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RESEARCH ARTICLE

Study of blood pressure, pre-hypertension, and hypertension in medical students

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ABSTRACT

Background: Hypertension (HTN) is a non-communicable disease of major public health problem, and pre-HTN in adolescents and young adults is an important risk factor for developing HTN in the future. By detecting pre-HTN earlier, some remedial measures may be adopted to prevent HTN. **Aims and Objectives:** To study normal blood pressure (BP), HTN, and pre-HTN in medical students studying at Government Medical College. **Materials and Methods:** A total of 222 medical students from three different professionals (MBBS) of Government Medical College were taken, interviewed with a predesigned questionnaire, and physical examination including BP measurement conducted. **Results:** About 164 students (73.9%) had normal BP and 58 students (26.1%) were pre-hypertensive, there was no case of HTN. Out of 117 male students, 39 (33.3%) and out of 105 female students, 19 (18.1%) were pre-hypertensives. No one had a current smoking habit of any type. There was no smokeless tobacco habit also, and one student had a past history of smoking. Only one had current alcohol habit. Passive tobacco exposure risk was present in 7 students. **Conclusion:** Mean systolic BP was 115.37 ± 8.21 and mean diastolic BP was 75.70 ± 7.00. If smoking or smokeless tobacco habit is less or nil, there is less chance of developing HTN or pre-HTN.

KEY WORDS: Hypertension; Pre-hypertension; Medical Student; Normal Blood Pressure

INTRODUCTION

Hypertension (HTN) is a non-communicable disease (NCD) of major public health problem resulting in increased morbidity and mortality among population. Pre-HTN in adolescents and young adults is an important risk factor for developing HTN in the future. Hence, general population would be alerted to this risk and encouraged to intervene and prevent the disease from developing pre-HTN and HTN.[1]

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Normal adult blood pressure (BP) is defined as a systolic BP (SBP) of 120 mmHg and a diastolic BP (DBP) of 80 mmHg. However, the cardiovascular benefits of normal BP extend to lower systolic (105 mmHg) and lower DBP levels (60 mmHg). HTN is defined as a SBP equal to or above 140 mmHg and/or DBP equal to or above 90 mmHg.[2] Joint National Committee 7 Report has introduced a new classification that includes the term "pre-HTN" for those with BP ranging from 120 to 139 mmHg systolic and/or 80-89 mmHg diastolic; HTN Stage I - 140-159/90-99 mmHg and HTN Stage II - 160 or above/100 or above mmHg. This new classification would identify those individuals, in whom early intervention by adoption of healthy lifestyles could reduce BP, decrease the rate of progression of BP to hypertensive levels with age, or prevent HTN entirely.[3]

One study conducted in Pakistan[4] regarding awareness of HTN among medical students and junior doctors showed

that only 26.74% participants were acquainted with the basic definitions including the cutoff levels for BP among the general population, in diabetics, in those with chronic kidney disease and pre-HTN.

By detecting pre-HTN earlier, some remedial measures may be adopted to prevent HTN and its consequences as age advances. Medical students are prone for stress and other risk factors of HTN; therefore, the present study is undertaken to find normal BP, pre-HTN, and HTN among undergraduate medical students. An attempt will be made to find what is mean BP and their standard variation for these young medical students and also to know how many are pre-hypertensives and hypertensives so that some recommendation could be advised for this age group.

High BP is a major global health risk, affecting 1 billion people worldwide in 2008, responsible for 45% of deaths due to heart disease.[2]

HTN is diagnosed and treated in 25% of the cases only, making it largely an underdiagnosed problem. HTN begins in childhood and adolescence. Several studies in India have reported the prevalence of HTN ranging between 0.46% and 11.7% among children and adolescents.[5]

One study[6] conducted in coastal Karnataka showed 277 students (55.4%) out of 500 students were pre-hypertensives, out of which 145 (29%) students had a high SBP and 132 (26.4%) had high DBP, and not a single student was hypertensive.

Overall prevalence of pre-HTN in the entire group was 37.45% (boys and girls - 39.18% and 35.43%, respectively) and 3.63% hypertensives in another study[7] conducted in 275 medical students of first to final year MBBS in the age group of 17-25.

