Relationship Between Obesity And Prehypertension In Young Adults: A Cross Sectional Study In Tripura

Sulakshana Mitra[1], Rajesh Ranjan Das[2], Evalyn Singnarpi[3], Bikash Debbarma[4]*

[1](Post Graduate Trainee, Department Of Physiology, Agartala Govt. Medical College, India)
[2](Associate Professor, Department Of Physiology, Agartala Govt. Medical College, India)
[3](Professor & Head, Department Of Physiology, Agartala Govt. Medical College, India)
[4]*(Assistant Professor & Corresponding Author, Community Medicine, Agartala Govt. Medical College, India)

Abstract:

Background: 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. The present study aimed to assess the relationship between obesity and prehypertension in young persons.

Materials and Methods: A cross sectional study was conducted in the Department of Physiology, AGMC & GBP Hospital among young graduates who are randomly selected during the year 2023. Demographic profile, BMI and vitals like blood pressure, pulse rate, respiratory rate was collected in a predesigned proforma. Data were expressed in descriptive statistics and analyzed using SPSS 21.0. A p value of <0.05 was considered as statistically significant.

Results: A total of 171 young graduate enrolled in the study (age ranges from 17 years-24 years) (55.6% are male and 44.4% are female). The prehypertension among the participants is more common among those overweight or obese (81.1%) compare to normal BMI (39.1%) and these differences are found to be statistically significant with a p value 0.000. The overweight or obese condition is highly (88% in overweight and 86% in obese) associated with prehypertension with a p value of 0.000 among the male young people in Tripura. Again, similar observation seen among the female young people also where higher the BMI status (obese - 70.6%, overweight -60.0%) is associated with being prehypertensive state (p value 0.04).

Conclusion: Obesity and prehypertensive state is highly associated among boys than girls in early life stage.

Key Word: Obesity; BMI; young adults; Prehypertension.

I.   Introduction

Prehypertension is 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] 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.[2] Many literatures in India, also found diverse findings where prehypertension are ranges from 20% to 65% in adult populations. Prehypertension is likely to progress to hypertension.[3-5] Though prehypertension has a strong familial predisposition, the pathophysiological mechanisms that cause its progression has not yet been fully elucidated.[6] 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] Many studies reveal that overweight and being obese are primary risk factor for pre-hypertension which are always symptom less. According to some studies, prehypertensive person is more than three times more likely to have a heart attack and 1.7 times more likely to have heart disease than a person with normal blood pressure.[7] The similar study conducted by Debbarma A et al shows that Prevalence of prehypertension, hypertension and optimum BP among the medical students of Agartala Government Medical College was found to be 45%, 4% and 51% respectively which was a cross sectional study during the year 2013.[8] The prehypertension and its risk factor such as overweight or obesity also

varied in different sex.[9-12] However, such comparison and relationship findings regarding obesity and elevated blood pressure is lacking in this part of India. The specific targeted intervention can be employed to counteract the burden of prehypertension and risk of cardiovascular diseases in neat future depending on the resourceful specially on lifestyle modifications and non-pharmacological interventions. This study aimed to determine the relationship between the obesity and development or prehypertensive state in young adults in comparison to different sexes in Tripura.

II. Material And Methods

This cross-sectional study was carried out in the Department of Physiology in collaboration with the Community Medicine Department of Agartala Government Medical College, Tripura which is randomly selected. The study site has catered more than 200 students intake per year in medical field. Basically, the study was teaching institution based observational analytical study where medical students of the year 2022-2023 were enrolled for the study. Ethical approval was taken prior from the institutional ethics committee. Sample size was calculated using the formula, $n = (Z_{1-\alpha/2})^2\sigma^2 / d^2$ (where, $Z_{1-\alpha/2}$ = Standard normal variate at 5% type 1 error (p<0.05), which is 1.96, σ = Standard deviation taken as 2.79[6], d = Absolute precision, which is 0.5 with non-response rate 20%). A total of 130 sample is calculated. All students were enrolled among these who are willing to participate and three attempts were made if anyone missed contact. Students having acute illness, thyroid issues, heart diseases, diabetes mellitus, known hypertensive or on medication for hypertension, girls on menstruation were excluded from the study. Simple random sampling was done to selected the study subjects.

