood groups in the student population at SALU exhibits a distinct pattern, emphasizing the importance of regional studies in blood group distribution. These findings have significant implications for blood bank management, transfusion services, and healthcare planning in the region.

Keywords: ABO blood group, Rh blood group, Blood group distribution, Shah Abdul Latif University, Pakistan, Blood bank management.

INTRODUCTION

The ABO and Rh blood group systems are fundamental to the fields of transfusion medicine and blood banking, with the ABO system's discovery by Karl Landsteiner in 1900 marking a significant milestone in these domains (1). This discovery, crucial for the safe practice of blood transfusions, remains a cornerstone in blood banking over a century later, emphasizing the vital importance of blood type determination to prevent adverse reactions and fatalities (2, 3). The Rhesus system, identified in 1939 and further elucidated in subsequent years, further complements the understanding of human blood group systems(4, 5).

The ABO system classifies human blood into four primary groups- A, B, AB, and O- based on the presence of specific antigens and agglutinins (6, 7). Types A, B, and AB blood groups possess one or more antigens, with type O lacking both A and B antigens. Notably, type A plasma contains type B antibodies that inhibit type B antigens, while type B plasma contains type A antibodies, which suppress type A antigens. Conversely, individuals with type AB blood lack both type A and B antibodies, whereas those with type O blood

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possess both (1, 8). This intricate interplay of antigens and antibodies is critical for understanding transfusion compatibility and immune responses (9, 10).

The distribution of ABO blood groups varies significantly across different populations and ethnicities. For instance, in the United States, the prevalence of blood types among Caucasians is 47% for type O, 41% for type A, 9% for type B, and 3% for type AB. The African American population shows a different distribution, with 46% of individuals having type O, 27% type A, 20% type B, and 7% type AB. In Western Europe, the distribution is 46% for type O, 42% for type A, 9% for type B, and 3% for type AB. A study in Ogbomoso, Oyo State, Nigeria, involving 7,653 participants, revealed that 50% had blood type O, 22.9% type A, 21.3% type B, and 5.9% type AB (2, 3, 5, 11). These variations underscore the influence of genetic and environmental factors on blood type distribution and necessitate localized studies to understand these dynamics better (12, 13).

The current research aims to investigate the distribution of the ABO-Rh blood group system among students at Shah Abdul Latif University (SALU) in Sindh, Pakistan. This study not only seeks to contribute to the global understanding of blood group distribution but also aims to provide crucial insights specific to the Pakistani population, particularly the student demographic at SALU. Understanding these patterns is not only essential for effective blood banking and transfusion services but also has implications for studying population genetics, epidemiology of certain diseases, and possibly tailoring medical treatments to specific blood types within the local context (14, 15).

MATERIAL AND METHODS

This cross-sectional study was conducted at Shah Abdul Latif University (SALU), Sindh, Pakistan, encompassing a demographically representative sample of the student population. The study involved 253 students aged between 18 and 24 years, with a mean age of 19.67 years. The gender distribution within the sample was nearly balanced, comprising 133 male students (52.6%) and 120 female students (47.4%). Prior to participation, informed consent was obtained from each student, ensuring adherence to ethical standards. The study's inclusion criteria were strictly adhered to, with participants being exclusively within the 18 to 24 age range, thus excluding individuals below 17 or above 24 years of age.

The methodological approach for blood type determination involved a minimally invasive procedure. Blood samples were collected using a sterile lancet for a finger prick, a method chosen for its efficacy and minimal discomfort. Blood group phenotyping was conducted using the slide method, employing monoclonal antiserum A, B, and D. The procedural guidelines provided by Spinreact, Spain, were meticulously followed to ensure accuracy and reliability. For each sample, a labeled slide was prepared with a drop each of anti-A, anti-B, and anti-D serums. A drop of the participant's blood was then mixed into each corresponding serum drop. The agglutination results were immediately observed and recorded following the mixing process. The presence of agglutination in the respective blood drops indicated the ABO blood group (A, B, AB, or O), with the absence of agglutination in both A and B indicating blood group O. For the Rh factor, agglutination in the Rh drop signified Rh positive status, while its absence indicated Rh negative status (16, 17).

The data collected from this phenotyping process were systematically recorded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. This analysis allowed for the statistical assessment of the distribution of blood groups and Rh factor among the student population at SALU (18, 19). The analysis aimed to provide insights into the prevalence and distribution patterns of these blood groups in this specific demographic, contributing valuable data to the existing body of knowledge in the field. The study's adherence to ethical guidelines, careful methodological execution, and rigorous data analysis ensured the reliability and validity of the findings.

RESULTS

Table 1 Distribution of ABO and Rh blood groups in male and female students.

