



ORIGINAL ARTICLE

## Association of blood pressure with frequency of different blood groups and body mass index among medical students.

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**ABSTRACT... Objective:** To determine the association of blood pressure with frequency of different blood groups and body mass index among medical students. **Study Design:** Cross-Sectional study. **Setting:** Ameer-ud-Din Medical College /Postgraduate Medical Institute, Lahore, Pakistan. **Period:** May 2022 to August 2022. **Material & Methods:** Comprised 105 healthy both male and female medical students of 1<sup>st</sup> year and 2<sup>nd</sup> year MBBS. Participants were divided into groups following ABO blood grouping and body mass index criteria. Blood grouping was done by using conventional slide method. Manual auscultatory method consisting of mercury sphygmomanometer was used for estimation of blood pressure. Blood Pressure of female students was measured during follicular phase (days 7-11) of menstrual cycle to exclude role of emotional state and endocrinological factors for causing variation in blood pressure. Data was analysed by using SPSS 26. **Results:** There were 105 students with an overall mean age of 19.7±1.2 years. Blood group B&O found most predominant with equal prevalence of 35(33.3%). Prevalence of prehypertension among our study subjects was found 17.4%. Mean systolic, diastolic and mean arterial pressure were not found statistically significant among blood groups; p values 0.39, 0.28 and 0.25 respectively. No statistically significant difference of pre hypertensive subjects (n=18) were noted among ABO blood groups. (p=0.201). Statistical analysis showed significant association of DBP and MAP with BMI, p=0.014 and p=0.011 respectively. 38.5% of obese subjects were found prehypertensive. Highest percentage of obese subjects with pre-hypertension was noted among blood group O. Among underweight and normal weight subjects highest of pre- hypertensives were found to have blood group AB., but no significant association of pre-hypertensive subjects among different groups of BMI (p=0.184). **Conclusion:** B&O blood group were found predominant with equal prevalence. No statistically significant association of prehypertensive subjects were found among different ABO blood groups and different groups of BMI.

**Key words:** BMI, Blood Group, Medical Students, Prehypertension.

### INTRODUCTION

In low income countries hypertension is more common, where approximately 80% of deaths are due to cardiovascular diseases.<sup>1</sup> It is predicted that global burden of hypertension may cross 1.5 billion by year 2025.<sup>2</sup>

Sedentary and unhealthy lifestyle in adolescents and increase of obesity in children and teenagers is causing an increase in its prevalence.<sup>3</sup> It has been considered traditional risk factor for cardiovascular diseases and can cause cerebrovascular accident.<sup>4</sup> In 1962 association

of ABO blood group with cardiovascular disease was first reported. A link between ABO blood type and hypertension independent of conventional cardiovascular modifiable risk factor has been suggested.<sup>5</sup> The distribution of hypertension in population resembles racial distribution and familial pattern of inheritance of ABO blood groups.<sup>6</sup> There has been great importance of ABO blood group system in different disease studies.<sup>7</sup> In previous researches high blood pressure has been shown to be associated with many genetic markers and familial patterns.<sup>8</sup>

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ABO blood group system was first discovered by Karl Landsteiner in 1901.<sup>9</sup> Then in 1940 Weiner and Karl Landsteiner identified another system called Rhesus blood group.<sup>10</sup>

Control of ABO gene expression regulates ABO blood group system.<sup>11</sup> On chromosome no 9 and 1 respectively genes for ABO antigens and Rh antigens are located.<sup>7,9</sup>

The exact mechanism for observed associations of ABO blood groups with cardiovascular disease are inconclusive and require further investigation. Blood groups association with different diseases and cancers has been observed in various researches, but more broad researches are needed in this regard.

Many past researchers reported the association of blood group B with hypertension and obesity.<sup>12</sup>

This study might be fruitful in providing valuable information for early detection and adoption of preventive measures in subjects at risk of developing high blood pressure on the basis of their blood group.

Monitoring prevalence of prehypertension is necessary as it is also associated with adverse cardiovascular outcomes and 1/3 of prehypertensives are found to progress to hypertensive stage within four years.<sup>13</sup>

Increased susceptibility to hypertension might be reflected by detection of a positive relation with blood groups which should be investigated further.

This study will explore the ABO blood type and body mass index relation with blood pressure levels in healthy adolescent population.

