# Association Between Hypertension and ABO Blood Groups: A Prospective Study among Students

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## Abstract

**Background**: High blood pressure (BP) is a major public health problem in India and its prevalence is rapidly increasing among both urban and rural populations. Age, gender, genetic factors and ethnicity are non-modifiable risk factors of hypertension. The ABO blood group is inherently heritable, genetically detected at time of conception and becomes permanent for whole life. This study intends to find out any effect of different blood groups on development of hypertension.

**Method :** A total of 172 subjects were studied between March 2017 to June 2018. Blood pressure of all the participants in the study was recorded using mercury sphygmomanometer. The formula, weight in kg was divided by height in meter square was used to calculate the BMI of patients and unit is kg/m2. The data collected was compiled and analysed using chi-square test. SPSS ver. 16 was used for this. P value of <0.005 was considered highly significant.

**Conclusion**: Blood group B has the highest tendency to be obese and developed both prehypertension and hypertension. Whereas blood group AB has least chance to develop hypertension and obesity.

***Key Words**: -ABO Blood Group, BMI, Hypertension, Obesity, Prehypertension*

## Introduction

High blood pressure (BP) is a major public health problem in India and its prevalence is rapidly increasing among both urban and rural populations.[1, 2] In fact, hypertension is the most prevalent chronic disease in India. Worldwide, 7.6 million premature deaths (about 13.5% of the global total) were occurring due to higher blood pressure. Globally around 54% stroke and 47% IHD (ischemic heart disease) were occurring because of high blood pressure.[3]

In India, total prevalence for hypertension was 29.8% (95% CI: 26.7–33).[4] Age, gender, genetic factors and ethnicity are non-modifiable risk factors of hypertension.

ABO blood group is one of them that requires to be investigated in some detail. Since hypertension is multifactorial, the ABO antigens might indirectly have some effect on arterial pressure. This ABO blood groups pattern was classified by the detection of A and B antigens on membrane of human RBC (red blood cell).[5] The antibodies that detected against RBC antigens called agglutinins. These antibodies were present in the individuals' serum whose RBCs had absence of corresponding antigen. ABO group was distributed into four major blood groups A, B, AB and O depending upon detection of these antigens and agglutinins in individuals.[5,6] The ABO blood group is entirely and inherently heritable, genetically detected at time of conception and became permanent for whole life. Therefore,frequency distribution of ABO blood group following to known pattern was regulated by transmission of gene from one generation to next generation and it differs geographically and racially among human beings.[7]

According to JNC 8, systolic 90-119 mm of Hg and diastolic 60-79 mm of Hg is normal blood pressure. Hypertension is a condition where systolic pressure

is >120 mm of Hg and diastolic is >80 mm of Hg. Prehypertension (high normal), systolic blood pressure is 120-139 mm of Hg and diastolic is 80-89 mm of Hg. In stage 1 hypertension, systolic blood pressure is 140-159 mm of Hg and diastolic is 90-99 mm of Hg. In stage 2 hypertension, systolic blood pressure is 160-179 mm of Hg and diastolic is 100-109 mm of Hg. In stage 3 hypertension (hypertensive emergency), systolic pressure is ≥180 mm of Hg and diastolic is ≥110 mm of Hg. Isolated systolic hypertension ≥140 mm of Hg and diastolic <90 .[8]

## Material and Method

The study was done in the Department of Physiology, Darbhanga Medical college& Hospital. A total of 172 subjects were studied between March 2017 to June 2018. Blood pressure of all the participants in the study was recorded using mercury sphygmomanometer. Blood pressure of individuals recorded in sitting position after the subject had been rested for at least 5 minutes. Two measurements of Blood pressure recording over the period of at least 3 minutes was obtain on left arm in sitting position by using mercury sphygmomanometer. The blood pressure at which the first Korotkoff sound heard would indicate systolic B.P and the pressure when the sound disappears would indicate diastolic B.P. The blood for blood grouping was obtain by finger prick in aseptic condition and ABO and Rhesus blood group was determine by using anti-sera by slide method. Height in meter and weight in kilogram (kg) of participants were measured to calculate BMI. The formula, weight in kg was divided by height in meter square was used to calculate the BMI of patients and unit is kg/m2. According to WHO (World Health Organization), "Asian Criteria" for BMI cut off point are less than 18.5 is underweight,18.5-22.9 is normal, 23-24.9 is overweight, 25-29.9 is pre-obese, ≥ 30 obese, 30-40 type 1 obese, 40.1-50 type 2 obese and more than 50 is type 3 or super obese.The data collected was compiled and analysed using chi-square test. SPSS ver. 16 was used for this. P value of <0.005 was considered highly significant.

## Results

The data of 172participants were collected and analysed by chi-square test. The mean age of students is 21.43 years. In total, 87(50.6%) were male and 85(49.4%) were female. Maximum 60(34.9%) had blood group B. Minimum students, 17(9.9%) had AB blood group. Most common blood group in both sexes was B group. Out of 172 students,162 students have Rhpositive blood group and 10 have negative. Seven male and 3 female had negative blood group.

