Original research article

Study of frequency of prehypertension and associated factors in medical students

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Abstract:

Introduction: Prevalence of prehypertension all over the world is 31% and in Indiaeven more. This calls for study of prehypertension and its association with different risk factors.

Aim: To find the frequency of prehypertension in medical students and it's correlation with associated factors like BMI, WHR, family history of hypertension, extra salt intake, exercise, type of diet.

Methods and Material: Study was carried out on 565 medical students of age group 18-22 years. Information regarding diet, exercise, salt intake and family history of hypertension was collected by administering a pretested & structured questionnaire. Anthropometric measurements were taken by standard methods. Blood pressure was measured by standard mercury sphygmomanometer.

Statistical analysis: The data was analyzed with SPSS software. Pearson's correlation test and Binary logistic regression analysis were used.

Results: Overall frequency of prehypertension was 45.3% (males 52%, females 47%). Family history of hypertension, extra salt intake, mixed diet and lack of exercise were found to be strong predictors of prehypertension.

Conclusions: The high prevalence of prehypertension in young age group and its association with family history of hypertension, dietary pattern and lack of exercise indicates the need of regular follow up of high risk population and targeted intervention with lifestyle modification.

Keywords: Prehypertension, BMI, WHR, exercise, diet.

INTRODUCTION:

The concept of prehypertension was introduced as the new guideline for the management of blood pressure by the seventh report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of high blood pressure (JNC–7) in 2003 & is defined as a systolic blood pressure of 120-139 mm Hg and /or a diastolic blood pressure of 80-89 mm Hg[1]. The relation between blood pressure and CVD risk is continuous over the whole range of blood pressure and therefore, prehypertension itself is associated with blood pressure related morbidity and mortality[2]. Also, Prehypertension is correlated with the recognized traditional cardiovascular risk factors such as Obesity, Diabetes Mellitus & Dyslipidemia and BMI is a strong predictor of prehypertension[3].

Prehypertensives with diabetes mellitus or nephropathy are at high risk and should receive antihypertensive treatment according to JNC 7. But, lifestyle modification in the form of DASH dietary pattern, weight loss, reduced sodium intake, physical activity and moderation of alcohol intake is the only intervention recommended for most prehypertensives with no other associated risk factors[4].The National Health and Nutrition Examination Survey (NHANES) 1999-2000 reported that the overall prevalence of prehypertension was 31% all over the world, which was higher in men than in women[5]. According to various studies conducted

in different demographic areas, the prevalence of prehypertension in India was found to range from as low as 30.15% in rural Andhra Pradesh to as high as 60% in Chennai.[6]

Although medical students are generally healthy, psychosocial factors like competitive nature of academic curriculum and change in the environment from home to hostel predispose these young ones to the stress that may increase the risk of prehypertension. This also predisposes them to lack of exercise and sedentary lifestyle. Moreover ongoing nutrition transition with progressive shift to a westernized diet leading to increased incidence of obesity in this age group may further increase the risk. So, expecting the lesser incidence of DM, dyslipidemia and renal diseases in very young adults (age 18-25 years) this cross-sectional study intend to find the frequency of prehypertension in young medical students and it'sassociation with factors like body mass index, waist hip ratio, family history of hypertension, extra salt intake, exercise, type of diet. So that early detection and follow up of prehypertension can help to manage it without pharmacotherapy and if not prevent, at least delay the complications.

METHODOLOGY:

Study design: Cross Sectional study

Place of study: Dept. of Physiology,Government Medical College &Hospital,Miraj.

Ethical consideration: This study is approved by Ethical committee of Govt. Medical College Miraj.

Sampling method: Simple random sampling.

Sample size: Assuming the prevalence of prehypertension to be 50 per cent, with 95% of confidence interval and 5 per cent absolute error, the sample size calculates to be 548. So, 565 students of second year onwards were enrolled in the study**.**

Inclusion Criteria:

All healthy medical students of age between 18-22 years studding in II & III year and giving informed consent to participate in the study were included in the study.

Exclusion Criteria:

1. Students reporting any resent illnesses like cold, fever etc.
2. Students on any medication for other short term illnesses.
3. Students with recent history of operations, blood transfusion.
4. Students with history of major illnesses or on treatment for renal disease, HTN, DM, dyslipidemia, endocrine disorders &Tuberculosis etc.
5. Students already diagnosed of or on medication for anxiety disorders & other psychological illnesses.

Subjects fulfilling inclusion criteria were enrolled. Written informed consent was obtained from each participant.

All the information was collected by administering a pretested & structured questionnaire that included questions regarding age, sex, dietary pattern, salt intake, medications, smoking & drinking habits, physical exercise and family history of hypertension.