## MATERIAL & METHODS

This cross-sectional study was conducted at Ameer-ud-din Medical college/PostGraduate Medical Institute Lahore Pakistan from May 2022 to August 2022 and comprised healthy both male and female medical students of 1<sup>st</sup> year & 2<sup>nd</sup> year MBBS.

Following formula was used for calculation of sample size for Proportions;

$$n = z^2(1-\alpha/2) \times P(1-P) / \text{Diff. (Design effect)} / d^2$$

(precision level)

$z = 1.96$  for 95% confidence interval

$p$  value  $< 0.05$  was considered statistically significant

$P$  for Blood Group B<sup>14</sup> = 44.8%, Diff. For Random sampling = 1

$d$  = degree of precision = 10%

After getting approval from research and ethics committee of the institute Reference No. (00-10-A-2022), this study was conducted. Rationale of the study was explained to study subjects. After obtaining formal consent of participants, selected through random sampling appropriate data regarding nationality, home place, age, medical problems and family medical history were obtained on a proposed pro-forma. Participants with diseases of cardiovascular system, diabetics, rheumatic fever history, having thyroid problems, congenital disorders and cancerous diseases were excluded.

Division of participants into four groups was done based on their ABO blood groups due to presence of antigen A and antigen B on red blood cell surface membrane.

For analysis based on BMI, participants were categorised into subgroups following criteria of WHO for Asians; underweight (BMI  $< 18.5$  kg/m<sup>2</sup>), normal weight (BMI 18.5-22.9 kg/m<sup>2</sup>), overweight (23-24.9 kg/m<sup>2</sup>) and obese (BMI  $> 25$  kg/m<sup>2</sup>)<sup>15</sup>

Blood pressure of female students was measured during follicular phase (days 7-11) of menstrual cycle to exclude role of emotional state and endocrinological factors for causing variation in blood pressure.<sup>16</sup> The phase of cycle determined from the date of onset of bleeding.

For calculation of BMI according to formula: BMI = weight in kg/height in m<sup>2</sup> stadiometer was used for anthropometric parameters.<sup>3</sup>

Simple conventional slide method was used for determination of blood groups. Under aseptic

measures, finger pricking with sterile lancet was done to obtain blood. Three ultra dry and sterile glass slides marked as A, B and D were used for placing blood drops. Then a drop of antisera anti-A, anti-B and anti-D was added on each slide. Three separate tooth picks were used to mix blood with antisera. Then on the basis of agglutination reaction blood groups were determined.<sup>17</sup>

Manual auscultator technique with a mercury sphygmomanometer was used for measurement of blood pressure like suggested by American Heart Association (AHA).<sup>18</sup> Before measurement of blood pressure subjects were allowed to sit relaxed comfortably for sixty seconds with arm and back in resting condition. After exposing required area cuff was tied about 2cm upward the cubital fossa. Stethoscope chest piece was put over brachial artery after its palpation. With palpation of radial artery inflation of cuff was done about 20-30mmHg above the threshold at which radial pulse vanishes. While cuff deflation reading of systolic pressure was measured with the beginning of distinct korotkoff sound and measuring of diastolic pressure was done with the fading of korotkoff sounds. To avoid parallax error and zero error careful observation of manometer was done. To measure correct blood pressure three readings with gap of one minute were recorded and then their average was taken.<sup>18</sup>

By following guidelines of joint National committee (JNC) Hypertension was classified as; (>140mmHg SBP and /or >90mmHg DBP) as hypertension, (121/81 to 139/89 mmHg) as Pre – hypertension, (91/61 to 120/80 mmHg) as normal and (<90/60 mmHg), as low.<sup>19</sup>

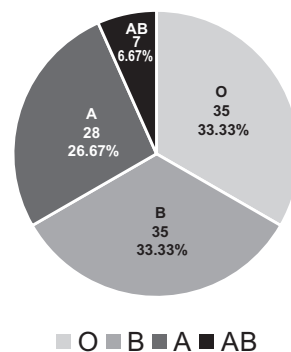
For data analysis SPSS 26 was used. Descriptive statistics was used for evaluation of demographic data of study participants. Mean ± standard deviation (SD) was used for expression of continuous variables like systolic, diastolic blood pressure, age and BMI. Frequency and percentages were used for presentation of categorical variable like pre-hypertension. To test for normality of data shapiro-wilk test was used. Then for the comparison of means parametric

test (ANOVA) was used. Pre-hypertension was expressed as absence versus presence. Prehypertension frequency and percentages between the varied blood groups and different grades of BMI for Asians (underweight, normal weight, over weight and obese) were determined by using chi- square test. Statistically significant was regarded as P<0.05.

