

## ASSOCIATION BETWEEN ABO BLOOD GROUP AND HYPERTENSION among Post-menopausal Females of North India

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**ABSTRACT** The present study is an attempt to explore possible associations between ABO blood group and the risk of hypertension among post-menopausal females of north India. This cross-sectional study covered 250 post-menopausal women, ranging in age from 45 to 80 years from North India. Four anthropometric measurements (height, weight, waist circumference and hip circumference) and blood sample of all the participants were taken. Analysis of data revealed total prevalence of hypertension was 32% as per JNC VII criteria. Hypertension was more prevalent in subjects having blood group O (10.4%), followed by blood group A (8.8%), B (8%) and least in AB (4.8%). Mean values for systolic blood pressure, diastolic blood pressure and pulse rate were higher in subjects with blood group O than non O blood group (that is, phenotype A, B and AB). Findings of present study suggest that subjects with blood group O has greater incidence of association with hypertension.

### INTRODUCTION

The ABO system occurs as a result of polymorphism of complex carbohydrate structures of glycoproteins and glycolipids expressed at the surface of erythrocytes or other cells, or present in secretions, as glycan units of mucin glycoproteins. The blood types are inherited through genes on chromosome 9 (Lewis et al. 1978). Many studies have revealed possible associations of various diseases with ABO blood group, but reasons for such associations are remain controversial. Several researchers (Reid and Bird 1990; Daniels 2002) suggested evolutionary significance of AB antigen because the frequencies of different ABO blood group types vary across different populations, suggesting that a particular blood type confers a selection advantage (for example, protection against an infectious disease). Loscertales and Brabin (2006) have reported that ABO blood groups to be one of the host risk factors for placental malaria infections and are also associated with other materno-foetal outcomes. Earlier reports have demonstrated a relationship between blood group and congenital cataract in the Asian race (Reid and Bird 1990; Hadley and Issitt 1993), blood group B with maxillofacial deformities (Rasoul et al. 2008), non-O blood groups with risk of cardiovascular disease (Erikssen et al. 1980; Nydegger et al. 2003). Better understanding of possible association of hypertension risk with ABO blood group will provide valuable information for early detection

of vulnerable group, because WHO-ISH (1999) reported that death and disability from cardiovascular diseases are increasing so rapidly in the developing countries that they will rank number one as cause of the global burden. So, this study aimed to explore any possible associations between ABO blood group and the risk of hypertension among post-menopausal females of north India.

### MATERIAL AND METHODS

A sample of two hundred and fifty post-menopausal females between 45 to 80 years of age living in various parts of North India (Punjab, Haryana, Chandigarh) was randomly selected. The people of this region belong to the Indo-Aryan type. Subjects of the present study were of Hindu and Sikh religions. Background information of all the subjects about their age, education, occupation, number of children, parity, and menopausal status was collected using a detailed questionnaire. The criteria for exclusion were as follows: females who were not Rh positive, chronic diseases affecting bone, taking bone-altering medications or estrogen replacement therapy. All the subjects gave their consent for participation and ethical guidelines were followed accordingly. The institutional ethics committee (Kurukshetra University, Kurukshetra) also approved the study.

All the subjects were divided in four categories on the basis of their blood groups that is, A

(57), B (91), AB (42), O (60). Four anthropometric measurements height (cm), weight (kg), waist circumference (cm), hip circumference (cm) were taken on each subject. Height (cm) and weight (kg) were measured by anthropometer and weighing machine respectively. Waist circumference (cm) and hip circumferences (cm) of each subject were measured with Freeman's steel tape. Body mass index (BMI) was calculated as body weight divided by height squared (kg/m<sup>2</sup>). Blood sample of all the females were taken to determine their ABO blood group status by standard method using antisera. Systolic and diastolic blood pressure of each subject was taken using manual mercury Sphygmomanometer, after the subject had rested at least for 15-20 minutes. Three readings were recorded on each female and the lowest value has been included in the study. All the subjects were classified into normal and hypertensive categories by following JNC-VII criteria. Any individual with raised blood pressure (BP) values of systolic blood pressure above 140 mm of Hg and diastolic blood pressure above 90 mm of Hg was classified as hypertensive. Pulse rate was recorded from the beats of the radial artery. Mean and standard deviation values were computed using the Statistical Package for Social Sciences (SPSS) version 14.0. Mann Whitney U test was employed to find statistical significance of the differences between groups.

