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DISTRIBUTION OF ABO AND RH BLOOD GROUP ALLELES IN GUJRAT REGION OF PUNJAB, PAKISTAN

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Abstract: A study has been carried out on blood groups, representing a random population sample from urban and rural areas of Gujrat region, Province of the Punjab, Pakistan. Blood samples were collected from the patients visiting the Aziz Bhatti Shahid Hospital, Gujrat. The objective of this study was to determine the frequency of different blood groups and their alleles in this region, which would not only help in blood transfusion services, but also eliminate the risk of erythroblastosis and some other diseases. Blood grouping was carried out over a period of 12 months from January 2004 to December 2004, and encompassed 2647 subjects, in which 80.59% were male and 19.41% female. The blood groups were categorized according to ABO/Rh system and allele frequency was determined according to Hardy-Weinberg law. The distribution of phenotypes in the total sample was 0.2489, 0.3691, 0.0688 and 0.3132 for groups A, B, AB and O respectively, with Rh-positive (R) 0.7958 and Rh-negative (r) 0.2042. The distribution of the alleles in the total sample was 0.1740, 0.2229, 0.0435 and 0.5596, for IA, IB, IAIB and i, respectively. From these studies it was concluded that phenotypically B group was dominant in the Gujrat region, with a high allelic frequency of O group.

Keywords: Alleles, gene frequency, blood groups, Rh factor, transfusion

Introduction

The regulation of ABO blood group system is under the control of ABO gene expression [1]. A loss of blood group A antigen expression has been reported in Bladder cancer, caused by the allelic loss or methylation of ABO gene [2]. Research on ABO group system has been of immense interest, due to its medical importance in different diseases. The ABO blood group system is not only important in blood transfusions, cardiovascular diseases, organ transplantation, erthroblastosis in neonates, but also one of the strongest predictors of national suicide rate and a genetic marker of obesity [3-8]. A significant deficit of group O has suggested that there may be susceptibility to develop osteoarthrosis in normal hip-joint and spinal osteochondrosis [9,10].

The genetic history of a person can be known by studying the blood groups [11]. For instance, type O blood is the oldest blood and shows a connection to the hunter-gatherer cultures. This blood type is strongly aligned with high animal protein consumption; individuals generally produce higher stomach acids and experience more incidence of gastric ulcer disease than the other groups. Blood group A is primarily associated with vegetarian food sources and individuals in this group secrete smaller amounts of stomach acid and have lesser chances for gastric ulcers, heart diseases, cancer and diabetes [12].

The carbohydrate antigens A, B and O appear to be located on the long arm of the autosomal locus at chromosome number 9 [13], which constitute the four blood types. The gene symbols IA, IB, IAIB and i are often used to denote these alleles. Two alleles, R and r, are responsible for the inheritance

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of rhesus blood groups, with R denoting Rh positive, and r being Rh negative allele. Gene frequency takes into consideration the numbers of various genotypes in the population, and the relative allele frequencies are determined by application of the Hardy-Weinberg Law [14].

The present study is carried out to record the phenotypic and genotypic frequency of various alleles in the blood groups of a sample of the population in the Gujrat region, Punjab, Pakistan. The study has suggested that the blood group frequencies of this region are similar to the Asian communities [15], in the sequence of B>O>A>AB, with the highest allele frequency of Rh positive in the studied Pakistani populations. These figures are reported in the hope that they may be used as reference for studies of ABO blood groups by health planners, while making an effort to face future health challenges in this region.

Materials and Methods

Subjects

A total of 2647 subjects, comprising 2133 (80.59%) male and 514 (19.41%) females, were screened for blood grouping. The subjects belonged to both rural and urban areas of Gujrat, Punjab, Pakistan.

Collection of blood samples

A 2.0 ml sample of blood was drawn from the antecubital vein of each subject in a disposable syringe, and transferred immediately to a tube containing ethylene diamine tetra acetic acid (EDTA).

