A Population Genetic Study of Southern Sindh (Hyderabad and Jamshoro) Pakistan: Distribution of ABO and Rh Blood Alleles

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A Sample of 38360 human individuals from population of Hyderabad and Jamshoro yield allelic frequencies of 0.1157 ± 0.00246, 0.1397 ± 0.00254 and 0.7479 ± 0.00150, for A(p), B(q) and O(r) alleles, respectively and 0.2209 ± 0.0088 for d allele. The data suggests that no significant difference between sexes and study years in the distribution of allelic frequencies. The Jamshoro population runs close to Sindhi, Baloachi, Siraiki, Punjabi and Urdu speaking groups of Hyderabad population, explained on similarly of genetic composition of these populations.
Keywords: Allelic frequencies, population similarities. Southern Sindh (Hyderabad and Jamshoro) Pakistan.

The distribution of blood alleles in different areas of the world and in different ethnic groups has been surveyed as a genetic markers. The mode of inheritance of blood groups, their association with certain characteristics as ear lobe attachment and height, as worked out by Kark-Friedlandes and their association with certain diseases, as blood group **A** and slightly with blood groups **B** Kaar-I; Singh-IP; Bhasin-MK (1992) with uterine and cervical carcinoma. It is interesting to find that out this has been most clearly demonstrated in the case of disorder of upper intestinal tract where the secretions of blood group substances is the highest. The strongest relationship is between duodenal ulceration and blood group **O**. Cancer of stomach in individuals with blood group **'A'** is seen more than in groups **'O'** and **'B'**. There is also strong evidence of an association between pernicious anemia and diabetes mellitus with group **'A'**. This has been extensively studied with great interest by the geneticists. Attempts have also been made to know the presence of **ABO** antigens in other body tissue e.g. epithelial cells and endothelial cells of various organs . Limas-C (1990). In pancreatic acinar, interlobular duct cells and islets of langerhans cells Ito-N; et, al. (1990) and involvement or changes in blood grouping antigen in tumors. As an study has indicated that the status of **AB** antigen and the tissue in most (79%) has transitional cell neoplasm only one of the two antigen, was consistently expressed. The result of the study may have implication for the clonal or specific gene deletion theories of neoplasia. Limas-C (1990).

Several investigations have been made and published, specially in recent year to map the geographic distribution of blood groups (2). The frequency of different types of blood groups particularly the **ABO** is also important from anthropological point of view. Shaukat Islam et, al. (1978). Their allelic frequencies used in studies on genetic distance between different ethnic groups. Afsar Mian and M. Arif Bhutta, (1993). Several studies are present in this regard as the differences in the frequencies of blood grouping genes analyzed by weng-2; et, al. (1990) for the different ethnic group in china.

Such attempts lead the study of blood groups frequencies to another aspect that how the different factors affecting the frequencies of blood group as, in different ethnic groups, the pattern of inheritance of blood group and the effect of different factors (genetic drift, migration, breeding pattern) affecting the frequencies of **ABO** alleles. It also has been observed that in any of these factors playing any significant role or insignificant is attempted by Garza and Rajas in Mexico. They have studied the **ABO** and Rh(**D**) blood group phenotypes and gene frequencies, based upon these factors. The risk of incompatibilities was estimated for both marriage incompatibilities (MI) and maternal fetal incompatibilities (MFI). They have found that the percentage of (MI) are higher for the persons with monophyletic than for the ones with polyphyletic surname.

Rh system is the next important system, like ABO incompatibility the Rh negative subjects readily form anti Rh antibodies which are capable of causing severe hemolytic reactions and is found to be associated with hemolytic diseases of new born. Altaf Hussain Rathore et, al. (1993). Several attempts have been made to enumerate the distribution of Rhesus (Rh) blood groups and heir relevant alleles (D and d) in different human population of the world including Turkey Onde-S; et, al. Lithuania Kucinskas-V; et, al. India Bhattacharjee and Kumar. (1979), Pakistan (Afsar Mian and Altaf Ahmed dasti.,(1991), Shaukat Islam et al., (1978), Afsar mian and M. Asif Bhutta (1993).

