

Association of ABO and Rh Blood Group Systems with Blood Pressure in a Population Sample from Peshawar, NWFP, Pakistan

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Background: Abundant literature is available on the association of blood groups to various diseases. It was thus hypothesized that similar linkage may also exist between blood groups and Hypertension, which prompted me to work on this project. **Material and Methods:** This study was carried out from June 2001 to September 2003 on 1304 subjects out of which 756 were male and 548 were females. Age ranged from 18-65 years. The blood groups and blood pressure were determined in PMRC Research Center KMC Peshawar, by using standard methods. **Results:** Out of 1304 subjects distribution of blood groups was such that blood group B (30.1%) > O (29.7%) > A (28.5%) > AB (10.1%). No significant difference in systolic and diastolic blood pressure was found among the all groups. However significant differences existed between the two sexes within blood group B & O for systolic BP and A & O groups for diastolic BP. Significant differences in systolic BP were found between A+ve and O+ve phenotypes only. A-ve males had lower systolic BP than O-ve males. Substantially more conspicuous Rh factor associated differences became evident among the ABO phenotypes. Nearly similar trends were evident for systolic and diastolic blood pressure as age of both genders of the A, B and AB phenotypes advanced. Statistically significant ($P < 0.05$) increase above the age of 16-20 years group was noticed at least as far as the 41-50 years age groups. Especially highly significant increase in systolic and diastolic Blood pressure in Group A (both males and females) and in Group B and AB (females only) was noticed. **Conclusion:** It is advisable that the males having blood group O-ve and females having AB-ve should be aware of their blood pressure and maintain it within the normal limits especially by changing their lifestyle.

Key Words: ABO, Rh blood groups; Hypertension

The ABO, Rh blood group systems has been associated with a variety of diseases¹ and hence are considered to be a marker of impending health hazards specially that of cardiovascular diseases^{2,3,4}. In studies carried out in Pakistan on a smaller scale, it has been found that there is association between ABO blood groups and hypertension and coronary heart disease^{4,5}.

Very little attention has been paid on this Work in this area of Pakistan. I felt that public awareness about normal blood pressure is necessary in this respect, as hypertension can lead to dangerous complications, particularly those of cardio-vascular system and cerebrovascular systems⁶.

The fixation of the terms "normotensive" "Hypertensive" or Hypotensive" is difficult as B.P. is variable particularly, according to age, posture, tension, method used, fault of doctor and type of apparatus. However 160/90 mm Hg. was considered safe upper limit in elderly persons in the past but now- a- days the physicians like their patients to have lower limits than this i.e. 140/90mmHg which has been labeled as borderline by WHO⁷. The aim of the present study was also on this analogy i.e. to find out the distribution of blood groups and association of different blood groups with hypertension in a sample population of Peshawar, N.W.F.P. and to invoke public awareness about blood pressure.

Material and methods:

Investigations were carried out on 1304 individuals (756 males & 548 females) belonging to Peshawar and adjoining areas of NWFP collected from 2001-2003. The

study was carried out on healthy and normal students and staff of Khyber medical college and those of Peshawar University. The Students community came mostly from Peshawar but some also belonged to other areas of the province, northern areas & tribal territory of the country. Information was taken from the volunteers about their health, dietary habits & life style. Body weight, height, B.P and pulse were recorded in each subject.

The B.P, both systolic and diastolic, were recorded by using mercury sphygmomanometer after complete rest for at least half an hour. ABO blood groups were determined by antigen - antibody agglutination test. For finding out of Rhesus factor (Rh), Plasmatic anti-D (1gm) Lo Du and LODu2 reagents were used.

Results:

Blood groups: Amongst 1304 subjects -28.5% had bloods group "A" 30.1% were blood group B. "AB" were 10.1% while 29.7% were group "O". The order of distribution of blood group in the population was B > O > A > AB. Group "O" was commonest group amongst female and group B amongst male subjects.

Blood Pressure: No significant difference, in systolic & diastolic Blood Pressure (SBP & DBP) was found among the blood groups. (Tables II and I). However statistically significant differences existed between the sexes within each of the "B" & "O" groups for systolic pressure ($P < 0.05$, table I, footnote) and "A" "O" groups for diastolic pressure ($P < 0.05$, table II foot note). The males in these three groups had higher systolic and diastolic pressures than the females.

