

# To Study the Relation between ABO Blood Groups, Prehypertension and BMI

Kavita Singh<sup>1</sup>, Rinku Garg<sup>2</sup>, Shikha Gautam<sup>3</sup>, Yogesh Tripathi<sup>4</sup>

<sup>1</sup>PG, Department of Physiology, Santosh Medical College, Ghaziabad

<sup>2</sup>Professor, Department of Physiology, Santosh Medical College, Ghaziabad

<sup>3</sup>Associate Professor, Department of Physiology, Santosh Medical College, Ghaziabad

<sup>4</sup>Professor, Department of Physiology, Santosh Medical College, Ghaziabad

## 1. Introduction

Hypertension has emerged as a major health issue in younger population in today's fast-moving life. Hypertension goes unnoticed most of the times and has been rightly termed as "silent killer".<sup>1</sup> Factors like obesity, increased fat intake, sedentary lifestyle, high cholesterol level, psychosocial stress has been implicated in the cause of hypertension. These all factors are modifiable and are common problems in younger population.<sup>2</sup>

Genetic factors are also important risk factors in developing hypertension and ABO blood group system is one such factors which needs investigation. ABO blood groups have been related to various diseases.<sup>3</sup> There are many studies which found out correlation between ABO blood group and Smoking<sup>4</sup>, pancreatic cancer<sup>5</sup>. Sharma G et al found more prevalence of lung and oral cancer in males with blood group B, while prevalence of cervical cancer was also more in females with Blood group B.<sup>6</sup> The ABO system is important genetic make up of an individual and provides valuable information for detection of diseases.<sup>7</sup> There are evidences from some studies showing link between blood groups and genetic markers and familial patterns.<sup>8</sup> The blood group system in many researches associated with various diseases including cardiovascular diseases.<sup>(9,10,11)</sup>

According to World health organization, body mass index (BMI) is defined as a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It provides a measure to determine the distribution of fat in children and adults. The precision of measurements of height and weight suggests that a variant for height for weight provides a more reliable measure of adiposity within populations.<sup>(4,13)</sup> Obesity and overweight both are harmful for health<sup>(14)</sup> and many studies have reported the link between increased BMI and risk of developing many diseases like diabetes mellitus<sup>15</sup>, stroke, coronary heart diseases<sup>16</sup>, allergic diseases.<sup>(17)</sup>

If high risk individuals are identified at an early stage, preventive lifestyle and dietary modifications can reduce the risk of developing hypertension and its complications.

And thus, to study the association between ABO blood group with prehypertension and BMI in medical students was undertaken.

## 2. Material and Methods

A cross-sectional study was conducted at Santosh medical college, Ghaziabad from February – march 2018. 250 medical students were randomly selected, who were between the age of 17-28 years. The purpose of the study was explained and informed consent was taken.

Ethical clearance was taken from the ethical committee of our college.

### Measurement of Blood Pressure

Blood pressure was measured in morning between 10-11 am, in sitting posture with the help of mercury sphygmomanometer. The subject was made to sit relaxed in a comfortable position with back and arm supported. The cuff was placed 2cm above the cubital fossa. Brachial artery was palpated and the chest piece of stethoscope was placed over it. Radial artery was palpated while inflating the cuff. It was inflated 20-30 mmHg above the point at which the radial pulse disappears. Then, cuff was deflated slowly and Korotkoff sounds were noticed. Systolic blood pressure (SBP) was recorded with the onset of clear Korotkoff sound and diastolic blood pressure (DBP) reading was noted with the disappearance of these sounds. Manometer was properly observed in a direct line to avoid parallax error. Zero error was checked prior to measurement of blood pressure. Three readings were taken at intervals of at least 1 minute, and the average value was recorded in order to acquire an accurate blood pressure. Three readings were taken and average was noted.

The individuals were categorized into normotensive, prehypertensive, and hypertensive based on the below guidelines:

Classification	SBP (mm Hg)		DBP (mm Hg)
Normal	< 120	&	< 80
prehypertension	120-139	or	80-89
Stage -I	140-159	or	90-99
Stage -II	≥ 160	or	≥ 100

### Determination of BMI

BMI (kg/m<sup>2</sup>) was calculated by Quetelet index for which height and weight was measured using standard scales and same apparatus for all the students.

