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DISTRIBUTION OF ABO AND RH BLOOD GROUP SYSTEM IN THE GENERAL HUMAN POPULATION OF LARKANA DIVISION NORTHERN SINDH IN FOCUS

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Abstract

The analysis of ABO blood groups and allelic frequencies were studied in a random sample of 9110 individuals. Blood samples collected from visitors of Chandka Medical College (CMC) Larkana, in the year 1996-97, yield allelic frequencies of 0.19±0.0030, 0.2315±0.0037, 0.5773±0.0082 and 0.7552±0.002337 and 0.2448±0.01677 for A, B, O and D alleles, Rh+ve and Rh-ve, while chi-square contribution is $x^2_{(3)}$=1.8065. and 'P' value comes out to be P=0.95. The distribution is similar to that recorded for many cities of Pakistan but different from the population of cities Hyderabad and Jamshoro (Southern Sindh).

Keywords: ABO and Rh (D) blood groups, allelic frequencies.

Introduction

Blood groups are hereditary characteristics which are controlled by the genes, like all characteristics blood groups follows the same laws of inheritance. ABO are inherited according to Mendel's law, through variant forms of gene (IA, IB, IO). Antigens are inherited as Mendelian allomorphs, A_1, A_2, and B and are dominant to O. Human red blood cells contain on their surface a series of glycoprotiens and glycolipids, which constitute the blood group antigens. Development of these antigens is genetically controlled; they appear early in fetal life and remain unchanged until death. On the basis of these antigens 15 well defined red cell blood group systems of wide distribution in most racial groups have been described. Though there are number of blood group systems as ABO, Rh, MNS, Lutheran, Kell, Lewis, Duffy, Kidd, Diego, I, Anoberger, Xg and donbrock and colton systems, but many of these are not clinically important as these do not produce severe incompatibility complications, thus there is no immediate threat to life and they are very rare. Of these only two are of major importance in clinical practice the ABO Rh systems. Inheritance of all these blood groups system is determined by autosomal genes, with the exception of Xg system which is determined by genes on the X chromosomes. (De Gruchys', 1989). The clinical significance of a blood group system depends upon two factors, the frequency of antibodies in the population and their relative potency. On the basis of this criteria the most important blood group system is ABO blood group system, followed by Rh system. Soon after the discovery of blood group system, researchers have started using blood groups system as genetical inheritance marker and since then a number of studies have been performed as Boyd, (1953), attempted to classify the racial groups of mankind according to incidence of blood groups. While a number of studies have been made for various countries, races and ethnic groups. Such as Bashwari. *et al.* (2001), have studied frequency of ABO blood group in the eastern region of Saudi Arabia, Schmidt. *et al.* (2001), have studied variability of blood group frequencies in Romania. A number of studies have also been performed in Pakistan. Khalique *et al.* (1984), have studied ABO and Rh (D) blood groups in Hazara division, Mian and Bhutta (1983), have studied genetic studies on human population of Multan.

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During the 1st world war when many persons were in the need of blood transfusions, it was discovered that frequencies of four blood groups are rather different in persons native to the different parts of the world. (W. F. Ganog, 1971). In this connection several studies have been conducted on the geographic distribution of allelic frequency of these bloods groups in different areas with the environmental conditions and natural selections. e.g. temperature (Nei and Imaizumi, 1996), age (Shami and Kamboh, 1979), their anthropometric variables (height, weight, right arm length, triceps skin fold thickness and a computed ponderal index). (Brecki *et al.*, 1985). These blood groups are believed to play role in natural selection (Chung and Morten 1961). Abundant literature is available on mode of inheritance, showing an association between ABO group and various disease processes. For instance, gastric cancer is associated with blood group A and sickle cell trait with blood group O. (Njoku *et al.*, 1996). Prevalence of Myocardial infarction is greater in blood group A. (Soomro *et al.*, 2000). ABO blood groups may also have some association with the risk of coronary artery disease. (Allan et al. 1968). The distribution of ABO blood group has been studied in relation to environmental factors and natural selection. Nei and Imaizumi (1996) have suggested that clines for ABO blood group gene frequencies in Japanese population show that the selection intensity may be primarily dependant on the temperature. Shami and Kamboh (1979) in a study of population of Punjab have suggested that the selection intensity of ABO blood group may depend on temperature. In the present study the distribution of ABO and Rh(D) blood groups in the general population of Larkana has been analysed.

