

## Research Article

# Prevalence of pre-hypertension and its relationship with body mass index among the medical students of Agartala government medical college

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### ABSTRACT

**Background:** Body Mass Index (BMI) is found to be positively co-related with the increased prevalence of elevated blood pressure among younger individuals. The present study was designed to find out the prevalence of pre-hypertension and its relationship with BMI among the medical students.

**Methods:** A cross-sectional study was conducted during June - July 2013 among 306 medical students of Agartala government medical college, chosen by stratified random sampling.

**Results:** Prevalence of pre-hypertension, hypertension and optimum BP were found to be 45%, 4% and 51% respectively. Mean BMI was found to be  $21.68 \pm 3.55$ , 80% of the students had ideal waist hip ratio, 19% were underweight, 61% had normal weight, 18% were overweight, and 2% were found to be obese. Pre-hypertension was significantly more prevalent among the senior medical students ( $\chi^2 = 4.933$ ,  $P = 0.026$ ), males ( $\chi^2 = 10.826$ ,  $P = 0.001$ ) and those who had family history of hypertension ( $\chi^2 = 4.228$ ,  $P = 0.039$ ). Pre-hypertension was significantly higher among the obese medical students ( $\chi^2 = 6.941$ ,  $P = 0.008$ ). Logistic regression analysis revealed that medical students had 12.8% more chance of having pre-hypertension with one unit increase in their BMI.

**Conclusion:** Prevalence of pre-hypertension among medical students is high and BMI is found to be significantly associated with pre-hypertension. Hence it can be used as an effective tool for predicting pre-hypertension and development of hypertension among medicos later on.

**Keywords:** Pre-hypertension, Hypertension, Body mass index, Medical student

## INTRODUCTION

According to reports from the World Health Organization, chronic non-communicable diseases are the leading causes of death worldwide.<sup>1</sup> Hypertension (HT) alone caused more than 7 million deaths worldwide in 2010.<sup>2,3</sup> Hence it has become a serious health problem everywhere, not only because of its prevalence, affecting up to one third of world population,<sup>1</sup> but as a risk factor directly related to diseases in other systems that may lead

to ischemic heart disease, heart failure, cerebrovascular disease and chronic renal failure, among others.<sup>3-5</sup> The seventh joint national committee on prevention, detection, evaluation, and treatment of high Blood Pressure (BP) has introduced Pre-Hypertension (PHT) as a new category of BP, where systolic BP lies between 120 and 139 mmHg and or diastolic BP between 80 and 89 mmHg.<sup>6</sup> Body Mass Index (BMI) was found to be positively related to the increased prevalence of elevated blood pressure among younger individuals aged 18-44

years. The association of BMI with pre-hypertension and hypertension depends up on age and sex.<sup>7</sup>

Though pre-hypertension has a strong familial predisposition, the patho-physiological mechanisms that cause its progression have not yet been fully elucidated.<sup>8</sup>

Additionally, it has been observed that the risk of developing coronary or cerebrovascular syndrome is double in patients with a systolic blood pressure of 135 mmHg compared to those with 115 mmHg. That is why it is necessary to identify those people with these levels of BP, which were previously considered to be normal, but have proven to have future implications.<sup>5,8,9</sup>

Prevalence of pre-hypertension among adults in the United States was approximately 31% and higher among men (39%) than women (23%). Prevalence of pre-hypertension and hypertension were significantly greater in South and West India as compared to Northern and Eastern India.<sup>10</sup>

The study of young adults in search of factors associated with pre-hypertension allows early detection and gives the possibility of implementing early preventive actions. Sufficient data regarding blood pressure of young adults of North Eastern region are not available. Hence the present study was designed to find out the prevalence of pre-hypertension and its relationship with BMI among the medical students of Agartala government medical college.

## METHODS

This cross-sectional study was conducted among medical students of Agartala government medical college during June - July 2013. Minimum sample size requirement for this study at 95% confidence was calculated to be 319 considering the prevalence of pre-hypertension among medical students of India as 58%<sup>11</sup> and margin of error and incomplete response rate as 10% each.