## RESULTS

Table 1 explains number and percentage prevalence of hypertension among post-menopausal females on the basis of their ABO blood group status. Out of the total two hundred and fifty

subjects, 170 (68%) were normal and 80 (32%) were hypertensive. Prevalence of hypertension was maximum in subjects having blood group O (10.4%) followed by blood group A (8.8%), blood group B (8%) and least in blood group AB (4.8%). Table 2 shows mean and standard deviation of various morpho-physiological variables of post-menopausal women with respect to their ABO blood group status. Systolic blood pressure of subjects with blood group O (136.15 mm of Hg) displayed higher mean value, followed by blood group A (134.70 mm of Hg), blood group B (132.55 mm of Hg) and minimum in blood group AB (131.71 mm of Hg). Similar trend was witnessed for diastolic blood pressure and pulse rate. Mean value for diastolic blood pressure was highest for subjects with blood group O (70.82mm of Hg) and least in subjects with blood group AB (84.57 mm of Hg). Pulse rate was highest in females with blood group O (70.82 beats per minute) than other blood groups and demonstrated a decreasing trend from blood group A (69.95 beats per minute) to blood group B (69.47 beats per minute) then blood group AB (69.22 beats per minute). Subjects with blood group O were heavier (64.78kg) followed by females with blood group

**Table 1: Number and percentage prevalence of hypertension among post-menopausal females on the basis of their ABO blood group status**

Blood group	Normal N (%)	Hypertensive N (%)
A (57)	35 (14%)	22 (8.8%)
B (91)	71 (28.4%)	20 (8%)
AB (42)	31 (12.4%)	12 (4.8%)
O (60)	33 (13.2%)	26 (10.4%)
Total (250)	170 (68%)	80 (32%)

**Table 2: Mean and standard deviation of various morpho-physiological variables of post-menopausal women with respect to their ABO blood group status**

Morpho-physiological variables	Blood groups			
	A (N= 57) Mean $\pm$ S.D	B (N= 91) Mean $\pm$ S.D	AB (N= 42) Mean $\pm$ S.D	O (N= 60) Mean $\pm$ S.D
Systolic blood pressure (mm of Hg)	34.70 $\pm$ 12.92	132.55 $\pm$ 12.33	131.71 $\pm$ 0.92	36.15 $\pm$ 14.82
Diastolic blood pressure (mm of Hg)	88.14 $\pm$ 8.368	86.51 $\pm$ 8.807*	84.57 $\pm$ 9.19*	90.38 $\pm$ 8.68
Pulse rate (beats per minute)	69.95 $\pm$ 3.471	69.47 $\pm$ 3.33	69.22 $\pm$ 3.15	70.82 $\pm$ 3.82
Height (cm)	156.01 $\pm$ 7.08	157.55 $\pm$ 6.22	156.29 $\pm$ 9.41	157.43 $\pm$ 7.95
Weight (kg)	60.88 $\pm$ 13.42*	60.21 $\pm$ 11.50*	62.21 $\pm$ 8.07	64.78 $\pm$ 11.41*
BMI (kg/m <sup>2</sup> )	25.01 $\pm$ 5.37	24.22 $\pm$ 4.21*	25.54 $\pm$ 3.21	26.16 $\pm$ 4.49*
Waist circumference (cm)	82.71 $\pm$ 9.88	82.22 $\pm$ 9.19	83.15 $\pm$ 7.62	83.31 $\pm$ 7.98
Hip circumference (cm)	91.44 $\pm$ 11.42	90.90 $\pm$ 11.95	92.02 $\pm$ 8.91	92.18 $\pm$ 10.05

\*Mann-Whitney U test statistically significant (p<0.05) vs blood group O

**Table 3: Mean and standard deviation values of various morpho-physiological variables of post-menopausal women with O blood group and Non-O blood group**

<i>Morpho-physiological variables</i>	<i>O blood group</i>	<i>Non O blood group</i>	<i>p-value</i>
Systolic blood pressure (mm of Hg)	136.15 ± 14.82	133.01 ± 12.21	ns
Diastolic blood pressure (mm of Hg)	90.38 ± 8.68	86.57 ± 8.81	p<0.05
Pulse rate (beats per minute)	70.82 ± 3.82	69.85 ± 3.35	ns
Height (cm)	157.43 ± 7.95	156.81 ± 7.28	ns
Weight (kg)	64.78 ± 11.41*	60.85 ± 11.45	p<0.05
BMI (kg/m <sup>2</sup> )	26.16 ± 4.49*	24.75 ± 4.42	p<0.05
Waist circumference (cm)	83.31 ± 7.98	83.05 ± 9.13	ns
Hip circumference (cm)	92.18 ± 10.05	91.37 ± 11.14	ns