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 subject. BMI was calculated by the formula: BMI = weight (kg)/ {height (m)}^{2}. Obesity classification according to WHO and ASI-Pacific guidelines is: A cut-off point of 18.5 kg/m^2 is used to define thinness or acute under nutrition according to both WHO and Asia-Pacific guidelines; and whereas a BMI of 23-24.90 kg/m^2 indicates overweight and BMI of equal to or over 25 kg/m^2 refers to obese respectively according to the Asia-Pacific guideline.

As study tools, a predesigned proforma, Mercury sphygmomanometer, A measuring stand with scale and A standard electronic weighing machine were used. Data were collected after ethical approval from the Institutional Ethic Committee, AGMC. It was collected without intervening the students teaching schedule. Weekly two times schedule has been fixed for data collection process. Selected students were called in procedure room for weight and height measurement maintain the privacy and confidentiality. Predesigned proforma consisted of demographic profile, anthropometric parameters and vital records were recorded. Proforma were checked for completeness and consistency. Study participants were counselled on life style modifications such as healthy diet consumption, active physically, proper sleep, quitting tobacco and smoking, alcohol and periodic medical check-up etc.

Statistical analysis:

Data was analyzed using SPSS version 21.0 (SPSS Inc., Chicago, IL). The study findings were expressed in mean, SD, frequency and proportion. Student's *t*-test was used to ascertain the significance of differences between mean values of two continuous variables. Chi-square and Fisher exact tests were performed to test for differences in proportions of categorical variables between two or more groups. The level *P* < 0.05 was considered as the cutoff value or significance. The study findings were presented in text, table and graph form as appropriate.

III. Result

A total of 171 young medical students included in the study. The most common age of the participant was 20 years ranges from 18 years to 24 years. Among the study participants, 55.6% are male and 44.4% are female. The demographic profile was shown in Table 1. General category students were more (38.1%) followed by ST caste students (29.2%) and Hinduism background students were more (65.5%) participated in the study (Table 1).

Baseline anthropometric parameters shows that the mean body weight is 59.7 ± 10.9 kgs, height is 1.59 ± 0.09 cm, BMI is in normal range (37.4%) but majority were above normal BMI 57.3%. The proportion obese young adults are 31.0% (53 out of 171) and overweight young peoples are 26.3%. Only 9 out of 171 (5.3%) shows their BMI <18.5 which is classified as underweight as per WHO Asian classification of BMI. (Table 2).

Among the participants, 65 of them (38%) were normotensive having both systolic and diastolic blood pressure measurement were in normal range. The proportion of pre-hypertension is 62% (106 out of 171 participants) (Figure 1).

Table 1: Demographic profile of the study participants (N=171) **Table 2:** Anthropometric of the study participants (N=171)

Variables	Frequency (%) / Mean ± SD
Age (years)	19.78 ± 1.23
Sex	
Male	95 (55.6)
Female	76 (44.4)
Caste	
General	65 (38.1)
ST	50 (29.2)
SC	38 (22.2)
OBC	18 (10.6)
Religion	
Hindu	112 (65.5)
Islamic	27 (15.8)
Christian	25 (14.7)
Buddhist	7 (4.1)

Variables	Frequency (%) / Mean ± SD
Body weight (Kg)	59.7 ± 10.9
Height (Cm)	1.59 ± 0.09
Body mass index (Kg/m^2)	
<18.5 (Underweight)	9 (5.3)
18.5 - 22.9 (Normal range)	64 (37.4)
23.0-24.9 (Overweight)	45 (26.3)
25.0 & above (Obese)	53 (31.0)
Systolic Blood Pressure (mmHg)	120.21 ± 12.27
Diastolic Blood Pressure (mmHg)	80.0 ± 7.99