Quetelet index—

$$BMI = \frac{\text{weight (kg)}}{[\text{Height (m)}]^2}$$

According to International guidelines, BMI is classified as

	BMI
Normal	18.5-24.9 kg/m <sup>2</sup>
overweight	25-29.9 kg/m <sup>2</sup>
Obese	>30 kg/m <sup>2</sup>

### Determination of Blood Group:

ABO blood group was determined by slide-agglutination test in our physiology laboratory. Under aseptic precautions blood was obtained with the help of lancet. One drop of blood was mixed with one ml of normal saline. This provided the red cell suspension. On one half of glass slide, one drop of Anti-A (Blue colour)-human poly clonal blood grouping serum was placed. On the other half of a glass slide one drop of Anti-B (yellow colour)-human poly clonal blood grouping serum was placed. Using a Pasteur pipette one drop of red blood cell suspension was added to each half of the slide. With separate applicator, the serum was well mixed back and forth and observe for agglutination.

### Statistical Analysis

Chi-square test was used to assess the frequency and percentages of pre-hypertension among the various blood groups and different categories of BMI.

Categorical variable (pre-hypertension) was presented by frequency and percentages. Multiple regression analysis was applied to assess the significant association between the dependant variables (SBP and DBP) and independent variables (age, BMI and blood groups). The significant associations were again tested by logistic regression analysis by using systolic and diastolic pressure as dichotomous variables to confirm the results.

### 3. Result

250 medical students were taken and data was analysed. Mean age of the students was 19.6 years, mean height, weight and BMI was 1.67 mt., 61.2 kg, 21.7 Kg/m<sup>2</sup>.

**Table 1:** Distribution of study subjects according to their blood group

Blood group	frequency	Percentage (%)
A	43	17.2
B	115	46
AB	26	10.4
O	66	26.4

The frequency of study subjects with blood group B is highest with 46% followed by O (26.4%), A (17.2%) and least is in AB (10.4%).

**Table 2:** Relationship of blood pressure of the study subjects according to their blood groups

Blood group	JNC – 8 BP classification			total
	Normal	prehypertension	hypertension	
A	16 (6.4%)	23 (9.2%)	4 (1.6%)	43
B	37 (14.8%)	63 (25.2%)	15 (6%)	115
AB	4 (1.6%)	20 (8%)	2 (0.8%)	26
O	23 (9.2%)	36 (14.4%)	7 (2.8%)	66

**Table 3:** Relationship of blood groups of the study subjects with BMI

BMI	Blood groups			
	A	B	AB	O
< 18.5 kg/sq m	9(3.6%)	27 (10.8%)	6(2.4%)	12 (4.8%)
18.5- 24.9 kg/sq m	28 (11.2%)	69 (27.6%)	12 (4.8%)	39 (15.6%)
25 -29.9 kg/ sq m	5 (2%)	19 (7.6%)	4 (1.6%)	10 (4%)
>29.9 kg/ sq m	0	6 (2.4%)	3 (1.2%)	1 (0.4%)

### 4. Discussion

Prevalence of hypertension is increasing rapidly among Indians.<sup>(18)</sup> An early and a regular screening to detect underlying hypertension is necessary to prevent any future complications<sup>(19,20)</sup> and to start control measures for hypertension. A non-modifiable factor like blood group can be used as a predictor for hypertension and its awareness can be created to initiate early lifestyle modifications in the susceptible group.<sup>21</sup>

Different studies have suggested the association of ABO blood group with different diseases and so the knowledge of distribution of blood groups may help in managing the various health issues.<sup>22</sup> Several vascular disorders like atherosclerosis and thromboembolism are linked to non -O blood groups and hypercholesterolaemia was the probable cause in these individuals.<sup>23</sup>

It was observed that B blood group was most common type of blood group in our study subjects. (46%>26.4% >17.2%>10.4% - B> O>A>AB)The blood group frequency distribution in North India is B>O>A>AB. The study conducted in Amritsar also observed similar frequency distribution B (38.5%)>O (33.5%)>A (21.62%)>AB (5.12%).<sup>21</sup> and this trend was followed by our study also.

