Distribution of ABO and Rh types in North of Asir region in Saudi Arabia

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Abstract

Background and Objectives.

This study was conducted to form a better understanding of the distribution of ABO and Rh types among the population of the north of Asir region in Saudi Arabia and compare the findings to similar studies that were carried out in other parts of the kingdom and the Middle East. Understanding the frequency of different blood types in different populations is imperative. Blood types are essential not only for transfusion therapy but also for the prediction of the outcome of different diseases. The study aims to establish an understanding of the blood group frequency among the residents of the north of Asir region, Saudi Arabia. Additionally, this study was conducted to compare the blood group frequency in the region to that in different parts of the Arabian Peninsula.

Subjects and Methods

This study was done throughout 1 year from January 1, 2020, to December 31, 2020, using samples from 4142 voluntary subjects at the blood bank of King Abdullah hospital, Bisha. Commercially provided ABO and Rh antibodies were used for the standard blood grouping procedure.

Results:

Our findings have shown that O is the most prominent ABO blood group while AB was the least frequent. The frequency of A blood type was the second high followed by B blood group while positive Rh factor was more common than the negative. A Comparison of our findings to other studies from Saudi Arabia and nations in the Middle East was also discussed.

Conclusion:

O+ > A+ > B+ > O- > AB+ > A- > B- > AB- is the order of blood groups frequency in our study for males, while in females the order was almost the same except for the last three blood types was as following: > A- > B- > AB+. AB- on the other hand, was completely absent in female donors. There are some similarities and differences between our findings and that of other studies from the kingdom and other countries. Knowing and understanding the distribution of ABO and Rh types is essential for creating better policies for transfusion interventions and blood banks managements.

Introduction

Landsteiner described ABO blood group systems in the 19th century. It was the first identifiable human blood group at the time. Blood cells antigens are inherited from the parents through a single gene and it has clinical significance as the safety of transfusion and organ transplantation depend on it. RBC antigens are a group of structural proteins that are present on the extracellular surface of the RBC membrane (1).

Up until now, more than 22 known blood group systems could stimulate the immune response. These systems include ABO, Rh, and Kell antigens, which in the case of mismatching could result in severe forms of post-transfusion reactions (2). The antibodies in ABO and Rh-D systems are naturally occurring antibodies that are typically found in the serum of healthy people whose red blood cells are not displaying antigens (3). For example, immunoglobulins such as IgM and IgA are mostly present in the serum of individuals who lack the A and B antigens.

The individuals are going to be either Rh-D positive or Rh-D negative depending on the presence or absence of Rh-D phenotype on the surface of the red cells. In blood transfusion therapy, A, B and D antigens are the most important red cell antigens as donor-patients ABO mismatching could result in severe post-transfusion reaction (2). Individuals whose red cells lack the D antigen could not have anti-D in their serum, unlike the case of A and B antigens. Overall, blood group compatibility has a clinical significance that is essential for blood management in a wide variety of clinical cases.

ABO and Rh-D phenotypes frequency in a given population in different parts of the world has been studied. Such study may provide an idea about deferent haematological conditions such as haemolytic disease of the fetus and newborn (HDFN). Blood groups are known to have some association with several clinical conditions such as urinary tract infection and diabetes (4).

The familiarity of the frequency of ABO and Rh blood groups at the resident of a given regional area is essential for proper operative management at the local hospitals and blood banks. Such study may contribute to the effective management of the blood bank's inventory and provide safe and reliable blood transfusion services. However, this study purposely focused on the population of Bisha province in Asir region.

Objective

This study aims to screen and determine the frequency of ABO and Rh-D blood group among the residence of the north of asir region, Saudi Arabia. This will provide a preliminary idea about the distribution of particular blood groups in the area. This study included many donors from both urban and rural populations of the province.

Methodology

A retrospective comparative study was conducted using blood samples from blood donors (male and female) during a period of 1 year from January 1, 2020, to December 31, 2020. The blood collection from the donors followed the clinical examination that determined their physical wellbeing.

All volunteers donated blood on their own free will and after fulfilling the ethical criteria of the study.

All donors provided written informed consent to participate in this study.

The study was conducted under the tenets of the Declaration of Helsinki.

The Institution Review Board of university of Bisha approved the study protocols.

Blood typing and collection from fit voluntary donors were done at the blood bank at King Abdullah hospital.

ABO and Rh status of 4142 samples were analysed by the slide method using commercially acquired anti-A, anti-B, and anti-D antisera. Agglutination reactions were observed after mixing the blood and antibodies on the slides and the results were recorded.

The final ABO, Rh blood groups for each sample were determined based on the presence or absence of agglutination. Furthermore, agglutination indicates a positive reaction while no agglutination indicates negative reactions to a particular group or Rhesus factor.

To determine the frequency of the blood groups, a descriptive statistical analysis was performed using Prism GraphPad sheets to obtain a graphical representation of the results.

