



PREVALENCE OF PRE-HYPERTENSION AMONG THE STUDENTS OF A MEDICAL COLLEGE IN NORTH-EASTERN PART OF INDIA : A CROSS SECTIONAL STUDY

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ABSTRACT **Introduction:** Pre hypertension is an American classification for cases where a person's blood pressure (BP) is elevated above normal but not to the level considered to be hypertension. The subjects with systolic BP between 120 and 139 mmHg or diastolic BP between 80 and 89 mmHg are considered to have pre-hypertension. Evidence is now accumulated to support that prehypertension is associated with traditional cardiovascular risk factors, increased cardiovascular events and target organ damage. So early diagnosis and intervention through lifestyle changes may eliminate the risk of development of complications. **Material And Methods:** A cross sectional, observational study was done with 340 students at a medical college in North-eastern India. : The students were included in the study after simple random sampling. Blood pressure (BP) was measured using standard mercury sphygmomanometer. Height and weight were measured using standard instruments. Data analysis was done using Microsoft excel and SPSS 26.0 software. **Results:** Out of 340 students, 167 were male and 173 were female. Overall, the prevalence of pre-hypertension was 30% which is again more in males (40.8%) than females (19.6%). A strong association was observed between BMI and Blood pressure in these students. **Conclusions:** The prevalence of prehypertension in students in a medical college of North east India is 30% with males being affected more than females and having strong association with BMI

KEYWORDS : Pre-Hypertension, Body Mass Index, Blood pressure, Medical students

INTRODUCTION

Pre hypertension is an American classification for cases where a person's blood pressure (BP) is elevated above normal but not to the level considered to be hypertension. Pre hypertension is defined as an independent category of blood pressure by seventh joint national committee on prevention, detection, evaluation, and treatments of blood pressure. The subjects with systolic BP between 120 and 139 mmHg or diastolic BP between 80 and 89 mmHg are considered to have prehypertension. Readings greater than or equal to 140 mmHg systolic and greater than or equal to 90 mmHg diastolic is considered hypertension^[1].

On the other hand, systolic BP between 90 and 119 mmHg, and diastolic BP between 60 and 79 mmHg are classified as the normal and desired blood pressure. Classification of blood pressure is based upon two or more readings at two or more separate occasions separated by at least one week^[2].

Prehypertension is likely to progress to hypertension. Approximately 40% of these individuals will progress to hypertension within 2 years. Evidence is now accumulated to support that prehypertension is associated with traditional cardiovascular risk factors, increased cardiovascular events and target organ damage. It is estimated that approximately 42 million men and 28 million women (37% of the adult US population) have prehypertension^[3].

Prevalence^[4] of pre-hypertension among young adults (20-30 years) in a community based cross sectional study in Coastal villages of Udaipur District in Southern India with 1152 young adults was found to be high (45.2%).

Prevalence of pre-hypertension among young adults (20-30 years) in a community based cross sectional study with 1152 young adults was found to be high (45.2%). Biological (age 25-30 years, pre obesity and obesity) and behavioral (sedentary occupation, intake of extra salt in meals/salty food and not using refined cooking oil) factors were associated with pre-hypertension^[5].

Multivariate logistic regression analysis revealed that age group of 25-30 years (adj OR: 4.25, 95% CI: 2.99-6.05), students (adj OR: 2.46, 95% CI: 1.22-4.95), pre-obese (adj OR: 1.66, 95% CI: 1.03-2.67) and obese (adj OR: 9.16, 95% CI: 2.54, 36.4) were the significant correlates of pre-hypertension^[6].

The prevalence^[4] of prehypertension among adults in the United States

was approximately 31%; higher among men (39%) than women (23%). The prevalence^[6] of prehypertension was significantly greater in South India (Trivandrum: Women (W) 31.5%; Men (M) 35.1%) and West India (Mumbai: W 30.0%; M 34.7%) compared to North India (Moradabad: W 24.6%; M 26.7%) and East India (Kolkata: W 20.9%; M 23.5%).

Based on data from the National Family Health Survey 2005-06, 9.3% of Males and 12.6% of Females Indian are overweight or obese, while, 4.8% of Males and 7.1% of Females in Tripura are obese^[8].

Prehypertension has recently been observed as a potent cardiovascular risk factor. Though prehypertension has a strong familial predisposition, the pathophysiological mechanisms that cause its progression has not yet been fully elucidated^[9].