Significant differences in S.B.P were found between "A^{ve}" & "O^{ve}" phenotypes only (Table I). Here "A" Rh^{ve} males had lower S.B.P than "O" Rh^{ve} males. The same sexes (Rh dependent) within the individual blood groups did not differ significantly (Table I, foot note). Between sex difference (within Rh group) were significant only for Rh^{ve} males & females within both "A" & "O" groups, the Rh^{ve} males showing higher S.B.P. than Rh^{ve} females, (Table I, foot note). Rh associated significant differences in D.B.P. of type "A" subjects were discernible relative to the "AB" and "B" phenotypes (Table-II). The association was mainly with the Rh^{ve} factor. The "A" Rh^{ve} males had higher DBP than Rh^{ve} AB and B males whereas the AB Rh^{ve} females had higher DBP than the corresponding A females (P<0.05). Rh^{ve} males had higher DBP than the Rh^{ve} "AB" and "B" males, whereas the "AB" Rh^{ve} females had higher DB.P. than the corresponding "A" females (P<0.05). Regarding the Rh^{ve} factor, only the AB

Rh^{ve} males had significantly higher DB.P than "A" Rh^{ve} males (Table II).

Both within sex and between sex, significant differences were found in the case of the "A" phenotype only. The "A" Rh^{ve} males had higher D.P, as compared to both "A" Rh^{ve} males (same sex, (p< 0.001) and the "A" Rh^{ve} females (between sex, (p<0.05)), Table II foot note.

Age and its Relation: The age frequency analysis displayed the trend in association of the advancing age with the selected parameters for all blood phenotypes. Nearly similar trends were evident for systolic and diastolic blood pressure as age of both genders of the A, B and AB phenotypes advanced. Statistically significant (P<0.05) increase above the age of 16-20 years was noticed which extended up to 41-50 years age. Especially noticeable was the highly significant increase in systolic and diastolic Blood pressure in-group A (both male and females) and group B and AB (females only) whereas no change in-group O subjects.

Table I: Mean systolic blood pressure (mm Hg) of various blood phenotypes partitioned according to sex and Rh factor.

Blood Group	Sex ^a	Rh ^b	Mean ± SEM	A/rest	AB/rest	B/rest	=n
A	F	-	107.50(4.79)				34
	M	-	122.50(2.50)				44
	F	+	117.03(1.76)				115
	M	+	119.21(1.33)				173
AB	F	-	115.00(6.45)	Ns			24
	M	-	120.00(10.00)	Ns			42
	F	+	119.38(3.46)	Ns			54
	M	+	120.15(1.86)	Ns			64
B	F	-	106.00(11.66)	Ns	Ns		35
	M	-	121.67(7.36)	Ns	Ns		29
	F	+	117.54(2.05)	Ns	Ns		115
	M	+	121.17(5.77)	Ns	Ns		205
O	F	-	115.00(2.44)	Ns	ns	ns	27
	M	-	130.00(5.77)	*	ns	ns	33
	F	+	115.87(1.57)	ns	ns	ns	144
	M	+	120.02(1.45)	ns	ns	ns	166

* P<0.05, ** P<0.001, ns - non-significant, N = sample, a - between sexes (same Rh): ns within all blood groups excepting A (Rh-) and O (Rh-) females and males, b - same sex (between Rh): ns within all blood groups.

Table II: Mean diastolic blood pressure (mm Hg) of different blood phenotypes partitioned according to sex and Rh factor.

Blood group	Sex ^a	Rh ^b	Mean ± SEM	A/rest	AB/rest	B/rest
A	F	-	67.50 (4.79)			
	M	-	87.50(2.50)			
	F	+	75.97(1.01)			
	M	+	77.89(0.94)			
AB	F	-	80.00(7.07)	*		
	M	-	80.00(5.00)	*		
	F	+	76.88(1.78)	ns		
	M	+	80.00(5.00)	*		
B	F	-	73.20(8.38)	Ns	ns	
	M	-	75.00(3.33)	***	ns	
	F	+	76.84(1.07)	ns	ns	
	M	+	79.57(0.92)	ns	ns	
O	F	-	75.00(2.44)	Ns	ns	ns
	M	-	85.67(6.67)	ns	ns	ns
	F	+	75.25(1.07)	ns	ns	ns
	M	+	77.31(1.18)	ns	ns	ns

* P<0.05 **p< 0.01 *** P<0.001 ns - non-significant, N= sample a = between sexes (same Rh): all ns within all blood groups excepting A Rh males & females, b - same sex (between Rh): ns within all blood groups excepting A female and male (P<0.001).

