Prevalence of prehypertension and its association with obesity and lipid parameters in medical students.

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Abstract

Background: Medical field is said to be associated with a lot of stress, both mental and physical. And medical students suffer more because during their training period they undergo a lot of stress in the form of little physical activity, altered food habits and social habits like smoking and alcohol. For this reason we decided to conduct this study amongst the medical students.

Objective: Our objective of this study is to determine the prevalence of prehypertension among Medical college students and study the association between prehypertension and other cardiovascular risk factors like lipid profile and Body Mass Index (BMI).

Methods: A total of 300 medical students of first to final year MBBS (18-23 years) were selected randomly for this study. Each participant's data was collected, BMI calculated. BP was measured by a mercury sphygmomanometer. Subjects were classified as 3 groups Normotensive, Hypertensive and Prehyperensive. Blood samples were collected and Fasting plasma glucose, serum cholesterol, triglyceride and HDLc, were estimated by using commercially available kits in automated analyzer. Serum LDLc, and VLDLc (Very Low Density Lipoprotein-cholesterol) were calculated by Friedwald's equation. All the data were analysed by using SPSS software.

Results: The overall prevalence of PHT was 38%. Prevalence of prehypertension is more in females. Among the students 75% had normal BMI, 20% were overweight, 3% were obese and 2% were underweight. BMI of Prehypertensive was significantly more than the normotensive students. BMI of female students are more than the male students. Among the lipid parameters, prehypertensives showed significant increase in TC, TG, LDLc than normotensive students. TC, TG, LDLc were high for female students than male students. Total prevalence of dyslipidaemia was 17.4% out of which 14.9% was hypercholesterolemia, 8.15% was hypertriglyceridaemia, 5.6% had high LDLc level and 10.4% had low HDLc level. There was a significant positive correlation between SBP with BMI, TG, TCh and VLDLc and significant positive correlation between DBP with TG and LDLc. There is negative correlation of SBP and DBP with HDLc. This might point out the contributory role of dyslipidemia and obesity towards prehypertention.

Conclusion: Prevalence of prehypertension was high and associated with a higher BMI and dyslipidemia .Prevalence of dyslipidemia is 17.4%. Hypercholesterolemia is more prevalent. Students should change their life style. They should do yoga, meditation regularly to cope with stress. They should avoid oily foods to decrease cholesterol level.

Keywords: Prehypertension, Cardiovascular disease, Lipid profile.

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Introduction

Cardiovascular Diseases (CVD) are among the leading causes of morbidity and mortality globally with hypertension ranking highest. Analysis by the National Health and Nutrition Examination Survey (NHANES), conducted during 1999-2006, showed that the overall prevalence of prehypertension in asymptomatic disease-free adults was an alarming 36.3% [1]. Similar studies conducted in India showed that more than 45% suffers from pre-hypertension [2].

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) defines "Prehypertension" as systolic blood pressure of 120-139 mm Hg or diastolic blood pressure of 80-89 mm Hg. Subjects with pre-hypertension have a greater risk of developing hypertension

later independent of other cardiovascular risk factors. Pre-hypertension is strongly associated with an increased risk of myocardial infarction and coronary artery diseases as stated by Framingham [3] and also there is higher risk to develop type-2 diabetes and chronic kidney disease [4,5].

Prehypertension in adolescents and young adults is a risk factor for developing hypertension in later years of life. So both patient and clinician are alerted to this risk and encouraged to intervene and prevent the disease from developing.

The higher the BP, there is higher the risk of both stroke and coronary events [6]. By detecting prehypertension earlier some remedial measures must be adopted to prevent hypertension and its consequences as age advances. Early identification of pre-hypertension plays an important role in screening for metabolic syndrome and prevention of CV accidents. Dyslipidemia is abnormal lipid profile. The prevalence of dyslipidemia is increasing worldwide [7]. The importance of treating dyslipidemias based on cardiovascular risk factors is highlighted by the National Cholesterol Education Program me guidelines. Several studies showed an increased prevalence of dyslipidemia in India. One of the causes of dyslipidemia is obesity. Dyslipidemia is a major risk factor for atherosclerosis also which contribute to cardiovascular complications [8].

In medical profession fast food consumption and stress are the major factors reported for obesity in teenagers. The causes which influence the fast food consumption are convenience, cost, menu choices, flavor and taste. Obesity is associated with sympathetic activation and is the leading risk factor for development of hypertension [9]. With this background we planned this study to find out the prevalence of pre-hypertension among medical students and its association with factors such as obesity and Dyslipidemia.