Our study reported increased prevalence of prehypertension (25.2%) and also the tendency for being overweight (7.6%) (BMI = 25 -29.9 kg/sq.m) in subjects with B blood group. This could possibly suggest that students with B blood group are more prone to develop prehypertension and these findings are similar to findings of a study conducted with 340 medical students of Nepal medical college. However, O blood group was most common in their study subjects. (1524) Another study conducted in blood donors showed that B blood group was more susceptible to develop hypertension and obesity.<sup>25</sup>

Qung and Abdel Hamid found high incidence of overweight and high leptin levels in subjects with group B compared to other blood groups within 151 staff and student participant.<sup>26</sup> This is similar to our findings which shows 7.6% of subjects with B blood group being overweight, in comparison with blood group O >A>AB.

This study indicates that individuals having BMI >25kg/m<sup>2</sup> are at the risk of getting pre-hypertension and subsequent hypertension later on. The current study observed that 48% of obese population was pre-hypertensive. (27) Modifying weight help to modify the development of hypertension rate.<sup>(28)</sup>

## 5. Conclusion

Blood group B was predominant and it showed increased predisposition to prehypertension and increased BMI. The increased BMI ( $< 25\text{kg/m}^2$ ) may be one of the reasons for increased prevalence of prehypertension. Thus, we can conclude that various health awareness programmes should be organized to make society aware of blood group-related diseases and to develop effective ways to identify the high-risk population of pre-hypertension. This can reduce the risk of hypertension and cardiovascular complications associated with it.

## 6. Limitations

Further studies should be conducted with larger and wider group of population.

## 7. Acknowledgment

We are very grateful to the first year students of our medical college for their co-operation and participation in conducting the study. We are also thankful to the technical staff for their valuable help in collecting the data.