**RESULTS**

Total 105 participants were enrolled for study including fifty female students and fifty five male students. The distribution of frequencies and percentage of Blood groups among subjects is 28(26.66%), 35(33.33%), 7(6.66%), 35(33.33%) for A, B, AB and O respectively. (Figure-1)

**Blood group distribution**



**Figure-1. Distribution of blood groups**

	Minimum	Maximum	Mean	Std. De- viation
Age	18	26	19.78	1.185
Weight	38	115	60.08	14.471
Height	1.50	1.89	1.6812	0.08800
Systolic Blood Pressure	90	140	113.71	8.689
Diastolic Blood Pressure	60	100	75.48	6.741
Mean Arterial Pressure	70.00	110.00	88.1714	6.35731

**Table-I. General characteristic of the study population**

Prevalence of prehypertension among our study subjects was found to be 17.4%.

The mean SBP (113.71±8.689), DBP (75.48±6.741) and MAP (88.17±6.357) were not found statistically significant among blood groups, p values 0.389, 0.277 and 0.252 respectively. (Table-II)

Highest percentage of pre-hypertensives were found among blood group A B but no statistically significant difference of prehypertensive subjects (n=18) were noted among ABO Blood groups (p=0.201) (Table-II)

Mean SBP values were 112.14 ± 10.04, 112.77 ± 8.59, 115.59 ± 6.35 and 118.08 ± 7.51 for four groups of BMI respectively, while mean DBP values were 72.68 ± 7.26, 75.32 ± 5.84, 78.24 ± 6.83 and 78.46 ± 6.58 respectively for all four groups of BMI. Mean MAP values were 85.83±7.45, 87.69 ±5.53, 90.68±6.07 and

91.66±4.81 respectively for all four groups of BMI, (Table-III).

Statistical analysis showed significant association of DBP and MAP with BMI, p=0.0146 and p=0.0119 respectively. Though SBP did not have statistical significant association (p=0.135) but it showed a positive trend towards BMI. (Table-III)

Highest percentage of obese subjects with prehypertension was noted among blood group O. Among underweight and normal weight subjects highest percentage of pre hypertensives were found to have blood group AB. (Table-IV) but no significant association of prehypertensive subjects among different groups of BMI. (Table-III)

Study Groups (n=105)	SBP (mm Hg) Mean ± SD	DBP (mm Hg) Mean ± SD	Mean Arterial Pressure (2/3 DBP + 1/3 SBP)	Normotensive (SBP ≤ 120 AND DBP ≤ 80)	Pre-Hypertensive (SBP ≥ 121 OR DBP ≥ 81)
A (n=28)	112.86 ± 6.86	74.29 ± 5.40	87.08 ± 4.73	26 (92.9%)	2 (7.1%)
B (n=35)	115.29 ± 8.66	77.29 ± 6.79	89.85 ± 6.52	26 (74.3%)	9 (25.7%)
AB (n=7)	116.43 ± 16.0	75.00 ± 9.57	88.81 ± 6.36	5 (71.4%)	2 (28.6%)
O (n=35)	112.29 ± 8.17	74.71 ± 6.96	87.24 ± 6.33	30 (85.7%)	5 (14.3%)
P-value	0.389	0.277	0.252	0.201	

Table-II. Comparison of study variables among ABO study groups

Study Groups (n=105)	SBP (mm Hg) Mean ± SD	DBP (mm Hg) Mean ± SD	Mean Arterial Pressure (2/3 DBP + 1/3 SBP)	Normotensive (SBP ≤ 120 AND DBP ≤ 80)	Pre-Hypertensive (SBP ≥ 121 OR DBP ≥ 81)
Underweight n=28 (BMI < 18.5)	112.14±10.04	72.68±7.26	85.83±7.45	24 (85.7%)	4 (14.3%)
Normal Weight n=47 (BMI=18.5-22.9)	112.77±8.59	75.32±5.84	87.69±5.53	40 (85.1%)	7 (14.9%)
Overweight n=17 (BMI=23-24.9)	115.59±6.35	78.24±6.83	90.68±6.07	15 (88.2%)	2 (11.8%)
Obese n=13 (BMI ≥ 25)	118.08±7.51	78.46±6.58	91.66±4.81	8 (61.5%)	5 (38.5%)
P-value	0.135	0.0146	0.0119	0.184	

Table-III. Study variables comparison among subgroups of BMI.

