

A Study on the Association of Blood Groups with Cardiovascular Risk Status

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INTRODUCTION

After the discovery of the ABO blood groups in 1900 by Land Steiner, many studies started correlating the blood groups in order to find out if there was any genetic susceptibility to any disease (Nath et al., 1963; Tiwari, 1985). The resistance and susceptibility to disease due to presence of certain blood groups may provide diagnostic clues for the biological significance of the genetic polymorphisms in man (Kulkarni and Agarwal, 1987).

Levels of blood pressure (BP) and blood lipids are clinically important for assessing risk for cardiovascular disease (CVD). The relative risk of CVD is associated with elevated levels of BP, serum cholesterol and triglycerides (Castelli, 1986; Arzenius, 1990; Pekkanen et al., 1990). High low-density lipoprotein (LDL) cholesterol and low high-density lipoprotein (HDL) cholesterol are independent risk factors for CVD (Parthasarathy et al., 1990). The LDL carries cholesterol from liver to all organs of the body where it accumulates, whereas HDL reverse cholesterol transport from the peripheral tissues to the liver for excretion (Steinberg, 1978; Reichl and Miller, 1983; Bates, 1971).

The word association means that a given disease occurs in people of a given blood group type more often than would be expected by chance. A few studies are available in India and abroad with regard to the association between blood groups and CVD (Oliver and Cumming, 1962; Srivastava et al., 1966; Talbot et al., 1972; Mehta and Mehta, 1984). The main objective of this paper is to provide whether individuals belonging to different ABO and Rh(D) blood groups do or do not differ in their susceptibility to CVD risk markers like blood pressure and serum lipids.

MATERIALS AND METHODS

The sample for the present study consists of

500 unrelated healthy adult subjects of both sexes (266 males, 234 females) aged 21-70 years selected randomly from 21 coastal villages in Nellore district of Andhra Pradesh. Both systolic blood pressure (SBP) and diastolic blood pressure (DBP) measurements were taken in a sitting position after at least five minutes rest. Pulse rate was measured for one minute. Venous blood from each individual was collected and serum total cholesterol, triglycerides, HDL cholesterol, and LDL cholesterol were estimated using standard procedures. The study design, sampling procedures and methodology have been reported elsewhere (Bulliyya et al., 1999; Bulliyya, 2000). Blood samples were also analyzed for the ABO and Rh(D) blood groups by serum agglutination methods using standard anti-A, anti-B and anti-D sera.

Since there was no significant difference between males and females for the mean values, the data were pooled for statistical analysis. Allele frequencies were calculated by following Bernstein's improved formula (Mourant et al., 1976).

RESULTS

The ABO blood groups data along with their allele frequencies are presented in table 1. Blood group O predominates in distribution with the highest frequency (59.8%), followed by blood group B (26.6%), A (13.4%) and AB (4.2%). The frequency of allele O predominates over the

Table 1: Observed and expected phenotype numbers and allele frequencies of the ABO blood groups

System	Phenotype	Number		Allele frequencies
		Observed	Expected	
ABO	O	279	307.2	O = 0.7838
	A	67	58.1	A = 0.0709
	B	133	124.4	B = 0.1453
	AB	21	10.3	
Total		500	500.0	1.0000

Chi-square = 14.2, d.f. 3 ($p < 0.01$)

alleles A and B. The chi-square test for goodness of fit between observed phenotypes and expected numbers show statistically significant differences ($p < 0.01$). In the Rhesus system, testing with anti-D revealed that 94.8% of individuals were Rh(D) positive and only 5.2% were Rh(D) negative (Table 2). There was a preponderance of allele D (0.7720) over d (0.2280) in this system.