One study conducted in Orissa[1] showed high overall prevalence of pre-HTN and HTN, i.e. 67% (pre-HTN 64% and HTN 3%) among medical students, which would be alarming. A study conducted in Iranian students[8] showed that the prevalence of pre-HTN and HTN was 6.9% and 5.6%, respectively.

Das et al. observed in their study[9] in Bengal, the overall prevalence of HTN was 13%, among which 11% had Stage I and 2% had Stage II HTN. Out of remaining medical students, another 21% were pre-hypertensive. Hence, almost one-third of medical students either suffered from HTN or were at risk of HTN (pre-HTN). Even pre-HTN, which is the starting point of cardiovascular disease continuum, is associated with detrimental heart change in young people. The age group of 18-22 years is important physically, mentally, and emotionally; medical students represent this group. HTN and pre-HTN are on the rise and not detected due to inadequate screening at this age.

Another study[10] of adults living in the largest urban slum in Kenya showed high age-adjusted prevalence of HTN with close to quarter (23%) classified as hypertensive and 60% as pre-hypertensive. 20% were aware of their hypertensive status, 52% were classified as harmful alcohol drinkers, and 10% were current smokers.

Kulkarni et al.[11] observed in one cross-sectional study, 67% were pre-hypertensive/hypertensive and mean SBP 117.68 ± 7.16 mmHg and that of DBP was 77.3 ± 7.93 mmHg among 100 medical students in Davangere.

Based on the history of intake of tobacco smoking, 14.5% of undergraduate medical students had smoking habit and prevalence of HTN was obviously higher (58.6%) among smokers than non-smokers (5.3%) and this difference was statistically significant.[9]

As most studies describe knowledge of HTN and its risk factors in older adults and the elderly, there is a paucity of such data among teenagers and young adults because they are considered to be at a lower risk of developing the disease. With a growing problem of HTN worldwide, there is a concern that HTN in young adults may also be on the rise and that cases are not detected because of inadequate screening in this age group. HTN in children increased significantly over the past few decades, tracks into adulthood, and is a major risk factor for cardiovascular disease.

A number of environmental factors have been found to be associated with HTN in children and adolescents. Thus, early detection of HTN and its aggravating factors becomes imperative. The data on BP profile of school/college adolescents are scanty in India. Considering the detection of HTN in adolescence as the best possible preventive intervention to avoid complication later in life.[5]

Aims and Objectives of Study

i. To study normal BP in medical students,
ii. To study HTN and pre-HTN in medical students.

MATERIALS AND METHODS

It is a cross-sectional study, and the study participants were all medical students of 3 admission year batches as a convenient sampling method. A total of 300 students were in 3 admission batches, those who gave consent were included in the study. A total of 222 medical students (117 males and 105 females) studying in Government Medical College, Raichur Institute of Medical Sciences (RIMS), Raichur admitted between year 2013-2014 and 2015-2016 were included in this study. Prior consent was sought from the Dean of the institute. Informed written consent to participate in this study was taken from all the participants, and the study proposal was approved from the Institutional Ethics Committee, RIMS, Raichur. The study period was from December 2015 to June 2016.

The college authority and study participants were explained about the purpose of the study and assured privacy and confidentiality of the information provided by them. Participants were given a predesigned, semi–structured, and pretested pro forma to collect the information.

Before the start of physical examination, students were briefed about the whole procedure. Any significant past history in the past 1 year along with family history of NCDs such as HTN, diabetes, and coronary heart disease was asked from the participants and appropriately recorded.

BP was measured in sitting posture using a standard sphygmomanometer on two different occasions, with at least 10 min gap, both the readings and the average were noted. BP was classified as per the Joint National Committee on prevention, detection, evaluation, and treatment of BP (BP in pre-HTN - 120-139/80-89 mmHg, HTN Stage I - 140-159/90-99 mmHg, and HTN Stage II - 160 or above/100 or above mmHg).

Those with normal BP (systolic and diastolic <120/80 mm of Hg) were grouped as "normal" and those between systolic 120 and 139 or diastolic 80-89 mm of Hg were labeled pre-hypertensive and those in the hypertensive Stage I or II were categorized as "hypertensive." The participants with a history of HTN and on antihypertensive drugs were also labeled as hypertensive.