Materials and Methods

Blood sample of 9110 individuals were randomly collected through finger prick from the visitors of Chandka Medical College Hospital, Larkana, during the year 1996-97 and were tested against A, B and D, antisera (Gamma Biological Inc.) by slide method. Results were observed within first one to two minutes, before it dried up. Whenever there was a doubt especially for Rh–ve, the sample were either rejected or rechecked for confirmation. The blood groups were determined in patients and donors. Techniques were used as described by Landsteiner and Wiener (1940). Proforma was designed for record of blood groups. Allelic frequencies and their standard deviations were calculated in accordance with Hardy-Weinberg Principle and were carried out by using method of Mather (1957). Chandka Medical College Hospital is a teaching Hospital receiving patients from the Northern Sindh and adjacent parts of Balochistan.

Results

Analysis of samples of 9110 individuals suggests that blood group A, B, O and AB are 25.5%, 32.09%, 33.33% and 9.18%, respectively. The distribution of allelic, frequencies of A, B and O individuals in the population under study are computed out by using Hardy-Weinberg law. On the assumption that the population under study is in equilibrium yields alleles frequencies for A, B and O, 0.1891 $\pm$ 0.0030, 0.2315 $\pm$ 0.0037, and 0.5773 $\pm$ 0.0082, respectively. The test for Rh factor suggests that 94.4% and 5.6% persons are positive and negative, respectively. The frequencies of D and d alleles have been calculated as 0.7552 $\pm$ 0.002337, 0.2448 $\pm$ 0.01677, respectively. On the bases of Hardy-Weinberg law the expected frequencies for all the genotypes have been obtained by using frequencies for blood alleles A, B and O. It has been observed for AA = 0.036, for AO = 0.218, for BB = 0.054, for BO = 0.267, for AB = 0.87 and for OO = 0.3333. Expected phenotypic

frequencies for blood group classes A, B, AB and O obtained 2314.851, 2923.399, 798.036 and 3036.363, respectively, on the basis of expected frequencies of the possible genotypes. Table. 1. The Chi-square contribution calculated for blood group A, B, AB and O is 0.000313, 0.0000124, 1.806015 and 0.000043, respectively with χ^2_t component = 1.806495. The higher values for $\chi^2_{(t)}$ mainly contributed to Chi-square values for the blood group AB. Our results have been compared with available data of various cities of Pakistan with special reference to cities (Hyderabad and Jamshoro) Southern Sindh.

TABLE: 1. PHENOTYPIC (%) AND ALLELIC FREQUENCIES (±STANDARD ERROR) OF DIFFERENT BLOOD GROUPS IN GENERAL POPULATION OF NORTHERN SINDH (PAKISTAN).

BLOOD GROUP	MALE	FEMALE	TOTAL	
	Phenotype Allele	Phenotype Allele	Phenotype Allele	Allelic frequencies
ABO Blood Group				
A	1937 (25.4)	377 (25.7)	2314 (25.4)	0.19±0.0030
B	2405 (31.5)	519 (35.4)	2924 (32.1)	0.2315±0.0037
O	2636 (34.5)	400 (27.3)	3036 (33.3)	0.5773±0.0082
AB	664 (8.7)	172 (11.7)	836 (9.2)	.....
Rh Blood Group				
Rh+ve	7217 (94.4)	1378 (93.9)	8595 (94.4)	0.7552±0.002337
Rh-ve	425 (5.6)	90 (6.1)	515 (5.7)	0.2448±0.01677

TABLE: 2. ABO AND Rh(D) BLOOD GROUPS IN LARKANA DIVISION MALE AND FEMALE

Blood Groups	A (%)	B (%)	O (%)	AB (%)	Rh+ve	Rh-ve	TOTAL
MALE	25.35 1937	31.47 2405	34.49 2636	8.69 664	94.44 7217	5.56 425	7642
FEMALE	25.68 377	35.35 519	27.25 400	11.72 172	93.87 1378	6.13 90	1468
%TAGE TOTAL	25.40 2314	32.09 2924	33.33 3036	9.18 836	94.35 8595	5.65 515	100 9110

TABLE : 3. FREQUENCIES (%) OF DIFFERENT BLOOD GROUPS IN POPULATIONS OF DIFFERENT GEOGRAPHIC LOCALITIES OF PAKISTAN.