Sympathovagal imbalance (SVI) was observed to be present in both normotensive and prehypertensive sibling of hypertensive parents. In normotensive sibling, SVI was mild in the form of proportionate increase in sympathetic and decreased vagal activity. In prehypertensive sibling, SVI was prominent with more of vagal withdrawal^[6].

BMI (body mass index) were found to be positively related to the increased prevalence rate of elevated blood pressure among younger individuals, aged 18-44 years. The association of BMI with prehypertension and hypertension depends on age and sex^[7].

The prevalence of elevated blood pressure (prehypertension and hypertension) and mean levels of systolic and diastolic blood pressure was correlated to be increased as BMI increased. Multivariate logistic regression revealed that overweight and obesity were risk factors for prehypertension and hypertension whether in males or females^[10].

As there is a drastic rise in the prevalence of prehypertension and hypertension in India in all the age groups including younger population, studying prevalence of prehypertension and evaluating its relationship with BMI among the medical students of Tripura will be helpful to prevent the progression of hypertension and its associated complications which forms the basis of conducting this study.

MATERIALS AND METHODS

Study Design: Cross sectional study.

Type of study: Observational.

Setting Of Study: Agartala Government Medical College, Agartala, Tripura.

Study Population: Students of Agartala Government Medical College, who fulfill the inclusion criteria, was included in the study.

Sampling Technique: Simple random sampling; with first participant taken randomly and thereafter every third participant was taken for the study.

Sample Size:

Calculations of sample size for cross sectional study:

$$n = \frac{(Z_{1-\alpha/2})^2 p (1-p)}{d^2}$$

Where,
 $Z_{1-\alpha/2}$ = Standard normal variate at 5% type 1 error (p<0.05), which is **1.96**

p= Expected proportion (prevalence) in population based on previous studies¹¹⁵
 = **68**

d= Precision or absolute error = **5%**

So,
 Sample size (n) = $\frac{(1.96)^2 \times 68 \times 32}{5^2} = 334.37$

Therefore,

n = 334.37; Rounded up to **340**.

Selection Criteria:

A) Inclusion Criteria: Only healthy students of Agartala Government Medical College of both sexes was selected for the study.

B) Exclusion Criteria: Participants having any acute illness, and chronic diseases such as thyrotoxicosis and myxoedema was not considered for the study. Individuals with history of heart diseases, metabolic disorder such as diabetes mellitus or under medications was not included in the study.

Data Collection Procedures:

Pre-designed and pretested **case study form** and **participant information sheet** was used for data collection. Each consenting participant having recruited for the study was taken through the following procedure in a complete manner:

- 1. Age** was recorded from the birthdays by calendar to the nearest of the years (<6 months and >6 months)
- 2. Standing heights** was recorded without shoes and with light clothes by a measuring stand with scale to the nearest of the centimetres (<5mm and >5mm).
- 3. Weight** was recorded without shoes and with light clothes on a standard electronic weighing machine with a least count of 500 grams.
- 4. BMI** was calculated by the formula: BMI = weight (kg) / {height (m)}². International obesity task force (IOTF-2000) has proposed the standards for adult obesity in Asia and India as follows: A cut-off point of 18 kg/m² is used to define thinness or acute under nutrition and a BMI of 23 kg/m² indicates overweight. A BMI of over 25 kg/m² refers to obesity. The International Classification of adult underweight, overweight and obesity according to BMI¹¹⁴.

| Classification | BMI (kg/m ²) | |
|----------------|--------------------------|---------------------------|
| | Principal cut-off points | Additional cut-off points |
| Underweight | <18.5 | <18.5 |
| Normal weight | 18.5-24.99 | 18.50 - 22.99 |
| | | 23.00 - 24.99 |
| Overweight | ≥25.00 | ≥25.00 |
| Obese | ≥30.00 | ≥30.00 |

The BMI of Participants was referred to the above classification and their association with Prehypertension and hypertension was analyzed statistically.

