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A cross-sectional study on pre-hypertension & its association with anthropometric indices among undergraduate medical students in Andhra Pradesh, India

Sir,

Hypertension (HTN) is an emerging public health concern in India owing to steady increase in prevalence across the past few decades[1], especially in urban communities with wide geographic variation[2]. HTN develops gradually preceded by pre-HTN as evidenced by longitudinal studies demonstrating a three-fold increased incidence among participants of pre-HTN as compared to their counterparts[3]. The Seventh Report of the Joint National Committee (JNC 7)[4] defined pre-hypertension as persons with blood pressure (BP) above optimal levels [systolic BP (SBP) of 120-139 mm Hg or diastolic BP (DBP) of 80-89 mm Hg]. Community-based studies in India have demonstrated close to a third of the studied population with pre-HTN[5-7].

While most studies focused on HTN among older adults and elderly, some studies suggested that HTN was seen more commonly among younger population due to 'Globesity' (global epidemic of overweight and obesity)[8,9]. Thus, an attempt was made to estimate the prevalence of pre-HTN among medical undergraduate students and its association with anthropometric measurements.

A cross-sectional study was conducted among first year medical students (2015-2016) of Narayana Medical College, Nellore, Andhra Pradesh, India, following approval by the Institutional Ethics Committee. Apparently healthy students who consented (informed and written) to participate and were present on the day of the study were included in the study. Participants with known HTN/cardiovascular diseases and on drugs that would affect the parameters, were excluded from the study. Data were collected using pre-designed and pre-tested questionnaire on age, gender, type of diet (vegetarian or mixed), physically active (engaging

in non-occupational physical activity for >150 min a week), family history of HTN, consumption of alcohol/smoking and on medications. BP was recorded with a calibrated mercury sphygmomanometer following standard procedure and was classified according to the eighth report of JNC 8 criteria[10]. Normal BP was defined (mm Hg) as SBP <120 and DBP <80. SBP of 120-139 and/or DBP of 80-89 mm Hg was classified as pre-HTN, SBP 140-159 and DBP of 90-99 as Stage I HTN and SBP >160 and DBP >100 as Stage II HTN. Height was measured with a stadiometer following standard procedure to the nearest 0.01 kg, on a load cell-operated calibrated digital scale. BMI (weight in kg/height in m^2) <18.5 was considered as underweight, 18.5-22.9 as normal weight, 23-27.5 as overweight and BMI ≥27.5 as obese[11]. Waist circumference (WC) and hip circumference (HC) were measured in centimeter following standard procedure using a stretch-resistant tape. Waist hip ratio (WHR) was calculated.

Statistical analysis was performed using SPSS version 20.0 software (IBM Corp., Armonk, NY, USA). Prevalence of pre-HTN was calculated according to formula (Number of cases of pre-HTN/study population×100). Participants were divided into two groups: normotensive and pre-hypertensive groups. Continuous variables are expressed as mean±standard error of the mean. Comparison of continuous variables between the two groups was made using Student's t test. Association of factors such as gender, place of stay, excess salt intake and family history of BP was done using Chi-square test. Binary logistic regression analysis was performed using pre-HTN as dependent and other variables which were significantly associated with pre-HTN as independent variables.

Of the 250 students, 210 participated in the study and three students were excluded based on exclusion

criteria. The mean (±standard deviation) age of the participants was 18.53±0.84 yr (range: 17-21 yr). The prevalence of pre-HTN was 15.9 per cent (33/207, males: 29.3% and females: 5.2%). None were hypertensive. Prevalence of overweight and obesity was 43 per cent (n=89) and underweight was 12.6 per cent (n=26). In univariate analysis (Table I), only male gender with higher odds of pre-HTN was associated at significant level. Further, pre-hypertensive students had significantly higher values of anthropometric indices [BMI (22.3±0.29 vs. 26.6±1.05 kg/m^2), WC (78.3±0.75 vs. 88.9±2.66 cm), HC (94.1±0.65 vs. 103.4±2.09 cm) and WHR (0.82±0.003 vs. 0.85±0.01)] as compared to their counterparts. Multivariable binary logistic regression analysis was carried out to assess the relative contribution of significant independent variables (age, WHR, BMI and gender), which showed (Table II) gender and BMI significantly contributing in determining pre-HTN.

