

ABO and Rh (D) Blood Groups Polymorphism in Four Tehsils of Bajaur Agency (Federally Administered Tribal Areas), Pakistan

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ABSTRACT The tribal populations at the Pakistan-Afghanistan border are of great scientific interest because of their transitory status which is due to the volatile law-and-order situation in this region from the last few decades. The present study aimed at elucidating the ABO and Rh blood groups polymorphisms in the Bajaur population, which is a war affected territory in the north-western Pakistan. Blood groups data were obtained from 1,200 unrelated male subjects belonging to four tehsils of Bajaur Agency. Phenotyping was performed through forward typing. At the ABO locus, allele [O] was observed to be highly frequent (0.544), followed by alleles [B] and [A] with the frequencies of 0.231 and 0.225, respectively. At the Rh locus, allele frequencies for [D] and [d] were found to be 0.707 and 0.293, respectively. The total sample was in conformity with the Hardy-Weinberg expectations. A comparison of allelic frequencies at both loci with neighboring populations through Nei's genetic distance D revealed that Bajaur sample had close affinities with Dir-Lower and Swat populations but least with Swabi and Peshawar populations. This study would be useful in the appreciating the genetic diversity of north-western populations of Pakistan.

INTRODUCTION

ABO and Rh blood groups are classical immunogenic markers which have been frequently reported in the medical and anthropological literature. Importance of these blood groups ranges from significance in blood transfusions, organ transplantation, evolutionary biology, and in inferring the phylogenetic relationships between populations (Bhasin 2009; Khan et al. 2009). Frequencies of ABO and Rh blood types vary greatly across different communities, geographic locations and ethnicities, reflecting the underlying genetic and ethnic diversity of human populations (Cavalli-Sforza et al. 1994; Ndoula et al. 2014). Studies on these blood types have been carried out for various Pakistani populations (Hameed et al. 2002; Malik and Amin-ud-Din 2013). However, the data is largely missing

for the north-western populations of Pakistan which have been severely affected by internal and internationalized conflicts. The current study was undertaken in order to report the frequencies of ABO and Rh blood groups in Bajaur Agency in north-west Pakistan. This population is in a transitory situation due to the war-conditions from the last few decades. A large number of families have emigrated to the southern and eastern regions of Pakistan. Hence, this population can be assumed to be highly distributed and fragmented. This study provides pilot analyses on the phenotypic and genotypic distributions of blood groups polymorphisms in the Bajaur population.

SUBJECTS AND METHODS

Bajaur Agency is situated in the Federally Administered Tribal Areas (FATA), in the north-west Pakistan. It shares boundary with Khyber Pakhtunkhwa (KP) province on its East and Afghanistan on its West. Bajaur Agency is subdivided administratively into four tehsils, namely, Khar, Mamond, Nawagai, and Salarzai.

Blood group phenotypic data were obtained at random from a total of 1,200 unrelated male subjects belonging to the area. Due to the strict cultural limitations, females did not provide con-

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sent to participate in the study. All the subjects included in the study were ethnically Pashtuns sharing common language and culture. Serological phenotyping was performed by the procedure of forward typing. The data were analyzed tehsil-wise for checking the blood groups variation across geography within Bajaur Agency. Phenotypic and allelic frequencies of both ABO and Rh blood groups were expressed in percentages. Allelic frequencies at both loci were employed to estimate the Nei's genetic distance D between Bajaur and its neighboring populations (Nei and Roychoudhury 1982).

RESULTS

In the total sample, blood type 'O' was most prevalent (30.08%), followed by blood types 'B' and 'A' (30% and 29.42%, respectively). Overall, allele O was highly frequent (0.544) followed by alleles B (0.231) and A (0.225) (Table 1). Individually across four tehsils of Bajaur Agency, allele O was highly frequent in Khar (0.564), followed by Mamond (0.549), Nawagai (0.548) and Salarzai (0.514). Allele B , on the other hand, had high-

est representation in Salarzai (0.262), followed by Khar (0.234), Mamond (0.216) and Nawagai (0.210). Highest frequency for allele A was observed in Nawagai (0.242), followed by Mamond (0.235), Salarzai (0.222) and Khar (0.198) (Table 1). Allelic frequencies in the overall data were not in conformity with the Hardy-Weinberg equilibrium assumptions.

With respect to Rh blood type, Rh+ blood group was highly prevalent (91.43%). In the total data, allele D was observed to be 0.707 whereas allele d was 0.293 (Table 2). Across four tehsils of Bajaur Agency, allele d was highest in Nawagai (0.334) whereas least prevalent in Salarzai (0.265).