Inclusion Criteria

1. Willing to give informed consent
2. Age between 18 and 24 years
3. Under antihypertensive medications.

Exclusion Criteria

1. Students with renal or renovascular disease, polycystic kidney, pheochromocytoma, Cushing syndrome, acromegaly, hypothyroidism, and hyperparathyroidism
2. Pregnancy
3. Students under other than antihypertensive medications, for example, oral contraceptive pill and anabolic steroids.

Statistical Analysis

The data were analyzed by SPSS software and presented by percentage, mean, and standard deviation. Chi-square test and ANOVA tests were applied as test of significance, wherever applicable.

RESULTS

Table 1 shows the distribution of normal BP, pre-HTN, and HTN among 222 medical students. 164 students had normal BP and 58 students had pre-HTN, there was no case of HTN. 26.1% were pre-hypertensive and 73.9% had normal BP. Out of total 222 medical students, 81 from 1st MBBS, 61 from 2nd MBBS, and 80 from 3rd MBBS were presented. Out of 58 (26.1%) pre-hypertensive students, 24 (30%) from 3rd MBBS, 21 (25.9%) from 1st MBBS, and 13 (21.3%) from 2nd MBBS were pre-hypertensives. Chi-square value for different MBBS for normal BP and pre-HTN was 1.356 with two degree of freedom. *P* - 0.508 was not significant.

Table 1: MBBS professional-wise distribution of BP, HTN, pre-HTN, and normal BP among MBBS students

MBBS groups	Normal BP (%)	Pre-HTN (%)	HTN	Total (%)
1st MBBS	60 (74.1)	21 (25.9)	0	81 (36.5)
2nd MBBS	48 (78.7)	13 (21.3)	0	61 (27.5)
3rd MBBS	56 (70.0)	24 (30.0)	0	80 (36)
Total	164 (73.9)	58 (26.1)	0	222

χ^2=1.356, df=2, *P*=0.508. *P*>0.05 (Not significant),
HTN: Hypertension, BP: Blood pressure

Table 2 shows the distribution of normal BP and pre-HTN between different MBBS versus male and female students among 222 medical students (male students - 117 and female students - 105). 39 (33.3%) male students and 19 (18.1%) female students were pre-hypertensives, 18 (37.5%) were from 3rd MBBS among male students, and 6 (18.7%) were from 3rd MBBS among female students. Out of 117 male students, 48 (60%) were from 3rd MBBS, and in 105 female students, 43 (53.1%) were from 1st MBBS.

Chi-square value of different MBBS for normal BP and pre-HTN among male students was 1.178 with two degree of freedom, *P* - 0.555 not significant; among female students was 0.58 with two degree of freedom, *P* - 0.971 not significant and among total students was 1.356 with two degree of freedom, *P* - 0.508 not significant.

Table 3 shows the distribution of normal BP and pre-HTN between different age groups of medical students versus male and female students among 222 medical students (male students - 117 and female students - 105). 39 (33.3%) male students and 19 (18.1%) female students were pre-hypertensives, 19 pre-hypertensives among male students and 11 pre-hypertensives among female students were from 19 to 20 years age groups. Out of 117 male students, 62 were from 19 to 20 years age groups, and in 105 female students, 64 were from 19 to 20 years age groups.

Chi-square value for different age groups of medical students for normal BP and pre-HTN among male students was 0.605 with three degree of freedom, *P* - 0.895 not significant; among female students was 1.719 with two degree of freedom, *P* - 0.423 not significant; and among total students was 3.164 with three degree of freedom, *P* - 0.367 not significant.

Table 2: MBBS group and sex-wise distribution of pre HTN/normal BP in medical students

MBBS groups	Gender						
	Male[α] (*n*=117) N (%)			Female[β] (*n*=105) N (%)			Total[μ] (%)
	Pre-HTN	Normal BP	Total	Pre-HTN	Normal BP	Total	
1st MBBS	13 (34.2)	25 (65.8)	38 (46.9)	8 (18.6)	35 (81.4)	43 (53.1)	81 (36.5)
2nd MBBS	8 (25.8)	23 (74.2)	31 (50.8)	5 (16.7)	25 (83.3)	30 (49.2)	61 (27.5)
3rd MBBS	18 (37.5)	30 (62.5)	48 (60.0)	6 (18.7)	26 (81.3)	32 (40.0)	80 (36)
Total	39 (33.3)	78 (66.7)	117 (52.7)	19 (18.1)	86 (81.9)	105 (47.3)	222

