

ORIGINAL ARTICLE

DISTRIBUTION OF ABO AND RHESUS BLOOD GROUPS IN GENERAL POPULATION OF DISTRICT DIR UPPER

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Background: The ABO and Rhesus blood groups are of utmost clinical importance. This study was conducted to determine the distribution of ABO and Rhesus blood groups in general population of District Dir Upper, Khyber Pakhtunkhwa, Pakistan during the year 2014. **Methods:** Data were collected from blood banks and laboratories in the district, entered into SPSS and analysed through percentage method and χ^2 test at 95% confidence level. Allelic frequencies were calculated by Hardy-Weinberg equation. **Results:** Record of a total of 1,000 subjects (481 males and 519 females) was included in the study. The highest percentage was recorded for blood group A (32.1%), followed by blood group B (29.8%) and O (25.7%) while the lowest prevalent group was AB (12.4%). Overall, 86.4% of subjects were Rh-positive. In males, distribution of blood groups A, B, O and AB was 16.6%, 15.4%, 9.8%, and 6.3% respectively. In females the distribution was 15.5%, 14.4%, 15.9%, and 6.1% for blood groups A, B, O and AB respectively. The distribution of Rh-positive phenotype was 40.7% in males and 46.0% in females. Allelic frequencies observed for A, B and O were 0.253, 0.240, and 0.507 respectively while for D and d were 0.631 and 0.368 respectively. **Conclusion:** The principal blood group in district Dir Upper is A, and majority of people are Rh-positive.

Keywords: ABO blood groups, Allelic frequency, Distribution, District Dir Upper, Rhesus system

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INTRODUCTION

Blood grouping is the classification of blood into different types on the basis of inherited substances called antigens located on the surface of red blood cells (RBCs). A blood group system is one or more antigens encoded by a single gene or by a cluster of two or more closely linked homologous genes. There are 25 blood group systems. Among these, the ABO blood system which was discovered by Karl Landsteiner in 1901 is of prime clinical importance in humans. This system is determined by the presence of antigens A and B on the surface of RBCs and anti-A and anti-B in the serum. Based on these, the individual's blood group may be A, B, O or AB. The ABO blood groups are controlled by a single gene I located on the chromosome 9 in humans. The gene I has three alleles, I^A , I^B and i. The I^A and I^B alleles are co-dominant to each other but both are completely dominant over the allele i. Another clinically important blood group system in humans is the Rhesus system (Rh-system) which was discovered by Landsteiner and Wiener in 1941. The most immunogenic and clinically important antigen of the Rh system is D antigen encoded by the gene RHD located on chromosome 1 of humans. The two alleles of RHD are D and d where allele D is dominant over allele d. When the allele is D, the blood group will be Rh⁺ and when the allele is d, the blood group will be Rh⁻.¹

Blood group of an individual has been associated with various diseases such as malignancies of different organs, peptic ulcer, coagulation and infection.² Blood grouping is of utmost importance in transfusion practices where it reduces the chances of

morbidity and mortality. It is also of help in studying population genetics, in evaluating probability of hemolytic diseases in newborns, in resolving the disputes of paternity and maternity, providing reliable geographical information and in forensic studies.^{3,4,5} Knowledge about the distribution of ABO blood groups at regional level is important in effective blood bank management and in blood transfusion services.⁶ All humans have the same types of blood groups but their frequencies differ in different parts of the world. Distribution of blood groups also varies in different parts of Pakistan.⁷ The present study was planned to determine the distribution of ABO and Rh-blood group systems in general population of District Dir Upper, Khyber Pakhtunkhwa, Pakistan.

MATERIALS AND METHODS

Subjects for this study were both males and females in District Dir Upper of Khyber Pakhtunkhwa province of Pakistan. Total area of Dir Upper is 3,699 Km². According to population census 1998, total population of Dir Upper was 575,858.⁸ All the people in the district are Muslims and Pashtoons.⁹

The study was conducted during the year 2014 after approval of the Institutional Research Committee. Data were collected from the blood banks and laboratories of the DHQ Hospital Dir Upper and THQ Hospital Wari. Blood samples were tested from donors who came for blood donation, outdoor patients who came to hospital for blood grouping and indoor patients who were admitted in the hospital and were advised test for blood grouping. Tile method was used to determine the blood group using commercially available anti-sera.

The data were analysed using SPSS version 16 and Chi-square test was used to compare the distribution of blood groups between males and females. The difference was significant when p -value was less than 0.05. Assuming that the population was in Hardy-Weinber equilibrium, allelic frequencies were calculated by using the following equation¹⁰:

$p=1-\sqrt{B+O}$, $q=1-\sqrt{A+O}$, $r=\sqrt{O}$, $E=1-E$, $e=\sqrt{dd}$, where p , q , r , E and e are the frequencies of the alleles I^A , I^B , i , D and d respectively.

RESULTS

Results of this study showed that blood group A was most prevalent (32.1%) followed by blood group B (29.8%) and blood group O (25.7%) while blood group AB was found to be the least common (12.4%). Frequencies of Rh antigen showed that 86.4% of the studied subjects were positive for Rh while 13.6% were Rh-negative (Table-1).