## References

- [1] Varghese A, Abraham ML, Ramachandran R, Thomas SA. Prospective study of the relationship between blood pressure and blood group among adult male blood donors in a Tertiary care center. *Inter J Clin Exp Phys*. 2015; 2: 51-5
- [2] Somer SK, Leo KC, Shields R, Clary M, Mark AL. Forearm endurance training attenuates sympathetic nerve response to isometric handgrip in normal humans. *Journal of Applied Physiology*. 1992;72(3):1039-43.
- [3] Pell S, D'Alonzo CA, Fleming AJ. A study of the relation of the ABO blood groups to peptic ulceration and hypertension. *Ann Intern Med*. 1957;46:1024-1030. doi: 10.7326/0003-4819-46-6-1024
- [4] Geoffrey J. Bourke, John P. O'riordan. Distribution of ABO and rhesus blood groups In relation to smoking habit. *Brit. J. Prev. Soc. Med.* (1964); 18: 109-13 blood groups in Blood donors. *Iran J Ped Hematol Oncol*.2(4): 140-145, 2012.
- [5] Wolpin BM, Chan AT, Hartge P, Chanock SJ, Kraft P, Hunter DJ, Giovannucci EL, Charles S. Fuchs, et al. ABO Blood Group and the Risk of Pancreatic Cancer. *J Natl Cancer Inst*. 2009;101(6):424-31
- [6] Sharma G, Choudhary R, Bharti D. Studies Showing the Relationship between ABO Blood Groups and Major Types of Cancers. *Asian J. Exp. Sci*. 2007;21(1): 129-13
- [7] Chuemere AN, Olorunfemi OJ, Nwogu JU, et al. Correlation between blood group, hypertension, obesity, diabetes, and combination of prehypertension and pre-diabetes in school aged children and adolescents in Port Harcourt. *IOSR J Dental Med Sciences*. 2015; 1(14): 83-89.
- [8] Kaur M. Correlation between body mass index and blood pressure in adolescents. *Pak J Physiol*. 2016; 12: 47-50.
- [9] Sukalingam K, Ganesan K. Rhesus Blood Groups Associated with Risk to Obesity and Diabetes Mellitus: A Report on Punjabi Population in Selangor, Malaysia. *Int J Intg Med Sci*. 2015; 2: 105-09
- [10] S. Biswas, P. K. Ghoshal, B. Halder, and N. Mandal, "Distribution of ABO blood group and major cardiovascular risk factors with coronary heart disease," *BioMed Research International*, vol. 2013, pp. 1-5, 2013
- [11] M. He, B. Wolpin, K. Rexrode et al., "ABO blood group and risk of coronary heart disease in two prospective cohort studies," *Arteriosclerosis, Thrombosis, and Vascular Biology*, vol. 32, no. 9, pp. 2314-2320, 2012
- [12] D'Adamo P, 2006. *Arthritis: Fight it with the Blood Type Diet*. Berkley Books, p: 300. ISBN 9780425207406
- [13] Parveen N, Rehman J, Hassan SH, Hassan Z, Rehman M. Different blood groups; association with body mass index in medical students of Karachi. *Professional Med J* 2016;23(8):1001-1004. DOI: 10.17957/TPMJ/16.3215
- [14] *Obesity and Overweight, 2017*, <http://www.who.int/mediacentre/factsheets/fs311/en/index.html>.
- [15] Bays HE, Chapman RH, Grandy S. The relationship of body mass index to diabetes mellitus, hypertension and dyslipidaemia: comparison of data from two national surveys. *International Journal of Clinical Practice*. 2007;61(5):737-747. doi:10.1111/j.1742-1241.2007.01336.x.
- [16] Lamon-Fava S, Wilson P, W Schaefer EJ. Body mass index and coronary heart disease risk factors in men and women: the Framingham Offspring Study. *Arterioscler Thromb Vasc Biol*. 1996;16:1509-1515
- [17] A. Irei, K. Takahashi, D. S. N. Le, P. Ha, and N. Hung, "Obesity is associated with increased risk of allergy in Vietnamese adolescents," *European Journal of Clinical Nutrition*, vol. 59, no. 4, pp. 571-577, 2005
- [18] Garg R, Malhotra V, Kumar A, Dhar U, Tripathi Y. Effect of Isometric Handgrip Exercise Training on Resting Blood Pressure in Normal Healthy Adults. *Journal of Clinical and Diagnostic Research: JCDR*. 2014;8(9):BC08-BC10. doi:10.7860/JCDR/2014/8908.4850.
- [19] Garg R, Malhotra V, Dhar U, Tripathi Y. The isometric handgrip exercise as a test for unmasking hypertension in the offsprings of hypertensive parents. *Journal of Clinical and Diagnostic Research*. 2013;7(6):996-999.
- [20] Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: Analysis of worldwide data. *Lancet* 2005;365:217-23
- [21] Manjeet Kaur, Kawalpreet Gill, Roopam Bassi, Deepinder Kaur. Association of ABO and Rh blood groups. *Pak J Physiol* 2016;12(2)
- [22] Pasha AK, Hashir MM, Khawar S. Frequency of ABO blood Groups among Medical Students. *J Surg Pak*. 2009; 14: 15-20
- [23] Etemadi A, Kamangar F, Islami F, Poustchi H, Pourshams A, Brennan P, et al. Mortality and cancer in relation to ABO blood group phenotypes in the Golestan Cohort Study. *BMC Med*. 2015; 13: 8.
- [24] Sapktoa, Jyotshna. (2018). *Relation of ABO Blood Group and Hypertension in Medical Students of Kathmandu Medical College, Duwakot Bhaktapur*.

*International Journal of Science and Research (IJSR).*  
6. 10.21275/ART20177693.

- [25] Chandra T, Gupta A. Association and Distribution of Hypertension, Obesity and ABO Blood groups in Blood Donors. *Iranian Journal of Pediatric Hematology and Oncology.* 2012;2(4):140-145.
- [26] YA. Qunq, A. Hamid. ABO blood group associations with obesity in random samples from Advanced Medical and Dental Institute Staff and Students. *Biohealth Science Bulletin.* 4(1),18 – 23,2012
- [27] Shireen Jawed, Sadaf Zia, Sundus Tariq. Frequency of different blood groups and its association with BMI and blood pressure among the female medical students of Faisalabad. *JPMA* 67: 1132; 2017.
- [28] Gupta J, Kumar S, Agrawal S. Study of Association between Body Mass Index and Hypertension in Elderly in a Rural Teaching Hospital. *World Journal of Pharmaceutical and Medical Research.* 2016;2(3):107-9.