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Original article

ABO and Rhesus Blood Group Frequency among Donors and Admitted Patients at Zawia Medical Center, AzZawya City, Libya

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ABSTRACT

The identification and categorization of blood groups play a crucial role in transfusion medicine as it allows for safe and compatible transfusions. Among the various blood group systems, the ABO and Rhesus blood grouping systems have special clinical significance. Understanding the distribution and frequency of ABO and Rhesus blood groups within a specific community is essential for healthcare planning, especially when it comes to blood supply management and organ transplantation. Additionally, studies have also shown a relationship between ABO blood groups and the onset and spread of diseases. Therefore, this study was conducted to detect the distribution and frequency of ABO and Rhesus blood groups in AzZawya City, Libya. In this retrospective study, data from the blood bank at Zawia Medical Center were collected over three years to detect the distribution of ABO and Rh blood groups among 5187 donors and admitted patients. The result shows that blood group O is the dominant among all study subjects (45%), as well as, among males (48.2%), and females (42.2%). Blood group A is the second most common at 34.6% among total, 33% among males, and 36% among females. For Rhesus antigens 89.4% of study subjects were Rhesus positive, 87.3% for males and 80% for females. In addition, the results show a statistically significant association between gender and blood group distribution $p<0.001$. Knowing the most common blood types helps maintain adequate blood bank supplies.

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INTRODUCTION

Karl Landsteiner from the University of Vienna published a study in 1900, the study has found that blood plasma contains antibodies that are specific to certain antigens, and red blood cells have antigens on their surfaces [1]. Then, this became the foundation of contemporary transfusion and blood-grouping medicine. Blood grouping is based on red blood cell antigens, which are proteins and carbohydrates bound to lipids or proteins. ABO is the most researched blood group in the human population out of more than 100 blood group systems with over 500 antigens [2]. These antigens perform a variety of tasks, including ensuring the structural stability of membranes and moving molecules through them. Human tissues and the majority of epithelial and endothelial cells express ABO antigens strongly [3].

The ABO and Rh blood groups are inherited traits, determined by specific genes. The ABO gene, located on chromosome 9, encodes the enzymes responsible for the production of A and B antigens. The presence or absence of these antigens determines the blood type. Similarly, the Rh gene, located on chromosome 1, determines the presence or absence of the Rh antigen [4]. Understanding the genetics behind blood groups provides valuable insights into the inheritance patterns and the potential risks associated with certain blood types [5].

Many studies have investigated the prevalence of ABO and Rh blood groups in different populations and ethnicities. These studies are performed for several reasons: their importance in blood transfusion and organ transplantation, their application in genetic research, forensic pathology and anthropology, and the study of human ancestry relationships [6]. In addition, several studies have suggested an association between ABO blood groups and the development of cardiovascular disease, cancer, and other conditions [5]. Thus, understanding population blood group distribution helps public health officials predict and prevent the prevalence of such diseases among specific communities. For example, people with blood group A are at high risk of developing gastric cancer [7]. Furthermore, knowledge of ABO and Rh blood groups is useful in population genetic studies, researching population migration patterns, as well as resolving certain medicolegal issues, particularly disputed parentage cases [8].

Moreover, during pregnancy, the mother's blood type can have implications for the health of both the mother and the baby. Incompatibility between the mother's blood type and that of the fetus can lead to complications, such as hemolytic disease of the newborn. This condition occurs when the mother's antibodies attack the red blood cells of the fetus, potentially causing anemia, jaundice, and even neurological damage [9]. Understanding the ABO and Rh blood groups of both the mother and the fetus allows healthcare providers to anticipate and manage potential complications. In addition, blood group prevalence studies are important for managing community blood and blood product resources [10]. Besides community health, blood group frequency knowledge is also crucial for managing blood bank inventory and transfusion services. Nowadays there is an increase of demand for various blood groups and blood products all over the world [11], as well as, in Az Zawya city because of the increase in the caesarian section and its complications such as postpartum hemorrhage. The prevalence of road traffic injuries and elective procedures is also on the rise. Thus, to maintain a sufficient supply of the most medically beneficial blood types, blood banks need current information about the distribution and frequency of various blood groups. Therefore, this study aims to ascertain the demographic profile of blood donors and the distribution of ABO and Rhesus blood groups in AzZawya City.