Table-1: Distribution of ABO and Rhesus blood groups [n (%)]

Blood Group	Rh+	Rh-	Total
A	292 (29.2)	29 (2.9)	321 (32.1)
B	249 (24.9)	49 (4.9)	298 (29.8)
AB	113 (11.3)	11 (1.1)	124 (12.4)
O	210 (21.0)	47 (4.7)	257 (25.7)
Total	864 (86.4)	136 (13.6)	1000 (100)

Sex-wise distribution showed that of the total 1000 studied subjects 48% were males and 52% were females. In overall, blood group A was predominant in males (16.6%) while blood group O was predominant in females (15.9%). Blood group AB was least common in both the sexes. Rh antigen was more prevalent in females (46%) than males (40.7%). Individually blood group A-positive was most common in both males (15.3%) and females (13.9). The negative blood group most prevalent in males was AB-negative (2.9%) while in females it was O-negative (2.1%). Statistically there was no significant difference between blood groups distribution and sex of the host ($p>0.05$) (Table-2).

Table-2: Sex-wise distribution of ABO and Rhesus blood groups [n (%)]

Blood group	Males			Females			Grand Total
	Rh+	Rh-	Total	Rh+	Rh-	Total	
A	153 (15.3)	13 (1.3)	166 (16.6)	139 (13.9)	16 (1.6)	155 (15.5)	321 (32.1)
B	125 (12.5)	29 (2.9)	154 (15.4)	124 (12.4)	20 (2.0)	144 (14.4)	298 (29.8)
AB	57 (5.7)	06 (0.6)	63 (6.3)	59 (5.9)	02 (0.2)	61 (6.1)	124 (12.4)
O	72 (7.2)	26 (2.6)	98 (9.8)	138 (13.8)	21 (2.1)	159 (15.9)	257 (25.7)
Grand Total	407 (40.7)	74 (7.4)	481 (48.1)	460 (46.0)	59 (5.9)	519 (51.9)	1000 (100)

$$\chi^2=24.5; df=7; P=9.15$$

Distribution of alleles showed a high frequency of the allele i over I^A and I^B alleles at ABO locus. Similarly, at Rh locus, Rh-D was more prevalent than Rh-d (Table-3).

Table-3 Frequencies of alleles of ABO and Rhesus blood group systems

ABO Locus			Rh Locus	
$p (I^A)$	$q (I^B)$	$r (i)$	Rh-D	Rh-d
0.253	0.240	0.507	0.631	0.368

DISCUSSION

The distribution of ABO blood groups and Rh antigens is different in different races and regions of the world.^{11,12} Even in a small country, the blood groups vary depending upon whether the one ethnic group mixes with the other or not.¹³ The commonest blood group in the world is type O and about 63% of humans share this group. The type O blood is particularly frequent in the indigenous populations of Central and South America where its distribution reaches up to 100%. Similarly, the type A blood is most common in Europe and type B is more prevalent in Central Asia.¹⁴

In the present study, blood group A was found the commonest and AB as the rarest blood group in District Dir Upper. This is in accordance to distribution of blood groups in District Dir Lower where also A was

recorded as the most prevalent blood group and AB as the least common blood group.¹⁵ Blood group A was also reported as the most prevalent blood group among different native ethnic groups (Kafirs, Kalash, Chitrali) in the Hindu Kush region of Afghanistan and Pakistan.¹⁶ This similarity in distribution of blood groups may be due to the close association of humans in these areas as the frequencies of genes differ slightly in adjacent populations.¹⁷ Dir Upper, Dir Lower, and Chitral lie in the same region of Hindu Kush and are adjacent to each other. Interestingly, A was also reported a dominant blood group among potential blood donors in Skardu Gilgit Baltistan in the north of Pakistan.⁷ However, in contrast to this study, B was reported as the most prevalent blood group in Swat, Swabi, Peshawar, Bannu, Nowshera, Gilgit, Rawalpindi/Islamabad, Gujranwala, Sahiwal, Faisalabad, and Mirpur. Blood group O was reported as major blood group among humans in Bajaur Agency, Hazara, Sindh, and Balochistan.¹⁵ These variations can be due to different factors such as mother-child compatibility, external environment, diversity in geography, racial background and genetic differences.^{16,18}

In the present study 86.4% of the subjects were Rh-positive. The distribution of Rh-positive antigen was 92.45% in Dir Lower, 90.13% in Swat, 92.88% in

Nowshehra, 91% in Rawalpindi/ Islamabad, 94.83% in Skardu, 92.03% in Gujranwala, 87.1% in Sahiwal, 91.43% in Bajaur Agency, 89.8% in Gilgit, 67.2% in Bannu, 79.5% in Gujrat, and 76.8% in Peshawar.^{15,19}

This shows great diversity in distribution of Rh antigens in Pakistan.

The dominance of blood group A in district Dir Upper showed that these people may be at increased risk for coronary heart diseases which has high incidence in people with blood group A.²⁰

CONCLUSION

A-positive is the most prevalent blood group both in male and female population of district Dir Upper while AB is the least prevalent group in both sexes. The prevalence of Rh antigen is more in females than males. It can be inferred that people in Dir Upper may be exposed to high risk of coronary heart diseases due to high frequency of blood group A.

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