Anthropometric measurements:

1. Standing height was measured to the nearest 0.1 cm using a wall mounted stadiometer (Chasmors Ltd. UK) and
2. Body weight was measured to the nearest 0.1 Kg in an automated balance (SECA, Germany).
3. Body Mass Index (BMI) was determined as Quetlet's Index (Kg/m^2). Overweight is defined as BMI>

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25 kg/m^2.

4. Waist Hip Ratio (WHR): Waist circumference was measured at the midpoint between lowermost point of the costal margin and highest point of iliac crest with the subject standing erect, at the end of normal expiration. Hip measurement was done at the maximum circumference of the hip and waist hip ratio was determined. Waist – hip ratio (WHR) of <1 was considered as normal and WHR > 1 was considered as high.
5. Blood pressure was measured in the morning between 8am & 9am with the standard mercury sphygmomanometer in a sitting position. The cuff encircling at least 80% of the arm circumference was applied to the non-dominant arm. The disappearance of lastregular Korotkoff sound was taken as the diastolic reading. The mean of three readings, recorded at 5 min interval were taken.[7,8]

   Care was taken to see that, there was no use of stimulants like smoking or caffeine ingestion at least an hour prior to the recording of their blood pressure. Prehypertension was defined as systolic blood pressure (SBP) 120-139 mm Hg and / or diastolic blood pressure (DBP) 80-89 mm Hg[1].

The data was analyzed with SPSS software (IBM Corp., Armonk, NY). Continuous data was expressed in terms of mean and standard deviation (SD). Association between variables was calculated using Pearson's chi-square test. Binary logistic regression analysis was carried out to find significant predictors of prehypertension.A 'p' value of 0.05 was considered as significant.

Results:

Tables: Table 1: Frequency of gender

Gender	Frequency	Percent
Female	270	47.8
Male	295	52.2
Total	565	100

Table 2: Frequency of prehypertension

PreHTN	Frequency	Percent
No	309	54.7
Yes	256	45.3
Total	565	100

Table 3: Frequency of prehypertension in Males and Females

Gender	PreHTN		Total
	No	Yes	
Male	130	165	295
	44.10%	55.90%	100.00%
Female	179	91	270
	66.30%	33.70%	100.00%
Total	309	256	565
	54.70%	45.30%	100.00%

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Table 4: Frequency of BMI categories

BMI	Frequency	Percent
Underweight	144	25.5
Normal	346	61.2
Overweight	60	10.6
Obese	15	2.7
Total	565	100

Table 5: Frequency of exercise

Exercise	Frequency	Percent
No	515	91.2
Yes	50	8.8
Total	565	100

Table 6: Frequency of Diet

Diet	Frequency	Percent
Mixed	485	85.8
Veg	80	14.2
Total	565	100

Table 7: Frequency of extra salt intake

Extra salt	Frequency	Percent
No	235	41.6
Yes	330	58.4
Total	565	100

Table 8a: Frequency of Family History of hypertension

Family History (Yes/No)	Frequency	Percent
No	270	47.8
Yes	295	52.2
Total	565	100

Table 8b: Family history of hypertension

Family History	Frequency	Percent
0	270	47.8
1	149	26.4
2	146	25.8
Total	565	100

0 = No family history of hypertension

1 = One parent family history of hypertension

2 = Both parent family history of hypertension

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Table 9: Mean, Std. deviation of different parameters

	SBP	DBP	Pulse	BMI	WHR	FH	Age
Mean	121.24	75.06	80.11	20.8439	0.8342	0.78	18.398
Median	120	75	80	20.1	0.84	1	18
Std. Deviation	8.048	6.689	5.015	4.01378	0.0523	0.83	0.6035
Minimum	98	55	69	12.57	0.71	0	18
Maximum	139	88	93	38.79	0.97	2	21

Table 10: Mean of BP, BMI, WHR of normotensives and prehypertensives

	All prehypertensives			All Normotensives		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
BP	253	128.32	4.815	312	115.49	4.978
DBP		79.23	5.44		71.58	5.401
BMI		21.7232	4.17323		20.131	3.73706
WHR		0.8452	0.04937		0.8253	0.05299

Table 11: Association of extra salt intake and prehypertension

Extra Salt	PreHTN		Total
	No	Yes	
No	210	25	235
	89.40%	10.60%	100.00%
Yes	99	231	330
	30.00%	70.00%	100.00%
Total	309	256	565
	54.70%	45.30%	100.00%
Pearson Chi-Square	195.184	0.000	