Table 3 indicates the mean values of blood pressure and serum lipids in association with the ABO and Rh(D) blood groups. Both systolic and diastolic pressures were highest in subjects with O blood group, followed by AB, B, and A. How-

ever, higher mean values for serum cholesterol, triglycerides, HDL cholesterol and LDL cholesterol were found in subjects with blood group AB as compared to B, O and A. The mean BP (SBP and DBP) was observed to be higher in Rh(D) positive individuals whereas, serum lipids were recorded to be in lower concentrations than in Rh(D) negatives. Results of analysis of variance (ANOVA) and t-tests revealed insignificant variation.

The relative risk status of CVD in relation to elevated levels of SBP (>140 mmHg), DBP (>90 mmHg), total cholesterol (>200 mg/dL), triglycerides (>200 mg/dL), HDL cholesterol (<35 mg/dL) and LDL cholesterol (>130 mg/dL) was shown in table 4. The prevalence of hypertension for both SBP and DBP was more in subjects with blood group AB, followed by blood groups O, B and A. The greatest difference was evident in the prevalence of high serum cholesterol, which was 47.6% among AB blood group individuals as compared to O (16.7%), B (15.8%) and A (11.9%) subjects. Similar observations

Table 2: Distribution of the Rh(D) phenotypes and allele frequencies

Phenotype	Observed		Allele frequencies
	Number	Per cent	
Rh(D)+	474	94.8	D = 0.7720
Rh(D)-	26	5.2	d = 0.2280
Total	500	100.0	1.0000

Table 3: Mean (+SD) values of blood pressure and serum lipids in different blood groups

Variable	ABO blood groups				Rh(D) blood groups	
	O	A	B	AB	Rh(D)+	Rh(D)-
<i>Blood pressure (mmHg)</i>						
SBP	117.5 ± 10.4	115.3 ± 10.2	115.8 ± 10.6	115.8 ± 10.2	116.6 ± 10.6	114.8 ± 8.1
DBP	77.5 ± 13.9	74.0 ± 7.1	75.9 ± 7.7	76.7 ± 6.4	76.7 ± 11.7	74.6 ± 6.9
<i>Serum lipids (mg/dL)</i>						
Total cholesterol	171.4 ± 32.7	170.3 ± 31.7	173.3 ± 29.1	185.2 ± 31.7	172.3 ± 32.1	179.3 ± 24.7
Triglycerides	144.2 ± 39.2	143.2 ± 32.6	146.3 ± 39.7	158.8 ± 35.7	145.3 ± 38.9	149.6 ± 33.4
HDL cholesterol	47.8 ± 5.7	46.3 ± 4.7	47.3 ± 5.2	48.2 ± 5.4	47.5 ± 5.5	47.2 ± 5.4
LDL cholesterol	94.6 ± 26.4	94.3 ± 29.3	97.5 ± 23.6	107.1 ± 26.9	95.9 ± 26.2	99.2 ± 28.4

Table 4: Prevalence of cardiovascular risk status in association with blood groups

Cardiovascular risk marker	ABO blood groups				Rh(D) blood groups	
	O	A	B	AB	Rh(D)+	Rh(D)-
Systolic blood pressure (>140 mmHg)	3.0 (10)	4.5 (3)	3.0 (4)	4.7 (1)	3.6 (17)	0.2 (1)
Diastolic blood pressure (>90 mmHg)	5.0 (15)	1.5 (1)	2.2 (3)	9.5 (2)	4.2 (20)	3.8 (1)
Serum total cholesterol (>200 mg/dL)	16.7 (50)	11.9 (8)	15.8 (21)	47.6 (10)	17.9 (85)	15.4 (4)
Serum triglycerides (>200 mg/dL)	5.7 (17)	4.5 (3)	6.8 (9)	9.5 (2)	5.9 (28)	11.5 (3)
HDL - cholesterol (<35 mg/dL)	0.3 (1)	0.0 (0)	0.7 (1)	0.0 (0)	0.4 (2)	0.0 (0)
LDL - cholesterol (>130 mg/dL)	11.4 (34)	14.9 (10)	12.0 (16)	38.1 (8)	13.5 (64)	15.4 (4)

Figure in parentheses denote number of subjects

were made observed for serum triglycerides and LDL cholesterol. The association of CVD risk status with blood groups revealed that the incidence of hypertension and hypercholesterolemia was more in Rh(D) positive individuals whereas serum triglycerides and LDL cholesterol were recorded to be lower than in Rh(D) negative individuals. The chi-square and t-tests however, showed non-significant differences for all the markers between risk and non-risk groups.