Materials and Methods

Study design and study setting

This descriptive prevalence study was conducted in Aarupadai Veedu Medical College, Puducherry, India after the study was approved by the Institutional Ethics Committee.

Data collection and techniques: The participating medical students were interviewed, and information regarding age, sex, personal habits such as smoking, alcohol intake, exercise profile, and dietary habits were collected using questionnaire. A written informed consent was obtained from all the participants who responded to the questionnaire survey.

A total of 300 medical students of first to final year MBBS (18-23 years) were selected randomly for this study. The students who were already diagnosed as hypertensive and under medication were excluded from this study. Each participant's data was collected by questionnaire method,

(which includes age, sex, family history) followed by anthropometric measurements of height and weight. BMI was calculated using the standard international formula (weight in kilograms /height in meter-square: kg/m^2).

To measure the blood pressure a mercury sphygmomanometer was used. Students were instructed not to smoke or take coffee half an hour prior to the checking of their blood pressure. A cuff bladder encircling at least 80% of the arm circumference was applied to the non-dominant arm. The disappearance of phase V Korotkoff sounds was taken as the diastolic reading. The mean of three readings, recorded 5 min apart was taken.

Subjects were classified as 3 groups:

• Normotensive (systolic blood pressure (SBP)<120 mmHg and diastolic BP (DBP)<80 or

• Hypertensive (SBP>140 or DBP>90) or

• Prehyperensive (SBP 120-139 or DBP 80-89)

Blood samples were collected in fluoride tube for glucose and Clot activator tubes for other estimations after an overnight fast. Fasting plasma glucose, serum cholesterol, triglyceride and HDLc, were estimated by using commercially available kits in automated analyzer. Serum LDLc, and VLDLc (very low density lipoprotein-cholesterol) were calculated by Friedwald's equation [LDLc=Total Cholesterol –(HDLc+VLDLc), Where VLDLc=TG/5]. All the data were analysed by using SPSS software.

Results

We enrolled 300 medical students of Aarupadai Veedu Medical College within the age group 18 to 23 years for this study. Students of different years were included after taking informed consent. Out of them 160 (53%) were males and 140 (47%) were females. The overall prevalence of PHT was 38%. Out of 160 male students 55 were Prehypertensive and 14 were hypertensive. Out of 140 female students 60 were Prehypertensive and 10 were hypertensive. So prevalence of prehypertension is more in females (Table 1 and Figure 1). Among the students 75% had normal BMI, 20% were overweight, 3% were obese and 2% were underweight (Figure 2).BMI of Prehypertensive were significantly more than the normotensive students (Figure 3). BMI of female students are more than the male students (Table 2 and Figure 4). Among the lipid parameters, prehypertensives showed significant increase in TC, TG, LDLc than normotensive students. TC, TG, LDLc were high for female students than male students (Table 3). Total prevalence of dyslipidaemia was 17.4% out of which 14.9% was hypercholesterolemia, 8.15% was hypertriglyceridaemia, 5.6% had high LDLc level and 10.4% had low HDLc level. So prevalence of hypercholesterolemia is more followed by low HDLc level (Table 4).

Table 1: Distribution of students according to Gender and BP.