Determination of blood groups

Blood grouping was done by the antigen-antibody agglutination test. The antisera used were obtained from Plasmatic (Kent, UK). Plasmatic ABO monoclonal reagents are *in vitro* culture supernatants of hybridized immunoglobulin secreting mouse cell-line. For determination of Rh factor, plasmatic anti D (1.0g) Lo-Du and LO-Du2 monoclonal reagents, prepared from different antibody producing human B-lymphocyte cell lines, were used.

Results

Table 1 shows the phenotypic frequency of ABO blood groups in the studied population, with gender distribution. The distribution of phenotypes in the total sample was 0.2489, 0.3691, 0.0688 and 0.3132 for groups A, B, AB and O respectively. Phenotypically B group was dominant and AB was rare in both males as well as females. Table 2 depicts the distribution of allele frequencies of ABO antigens in the studied population, in comparison with certain

Table 1.
Phenotypic frequencies of various blood groups (ABO and Rh) in the studied.

Blood Groups	Total Subjects			Male Subjects			Female Subjects		
	Complete	Rh+	Rh-	Complete	Rh+	Rh-	Complete	Rh+	Rh-
A	0.2489	0.2475	0.2830	0.2705	0.274	0.2683	0.2289	0.2329	0.2207
B	0.3691	0.3652	0.4622	0.3623	0.3687	0.3092	0.3636	0.3571	0.3158
AB	0.0688	0.0680	0.0849	0.0346	0.0210	0.1680	0.0893	0.1021	0.0981
O	0.3132	0.3193	0.1699	0.3326	0.3362	0.2545	0.3182	0.3079	0.3654
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

earlier studies. The distribution of the alleles in the total sample was 0.1740, 0.2229, 0.0435 and 0.5596 for IA, IB, IAIB and i respectively, indicating that the allelic frequency of O positive group was higher than the other blood groups. Table 3 compares the distribution of allele frequencies of Rh factor antigens in the Gujrat population with earlier studies on different populations. The distribution of Rh alleles was 0.7958 and 0.2042 for R and r gene, suggesting the dominance of Rh positive. The studied population exhibited the frequency in the order of i> IB > IA > IAIB and R>r respectively.

Discussion

In the study under discussion, the relative frequency of the various blood group alleles does not seem to deviate from those which have been recorded in the past for most of the Pakistani regions (Table 2). This study has demonstrated that phenotypically, there was a dominance of B blood group (B=0.3652, O=0.3322, A=0.2475), but the allele frequency of O blood group was higher (O=0.5596, A=0.1901, B=0.2503), than the other blood groups. These findings are inconsistent with the results obtained in earlier studies carried out in Wah Cantt (O=0.5400, A=0.1813. B=0.2450) and Punjab division (O=0.5760, 0.2440, B=0.1380), but significantly higher from the other regions of Pakistan (Bannu, O=0.2507, A=0.3103, B=0.3623, Peshawar O=0.3100, A=0.2800, B=0.3400, Swabi, O=0.3220, A=0.2760, B=0.3040, Hazara,

Table 2.
Allelic frequency of blood groups (ABO) studied in different populations.