Table 12: Association of diet and prehypertension

Diet	PreHTN		Total
	No	Yes	
Mixed	243	242	485
	50.10%	49.90%	100.00%
Veg	66	14	80
	82.50%	17.50%	100.00%
Total	309	256	565
	54.70%	45.30%	100.00%
Pearson Chi-Square	29.086	0.000	

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Table 13: Association of Exercise and prehypertension

Exercise	PreHTN		Total
	No	Yes	
No	262	253	515
	50.90%	49.10%	100.00%
Yes	47	3	50
	94.00%	6.00%	100.00%
Total	309	256	565
	54.70%	45.30%	100.00%
Pearson Chi-Square	34.207	0.000	

Table 14: Association of Gender and prehypertension

Gender	PreHTN		Total
	No	Yes	
Male	130	165	295
	44.10%	55.90%	100.00%
Female	179	91	270
	66.30%	33.70%	100.00%
Total	309	256	565
	54.70%	45.30%	100.00%
Pearson Chi-Square	28.11	0.000	

Table 15: Association of BMI and Prehypertension

BMI	PreHTN		Total
	No	Yes	
Underweight	99	45	144
	68.80%	31.30%	100.00%
Normal	176	170	346
	50.90%	49.10%	100.00%
Overweight	27	33	60
	45.00%	55.00%	100.00%
Obese	7	8	15
	46.70%	53.30%	100.00%
Total	309	256	565
	54.70%	45.30%	100.00%
Pearson Chi-Square	16.192	0.001	

Table 16: Association of Family history and prehypertension

Family History (Yes/No)	PreHTN		Total
	No	Yes	
No	258	12	270
	95.60%	4.40%	100.00%
Yes	51	244	295
	17.30%	82.70%	100.00%
Total	309	256	565
	54.70%	45.30%	100.00%
Pearson Chi-Square	348.496	0.000	

Table 17: Association of Positive family history and prehypertension

Family History	PreHTN		Total
	No	Yes	
1	51	98	149
	34.20%	65.80%	100.00%
2	0	146	146
	0.00%	100.00%	100.00%
Total	51	244	295
	17.30%	82.70%	100.00%
Fisher's Exact Test	0.000		

Table 18: Association of Waist-Hip Ratio and prehypertension

Risk of metabolic complications*	PreHTN		Total
	No	Yes	
No risk	231	195	426
	54.20%	45.80%	100.00%
Risk	78	61	139
	56.10%	43.90%	100.00%
Total	309	256	565
	54.70%	45.30%	100.00%
Pearson Chi-Square	0.151	0.698	

* a waist-hip ratio of >= 0.90 in males and >= 0.85 in females

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Table 19: Binary logistic regression to find out significant predictors of prehypertension

Variables in the Equation	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Pulse	-0.032	0.034	0.891	1	0.345	0.968	0.905	1.035
BMI	0.077	0.041	3.534	1	0.060	1.08	0.997	1.17
Age	0.489	0.273	3.218	1	0.073	1.631	0.956	2.785
Salt(Yes)	-2.094	0.368	32.377	1	**0.000**	0.123	0.06	0.253
Diet(Mix)	-1.538	0.554	7.717	1	0.005	0.215	0.073	0.636
Exercise(No)	2.311	0.862	7.19	1	0.007	10.081	1.862	54.571
Gender	-1.101	0.334	10.903	1	0.001	0.332	0.173	0.639
Family History	4.663	0.44	112.291	1	**0.000**	105.986	44.736	251.095
Constant	-9.654	6.274	2.368	1	0.124	0		

B: Regression coefficient, S.E.: Standard Error, Wald: Wald's coefficient, df: degrees of freedom,

Sig: significance, Exp(B): odds ratio,

RESULTS:

Table 1 shows that 52.2 % of the study subjects are males and 47.8% are females.

Table 2 shows that overall frequency of prehypertension is 45.3%

Table 3 shows that frequency of prehypertension is more in males (55.90%) than in females (33.70%)

Table 4 shows that 25.5% of the subjects are underweight, 61.2% have normal BMI and remaining 13% are overweight to obese.

Table 5 shows that only 8.8% of the subjects are doing regular exercise.

Table 6 shows that maximum that is 85.8 % subjects are having mixed diet.

Table 7 shows that more than half (58.4%) the subjects are taking extra salt in their diet.

Table 8a & 8b shows that half (52.2%) of the subjects has family history of hypertension either maternal or paternal or both sides. Out of these 26.4% have one parental side & 25.8% have both parental side family history of hypertension.

Table 9 shows Mean and Std deviation of SBP, DBP, BMI and Waist hip ratio of the study population.