5. Blood pressure was measured in the extended right arms, with the

subject in sitting position | with a minimum of five minutes of rest using standard mercury sphygmomanometer with appropriate cuff sizes. Three BP readings were recorded consecutively with at least 15 minutes interval and the average of three readings was taken. This procedure was repeated, to measure the BP, for another two days. Finally, the minimum value among the three day readings was taken as the blood pressure of the subject¹¹⁶. Blood pressure readings with systolic BP between 120 and 139 mm Hg or diastolic BP between 80 and 89 mm Hg was considered to have **Prehypertension** and readings greater than or equal to 140/90 mm Hg are considered **hypertension**¹¹.

| Blood Pressure category | Blood Pressure reading (value) | |
|---------------------------------|--------------------------------|------------------|
| | Systolic (mmHg) | Diastolic (mmHg) |
| Normal (desired blood pressure) | 90 - 119 | 60 - 79 |
| Prehypertension | 120 - 139 | 80 - 89 |
| Hypertension | ≥ 140 | ≥ 90 |

Category of Blood pressure of participants was referred to the above values and was statistically analyzed for their association with BMI.

Statistical Tools:

Statistical analysis of the obtained variables was done by Microsoft excel and SPSS software.

Ethical Consideration:

The study was done after approval of Institutional ethical committee. Confidentiality of the respective participants was maintained and no disclosure of the measured parameters was done.

RESULTS

A total of 340 medical students were examined. Out of these, 173 were female and 167 were male. The overall prevalence of pre-hypertension among the whole group was 30% as 102 out of 340 students were pre-hypertensive while 238 (70%) were normotensive.(Figure 1)

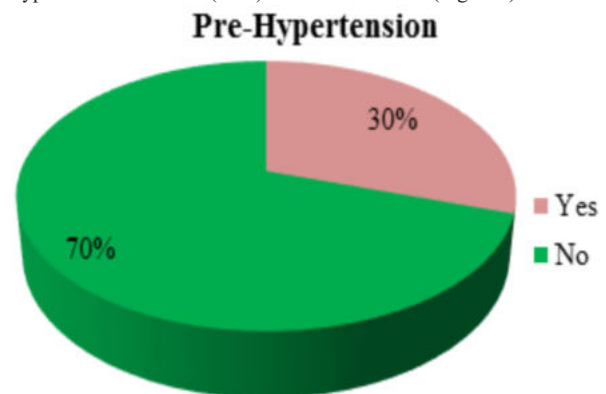


Figure 1: Prevalence Of Prehypertension Among Medical Students (N=340)

Out of these 102 (30%) pre-hypertensive students, 34 were female and 68 were male and the association between gender and prehypertension was found to be significant (P value 0.021). The distribution of students according to blood pressure and gender is shown in **Table 1**.

Table 1: Association Between Gender And Prehypertension (N=340)

| Variable | | | Prehypertension | | P value |
|----------|--------|-----------------|-----------------|-------|---------|
| | | | No | Yes | |
| Gender | Male | Count | 99 | 68 | |
| | | % within Gender | 59.2% | 40.8% | |
| | Female | Count | 139 | 34 | 0.021 |
| | | % within Gender | 80.4% | 19.6% | |
| Total | | Count | 238 | 102 | |
| | | % within Gender | 70.0% | 30.0% | |

When the students in both groups (normotensive and prehypertensive) were categorized based on their BMI, it was seen that percentage of students having pre-hypertension gradually increased from 16.7% in Low BMI group to 54.5% in the obese group which was statistically significant (P value 0.034). **Table 2**

Table 2: Association Between BMI And Prehypertension (N=340)

| Body mass index vs prehypertension | | | Prehypertension | | P value |
|------------------------------------|------------|--------------|-----------------|-------|---------|
| | | | No | Yes | |
| BMI classification | Low BMI | Count | 17 | 5 | 0.034 |
| | | % within BMI | 83.3% | 16.7% | |
| | Normal BMI | Count | 124 | 34 | |
| | | % within BMI | 78.3% | 21.7% | |
| | Overweight | Count | 61 | 22 | |
| | | % within BMI | 75.0% | 25.0% | |
| | Obese | Count | 35 | 45 | |
| | | % within BMI | 45.5% | 54.5% | |

Table 3: Association Between Alcohol Consumption And Prehypertensive State (N=340)

| Alcohol vs prehypertension | | | Prehypertension | | P value |
|----------------------------|------------------|------------------|-----------------|-------|---------|
| | | | No | Yes | |
| Alcohol | no | Count | 214 | 85 | 0.34 |
| | | % within alcohol | 71.6% | 28.4% | |
| | yes | Count | 24 | 17 | |
| | | % within alcohol | 58.3% | 41.7% | |
| Total | Count | 238 | 102 | | |
| | % within alcohol | 70.0% | 30.0% | | |