Material And Methods

The data was collected from Liaquat Medical College hospital Jamshoro and Hyderabad, during the year Jan: 1996 to April 1997 from the record of hospital along with both the sexes donors and as well as recipients. This study includes healthy individuals (Donors).The blood groups

were determined in the patients and donors. Techniques were used as described by Karl-Landsteiner and wiener,(1940). ABO and Rh(D) grouping was checked by slide method. Results were observed within first one to two minutes, before it dried up. Anti sera A, B & D, (Gamma biological Inc.) were used. Whenever there was doubt especially for Rh -ve, the group were rechecked and confirmed. The calculation of allelic frequencies, in accordance with Hardy-weinberg principle, were carried out by using the methods of Mather (1957).

Results

Out of 38368 subjects tested for blood groups 7151, 8764, 985, 21460 subjects were found having blood group A, B, AB and O respectively with a respective percentages are 18.64%, 22.85%, 2.57% and 55.94%. (Column 1st, 2nd, 3rd Table 1). Frequency distribution of alleles A, B and O individually in the population under study are computed by using Hardy Weinberg law. It indicates that alleles A, B and O has the frequency distribution of 0.1157 $\pm$ 0.00246, 0.1397 $\pm$ 0.00254 and 0.7479 $\pm$ 0.001500 respectively (Column 4th, 5th table 1). On the basis 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 observed for AA=0.0134, for AO=0.1731, for BB=0.0195, for BO=0.2381, for AB=0.323 and for OO=0.5594 (Column 6th and 7th table 1). Expected phenotypic frequencies for blood group classes A, B, AB and O obtained 7154.14, 8761.42, 1239.03 and 21458.58 respectively on the basis of expected frequencies of the possible genotypes (Column 8th table 1). The chi-square contribution calculated for blood group A, B, AB and O is obtained 0.00137877, 0.00075162, 65.513950 and 0.00009396 respectively with X^2_3 component = 65.516174 (Column 9th table 1). The higher values for X^2_3 component are mainly contributed to the chi-square values for the blood group AB. The data also has been analyzed differentially for both the sexes (Table II and III) individually and (Table IV) collectively. No significant difference was found between two sexes except a slightly higher percentage of blood group AB has been seen in the females (7.02%)as compared males (1.43%).

Table I

PHENOTYPE		ALLELE	GENOTYPE				
Class	No observed	%age observed	Class	Frequency ±Standard Deviation	Class	Expected Frequencies	Expected Phenotype Frequencies	Chi –Square Contribution
A	7151	18.64%	A	0.1157±0.00246	AA	0.0134	---	---
---	---	---	---	---	AO	0.1731	7154.14	0.001378
B	8764	22.85%	B	0.1397±0.00254	BB	0.0195	---	---
---	---	---	---	---	BO	0.2381	8761.42	0.000751
AB	985	2.57%	---	---	AB	0.0323	1239.03	65.51395
O	21460	55.94%	O	0.7479±0.001500	OO	0.5594	21458.58	0.000093
Total	38360	100	---	1.0033	---	1.00358	38613.17	65.51617

Table II FEMALE

PHENOTYPE		ALLELE	GENOTYPE				
Class	No observed	%age observed	Class	Frequency ±Standard Deviation	Class	Expected Frequencies	Expected Phenotype Frequencies	Chi –Square Contribution
A	1606	20.56	A	0.1355±0.00475	AA	0.0184		
					AO	0.1872	1605.73	0.000045
B	1929	24.69	B	0.1601±0.00494	BB	0.0256		
					BO	0.2212	1927.51	0.001509
AB	548	7.02			AB	0.0435	339.74	74.87169
O	3727	47.72	O	0.6908±0.00456	OO	0.4772	3726.93	0.000001
	7810			0.9861		0.9731	7599.91	74.87325

Table III (Male)

PHENOTYPE		ALLELE	GENOTYPE				
Class	No observed	%age observed	Class	Frequency ±Standard Deviation	Class	Expected Frequencies	Expected Phenotype Frequencies	Chi –Square Contribution
A	5545	18.15	A	0.1110±0.00284	AA	0.0123		
					AO	0.1691	5541.78	0.00187
B	6833	22.37	B	0.1349±0.00292	BB	0.182		
					BO	0.2056	6837.09	0.00064
AB	437	1.43			AB	0.0299	913.45	519.4613
O	17733	58.05	O	0.7619±0.00179	OO	0.5805	17734.28	0.00009
	30550	100		1.0078		1.0156	31026.6	519.4639

Table IV Distribution of Phenotypic and allelic frequencies of ABO blood groups in the general population of Hyderabad and Jamshoro cities.