During data collection 2 students denied to participate in the study and 11 were out of station, thus total 13 students met exclusion criteria and final sample size came down to 306 giving a response rate of 95.92%. Stratified random sampling technique was followed to choose the study subjects. A pre-tested and validated structured questionnaire, mercury sphygmomanometer, electronic bathroom weighing scale, a non-stretchable measuring tape having lowest measuring capacity up to 0.1 cm and a wall mounted stature meter were used as study tools. Data were collected by the self-administered questionnaire, which contained questions regarding age, sex, ethnicity, family income, dietary habit, medication, smoking and drinking habits, salt and oil intake, physical exercise, family history of hypertension etc. and space for entering the values of body parameters. After obtaining informed verbal consent, the students were asked to fill in the questionnaire themselves confidentially without

consulting each other in specially arranged class room sessions providing equal time for each session, which was followed by measurement of blood pressure, height, weight, hip circumference, waist circumference etc. of the participants and recording in the respective questionnaire. Measurement of blood pressure, height, weight, waist and hip circumference etc. and calibration of the measuring instruments were performed as per the techniques adopted from WHO MONICA study.<sup>12</sup>

Waist-Hip Ratio (WHR) of  $\leq 1$  was considered as normal and WHR  $> 1$  was considered as high. The study participants were categorized as 'under-weight', 'normal-weight', 'over-weight' or 'obese' according to the guidelines adopted from WHO Technical Report Series - 854.<sup>13</sup>

Hypertension, pre-hypertension and optimum BP were defined as per JNC-VII classification.<sup>14</sup>

Data entry and analysis were performed in computer using SPSS 15 version.<sup>15</sup>

Descriptive statistics, chi-square test, student - t test, binary logistic regression etc. were used for presenting data and testing the significance and  $P \leq 0.05$  was considered as statistically significant. This study was approved by the institutional ethics committee of Agartala government medical college and also obtained 'Short term studentship award' during 2013 from the Indian Council of Medical Research.

## RESULTS

Prevalence of pre-hypertension, hypertension and optimum BP among the medical students of Agartala government medical college was found to be 45%, 4% and 51% respectively.

Among the study subjects, 48% were male and 70% had the family history of hypertension. Regarding community, 23% belonged to scheduled caste, 32% to scheduled tribe and the rest to general community. Among the participants, 19% were underweight, 61% had normal weight, 18% were overweight, and 2% were found to be obese. Ideal WHR was observed among 80% of the students.

Non-vegetarians constituted 92%, 23% were regular consumers of extra salt and only 3% of the study subjects were performing regular physical exercise for remaining healthy. About 5% of the study subjects were occasional smokers and 7% used to consume alcohol occasionally.

Mean  $\pm$  SD BMI of the study subjects was found to be  $21.68 \pm 3.55$  and gender wise it was  $21.79 \pm 3.40$  and  $21.58 \pm 3.70$  among the male and female students respectively.

**Table 1: Prevalence of pre-hypertension by age, sex, community and family history of hypertension.**

Variables	Subgroups	Pre-hypertensive Number (%)	Not Pre-hypertensive Number (%)	Significance
Age	18 year to <20 year	49 (40.0)	73 (60.0)	$\chi^2 = 4.933$
	20 year and above	99 (53.80)	85 (46.20)	P = 0.026
Sex	Male	85 (58.0)	62 (42.0)	$\chi^2 = 10.826$
	Female	61 (38.0)	98 (62.0)	P = 0.001
Community	Scheduled caste	32 (46.0)	38 (54.0)	$\chi^2 = 0.507$
	Scheduled tribe	44 (45.0)	54 (55.0)	P = 0.776
Family history	General community	68 (49.0)	70 (51.0)	$\chi^2 = 4.228$
	Present	126 (60.28)	83 (39.72)	P = 0.039

It shows that pre-hypertension was significantly more prevalent among the senior medical students ( $\chi^2 = 4.933$ , P = 0.026), males ( $\chi^2 = 10.826$ , P = 0.001) and those who had family history of hypertension ( $\chi^2 = 4.228$ , P = 0.039).

**Table 2: Prevalence of pre-hypertension by BMI and WHR.**

Variables	Subgroups	Pre-hypertensive Number (%)	Not Pre-hypertensive Number (%)	Significance
BMI	≤25	116 (47.35)	129 (52.65)	$\chi^2 = 6.941$
	>25	41 (67.21)	20 (32.79)	P = 0.008
WHR	≤1	111 (45.30)	134 (54.70)	$\chi^2 = 4.983$
	>1	38(62.29)	23(37.71)	P = 0.025

It shows that prevalence of pre-hypertension was significantly higher among the obese medical students ( $\chi^2 = 6.941$ , P = 0.008) and those with higher waist hip ratio ( $\chi^2 = 4.983$ , P = 0.025).