**Table 1: Gender distribution according to blood group of students**

| Blood Group | Male | Female | Total |
|---|---|---|---|
| A | 22 (12.8) | 24 (13.9) | 46 (26.74) |
| B | 30(17.44) | 30 (17.44) | 60 (34.9) |
| AB | 8 (4.65) | 9 (5.23) | 17 (9.9) |
| O | 27 (15.7) | 22 (12.8) | 49 (28.5) |
| Total | 87(50.6) | 85(49.4) | 172 (100) |
| Rh(+) | 80 | 82 | 162 |
| Rh(-) | 7 | 3 | 10 |

Maximum 4 (2.33%) students had obesity (≥30) was found in students with blood group B. There were no obese students in blood group AB. Students with blood group O were maximum 10(5.81%) underweight. Maximum

overweight (23-24.9) was found in A blood group. And pre-obese were maximum (5.23%) in B blood group. So, tendency of obesity was maximum in B and minimum in AB blood group.

**Table 2: BMI distribution according to blood group**

| Blood Group | Under weight | Normal | Overweight | Pre-Obese | Obese | Total |
|---|---|---|---|---|---|---|
| A | 6 | 23 | 9 | 7 | 1 | 46 |
| B | 5 | 34 | 8 | 9 | 4 | 60 |
| AB | 1 | 11 | 3 | 2 | 0 | 17 |
| O | 10 | 27 | 7 | 5 | 0 | 49 |
| Total | 22 | 95 | 27 | 23 | 5 | 172 |

**Table 3: Systolic and Diastolic blood pressure stages in relation to different blood groups**

| | Normal | | Prehypertension | | Stage 1 HTN | | Total |
|---|---|---|---|---|---|---|---|
| | Systolic | Diastolic | Systolic | Diastolic | Systolic | Diastolic | |
| A | 26 | 23 | 20 | 21 | 0 | 2 | 46 |
| B | 25 | 26 | 32 | 31 | 3 | 3 | 60 |
| AB | 12 | 10 | 5 | 6 | 0 | 1 | 17 |
| O | 30 | 25 | 19 | 22 | 0 | 2 | 49 |

Table 3 shows that blood group B has maximum prehypertension (systolic) n = 32(18%) and maximum prehypertension(diastolic) n=31(18.02%). It also shows that blood group B has maximum stage 1 hypertension(systolic) 3 (1.74%) as well as maximum stage I Hypertension for diastolic blood pressure n = 3(1.74%). Students with blood group AB has minimum prehypertension and no stage 1 hypertension for both systolic and diastolic blood pressures.

**Table 4: Comparison of BMI with different stages of systolic blood pressure**

| Body Mass Index | Normal | Pre-Hypertension | Stage 1 Hypertension | Total | Chi-square test |
|---|---|---|---|---|---|
| Under weight | 17 | 5 | 0 | 22 | |
| Normal | 58 | 37 | 0 | 95 | |
| Overweight | 8 | 19 | 0 | 27 | 0.00 |
| Pre-Obese | 8 | 12 | 3 | 23 | |
| Obese | 2 | 3 | 0 | 5 | |
| Total | 93 | 76 | 3 | 172 | |

**Table 5: Comparison of BMI with different stages of diastolic blood pressure**

| Body Mass Index | Normal | Pre-Hypertension | Stage 1 Hypertension | Total | Chi-square test |
|---|---|---|---|---|---|
| Under weight | 16 | 6 | 0 | 22 | |
| Normal | 54 | 39 | 2 | 95 | |
| Overweight | 7 | 18 | 2 | 27 | 0.00 |
| Pre-Obese | 6 | 15 | 2 | 23 | |
| Obese | 1 | 2 | 2 | 5 | |
| Total | 84 | 80 | 8 | 172 | |

## Discussion

This current study showed that the B blood group has more tendency to develop hypertension and obesity followed by blood group O, A and AB. Whereas AB blood group has least chance of getting hypertension and obesity. Similar result were seen in study done in Iran by Abdollahi AA et.al.[9]

In this study, blood group O was the most common type, maximum 112(32.9%) and AB is least common 32(9.4%). A Saudi Arabian study also showed similar result.[10] A study done by Siva KGV had shown different result. That study showed blood group O was more susceptible for obesity. But in current study, blood group B had more prevalence of overweight, obesity and hypertension.[11]

A study done by Das PK et al in the southern region of India the commonest blood group be of the O type and the second commonest to be of the B type.[12]Another study done by Behera Swikruiti showed O blood group was most common type in male and A was common in female. Whereas blood group AB had maximum Body Fat Percentage (BFP) >21% and Waist Hip Ratio (WHR)>0.9.[13] In similar study, showed blood group B had high incidence of obesity and high leptin level.[14] A study was done in Saudi Arabia by AboelFetoh, which showed no statistically significant association among overweight, obesity and blood group.[15] Similar study showed the most common type of bloodgroup was A. which was associated with higher incidence of high serum cholesterol level, HTN and DM but no significant association.[16] A study done in Iran showed similar result blood group A was the most common type with high tendency of getting obese and overweight.[17]Intwo different studies done by Purushottam A, Yadav S, et al and Warghat NE, Sharma NR et al the results are on a similar trend to our study with the RH positive blood group being more common.[18,19]A study was carried out in medical students of Kasturba Medical Collegeshowed tendency of prehypertension was associated with increased BMI. And blood group O was more susceptible to develop hypertension.[20]

## Conclusions

Blood group B has the highest tendency to be obese and developed both prehypertension and hypertension. Whereas blood group AB has least chance to develop hypertension and obesity.

**Ethical Clearance**: Present study was approved by Departmental ethical committee, DMC,Laheriasarai, Darbhanga, Bihar

**Conflict of Interest:** – Nil

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