Almost one-third of the general population in our study setting[12] were reported to be hypertensive. To tackle the growing epidemic of HTN, assessment of the prevalence of pre-HTN in any community warrants utmost priority owing to its associated risk

of developing HTN[3]. Relatively, lower prevalence (15.9%) of pre-HTN was noted in our study similar to the findings from Kolkata (19.18%)[13] but in contrast to studies conducted among medical undergraduates within Andhra Pradesh (37.45%)[14], Agartala (45%)[15], Chennai (46.7%)[16] and Karnataka (55.4%)[17]. Prevalence of pre-HTN was higher among males as was observed by other researchers[6,15,16] also.

In the present study, pre-hypertensives had higher BMI, WC and WHR, indicating that overweight and obesity were major accompaniments before the development of HTN in accordance with other studies[18]. Overweight and obesity calculated by BMI were demonstrated as independent risk factors for the development of pre-HTN and cardiovascular disease[5,19] in India. Similarly, WC and WHR as a measure of abdominal/central obesity are also found to be a risk factor[20].

On logistic regression analysis, male gender and BMI were found to be significantly associated with pre-HTN. Similar to our findings, a few other studies have observed an independent association between BMI with either SBP or DBP among medical students[21,22]. Although WHR showed independent association, it was not significant in our study in contrast to the

Table I. Characteristics associated with pre-hypertension among undergraduate medical students				
Characteristic	Sample (%) (n=207)	Pre-HTN, n (%)	OR (95% CI)	*P*
Gender				
Female	115 (55.6)	6 (5.2)	1	0.001
Male	92 (44.4)	27 (29.3)	7.54 (2.96-19.25)	
Place of stay				
Hostel	158 (76.3)	23 (14.6)	1	0.328
Day-scholar	49 (23.7)	10 (20.4)	1.51 (0.66-3.43)	
Type of diet				
Vegetarian	18 (8.7)	1 (5.6)	1	0.208
Mixed	189 (91.3)	32 (16.9)	3.46 (0.45-26.98)	
Excess salt intake				
No	191 (92.3)	30 (15.7)	1	0.749
Yes	16 (7.7)	3 (18.8)	1.23 (0.33-4.61)	
Physical activity				
Adequate	175 (84.5)	25 (14.3)	1	0.128
Inadequate	32 (15.5)	8 (25.0)	2.00 (0.81-4.95)	
Family history of HTN				
No	131 (63.3)	19 (14.5)	1	0.458
Yes	76 (36.7)	14 (18.4)	1.33 (0.62-2.84)	
HTN, hypertension; CI, confidence interval; OR, odds ratio				

Table II. Multivariable binary logistic regression analysis of pre-hypertension

Variable (reference)	B	SE	Wald	df	P	OR	95% CI for OR	
							Lower	Upper
WHR	−7.475	5.146	2.110	1	0.146	0.001	0.001	13.615
Gender (female)	2.089	0.573	13.264	1	0.001	8.073	2.624	24.840
BMI	0.233	0.060	14.880	1	0.001	1.262	1.121	1.421
Age	0.290	0.269	1.164	1	0.281	1.337	0.789	2.266
Constant	−7.742	6.003	1.664	1	0.197	0.001		

Nagelkerke R^2=0.331. SE, standard error; OR, odds ratio; CI, confidence interval; WHR, waist hip ratio; BMI, body mass index

independent relationship noted between WHR and either systolic or DBP by a few others[21,22], which could be attributed to a small number of participants. In conclusion, about 16 per cent medical and graduate students had pre-HTN in our study. In view of the growing burden due to HTN, early intervention for lifestyle changes is needed.

Conflicts of Interest: None.

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