Blood Groups	Bahawalpur	Peshawar	Hazara	Faisala bad	Jamshoro	Hyder abad	Karachi	Larkana Present Study
O	37	31	33	31	49	60.15	40.78	33.33
A	21	28	24	23	24	15.6	19.38	25.40
B	36	34	32	36	24	21.76	19.62	32.09
AB	06	07	11	08	03	2.49	20.21	9.18
Rh+ve	*	95	94.6	95.4	96	93	89.42	94.35
Rh-ve	*	05	5.4	4.6	04	7	10.58	5.65

SOURCE: (Khalique *et al.* 1984)

TABLE: 4. COMPARISON OF ABO BLOOD GROUPS OF NORTHERN SINDH WITH SOUTHERN SINDH

	Hyderabad and Jamshoro		Larkana	
Blood Group	No.of Persons Observed	Percentage	No.of Persons Observed	Percentage
A	7151	18.64	2314	25.40
B	8764	22.85	2924	32.09
AB	985	2.57	836	9.18
O	21460	55.94	3060	33.33
Rh+ve	36574	95.34	8595	94.35
Rh-ve	1786	4.66	515	5.65
TOTAL	38360	100	9110	100

SOURCE: (Bhatti, R.& Shaikh D.M., 1998)

TABLE: 5. TABLE SHOWING PHENOTYPIC FREQUENCIES AND THE CALCULATED BLOOD ALLELES AND EXPECTED GENOTYPIC FREQUENCIES.

PHENOTYPE			ALLELES		GENOTYPE			
Class	Number Observed	Percentage Observed	Class	Allelic Frequencies	Class	Expected Frequencies	Expected Phenotypic frequencies	Chi-square Contribution
A	2314	25.40%	A	0.1891± 0.0030	AA	0.036	2314.851	0.000313
-	-	-	-	-	AO	0.218	-	-
B	2924	32.09%	B	0.2315± 0.0037	BB	0.054	2923.399	0.0000124
-	-	-	-	-	BO	0.267	-	-
AB	836	9.18%	AB	-	AB	0.087	798.0361	1.806015
O	3036	33.33%	O	0.5773± 0.0082	OO	0.3333	3036.363	0.000043
Total	9110	100%	-	0.9979	-	0.9953	9067.183	1.806495

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AB	836	9.18%	AB	-	AB	0.087	798.0361	1.806015
O	3036	33.33%	O	0.5773± 0.0082	OO	0.3333	3036.363	0.000043
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Discussion

The analysis of the population distribution of ABO blood groups has been attempted repeatedly for different human populations in different parts of the world, including India and Pakistan. A few studies have been carried out in this area of Pakistan (Sindh), (Khaskheli *et al.*, 1994). According to present study the distribution of ABO and Rh (D) blood groups are in general agreement with their distribution in other cities of Pakistan (Mian and Bhutta *et al.*,1993; Rathore *et al.*, 1993; Mian *et al.*, 1985), Khaliq *et al.*, 1984) but strangely it shows difference from the adjacent cities of Hyderabad and Jamshoro (Bhatti and Shaikh, 1998), where the difference in the percentage of blood group A and B is small and O has got significantly higher percentage. Blood group B has the 2nd highest percentage (32.09), having a slight difference from the 1st highest blood group O (33.33%). While the difference between the percentage of B and A (25.40%) is quite insignificant. Similarly the percentage of A B (9.18 %) is similar to other cities of Pakistan, while it is significantly higher than the adjacent cities of Hyderabad and Jamshoro (2.57%).The percentage of Rh + ve (94.35) and Rh –ve (5.65) are similar to those for other cities of Pakistan, including Hyderabad and Jamshoro. The differences in the distribution of ABO blood group in the population of Larkana compared with twin cities of Hyderabad and Jamshoro is quite strange. It can be attributed to the fact that population of Hyderabad and Jamshoro are very much heterogeneous than the population of Larkana and has more immigrants from India. In terms of distribution of allels there is significant difference found between Larkana (A=0.1891,B=0.2315 and O=0.5773) and southern Punjab (A=0.179,B=0.2910 and O=0.5244) (Mian, and Farooq, 1999) and Sailkot (A=22.23, B=39.06 0=11.5 and AB =27.50)% (Sabir *et al*, 2002). The percentages of Rh + ve (94.35) and Rh –ve (5.65) are similar to those for other cities of Pakistan, Sialkot Rh factor 92.76 (Positive) and 7.23 (Negative) including those of Hyderabad and Jamshoro. The distribution of ABO blood group in the population of Larkana and Hazara (Khalique *et al.*, 1984) are very much similar. No explanation could be offered with the present study, though further studies of the local population of both cities may yield some valid explanation.

Conclusion

The present study suggests that differences in distribution of population is slightly insignificant in Larkana population. Comparison between distributions of ABO blood group is quite different from Hyderabad and Jamshoro and it is significant. The reason for this apparently seems that Hyderabad and Jamshoro have frequent visitors from rural areas of India and are heterogeneous. Present results are similar with other cities of Pakistan.

Map of Sindh
Sampling District Larkana



Fig 1: Map of Sindh showing in order of north west direction, sampling area from where the data has been collected randomly.



Photographs, during field-work.

Random Blood sampling was carried out at various places of District Larkana; including Chandka Medical College, Larkana, Sindh.

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