	BLOOD GROUP (PHENOTYPE)				ALLELE FREQUENCIES					
	A	B	AB	O	Total	$A_{(P)}$	$B_{(q)}$	$O_{(r)}$	X^2	P
Male	5545	6833	437	17733	30550	0.1110± 0.00284	0.1349± 0.00292	0.7619± 0.00179	519.463	<0.0001
Femal e	1606	1929	548	3727	7810	0.1355± 0.00475	0.6901± 0.00494	0.6908± 0.00451	74.8732	<0.0001
Total	7151	8764	985	21460	38360	0.1157± 0.00246	0.1397± 0.00254	0.7479± 0.00150	65.5161	----

Table V Distribution of phenotypic and allelic frequencies of Rh d -ve and Rh D +ve. Rh blood genes in general population of Hyderabad and Jamshoro.

PHENOTYPIC			ALLELE		
			D	d	
	Rh +ve	Rh -ve	Total	Rh +ve	Rh -ve
MALE	1359(95.55%)	1359(4.45%)	30550	0.7842±0.0011	0.2158±0.01
FEMALE	7383 (94.53%)	427(5.47%)	7810	0.7595±0.0025	0.2405±0.0183
TOTAL (M & F)	36574(95.34%)	1786(4.66%)	38360	0.7791±0.0011	0.2209±0.0088

Frequencies for the Rhesus alleles(D and d) also has been calculated. It has been found that out of total 38360 subjects tested, 36574 (95.34%) were Rh positive while only 1786 (4.66%) were Rh negative. The frequencies calculated for D and d alleles were 0.7791 ± 0.0011 and 0.2209 ± 0.0088 respectively (Table V). Also no significant difference was found in regard to rhesus blood group between two sexes.

Discussion

Our data suggests that out of 38360 individuals of both sexes persons having blood group A were 7151 (18.64%), B were 8764 (22.85%), O were 21460 (55.94%) and AB were 985 (2.57%), which has yield frequencies for A, B and O alleles 0.1157 ± 0.00246, 0.1397 ± 0.00254 and 0.7479 ± 0.001500 respectively. This indicates that **O** allele has highest frequency (0.7479 ± 0.001500), which appears to be a universal feature, shared by all the hither to known populations of the world (livingstone, 1969). It is also the highest frequency for O allele in various cities of Pakistan as in Peshawar (0.5568) P.M.R.C, 1984, Hazara (0.5745) Khaliq et, al.1984, Quetta (0.5736); Afsar Mian Altaf et, al (1985). It is also higher than the frequencies of O alleles in various parts of India, Gujrat (0.61) Papiha et, al. (1981); Punjab (0.61) Chahal and Papiha. (1981); Himachal pardesh (0.59) chahal et, al. (1982); Rajasthan (0.576); Bihar (0.671) Bhattacharjee et, al. (1969); and then various countries of world (Vietnam = 0.6708, Australia = 0.6325, USA = 0.6708, UK = 0.6856 and Germany = 0.6557); Altaf et, al. (1993). The frequency for allele O is followed by the frequency of allele B (0.1397 ± 0.00254) which is slightly higher from the frequencies for allele A (0.1157 ± 0.00246), which is similar pattern for Asian, as in Bihar (India) (A allele, 0.186 and B allele, (0.178). Bhattacharjee, et, al. (1969). But it is significantly different pattern from some countries as USA (A = 0.2512 and B = 0.0708), UK (A = 0.2578 and B = 0.0560) and Germany (A = 0.2663 and B = 0.0792), where the 'A' allele has significantly higher frequency than allele B. A higher total chi-square value = 65.516174 is obtained. It is mainly because of the differences in the observed and expected number of persons in blood group AB which contributes 65.513950 out of a total chi-square value of 65.516174. The higher total chi-square values suggest that the population in our study is not in an equilibrium state according to Hardy-Weinberg law. It may be mainly contributed to the fact that the population in these two districts is very heterogeneous and comprises of many ethnic groups that is Sindhi, Baloach, Siraiki, Pathan, Punjabi, Brohi and Urdu speaking, who have migrated from different areas (genetic drift and their pattern of marriages). They tend to marry in their own ethnic groups and this lake of inter-breeding between ethnic groups (mating habits) may result deviation from equilibrium state. The present data reveals that out of 38360 persons only 1786 were Rh negative with the percentages of Rh positive = 95.34% and Rh negative 4.66% with the frequencies for allele D = 0.7791± 0.0011 and for allele d = 0.2209 ± 0.0088. This pattern is similar to the various cities of Pakistan.