Populations	Frequency of blood groups A	B	AB	O	References
American Indian	0.0390	0.0110	0.000	0.9500	16
Turky	0.1220	0.1213	0.0085	0.7398	17
Nairobi (Kenya)	0.1580	0.1261	0.0239	0.6900	15
Sudan	0.1814	0.1235	0.0268	0.6683	18
Kuwait	0.1608	0.1400	0.0265	0.6678`	19
W.Germany	0.2565	0.081	0.0225	0.6400	20
Ukraine	0.2360	0.2250	0.0704	0.5760	21
Hungary	0.2766	0.1218	0.0423	0.5593	22
Nigeria	0.2443	0.2388	0.0275	0.4894	23
Kenya	0.2620	0.2200	0.0440	0.4748	15
Britain (UK)	0.4170	0.0860	0.0300	0.4670	25
India	0.2470	0.3750	0.0530	0.3250	25
Bannu (Pakistan)	0.3103	0.3623	0.0767	0.2507	26
Peshawar (Pakistan)	0.2800	0.3400	0.0700	0.3100	27
Swabi (Pakistan)	0.2760	0.3040	0.0880	0.3220	28
Hazara (Pakistan)	0.2400	0.3200	0.1100	0.3300	29
Bahawalpur (Pakistan)	0.2100	0.3600	0.0600	0.3700	30
Wah cant (Pakistan)	0.1813	0.2450	0.0517	0.5400	31
Punjab (Pakistan)	0.2440	0.1380	0.0420	0.5760	32
Gujrat (Pakistan)	**0.1740**	**0.2229**	**0.0435**	**0.5596**	**Present study**

Table 3.
Frequency of Rh antibody allele in different populations.

Populations	Allele frequency R	r	References
Nigeria	0.9430	0.0570	23
Azad Jammu and Kashmir	0.8480	0.1520	33
Kenya	0.8030	0.1970	24
Sudan	0.7436	0.2564	18
Bannu (Pakistan)	0.6720	0.3280	26
Lahore (Pakistan)	0.7170	0.2830	34
Islamabad (Pakistan)	0.7290	0.2710	35
Wah Cantt (Pakistan)	0.7300	0.2710	31
Peshawar (Pakistan)	0.7680	0.2320	27
Gujrat (Pakistan)	**0.7958**	**0.2042**	**Present study**

O=0.3300, A=0.2400, B=0.3200, Bahawalpur, O=0.3700, A=0.2100, B=0.3600). However, the data for the American Indians, Turkey, Nairobi (Kenya), Sudan, Kuwait, W.Germany, Ukraine, Hungary, Nigeria, Kenya and Britain, presented in the same Table, reveals that there is dominance of O group, in these populations in contrast to the Indo-Pak sub-continent, in which both B and O groups show comparable frequency. The least reported group in all the populations has been AB. These studies suggest that the heterogeneity in these populations is due to the genetic and environmental factors which are responsible for varying frequency of the blood groups [26]. Perhaps the environment of the Indo-pak region helps in the expression of blood group B alleles, which are progressively dominating in this region, rather than the oldest O blood group.

In terms of presence of Rh antibody alleles, the data from several studies on Pakistani as well as African, British and other countries populations is compared in Table 3. The present study has shown 0.7958 Rh positive alleles and 0.2042 Rh negative cases, which are very close to those for Kenya (R=0.8030 r=0.1970) and Peshawar (Pakistan, R=0.7680, r=0.2320) populations, suggesting that there is no significant difference between the frequencies for these populations. However the frequency of Rh positive alleles was less than the Nigerian population (R= 0.9430, r=0.0570). These findings suggest that Gujrat population seems to show the highest rate of Rh positive alleles compared to the other regions of Pakistan studied so far (Table 3).

It is well known that blood groups are associated with several diseases, like cardiovascular, obesity, osteoarthrosis, erthroblastosis in neonates and many other diseases especially, osteoporosis and suicide rate in different nations [2-12]. The prevalence of osteoporosis in the proximal femur and lumbar spine averaged 2.3- and 1.7-fold higher in women with blood type AB than in those with blood type O. Thus, ABO blood group status seems to have a significant relationship to the prevalence of osteoporosis in postmenopausal women [36]. Lester [7] has recently demonstrated that Blood types are one of the strongest predictors of national suicide rates. He studied that in a sample of 51 nations, the suicide rates were negatively associated with the proportion of people with Type O blood, while

homicide rates were positively associated with A and B blood groups. The data generated in the present study may be useful for health planners, while making efforts to face the future health challenges in the region. In short, generation of a simple database of blood groups, not only provides data about the availability of human blood in case of regional calamities, but also serves to enable insight into possibilities of future burden of diseases.

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