METHODS

This retrospective cross-sectional study was conducted in one of the largest governmental hospitals in Libya, Zawia Medical Centre, at AzZawya City. Permission was obtained from the blood bank at the Zawia Medical Center through the hospital administration to view the records of ABO and Rhesus blood typing results for donors and admitted patients at the hospital and use them as data for this study. Data of ABO and Rh blood typing results for donors and admitted patients during the period from the beginning of January 2018 to the end of December 2021 were collected and included in this study. Data was then analyzed using SPSS.

RESULTS

Blood groups of 5187 donors and admitted patients from all age groups were included in this study. There were more females (52.2%, n = 2708) as compared with males (47.8%, n = 2479).

Distribution of different blood group phenotypes and Rh factor for all donors and admitted patients

As shown in Table (1), the most common blood type among the study subjects was blood group O (45%, n = 2335), followed by blood group A (34.6%b, n = 1797), blood group B (15.8%, n = 823) and blood group AB (4.4%, n = 232). Table (2) shows, that 89.4% (n = 4640) of study subjects were Rhesus positive while 10.6% (n = 547) were Rh negative.

Table 1. Distribution of ABO blood group among study subjects

Blood group	Frequency	Percentage
A	1797	34.6 %
B	823	15.8 %
AB	232	4.4 %
O	2335	45 %
Total	5187	100 %

Table 2. Distribution of Rh blood group among study subjects

RH factor	Frequency	Percentage
Positive	4640	89.4 %
Negative	547	10.6 %
Total	5187	100 %

The prevalence of Rh-negative antigens were 4 % (n = 223), 1.6 % (n = 88), 0.7 % (n = 37), and 3.8 % (n = 199) for blood groups A, B, AB, and O respectively, as shown in Table (3).

Table 3. Distribution of ABO and Rh blood groups among study subjects

Blood group	Frequency	Percentage
A+	1574	29 %
A-	223	4 %
B+	735	14 %
B-	88	1.6 %
AB+	195	3.7 %
AB-	37	0.7 %
O+	2136	41 %
O-	199	3.8 %
Total	5187	100 %

Gender distribution of ABO blood group among the study subjects

Table (4) shows the gender distribution of ABO blood group among study subjects. Blood group O is the most common overall, making up 45% of the total. Blood group A is the second most common at 34.6%. Among males, blood group O is also the most prevalent at 48.2%, followed by A at 33%. Among females, blood group O is slightly more common than blood group A (42.2% vs 36%). A higher percentage of females have blood group B compared to males (17.6% vs 14%). The chi-square value is 23.966 which is significant at p<0.001. This indicates there is a statistically significant association between gender and blood group distribution. In other words, the distribution of blood groups is not the same between males and females.

Table 4. Gender distribution of ABO blood group among the study subjects.

Gender	Blood Group								Total	Chi-square	P-value
	A		B		AB		O				
	N	%	N	%	N	%	N	%			
Males	818	33 %	350	14 %	120	4.8%	1191	48.2 %	2479	23.966	<0.001
Females	979	36 %	473	17.6%	112	4.2%	1144	42.2%	2708		
Total	1797	34.6%	823	15.8%	232	4.4%	2335	45 %	5187		

Gender distribution of RH antigen among the study subjects

The result in Table (5) shows the gender distribution of the RH antigen among the study subjects. The frequency of Rh+ in males was 87.3%, whereas in females was 80% and Rh- was 12.7% in males and 20% in females. It also appears that there is a significant difference in the distribution of the RH antigen between males and females, as indicated by the chi-square test with a p-value of less than 0.001.

Table 5. Gender distribution of RH antigen among the study subjects

Gender	Rh type				Total	Chi-square	P-value
	Rh+		Rh-				
	N	%	N	%			
Male	2165	87.3%	314	12.7%	2479	22.640	<0.001
Female	2475	80%	233	20%	2708		
Total	4640	89.4 %	547	10.6 %	5187		

DISCUSSION

This study provides valuable insights into the distribution of blood groups and Rh factors among donors and admitted patients at Zawia Medical Center in AzZawya City, where there is a lack of data on this subject. The study has found that blood group O is the most common, followed by A, B, and AB, this distribution is similar to other populations, but slight variations may exist depending on ethnicity and geographic location. The findings are consistent with earlier local research in eastern [12] and western Libya [13]. Similar findings have been observed in Arabic countries such as Saudi Arabia, Mauritania, and Sudan [14, 15, 16]. As well as, data from the US [17], China [18], Nigeria [19], Kenya [20], and Tanzania [21] indicate that O is the most frequent blood type while AB is the least prevalent in most global populations.