The frequencies for the 'd' allele is also similar in various cities of India as Andhra Pardesh, 0.26, Ramesh et, al., (1980); Rajputs of Himachal Pardesh 0.19 in Chamba Rajputs and 0.27 in Kangra, Chahal et, al., (1982). No significant difference has been found in two different sexes.

References

1. Kaar-I; Singh-IP; Bhasin-MK. Blood groups in relation to carcinoma of cervix uteri. Hum-Hered. 1992; 42(5): 324-6.
2. Limas-C. A,B blood group antigens in tissues of AB heterozygotes. Emphasis on normal and neoplastic urothelium. Am-J-Pathol. 1990 Nov; 137(5): 1157-62.
3. Ito-N; Nishi-K; Nakajima-M; Okamura-Y; Hirota-T. Histochemical localization and analysis of blood group-related antigens in human pancreas using immunostaining with monoclonal antibodies and exoglycosidase digestion. J-Histochem-Cytochem. 1990 Sep; 38(9): 1331-40.
4. Shaukat Islam and Islam Mahmood Khan. Analysis of gene frequencies of A, B, O and Rh blood group system in Busra, Iraq, Biologia vol.: 24, no 2 (1978).

5. Mian, A. and Bhutta, M. A, 1993. Genetic studies on human population of Multan (Pakistan). Distribution of ABO and Rh blood alleles. Pakistan J. Zool. vol.: 25(2), P.149-151.
6. Weng- Z; Yuan-Y; Du- R. l- Chuan Hsueh-Pao. 1990; 17(4): 260-8.
7. Altaf Hussain Rathore, Muhammad Arshad, Safdar Ali Bajwa and Riaz Hussain. 1993. ABO and Rh(D). Blood groups in an industrial city of Pakistan. Specialist, of Pakistan's Med. Sci. Oct-Dec. vol. 10, no.1: PP.59-62.
8. Onde-S; Kence-A. Geographic variation analysis of the ABO and Rh systems in Turkey. Gene-Geogr. 1995 Dec; 9(3): 211-20.
9. Kucinskas-V; Radikas-J; Rasmuson-M. Genetic diversity in the lithuanian rural population as illustrated by variation in the ABO and Rh(D) blood groups. Hum-Hered. 1994 Nov-Dec; 44(6): 344-9.
10. Bhattacharjee, P.N and Kumar, N., 1969. A blood group genetic survey in Dudh Khasias of Ranchi Distt:(Bihar, India). Hum-Hered, 199:385-397.
11. Mian, Afsar and Dasti, Altaf Ahmed, 1991. Distribution of Rhesus blood alleles in general population of Quetta (Pakistan). J. Zool., 23:188.
12. Living Stone, F., B., 1969, An analysis of ABO blood group clines in europe. A.m.J. Physiol. Anthrop., 31:1-10.
13. Pakistan Medical Research Council Manual of normal parameter of health. Peshawar, 1984, P.79.
14. Khaliq M. A., Khan J. A., shah H., Khan S.P., frequencies of ABO and Rh(D) blood groups in Hazara Divisionn, Abbotabad, Pak. J. Med. Res., 1984, 23:102-104.
15. Mian A., Dasti A. A., Jabeen F., frequencies of ABO blood alleles in general human population of Quetta Pakistan. Pak. J. Zool., 17 (3), PP. 257-262, 1985.
16. Papiha, S. S, Roberts, D. F., Shah, K.C and Shah, A. C., 1981. A genetic study of some Gujrat populations. Acta Anthropogent, 5:23-40.
17. Chachal, S. M. S and papiha, S. S., Roberts, D. F. and Suigh, I. P., 1982. Serological and biochemical variation Gaddi tribe of Himachal Paradesh. India. Z. Morph. Anthrop., 73:197-208.
18. Ramesh, A., Blake, N. M., Vijay Kumar. M. and murty, J. S., 1980. Genetic studies on the chenchu tribe of andhra pardesh, India. Hum-Hered., 30:291-298.