The gender comparison of prehypertensive state among the participants are shown in figure 2. Among the prehypertensive people, male is more (65%) than female (35%). This difference is statistically significant with a p value of 0.001. (Figure 2)
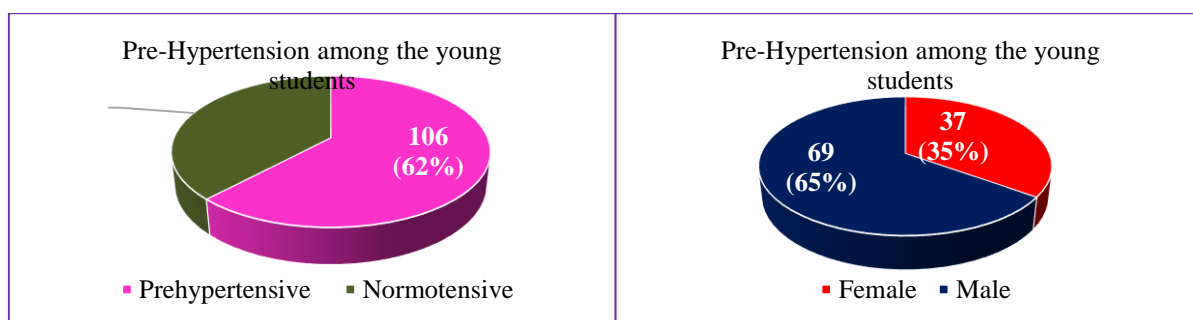

Fig 1: Pre-hypertension among the participants (N=171)   **Fig 2: Gender wise pre-hypertension (N=106)**
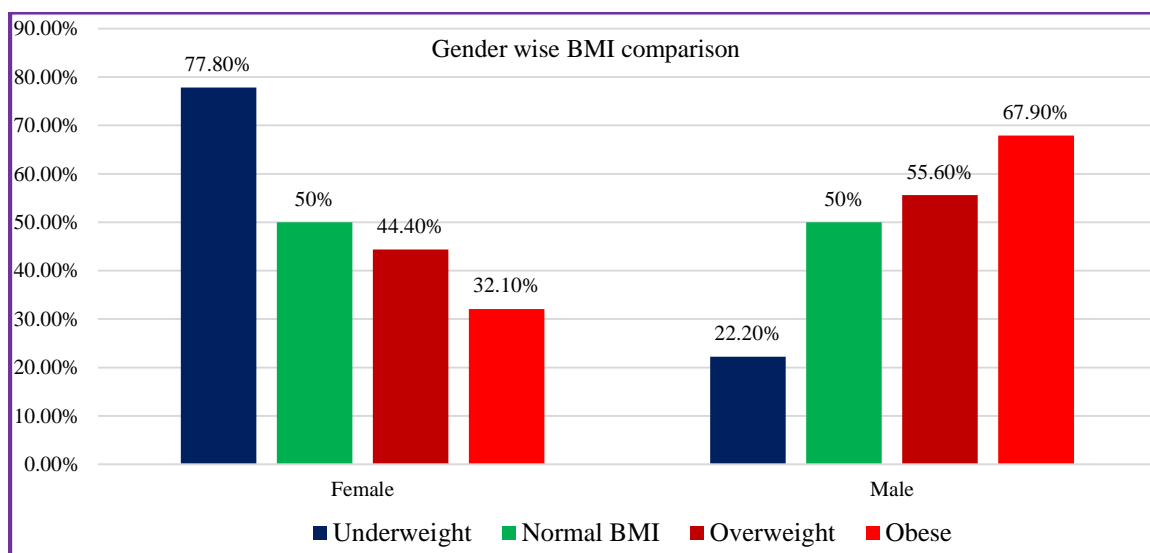

Fig 3: Gender wise Obesity comparison among the participants (N=171)

Above figure 3 shown gender wise comparison of obesity among the participants where underweight was more among female individual (77.8% vs 22.2%). In contrary, male (67.9%) is having more obese than female (32.1%). Overweight is slightly higher in male (55.6%) than female (44.4%). BMI in normal range was equal in both sexes (50%). These differences are found to be statistically significant with a p value of 0.04 (Figure 3).