DISCUSSION

Hypertension or high BP is defined as SBP >140 mmHg or >90 mmHg of DBP and it directly increases the risk of CVD (Arzius, 1990). Medalic and his colleagues (1971) reported that subjects with blood groups A had an overall greater risk of developing hypertension than those belonging to blood group O. Similar findings were also documented in other studies (Mauras et al., 1969). The present study shows a reverse trend with O group individuals having lowest prevalence of hypertension compared to other blood groups, however, O group individuals showed a greater mean BP levels. The prevalence of hypertension was more in Rh(D) positive individuals. No data are available on Rh(D) system for comparison.

Using the classification defined by National Cholesterol Education Program (1993), the prevalence of several at-risk categories for cholesterol (>200 mg/dL), HDL cholesterol (<35 mg/dL), LDL cholesterol (>130 mg/dL) and triglycerides (>200 mg/dL) are evaluated. The risk status in this study for cholesterol, triglycerides, HDL cholesterol and LDL cholesterol showed a much greater prevalence in AB individuals as compared to individuals of A, B, and O groups. In a survey of 6000 healthy adult males (Mauras et al., 1969), blood donors with A blood group has a higher mean cholesterol concentration as compared to O and B groups, but no correlation was found with Rh(D) positive than Rh(D) negative individuals, another study conducted on a series of 1222 patients with arteriosclerosis revealed that patients with blood group A were susceptible to occlusive type of disease (Kingsbury, 1971).

In an extensive study among women developing thrombosis under various circumstances,

an excess of blood group A patients and a deficit in O patients was found (Bates, 1971). Similarly, occurrence of venous thromboembolism and occlusive arterial disease was found to be less in patients with blood group O (Talbot et al., 1972; Morris and Bouhousens, 1973). These authors observed that blood group O appeared to give some immunity against these diseases. However, the incidence of CVD was found higher in blood groups A, B and AB persons as compared to blood group O persons (Revai and Konig, 1972).

It is evident from the present study and other data available that there are some associations, albeit usually difficult to sustain any statistical test, in respect of blood groups and the risk for CVD, but no clear-cut relationship exists. Therefore, further studies are warranted along with other blood groups to gain a meaningful picture. Such studies will help to fill in various lacunae and to explore the genetic susceptibility of blood groups as a diagnostic tool.

ACKNOWLEDGEMENTS

The author wishes to express his deep sense of gratitude to his teachers Dr. P. Chengal Reddy, Department of Physical Anthropology, Sri Venkateswara University, Tirupati and Dr. P. Reddanna, School of Life Science, University of Hyderabad, Hyderabad, for their constant guidance and inspiration during the course of this study. Thanks are also due to CSIR and DST, New Delhi for financial support.

KEY WORDS Blood Groups. Cardiovascular Risk Factors. Blood Pressure. Serum Lipids.

ABSTRACT In the present study, an attempt has been made to find out whether there exists any relationship between blood groups and the risk for cardiovascular disease based on 500 subjects from Nellore district of Andhra Pradesh. Mean values of systolic and diastolic blood pressures were higher in O group individuals, whereas those of serum lipids (total serum cholesterol, triglycerides, HDL cholesterol and LDL cholesterol) were higher in AB group subjects as compared to other blood groups. Rh(D) positive individuals had higher blood pressure and lower serum lipids levels. The prevalence of risk status was higher in individuals with AB blood group than in Rh(D) positives but this study did not show any significant association of blood groups with the cardiovascular risk factors.

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