**Table 3: Prevalence of pre-hypertension by mean BP and BMI.**

Variables	Subgroups	Mean ± SD	Significance
Systolic BP (mm Hg)	18 year to <20 year	126 ± 6.20	t = 3.332
	20 year and above	128 ± 4.30	P = 0.001
Diastolic BP (mm Hg)	18 year to <20 year	60 ± 2.36	t = 9.563
	20 year and above	64 ± 4.20	P = 0.000
Systolic BP (mm Hg)	Male	124 ± 4.08	t = 16.419
	Female	118 ± 2.06	P = 0.000
Diastolic BP (mm Hg)	Male	66 ± 4.07	t = 15.955
	Female	60 ± 2.34	P = 0.000
BMI	18 year to <20 year	20.64 ± 2.05	t = 2.588
	20 year and above	21.39 ± 2.73	P = 0.010
	Male	21.79 ± 3.40	t = 0.516
	Female	21.58 ± 3.70	P = 0.606

It shows that mean systolic and diastolic BP differed significantly between the junior and senior medical students (t = 3.332, P = 0.001 and t = 9.563, P = 0.000 respectively) and their sex (t = 16.419, P = 0.000 and t = 15.955, P = 0.000) whereas mean BMI was significantly different among the junior and senior medical students only.

**Table 4: Binary logistic regression analysis.**

		Odds ratio (95% CI)	P value
<b>Continuous variables</b>			
Age		1.037 (1.028-1.053)	0.000
BMI		1.128 (1.047-1.218)	0.001
Waist hip ratio		13.158 (0.398-457.831)	0.131
<b>Discrete variables</b>			
Gender	Male	1.238 (0.698-2.981)	0.389
	Female	1	
Family history of hypertension	Present	0.899 (0.498-1.697)	0.897
	Absent	1	

Binary logistic regression analysis shows that medical students had 3.7% higher chance of having pre-hypertension with one year increment of age (OR = 1.037, 95% CI = 1.028-1.053, P = 0.000). Likewise they had 12.8% more chance of having pre-hypertension with one unit increase in their BMI (OR = 1.128, 95% CI = 1.047-1.218, P = 0.001) while rest of the variables did not attain the level of statistical significance.

## DISCUSSION

Present study detected the prevalence of pre-hypertension to be 45%, similarly Mohit Shahi et al., 2013<sup>16</sup> and Mona Soliman et al., 2014<sup>17</sup> also found it to be 40.2% and 47.4% respectively. But Abdul-Hussein F. et al., 2011<sup>18</sup> and Samuel I. Merino Barrera et al. 2014<sup>19</sup> found it to be 31.8% and 27.6% respectively.

Lower prevalence in these two studies may be attributable to ecological and racial differences among the studies. This study detected the prevalence of pre-hypertension as 38% among female medicos, whereas Mohit Shahi et al., 2013<sup>16</sup> and Kavita Chaudhry et al., 2012<sup>11</sup> found it to be 46.9% and 58% respectively, which were higher than our study. But Abdul-Hussein F. et al., 2011<sup>18</sup> and M. R. Koura et al., 2012<sup>20</sup> found it to be 13.1% and 13.5% respectively, which were lower than the present study. These differences may be due to the racial differences of the study subjects. In this study mean BMI of the study subjects was found to be  $21.68 \pm 3.55$ , Kavita Chaudhry et al., 2012<sup>11</sup> found it to be  $22.33 \pm 3.83$  and Sreedharan J et al., 2010<sup>21</sup> found it to be  $24.9 \pm 5.7$ , which were similar. Mean BMI of the male and female subjects was found to be  $21.79 \pm 3.40$  and  $21.58 \pm 3.70$  respectively in this study whereas Ujunwa et al., 2013<sup>22</sup> found it to be  $19.81 \pm 3.61$  and  $21.16 \pm 3.29$  respectively, which were similar. WHR was found to be within normal range among 80% of the study subjects and this was similar with the findings of Ujunwa et al., 2013.<sup>22</sup>

Age, sex and BMI were found to be the significant predictors of pre-hypertension among the study subjects, which was similar with the findings of Kavita Chaudhry et al., 2012,<sup>11</sup> Mona Soliman et al., 2014<sup>17</sup> and Samuel I. Merino Barrera et al. 2014.<sup>19</sup>

## CONCLUSION

This study concluded that the prevalence of pre-hypertension among medical students is high and high BMI was found to be significantly associated with pre-hypertension. Hence it can be used as an effective tool for predicting pre-hypertension and development of hypertension among medicos later on. It may prompt Public Health stakeholders for timely primary interventions against developing hypertension in them.

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