		Blood Groups			
		O	B	A	AB
Underweight	Normotensive	10(100%)	6 (75%)	5(83%)	3(75%)
	Pre-Hypertensive	0	2 (25%)	1(17%)	1(25%)
Normal Weight	Normotensive	13(100%)	12(71%)	14(93%)	1(50%)
	Pre-Hypertensive	0	5(29%)	1(7%)	1(50%)
Overweight	Normotensive	6(100%)	6(75%)	3(100%)	0
	Pre-Hypertensive	0	2(25%)	0	0
Obese	Normotensive	1(17%)	2(100%)	4(100%)	1 (100%)
	Pre-Hypertensive	5(83%)	0	0	0

Table-IV. Distribution of blood groups type according to BMI and Blood Pressure

## DISCUSSION

ABO blood group distribution diversity has been described by various studies across the whole world population including Pakistan.<sup>9</sup> Various previous studies documented the relation of ABO blood groups with different diseases.<sup>7</sup> Past researches results are conflicting about relation of blood pressure with frequency of different blood groups. This study was done to explore association of frequency of ABO blood type and body mass index relation with blood pressure levels in healthy adolescent population.

Most common blood groups among sample studied were B and O showing equal prevalence, followed by A, and AB group was the least common. In the year 2021 published review article reported that in Pakistan, frequency (%age) of blood group B is 33.4%, while O is 33.1%, A is 23.9% and AB is 9.74% which are very close to our frequency distribution of blood group results.<sup>22</sup> Recently another review article reported blood group B as most prevalent and like our study results AB blood group has been shown as least prevalent in Pakistani Population.<sup>23</sup>

Prevalence of prehypertension in the current study was found to be 17.4% for study subjects. Different population based surveys evaluation, reported pooled prevalence of hypertension in Pakistan to be 26.45 with more urban burden (26.6%) in comparison to rural. (21.3%).<sup>24</sup> A cross-sectional study from eastern Nepal found prevalence of prehypertension in adolescents of 20.8%.<sup>25</sup>

No statistically significant difference of systolic, diastolic and MAP between various blood groups was found. Our result is similar to studies performed by GAO Jiang et al<sup>20</sup> and Siddiqui N et al<sup>5</sup> where no significant association of blood pressure and blood group was identified.

Additionally, we have measured Blood pressure in females during follicular phase of menstrual cycle to exclude the pre-menstrual hormonal (Progesterone) effect on Blood pressure<sup>16</sup>, while other studies have not distinguished the pre-menstrual hormonal effect on Blood pressure

which may be a confounding factor in their studies.

In this study highest percentage of pre hypertensives were found among blood group AB. Similarly another study in valley view university found higher prevalence of Prehypertension among group AB.<sup>4</sup>

BMI has been considered as a risk factor for prehypertension and hypertension by previous researches. Previous studies documented 9-12% of prehypertensive and 7.7% adolescent hypertensives are overweight.<sup>21</sup> Current study indicated that 39% of obese adolescents are prehypertensives. Similar to our study another study conducted in Faisalabad university students found 29.7 % of study population was obese and concordant to our study results individuals with blood group O were found more prone to obesity<sup>26</sup> and no individual with blood group AB was found overweight or obese. But in the current study there is no significant association of prehypertensive subjects among different groups of BMI ( $p=0.184$ ).

Our result is similar to study by Zafar et al<sup>24</sup> and study by Kwaling et al<sup>4</sup> in which no significant association of BP with BMI was found. However significant association of BP with BMI was found in previous studies in Pakistan on medical students.<sup>12,14</sup>

Limitation of the current study was small sample size so for this reason its findings may not portray the entire population.

## CONCLUSION

Prevalence of Prehypertension among medical students was found to be 17.4%. However no significant association of blood pressure and blood group was identified. 39% of obese adolescents were found as prehypertensive. But no significant association of prehypertensive subjects among different groups of BMI.







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3	Umara Yousaf	Write up, Literature search.	
4	Muhammad Fawad Ahmad Khan	Data collection.	
5	Amer Hassan Siddiqui	Concept, Literature review, Study design.	
6	Ahmar Arif	Data analysis & Data interpretation.	
7	Mohammad Saad Tanveer	Data analysis, Data interpretation.	