[α](χ^2=1.178, df=2, *P*=0.555, *P*>0.05 [Not significant]), [β](χ^2=0.58, df=2, *P*=0.971, *P*>0.05 [Not significant]), [μ](χ^2=1.356, df=2, *P*=0.508, *P*>0.05 [Not significant]). HTN: Hypertension, BP: Blood pressure

Table 3: Age groups and sex-wise distribution of pre HTN/normal BP in medical students

Age groups (years)	Gender						
	Male[α] *n*=117 (%)			Female[β] *n*=105 (%)			Total[μ] (%)
	Pre-HTN	Normal BP	Total	Pre-HTN	Normal BP	Total	
17-18	7 (33)	14 (66)	21 (42.9)	4 (14.3)	24 (85.7)	28 (57.1)	49 (22.1)
19-20	19 (30.6)	43 (69.4)	62 (49.2)	11 (17.2)	53 (82.8)	64 (50.8)	126 (56.8)
21-22	12 (38.7)	19 (61.3)	31 (70.5)	4 (30.8)	9 (69.2)	13 (29.5)	44 (19.8)
≥23	1 (33.3)	2 (66.7)	3 (100)	0	0	0	3 (1.3)
Total	39 (33.3)	78 (66.7)	117 (52.7)	19 (18.1)	86 (81.9)	105 (47.3)	222

[α](χ^2=0.605, df=3, *P*=0.895, *P*>0.05 [Not significant]); [β](χ^2=1.719, df=2, *P*=0.423, *P*>0.05 [Not significant]); [μ](χ^2=3.164, df=3, *P*=0.367, *P*>0.05 (Not significant), HTN: Hypertension, BP: Blood pressure

Table 4 describes the distribution based on smoking habits, alcohol consumption, and passive tobacco exposures in medical students of RIMS, which shows that no one had a current smoking habit of any type. There was no smokeless tobacco habit also, and one student had a past history of smoking. Only one student had current alcohol habit. Passive tobacco exposure risk was present in 7 students.

Table 5 shows SBP and DBP reading in different MBBS students. Mean systolic reading of 3rd MBBS students was 117.60 ± 7.75 and mean diastolic reading of 3rd MBBS was 77.05 ± 7.52, whereas for whole MBBS students, mean systolic reading was 115.37 ± 8.21 and mean diastolic reading was 75.70 ± 7.00.

Table 6 shows a comparison of SBP and DBP reading between different MBBS groups. After applying ANOVA test between 1st MBBS, 2nd MBBS, and 3rd MBBS, all three systolic readings – 1st, 2nd, and mean reading were found significant. While diastolic 1st, 2nd, and mean reading were not significant.

DISCUSSION

In the present study among 222 medical students, 164 students were having normal BP and 58 students had pre-HTN, there was no case of HTN. 26.1% were pre-hypertensive and 73.9% had normal BP. Out of 222 medical students, 81 from 1st MBBS, 61 from 2nd MBBS, and 80 from 3rd MBBS were presented. Among 58 (26.1%) pre-hypertensive, 24 (30%) from 3rd MBBS, 21 (25.9%) from 1st MBBS, and 13 (21.3%) from 2nd MBBS were hypertensives. Chi-square value for different MBBS for normal BP and pre-HTN was 1.356 with two degree of freedom. *P* value was 0.508, which was not significant. In the present study, it was good that no case of HTN was detected, whereas 26.1% were pre-hypertensives.

Similar findings were in one study conducted in Karnataka by Shetty and Nayak[6] showed that there was no HTN case in medical students of coastal Karnataka, whereas pre-HTN was 55.4% which were much higher than our study. One another study[7] in Andhra Pradesh in 275 medical students showed pre-HTN were 37.45 % and HTN 3.63%. Another study[11] at Davangere, HTN and pre-HTN were 67%.

In our study (Table 2), normal BP and pre-HTN between different MBBS versus male and female students among 222 medical students (male students - 117 and female students - 105) had been shown. 39 (33.3%) male students and 19 (18.1%) female students were pre-hypertensives, 18 (37.5%) were from 3rd MBBS among male students, and 6 (18.7%) were from 3rd MBBS among female students. Out of 117 male students, 48 (60%) were from 3rd MBBS, and in 105 female students, 43 (53.1%) were from 1st MBBS.