Table 10 shows Mean and Std. deviation of SBP, DBP, BMI and WHR in normotensives and prehypertensives

Table 11 shows 70 % of those taking extra salt in their diet were prehypertensives while only 10.6% of those not taking extra salt in diet were prehypertensive. This suggests highly significant association between prehypertension and use of extra salt in diet.

Table 12 shows 49.9% of those taking a mixed diet were prehypertensives whereas only 17.50% of vegetarians were having prehypertension. This suggests highly significant association between mixed diet and prehypertension.

Table 13 shows that only 6% of those doing regular physical exercise were prehypertensives in contrast 94% of regular exercisers were normotensives suggesting highly significant association between no exercise and prehypertension.

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Table 14 shows 55.90% of males were prehypertensives compared to 33.70% females suggesting highly significant association between male gender and prehypertension.

Table 15 shows highly significant association between higher BMI(overweight and obese) and prehypertension

Table 16 shows 82.70% of the prehypertensives had family history of hypertension. This suggests highly significant association between family history of hypertension and prehypertension.

Table 17 shows that among the prehypertensives all of those who had both maternal and paternal history of hypertension were having prehypertension. This suggests highly significant association between both maternal and paternal history of hypertension and prehypertension.

Table 18 shows there is no association between Waist hip ratio and prehypertesion.

In table no. 19 binary logistic regression was applied to find out the significant predictors.

We found that extra salt intake, family history of hypertension, gender, mixed diet and no exercise are highly significant predictors of prehypertension. Out of these extra salt intake and family history of hypertension were most significant predictors.

DISCUSSION:

Present study included 565 medical students of age group 18-22 years with 52.2% males and 47.8% females. Overall prevalence of prehypertension in entire group was 45.3%, more in males (55.9%) than in females (33.7%). Prevalence of prehypertension in our study was higher than the prevalence reported from the study in medical college in Puducherry (21.7%)[9] and Amlapurum (37.45%)[8] but is lower in comparison with the studies in medical students carried out at Davangere (64%)[10], Wardha(52%)[11,12], Deheradun (58.75%)[13] and Manglore (55.4%)[14]. Our finding is consistent with the well-known fact that higher blood pressure is common in males than females in reproductive age[15].

In our study, there was significant correlation between prehypertension and BMI, similar to finding in other studies. A study in medical students in coastal Karnataka has a similar finding[14]. A population study from China also concluded similarly[16]. However, the proportion of students in different categories of BMI (Underweight, normal, overweight, obese) was similar among normotensives and prehypertensives.

In the present study, highly significant correlation was found between prehypertension and extra salt intake in the diet. There are many proposed mechanisms by which increased salt intake increases blood pressure like increase in cardiac output, increase in peripheral resistance. Whether increased salt intake increases blood pressure by increasing cardiac output or peripheral resistance or both is not clear but what is clear is that salt can activate a number of neural, endocrine, paracrine and vascular mechanisms, all of which have the potential to increase blood pressure. In the present study, highly significant correlation was found between prehypertension and family history of hypertension. And it was more significant in students who had both maternal and paternal history of hypertension than who had only maternal or paternal history of hypertension. Our finding is similar to the finding in the study conducted at Agartala government medical college[7], and also similar to the finding in the study conducted at coastal Karnataka[14]. Adoption, twin, and family studies document a significant heritable component to blood pressure levels and hypertension[15].In the present study, significant correlation was found between prehypertension and mixed diet, no exercise.

In the present study, significant correlation was found between prehypertension and +male gender. Our finding is similar to the findings in the study conducted at Agartala government medical college[7], the study at coastal Karnataka[14] and also to the finding by Trevor Ferguson et al[17].

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In our study, no correlation was observed between prehypertension and waist-hip ratio. This finding is different from the finding in the study conducted at Agartala government medical college[7]. This could be because they considered a WHR with <= 1 and >1 while we considered the WHO guideline for the WHR values as >=0.90 in males and >= 0.85 in females[18]. Extra salt intake, family history, male gender, mixed diet and no exercise were found to be the significant predictors of prehypertension. A study at Agartala medical college[7] also found male gender to be significant predictor of prehypertension. However they also found BMI to be significant predictor of prehypertension. BMI was also found to be significant predictor by Itamar Grotto et al[19]. In our study, we didn't find BMI to be significant predictor.

LIMITATIONS OF PRESENT STUDY:

The cross-sectional design of our study prohibits any causal inference from the identified associations as a time sequence relationship cannot be determined. We didn't consider the extra salt intake in quantitative terms.

CONCLUSION:

We suggest that medical student should be educated about prehypertension and be advised to modify their lifestyle to prevent / delay the occurrence of prehypertension in them.

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