	Total	Male	Female
No of students	300	160	140
Normotensive	161	91	70
Prehypertensive	115	55	60
Hypertensive	24	14	10
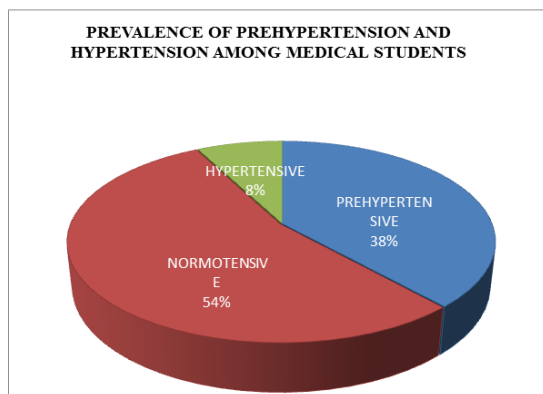
Figure 1. *Prevalence of prehypertension and hypertension among medical students.*
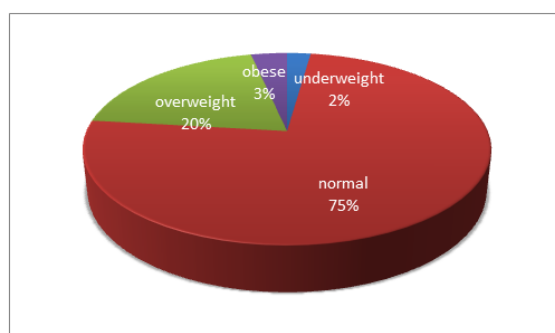
Figure 2. *Distribution of students according to BMI.*
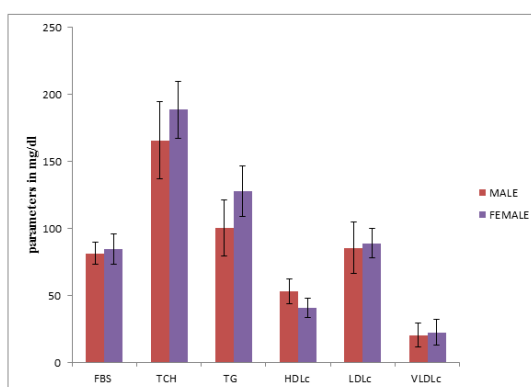
Figure 3. *FBS and Lipid profile among medical students.*

Table 2: BMI and BP in study group.

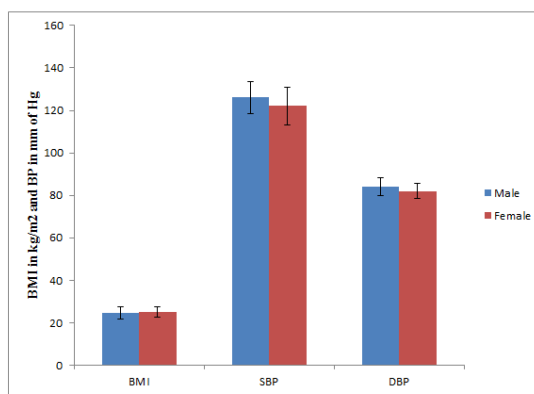|		BMI in Kg/m² (Mean ± SD)	SBP in mm of Hg (Mean ± SD)	DBP in mm of Hg (Mean ± SD)
Normotensive	M	22.8 ± 2.8	110 ± 7.7	76.8 ± 4.2
	F	21.8 ± 2.1	104 ± 7.2	70.8 ± 4.2
Prehypertensive	M	26.9 ± 4.1	124 ± 10.74	84.8 ± 2.6
	F	24.7 ± 4.1	122 ± 8.7	82.8 ± 3.6
Hypertensive	M	23.2 ± 2.5	130 ± 2.8	93.3 ± 1.6
	F	22.2 ± 2.4	128 ± 3.8	96.4 ± 1.6

Figure 4. BMI and BP among medical students.

Table 3: Biochemical parameters in study group.

Parameters (Mean ± SD)		FBS in mg/dl	TC in mg/dl	TG in mg/dl	HDLc in mg/dl	LDLc in mg/dl	VLDLc in mg/dl
Normotensive	M	83.6 ± 12	160 ± 35	88.6 ± 11.5	53.6 ± 9	82.6 ± 24.4	15.1 ± 5.5
	F	84.9 ± 12.4	165.5 ± 27	95.6 ± 20	46.4 ± 12	83.3 ± 22	17.6 ± 6.1
Prehypertensive	M	81.6 ± 8.1	165.9 ± 29	100.3 ± 21	53.3 ± 9.2	85.6 ± 19	20.6 ± 8.9
	F	88.6 ± 11	176.3 ± 28	123.6 ± 19	41.3 ± 8.9	91.5 ± 21	20.5 ± 7.8
Hypertensive	M	86.6 ± 11	167.6 ± 12	111.6 ± 22	49.6 ± 11	90.6 ± 13	23.6 ± 9.9
	F	84.6 ± 11.3	188.6 ± 21	127.8 ± 19	40.6 ± 7.2	88.9 ± 11	22.6 ± 9.8

Table 4: Prevalence of Dyslipidemia among medical students.

Dyslipidemia	Prevalence rate
Total dyslipidemia	17.4
Hypercholesterolemia	14.9
Hypertriglyceridemia	8.1
Low HDLc	10.4
High LDLc	5.6

There was a significant positive correlation between SBP with BMI, TG, TCh and VLDLc as shown in Table 5, significant positive correlation between DBP with TG and LDLc as shown in Table 6. There is negative correlation of SBP and DBP with HDLc. This might point out the contributory role of prehypertention towards dyslipidemia and obesity.