\*Mann-Whitney U test statistically significant (p<0.05)

AB (62.21kg), blood group A (60.88 kg) and then blood group B (60.21kg). Similarly mean values for circumferential measurements (both waist and hip) of subjects with blood group O were highest as compared to subjects with blood group A, Blood group B and Blood group AB. Table 3 presents mean and standard deviation values of various morpho-physiological variables of post-menopausal women with O blood group and non-O blood group (that is, phenotype A, B, or AB). Subjects with blood group O were taller (157.43 vs 156.81 cm, p>0.05) and significantly heavier (64.78 vs 60.85 kg, p<0.05) than subjects with non-O blood group. Circumferential measurements (waist 83.31 vs 83.05 cm, p>0.05 and hip 92.18 vs 91.37 cm, p>0.05) and body mass index (26.16 vs 24.75 kg/m<sup>2</sup>, p>0.05) were higher among post-menopausal women with O blood group as compared to females with non-O blood group.

## DISCUSSION

Hypertension is a worldwide problem with serious implications in terms of increased morbidity and mortality rates. The present study demonstrated that total prevalence of hypertension was 32% (as per JNC VII criteria), out of which 10.4% subjects were having blood group O. Nishi et al. (2012) also observed that the incidence of hypertension was highest in blood group O (43.25%) followed by group A (27.78%), group B (22.62%), and least in group AB (6.35%). Similar finding have been reported by Jassim (2012) showing blood pressure was significantly higher in patients in blood group O than other groups, with a decreasing trend from group A to B then AB. Increased susceptibility of hypertension in blood group O may be due to individuals with blood group O have about 25% less factor VIII (F VIII) and von Willebrand factor (vWF) in

their plasma (O'Donnell and Lasffan 2001). Previous research had proven that low levels of these proteins involved in blood clotting, are a cause of excess bleeding thereby may also increase the risk of both arterial (ischaemic heart disease) and venous (thromboembolic disease) problems (Haque and Rahman 2000; Williams et al. 2000). The molecular basis of the ABO blood group system illustrated by Yamamoto et al. (1990) also suggested that the gene encodes a glycosyltransferase, which transfers *N*-acetyl D-galactosamine (group A) or D-galactose (group B) to the nonreducing ends of glycans on glycoproteins and glycolipids. The group O phenotype results from inactivation of the A1 glycosyltransferase gene, and the nonreducing ends of the corresponding glycans in group O subjects express the blood group H antigen. The biologic significance of the A/B transferase has not been clearly demonstrated, but it would be expected that loss of this functional protein in group O patients would have some deleterious consequences for patients of this blood type.

On the contrary, Sachdev (2011) observed that those carrying the B blood group were more susceptible to hypertension as compared to blood group A and O. Whereas AB blood group had less chance of getting hypertension. Abdollahi et al. (2009) found that prevalence of cardiovascular major risk factors were similar in subjects with different blood groups. Amirzadegan et al. (2005) also reported no correlation between various ABO blood groups and development of coronary artery disease. Mean values for systolic (136.15 vs 133.01 mm of Hg), diastolic blood pressure (90.38 vs 86.57 mm of Hg) and pulse rate (70.82 vs 69.85 beats per minute) were higher in subjects with blood group O than non O blood group. Subjects with blood group O were

taller (157.43 vs 156.81 cm,  $p > 0.05$ ) and significantly heavier (64.78 vs 60.85 kg,  $p < 0.05$ ) than subjects with non-O blood group. Circumferential measurements (waist 83.31 vs 83.05 cm,  $p > 0.05$  and hip 92.18 vs 91.37 cm,  $p > 0.05$ ) and body mass index (26.16 vs 24.75 kg/m<sup>2</sup>,  $p > 0.05$ ) were higher among post-menopausal women with O blood group as compared to females with non-O blood group. Kaur (2012) also observed a positive and significant association of blood pressure with body mass index, waist circumference among elderly females. Deshmukh et al. (2006) also suggested that body mass index and waist circumference were important predictor of hypertension. Hence findings of present study suggest that subjects with blood group O have greater risk of having hypertension as compared to blood group A, B and AB.

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