The comparison of allelic frequencies between Bajaur sample and neighbouring populations of KP was carried out through Nei's measure of genetic distance D , and a distance matrix was generated in order to check all pair-wise outputs (Table 3). It was observed that Bajaur population had close affinities with the populations of Dir-Lower and Nowshera ($D=0.0005$ and 0.0008 , respectively), while there were least similarities with Swabi and Peshawar populations ($D=0.0056$ and 0.0037 , respectively) (Table 3).

Table 1: Distribution of phenotypic and allelic frequencies at ABO locus in Bajaur population

Tehsil	Sample	Phenotypes (No. and percentages)*				Allelic frequency		
		A	B	AB	O	A	B	O
Khar	391	111 (28.39)	130 (33.25)	31 (7.93)	119 (30.43)	0.202	0.234	0.564
Mamond	236	67 (28.39)	60 (25.42)	32 (13.56)	77 (32.63)	0.235	0.216	0.549
Nawagai	359	117 (32.59)	99 (27.58)	36 (10.03)	107 (29.81)	0.242	0.210	0.548
Salarzai	214	58 (27.10)	71 (33.18)	27 (12.62)	58 (27.11)	0.222	0.262	0.514
Total	1200	353 (29.42)	360 (30.00)	126 (10.50)	361 (30.08)	0.225	0.231	0.544

*Number in parentheses show percentages

Table 2: Distribution of phenotypic and allelic frequencies at Rh (D) locus in Bajaur population

Tehsil	Sample	Phenotypes (No. and percentages)*		Allelic Frequency	
		Rh+	Rh-	D	d
Khar	391	362 (92.55)	29 (7.45)	0.728	0.272
Mamond	236	215 (91.12)	21 (8.88)	0.702	0.298
Nawagai	359	319 (89.00)	40 (11.00)	0.666	0.334
Salarzai	214	199 (93.05)	15 (6.95)	0.735	0.265
Total	1200	1097 (91.43)	103 (8.57)	0.707	0.293

*Number in parentheses show percentages

Table 3: Nei's measure of genetic distance D matrix showing the affinities between Bajaur sample with six neighboring populations

	<i>Bajaur</i>	<i>Dir-L</i>	<i>Swat</i>	<i>Mardan</i>	<i>Buner</i>	<i>Peshawar</i>	<i>Nowshera</i>
Dir-L	0.0005						
Swat	0.0006	0.0022					
Mardan	0.0010	0.0001	0.0029				
Buner	0.0017	0.0020	0.0023	0.0020			
Peshawar	0.0037	0.0021	0.0062	0.0014	0.0017		
Nowshera	0.0008	0.0005	0.0021	0.0005	0.0006	0.0013	
Swabi	0.0056	0.0031	0.0091	0.0022	0.0038	0.0004	0.0028

DISCUSSION

The ABO and Rh blood grouping is commonly used in blood transfusion and organ transplantation. Different blood types have also been shown to be associated with certain hereditary diseases (Waseem et al. 2012). Few studies from Pakistan have reported the frequencies and distributions of ABO and Rh blood groups in different regions (Zafar et al. 1997; Malik and Aminud-Din 2013; Khan et al. 2014). The studies from the north-western populations of Pakistan are scarce mainly due to the law-and-order situation, difficult accessibility and poor infrastructure of transportation and logistics.

Bajaur population is in a transition due to geo-political situation at the north-western borders of Pakistan. Particularly in the past decade, there have been several episodes of mass movement of tribes which are forced to flee due to war and military operations. It is, therefore, pertinent to document the genetic polymorphisms in this population for various population inferences and future reference.

The present study showed that among the four tehsils of Bajaur Agency, there were variations in the allelic frequencies at ABO and Rh loci. The overall sample of Bajaur was compared with the neighboring populations of KP (Ali and Malik 2014). It was observed that Bajaur population was closer to Dir-Lower and Swat, which are present to the North and East of Bajaur, respectively. This similarity could be due to the migration of large number of families from Bajaur to Dir-Lower and Swat valleys. However, the sample of Bajaur was markedly different from the reported data of Peshawar and Swabi populations. Both these populations are relatively far away from Bajaur and are compositionally cosmopolitan. It would be worthwhile to also observe the allelic polymorphisms of blood group and other loci in the adjoining populations of FATA, like Malakand and Mohmand, and to check the affinities of these populations with other Pashtun

populations inhabiting the North-Western areas of Pakistan. In conclusion, this study provides the documentation of ABO and Rh blood group polymorphisms in a war-affected population of Pakistan. These analyses need to be complimented with more polymorphic markers at an extended set of loci in order to draw useful inferences about the dynamics of this population.

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