Table 3: Relationship between BMI and prehypertensive state among the participants (N=171)

BMI classification	Prehypertension		P value
	Yes N (%)	No N (%)	
Underweight (<18.5)	4 (44.4)	3 (55.6)	0.000
Normal BMI (18.5-22.9)	25 (39.1)	39 (60.9)	
Overweight (23.0 -24.9)	34 (75.6)	11 (24.4)	
Obese (>25.0)	43 (81.1)	10 (18.9)	

Table 3 shown that the prehypertension among the participants is more common among those overweight or obese (81.1%) compare to normal BMI (39.1%) and these differences are found to be statistically significant with a p value 0.000, it means obesity is strongly associated with development of pre-hypertension among the young medical students.

Table 4: Gender wise comparison of prehypertension with their obesity status

BMI/Obesity status	Male		P value	Female		P value
	Prehypertension N (%)			Prehypertension N (%)		
	Yes	No		Yes	No	
Underweight (<18.5)	1 (50)	1 (50)	0.000	3 (42.9)	4 (57.1)	0.04
Normal BMI (18.5-22.9)	15 (46.9)	17 (53.1)		10 (31.3)	22 (68.7)	
Overweight (23.0 -24.9)	22 (88.0)	3 (12.0)		12 (60.0)	8 (40.0)	
Obese (>25.0)	31 (86.1)	5 (13.9)		12 (70.6)	5 (29.4)	

In table 4, it is observed that overweight or obese condition is highly (88% in overweight and 86% in obese) associated with prehypertension with a p value of 0.000 among the male young people in Tripura. Again, similar observation seen among the female young people also where higher the BMI status (obese – 70.6%, overweight -60.0%) is associated with being prehypertensive state (p value 0.04). However, male is proportionately highly associated with prehypertension than female at early life stage.

IV. Discussion

In the present study, pre-hypertensives had higher BMI indicating that overweight and obesity were major accompaniments before the development of HTN in accordance with other studies.[13] Overweight and obesity calculated by BMI were demonstrated as independent risk factors for the development of pre-HTN and cardiovascular disease in India.[14] The study indicates a high prevalence of prehypertension in apparently healthy medical students which is a cause for concern as these individuals are at high risk of developing hypertension and cardiovascular disease in later life.

The prevalence of prehypertension in the present study is higher (62%) than prevalence reported from a study in a medical college in Puducherry[15] but is lower when compared to several other studies in medical students. A study of 100 medical students in Davangere showed a prevalence of prehypertension in 64%[16] while two studies of 100 boys + girls and 150 girls in a medical college in Wardha showed a prevalence of prehypertension in 52% and 58% respectively.[17,18]. Another study from a medical college in Dehradun among 400 students also revealed an overall prevalence of prehypertension of 58.75%.[20] A study of 500 medical students in a Mangalore college showed a point prevalence of 55.4%. A possible reason for the prehypertension in our group could be prevalence of overweight.[21] The Mangalore group had a higher prevalence of overweight of 31.8% (159/500) compared to the present study which showed a prevalence of 12.1% of overweight + obesity in the entire group. A positive correlation has been shown between prehypertension and BMI in these studies among boys.[22] The study also revealed a higher mean BMI among prehypertensive compared to normotensives which is statistically significant. There was a significant association between excess weight and prehypertension in our study, similar to findings in other studies.[13-15,18,19] A study from Israel concluded that BMI was the strongest predictor of prehypertension among males and females.[21] A study among medical students in coastal Karnataka has found a significant correlation between prehypertension and BMI in boys[20] while a study in Jamaica found a relation to overweight/obesity and waist circumference among younger prehypertensives.[21] A population study from China also concluded that BMI was a major determinant of prehypertension even after controlling for gender, lipid profile, uric acid, insulin resistance, smoking and drinking.[23]

The study also not free from bias as the participants were not selected on probability basis. Though many medical students were there in the college and sample was limited to only 171, generalizability issues will be there.

V. Conclusion

The present study concluded the overweight or obesity is strongly associated with prehypertensive state among young medical students. Both genders were associated with prehypertension but rate was much higher in boys. These finding will guide policy makers to employ early health promotional activities during early stage of life.

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