Results

Out of 4142 subjects, (4035) were males and (107) females. The most prominent blood group among the donors was O (1888) followed by A (1142), then B (905) and AB (207). O was the most prominent blood group in males (1836) followed by A (1109), B (885) and AB (205). Likewise, in females type O was the most common blood type (52) followed by A (33), B (20) and AB (2). (Table.1)

Table 1: Frequency and distribution of the ABO system.

	N	A	B	AB	O
Male	4035	1109	885	205	1836
Female	107	33	20	2	52
Total	4142	1142	905	207	1888

Table 1: Frequency and distribution of the ABO system.

The most prominent Rh factor among the donors in this study was Rh+ (3714) followed by Rh- (453). In different genders, (3623) male donors were Rh +ve and (435) were Rh -ve. In female donors, (91) were Rh +ve. While (18) were Rh -ve. (Table 2) & (figure1).

sex	Rh+	Rh-
Male	3623	435
Female	91	18
Total	3714	453

Table 2: Frequency and distribution of Rh factor.

In the complete ABO and Rh factor analysis for all donors , the blood group O+ was the most prevalent in both males (37.6%) and females (1.03%). Followed by types A+ (24.16%), B+ (21.04%), O- (7.0%), AB+ (4.80%), A-(2.44%), B-(0.74%), AB- (0.23%) in males. The distribution of the rest of blood types was slightly deferent in female donors; A+ blood group came in as the second most common blood type (0.64%). Followed by types B+ (0.40%), O-(0.21%), A-(0.14%), B-(0.07%), AB+ (0.04%). A complete absence of AB- was observed in all-female donors (Table 3) & (figure 2A&B).

Blood type and Rh	Male	Percentage	Female	Percentage
A+	1007	24.16 %	27	0.64 %
A -	102	2.44%	6	0.14%
B+	854	21.04%	17	0.40%
B-	31	0.74%	3	0.07%
AB+	195	4.80%	2	0.04%
AB-	10	0.23%	0	0
O+	1567	37.6%	43	1.03%
O-	292	7.00%	9	0.21%
Total	4058	98.01%	107	2.53%

Table 3: Distribution of ABO system and Rh factor.

Discussion

The basic knowledge of the blood groups distribution in a given population could help predict HDFN prevalence. Moreover, the essential association between blood groups, organ transplantation and transfusion therapy make identifying blood types one of the vital information in any clinical patient's report (4, 5).

The heterozygosity of the blood types is attributed to the pattern of ABO group & Rh-D mode of inheritance. For instance, A and B alleles are inherited in an autosomal codominant fashion while the O allele is autosomal recessive. Rh-D factor, on the other hand, is inherited through a dominant gene that is passed on from one or both parents to the offspring (1, 6).

Furthermore, several studies have linked blood groups to a certain clinical condition, for example, in patients who are suffering from stomach cancer, the prevalence of blood group A was higher compared to blood group O (5). Most recently, a relationship between COVID-19 and blood groups has been established. In patients with COVID-19, the fraction of blood group A was significantly higher than that in normal people. On the other hand, blood group O fraction was much lower than that in normal people. This suggests that individuals with blood group A are at higher risk than individuals with O blood group for COVID-19 infection and much severe clinical symptoms (7). Another study failed to link blood groups to obesity (8).

An early study that was conducted in the eastern region of Saudi Arabia estimated the frequency of ABO blood groups and its findings relate to the results in the present study (9). In comparison, O blood group was determined to be the most prominent blood group, which is similar to our study. Likewise, blood group A followed as the second most common blood type in both studies. Another similarity, AB blood group was the lowest in both studies.

In a much broader scale, a recent study that discussed ABO, Rh distribution around the Middle Eastern countries has shown some interesting highlights (9). For instance, a high frequency of blood group A was observed in the Northern region of the Arabian Peninsula while the frequency of the same blood group was lower moving toward the southern part of the studied region and at a minimum in the central region of Saudi Arabia.

At the same study (10), in the North-Eastern part of the Arabian Peninsula, blood group B was the most prevalent blood type however, phenotype B distribution was much less in the southern region of the Arabian Peninsula. On the other hand, high frequency of blood group O was noticeable in the South-Western of the Arabian Peninsula which is in sort of agreement with our findings. Nevertheless, O blood group has shown much less frequency in the Northeastern part of the region of interest (10). Additionally, Rh-positive was concentrated in the Domah region of Saudi Arabia and more widespread in the southern part of the Arabian Peninsula. The Rh-negative frequency was determined to be higher in Lebanon and Jordan.

The current study provides a better understanding of ABO, Rh distribution among the residence of the north of asir region, Saudi Arabia, which facilitates recourses management and efficient health planning. It also allowed a comparative analysis to be made with other studies that had similar interests. Giving the recognized connection between certain clinical conditions and the types of blood group, such studies could be helpful in the prediction of diseases consequences in certain geographical regions.

Declarations

Conflict of interest:

The authors declare no conflict of interest.

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Figures

Figure 1

Frequency and distribution of Rh factor.

Figure 2

A&B: Graphical representation of ABO and Rh frequency