Discussion:

Geographical and regional differences in distribution of the ABO blood groups are not uncommon in view of multiplicity of factors. In the population sample from Peshawar, the relative distribution of A, B, and O blood groups and least representation of AB phenotype differs only marginally from the frequencies recorded in populations from other geographical regions. In a study carried out in Punjab described nearly the same distribution as in our study⁷. Moreover, Rh+ve individuals outnumbered the Rh-ve subjects (92 and 8% respectively) in both the studies. The frequency of ABO blood groups in the white US population (Caucasian in general), US blacks and Asians is O>A>B>AB with far more pronounced differences in relative frequencies of the various blood types than noted in the present study⁸. In Syrians Arabs, the distribution is O>A>B>AB⁹. The racial differences that may have genetic basis but influence of environmental and other factors also likely have some role¹⁰. Whether the distribution of the ABO groups in Peshawar sample has entirely genetic basis or reflects influences of environmental factors as well remains open to detail analysis.

According to W.H.O. definition, SBP & DBP values of 140 and 90 mm Hg respectively represent borderline levels of B.P.^{11,12}. Elevated B.P is liable to assume serious dimensions in association with other accompanying risk factors, such as obesity, total cholesterol and such environmental factors as physical activity and diet^{12,13}.

In our case the mean B.P. was generally within or close to the average of healthy adult. Exceptions were rare, where marked deviation was noticeable in the mean B.P. values. Regarding the ABO heterogeneity in B.P. only the "A" & "O" phenotypes differed in mean SBP. The "A" phenotype had lower mean SBP. than "O" subjects suggesting lesser risk, if any, in the former group than in the latter group. The difference was again Rh^{ve} factor dependent. Diastolic means too differed but the difference remained confined to "A-ve" and "O -ve" and "AB-ve" groups only.

All of these differences among the ABO groups showed a relationship with Rh factor and within individual blood group with both sex and Rh factor. The relative pattern of mean values showed no consistent trends that could suggest dominance of one blood phenotype over the other in terms of a predilection for risk of hypertension.

The observations on the Peshawar sample thus provide no support to the view that the "A" phenotype has a predisposition for elevated B.P. compared to the other groups. In the Bogalusa study³ on Americans white & blacks, both total cholesterol and systolic BP show tracking in the range of 20-80 years of age and constitute a risk for cardiovascular impairment in the "A"

phenotypes adolescents. In the Framingham study (Massachusetts, USA), Castelli and Leaf¹⁴ have demonstrated that the risk for coronary heart disease rises with rise in total cholesterol level and that the effect is synergistic in combination with such risk factors as elevated SBP. Systolic pressure has been associated with coronary heart disease, in the American heart study (AHS) as well as Japanese studies^{15,16}. The risk of heart disease is known to increase by 28% with 10 mmHg rise in systolic pressure and 5mm Hg in diastolic pressure in middle age men as shown by the seven country study research groups^{6,13}, have shown that both increase in TC & S.B.P. are associated with risk of CVD. Kawabe et. al¹⁷ has observed a positive correlation between S.B.P, DBP and body weight in Japanese students of 15-16 years. Other workers^{18,19,20} showed similar relationship between CVD and elevated B.P.

Conclusion:

The division and subdivision of the subjects according to blood groups, Rh factor and gender leaves some sections very small to draw any conclusion. However It is concluded from our study that all subjects specially males having blood group O-ve and females having blood group AB-ve should be aware of their blood pressure and should check it regularly as the age advances. It is also suggested that they should change their lifestyle to keep their blood pressure within normal limits. However more work is needed all over the country to reach definite conclusion

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