The results show that the majority of subjects are Rh-positive (89.4%), with Rh-negative individuals representing 10.6%. This finding is consistent with reports from other local regions, Al Bayda city [12], where 16% of the population has Rh− blood group, and 8% in the Fezzan area [22]. Globally, Tanzania (3.2%), the United States (14.6%), and China (1.0%) have recorded similar figures [21, 17, 18].

On the other hand, our results show that gender has a significant effect on the frequency of ABO blood groups and Rh factor. The study reveals statistically significant differences in ABO blood group and Rh factor distribution between males and females. Females have a slightly higher prevalence of blood group B and Rh negative compared to males. This observed difference could be due to underlying genetic or biological factors.

Although transfusion therapy has saved millions of lives around the world, patients face hazards when there is a shortage of blood in situations like pregnancy, trauma, and several other disorders [11]. Blood group prevalence studies are important for managing community blood and blood product resources, and assessing the risk of various blood group-related disorders such as venous thromboembolism syndrome, blood coagulation, and coronary artery disease [5]. This study offers valuable data on blood group and Rh factor distribution in the studied population. The observed differences between genders highlight the importance of considering patient demographics when ensuring safe and effective blood transfusion.

CONCLUSION

ABO and Rh blood group distribution in the study subjects shows dominance of blood group O and Rh-positive antigen, which aligns with global trends. Understanding an individual's blood type allows healthcare professionals to provide safe and effective care, whether it be through blood transfusions, organ transplantation, or managing pregnancy complications. Moreover, blood grouping offers insights into population demographics and disease susceptibility, contributing to the advancement of medical knowledge and personalized medicine. As we continue to unravel the mysteries of blood grouping, its significance in public health and demographic profiles becomes increasingly apparent, guiding us toward enhanced healthcare practices and improved patient outcomes. Hence, another screening study to detect the prevalence of ABO and Rhesus blood types in different geographical locations of AzZawya City is recommended to identify vulnerable populations to managing blood bank inventory and transfusion services

Conflicts of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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تواتر فصيلة الدم ABO وRhesus بين المتبرعين والمرضى في مركز الزاوية الطبي، مدينة الزاوية، ليبيا

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المستخلص

يلعب تحديد وتصنيف فصائل الدم دورًا حاسمًا في طب نقل الدم لأنه يسمح بنقل آمن ومتوافق .ومن بين أنظمة فصائل الدم المختلفة، تتمتع أنظمة فصائل الدم ABO و Rh بأهمية سريرية خاصة .يعد فهم توزيع وتواتر فصائل الدم ABO و Rh ضمن مجتمع معين أمرًا ضروريًا للتخطيط الرعاية الصحية، خاصةً عندما يتعلق الأمر بإدارة إمدادات الدم وزرع الأعضاء .بالإضافة إلى ذلك، أظهرت الدراسات أيضًا علاقة بين فصائل الدم ABO وظهور وانتشار الأمراض .لذلك، أجريت هذه الدراسة لتحديد توزيع وتواتر فصائل الدم ABO و Rh في مدينة الزاوية، ليبيا. في هذه الدراسة الاستعادية، تم جمع البيانات من بنك الدم في مركز الزاوية الطبي على مدى ثلاث سنوات لتحديد توزيع فصائل الدم ABO و Rh بين 5187 من المتبرعين والمرضى المقيمين. أظهرت النتيجة أن فصيلة الدم O هي السائدة بين جميع المشاركين في الدراسة (45٪)، وكذلك بين الذكور (48 ٪2.والإناث (42 .٪2). فصيلة الدم A هي ثاني أكثر الأنواع شيوعًا بنسبة 34 ٪6.من إجمالي المشاركين، 33٪ من الذكور، و 36٪ من الإناث .بالنسبة لمستضداتRh ، كان 89 ٪4.من المشاركين في الدراسة موجبًا لـRh ، ٪87.3للذكور و 80٪ للإناث .بالإضافة إلى ذلك، تُظهر النتائج ارتباطًا إحصائيًا مهمًا بين الجنس وتوزيع فصائل الدم.p <0.001 . تساعد معرفة أكثر أنواع الدم شيوعًا في الحفاظ على إمدادات كافية لبنك الدم.

الكلمات الدالة. طب نقل الدم، فصيلة الدم ABO، فصيلة الدم الريسوس، زراعة الأعضاء، بنك الدم، الجهات المانحة.