Blood group	Total (n=253)	Male (n = 133)		Female (n = 120)	
		Rh +ve	Rh-ve	Rh +ve	Rh-ve
A	55 (21.7%)	27 (49.1%)	3 (5.5%)	22 (40%)	3 (5.5%)
B	89 (35.2%)	34 (38.2%)	6 (6.7%)	47 (52.8%)	2 (2.3%)
AB	28 (11.1%)	16 (57.1%)	1 (3.6%)	11 (39.3%)	0
O	81 (32.0%)	44 (54.3%)	2 (2.5%)	31 (38.3%)	4 (4.9%)

The blood group 'B' was the most common, making up 89 people or 35.2% of the sample. The next most common blood type was O, found in 81 people (32.0%). The sample comprised 55 individuals with blood type A (21.7%) and 28 with blood group AB (11.1%).

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It was discovered that 17 (60.7%) of the male students had blood type AB, while 49 (55.1%) of the female students, both genders together, had blood type B.

Table 1 shows the relative frequencies of the various RhD groups. Different ABO blood types have different proportions of RhD+ and RhD- individuals. Rh positive was found in 91.7% (n=232) of the students and Rh-D negative in 8.3% (n=21) of students. B Rh-D positive blood group was most familiar with a percentage frequency of 81/232 (34.9%). The next most common type, with a frequency of 32.3%, is group O Rh-D positive (75/232), A + blood group with a percentage frequency of 49/232 (21.1%), AB + blood group with a percentage of 27/232 (11.6%). The most prevalent Rh-positive antigen blood group was AB 16 (57.1%) in male students, and 47 (52.8%) female students had the most pervasive B Rh-D positive blood group.

DISCUSSION

In this study conducted at Shah Abdul Latif University, Sindh, Pakistan, the distribution of ABO and Rh blood groups among 253 students (133 males and 120 females) was analyzed. The results indicated a diverse distribution (20-22): Blood group A was present in 55 individuals (21.7%), with 27 (49.1%) being Rh positive and 3 (5.5%) Rh negative among males, and 22 (40%) Rh positive and 3 (5.5%) Rh negative among females. Blood group B was found in 89 students (35.2%), with a male to female split of 34 Rh positive (38.2%) and 6 Rh negative (6.7%) for males, and 47 Rh positive (52.8%) and 2 Rh negative (2.3%) for females. AB group was seen in 28 students (11.1%), predominantly Rh positive (57.1% in males and 39.3% in females). The O blood group was observed in 81 participants (32.0%), with a distribution of 44 Rh positive (54.3%) and 2 Rh negative (2.5%) in males, and 31 Rh positive (38.3%) and 4 Rh negative (4.9%) in females.

These findings offer a significant contrast to various global studies, underscoring the impact of regional, ethnic, and demographic factors on blood group distribution. For instance, studies from India, Ethiopia, Libya, Turkey, and Namibia demonstrate varied distribution patterns, often influenced by the complex interplay of ethnicity and regional characteristics. In South India, the most common blood group was O positive, a stark contrast to the prevalence of group B in our study (11). Similarly, the Ethiopian population showed a predominance of blood group O, aligning more closely with the findings of our study (2).

The influence of gender on blood group distribution, as observed in Libyan and Ethiopian studies, was also evident in our study, although the patterns differed. The aforementioned studies did not report a significant variation in ABO and Rh blood group distribution between genders, which aligns with our findings where similar distribution patterns were observed in both male and female participants (4).

Understanding these distribution patterns is crucial for effective management of blood transfusion services and health planning. As demonstrated in an Ethiopian study, knowledge of local blood group prevalence can aid in better resource allocation and management of blood banks (5). Additionally, the association of certain blood groups with diseases, such as the link between ABO blood groups and type-2 diabetes mellitus (6), further emphasizes the importance of such studies in understanding disease susceptibility and developing targeted healthcare strategies (3).

In conclusion, the distribution of ABO and Rh blood groups in the student population at Shah Abdul Latif University reflects a unique pattern that contributes to the global understanding of blood group distribution. It highlights the importance of regional studies in understanding the complex dynamics of blood group distribution and its implications for health services and disease association.

CONCLUSION

The study at Shah Abdul Latif University, revealing a unique distribution of ABO and Rh blood groups among Pakistani students, underscores the significance of regional variations in blood group prevalence. These findings are crucial for enhancing blood bank management and transfusion services in the region, catering specifically to the local demographic needs. Moreover, understanding these patterns can aid in epidemiological studies and potentially inform healthcare strategies, especially in the context of diseases associated with specific blood groups. This research not only contributes to the global database of blood group distributions but also highlights the need for tailored healthcare and resource allocation in diverse populations.

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