The number of students having prehypertension with history of alcohol intake was 17 (41.7%) out of 41 students. But the association was not found to be statistically significant. (p value 0.34). Table: 3

Association of smoking with development of prehypertensive state was found to be statistically insignificant. Table:4

Table 4: Association Between Smoking Status And Prehypertensive State (N=340)

| Smoking vs prehypertension | | | Prehypertension | | P value |
|----------------------------|------------------|------------------|-----------------|-------|---------|
| | | | No | Yes | |
| Smoking | no | Count | 231 | 95 | 0.37 |
| | | % within smoking | 70.8% | 29.2% | |
| | yes | Count | 7 | 7 | |
| | | % within smoking | 50.0% | 50.0% | |
| Total | Count | 238 | 102 | | |
| | % within smoking | 70.0% | 30.0% | | |

The association of pre-hypertension with physical activity was however found to be statistically significant (P value 0.024). The percentage of students who had physical activity and prehypertension was 26.2% as compared to 35.9% of those students who did not have physical activity and prehypertension. Table:5

Table 5: Association Between Physical Activity And Prehypertensive State (N=340)

| Physical Activity (PA) vs Prehypertension | | | Prehypertension | | P value |
|---|-------------|-------------|-----------------|-------|---------|
| | | | No | Yes | |
| PA | No | Count | 85 | 47 | 0.024 |
| | | % within PA | 64.1% | 35.9% | |
| | Yes | Count | 153 | 55 | |
| | | % within PA | 73.8% | 26.2% | |
| Total | Count | 238 | 102 | | |
| | % within PA | 70.0% | 30.0% | | |

DISCUSSION

Prehypertension and hypertension is an epidemic, which is also responsible for about 6.7 million deaths from stroke and 7.4 million deaths from coronary artery disease. A study that was done in 21 regions on the grouping of cardiovascular ailment load (disease burden) revealed in excess of nine million deaths linked to complications of HTN. Among all people, it was found that about 40 % of adults over 25 years of age have been clinically diagnosed with HTN^[12].

Prehypertension is associated with 3-fold greater likelihood of developing hypertension, and roughly twice the number of cardiovascular events, than BP < 120/80 mmHg. Prehypertensive individuals are more likely to be overweight and obese, to have other cardiovascular risk factors, to progress to established hypertension, and to experience premature clinical cardiovascular disease^[9]. Our study shows the prevalence of pre-hypertension to be 30% amongst medical students.

cardiovascular disease risk factors in puducherry” where during the analysis of anthropometric variables among the study groups BMI was found to be significantly high in male and female prehypertensives compared to the normotensives^[10]. Our study shows that males are more prone to develop prehypertension than female.

It was revealed that overweight and obesity was the strongest predictor of Prehypertension, a study suggested a need for routine blood pressure measurements and risk assessment in young adult females in Saudi Arabia^[11]. BMI is associated with the severity of ambulatory hypertension and the increase of daytime BP^[12]. Our study shows a significant association between prehypertension and BMI.

Human blood vessels and microcirculation systems change with increasing BP. These changes are especially obvious for patients with severe hypertension. Hypertension in various stages can prompt fluctuating degrees of cardiovascular dissemination change; a few changes are gentle or reversible (unstable changes, for example, prehypertension or stage 1 hypertension), while others are subjective (chronic changes, for example, stage 2 hypertension and serious hypertension, for which it is difficult to reestablish the ordinary BP level)^[16].

High incidence of prehypertension is reported in young adults. It appears that obesity and male gender are the major risk factor of prehypertension in young apparently healthy adults. BMI was identified as a major contributor to elevated blood pressure, particularly systolic blood pressure (SBP). Probably, diastolic blood pressure (DBP) which is a function of total peripheral resistance is not influenced to such a great extent at an early stage of life. BMI of prehypertensive group was significantly higher compared to normotensive group. Incidence of prehypertension was significantly higher in males compared to female subjects. In both males and female prehypertensives, BMI (a modifiable risk factor) was higher compared to normotensives. Our study also agrees with the above findings^[17].

CONCLUSION

The prevalence of pre-hypertension in young adults was 30%. The risk factors found to be strongly associated with pre-hypertension were gender, pre-obesity, and obesity and lack of exercise. Screening strategies for pre-hypertension should be initiated at an early age in the community. The importance of lifestyle modifications with respect to personal habits, dietary habits, physical exercise, and relaxation techniques needs to be impressed upon young adults in the community.

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