Discussion

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 overall prevalence of prehypertension in the entire group was 38%. The prevalence was more in girls (around

Table 5: Comparision of different parameters in Normotensive and Prehypertensive.

	BMI	FBS	TC	TG	HDLc	LDLc	VLDLc
Normotensive vs. Prehypertensive	P=0.02	P=0.07	P<0.001	P<0.001	P=0.12	P<0.001	P=0.09
	*	ns	***	***	ns	***	Ns

ns=Not significant, *Significant, ***Highly Significant

Table 6: Correlation (r-values) of different Biochemical Parameters in Prehypertensive group.

	AGE	BMI	FBS	SBP	DBP	TG	TCh	HDLc	LDLc	VLDLc
AGE	1									
BMI	0.003	1								
FBS	0.734	0.052	1							
SBP	0.769	0.531	0.21	1						
DBP	0.541	0.432	0.32	0.45	1					
TG	0.534	0.468	0.457	0.519	0.419	1				
TCh	0.11	0.4	0.254	0.633	0.733	0.257	1			
HDLc	-0.578	0.045	-0.357	-0.541	-0.441	-0.292	0.002	1		
LDLc	0.135	0.319	0.25	0.393	0.593	0.131	0.971	-0.15	1	
VLDLc	0.519	0.415	0.44	0.518	0.18	0.993	0.268	-0.3	0.142	1

50%) than boys (35%). Hypertension was found in 8% of students of whom 14 were male and 10 were female. The prevalence of prehypertension in the present study is higher than prevalence reported from a study in a medical college in Puducherry [10] 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% [11] 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 [12,13]. A third study from a medical college in Dehradun among 400 students also revealed an overall prevalence of prehypertension of 58.75% [14]. A study of 500 medical students in a Mangalore college showed a point prevalence of 55.4% [15]. A possible reason for the prehypertension in our group could be prevalence of overweight. 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 [15] among girls [13] and in both genders in the third study [11]. Our study also revealed a higher mean BMI among prehypertensives 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 [11-13,15]. A study from Israel concluded that BMI was the strongest predictor of prehypertension among males and females [16]. A study among medical students in coastal Karnataka has found a significant correlation between prehypertension and BMI in boys [15] while a study in Jamaica found a relation to overweight/obesity and waist circumference among younger prehypertensives [17]. 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 [18].

Studies have found an association of dyslipidemia, overweight and glucose intolerance with prehypertension [18-20]. A population study in China in 1154 subjects found that total cholesterol and triglycerides were significantly higher in prehypertensives compared to normotensives but LDL and HDL were similar [18]. BMI and waist circumference were of course higher among the prehypertensives. The Puducherry study too reported similar relation to the lipid profile [10]. Studies have also reported an association between prehypertension and glucose intolerance with the Lucknow study of 1746 adults (>30 yrs) showing, from multiple logistic regression analysis that impaired glucose tolerance, along with age, BMI and obesity were independent risk factors for hypertension and prehypertension [21]. A study in 83 pre hypertensives found a higher response to oral glucose tolerance test suggesting insulin resistance, but the fasting glucose levels were similar to normotensives [22]. However, in the present study, the mean fasting glucose levels were similar in both the groups. Similarly there

significant difference in lipid profile (P<0.001 for TC, TG and LDLc) between the samples of pre hypertensives and normotensives tested. One of the reasons for prehypertension could be this dyslipidemia. Out of these hypercholesterolemia is more prevalent and that could be due to taking more junk foods and oily foods from outside. A study from Iran among 892 adults (>30 years) however found, from multivariate logistic regression analysis, that overweight /obesity was the strongest predictor for prehypertension with an odds ratio of over 2.5 followed by male gender (OR=1.89), while diabetes, cholesterol, triglyceride, HDL and LDL were not significantly associated [23]. We recommend healthy lifestyle methods including exercise for maintaining a normal weight and preventing obesity and overweight as most studies have found that BMI /weight is a very strong predictor of prehyperension [24-26].

Conclusion

In conclusion, our study among healthy medical students found a prevalence of prehypertension of 38% and this was associated with a higher BMI and dyslipidemia .Prevalence of dyslipidemia is 17.4%. Hypercholesterolemia is more prevalent .Students should change their life style. They should do yoga, meditation regularly to cope with stress. They should avoid oily foods to decrease cholesterol level.

Acknowledgement

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