Chi-square value of different MBBS for normal BP and pre-HTN among male students was 1.178 with two degree of freedom, *P* - 0.555 not significant; among female

Table 4: Distribution based on smoking habits, alcohol consumption, and passive tobacco exposure in medical students

Habits	Frequency (%)	Characteristics	Remarks
Current smoker	Nil		Less frequency or nil of smoking habits, alcohol consumption, smokeless tobacco and very less 3.2% of passive smoking exposure shows that good habits in these MBBS students were more prevailing. It may be due to two reason, college was not very old, hardly 10 years old, so bad habits were not so much prevalent. Being a district place, so less exposure to metro cities life, where these habits were more. Out of 7 passively exposed to smoking, 3 had pre-HTN
Ex (past/quit) smoker	1 (0.5)	Male, 24-year-old, 3rd MBBS, 1 year back, started smoking at 22 years smoked for 7 months, and since last 1½ year left smoking	
Smokeless tobacco	Nil		
Current alcohol user	1 (0.5)	Male, 21-year-old, 3rd MBBS, Occasionally, all types of alcohol products, once in month, 250 ml	
Ex (former) alcohol user	Nil		
Passive tobacco exposure	7 (3.2)	All males, 2 from 1st MBBS of 18 years age, 2 from 2nd MBBS of 19 years age, 3 from 3rd MBBS of 20 years and 21 years (2)	

HTN: Hypertension

Table 5: SBP and DBP reading (1st, 2nd, and mean), in different MBBS professional (mean±SD)

MBBS groups	Mean±SD					
	Systolic reading			Diastolic reading		
	1st	2nd	Mean	1st	2nd	Mean
1st MBBS (*n*=81)	113.14±8.17	112.70±9.65	112.92±8.49	75.31±6.77	75.20±7.57	75.25±6.80
2nd MBBS (*n*=61)	115.43±7.90	115.96±7.64	115.70±7.65	74.36±6.35	74.70±6.57	74.53±6.36
3rd MBBS (*n*=80)	117.59±7.76	117.61±7.89	117.60±7.75	77.13±7.74	76.98±7.44	77.05±7.52
Total (*n*=222)	115.37±8.14	115.37±8.74	115.37±8.21	75.70±7.09	75.70±7.29	75.70±7.00

DBP: Diastolic blood pressure, SD: Standard deviation, SBP: Systolic blood pressure

Table 6: Comparison of SBP and DBP reading (1st, 2nd and mean), in different MBBS professional (mean±SD) and ANOVA test within the group

BP reading	MBBS groups (mean±SD)			Sum of square within group	DF	Mean sum of square	F-value	Significance
	1st MBBS	2nd MBBS	3rd MBBS					
1st systolic reading	113.14±8.17	115.43±7.90	117.59±7.76	13849.8	219	63.24	6.308	0.002
2nd systolic reading	112.70±9.65	115.96±7.64	117.61±7.89	15867.8	219	72.46	6.900	0.001
Mean systolic	112.92±8.49	115.70±7.65	117.60±7.75	14015.6	219	63.99	6.958	0.001
1st diastolic reading	75.31±6.77	74.36±6.35	77.13±7.74	10814.1	219	49.38	2.879	0.058
2nd diastolic reading	75.20±7.57	74.70±6.57	76.98±7.44	11541.5	219	52.70	2.001	0.138
Mean diastolic	75.25±6.80	74.53±6.36	77.05±7.52	10592.3	219	48.37	2.534	0.082

DBP: Diastolic blood pressure, DF: Degree of freedom, SD: Standard deviation, SBP: Systolic blood pressure

students was 0.58 with two degree of freedom, *P* - 0.971 not significant; and among total students was 1.356 with two degree of freedom, *P* - 0.508 not significant.

One study by Chitrapu and Thakkallapalli[7] showed that pre-HTN prevalence in boys was 39.18% and among girls was 35.43%, whereas in my study, its 33.3% and 18.1%, respectively.

About 19 pre-hypertensives were from 19 to 20 years age groups among male students and 11 pre-hypertensives were from 19 to 20 years age groups among female students. Out of 117 male students, 62 were from 19 to 20 years age groups, and in 105 female students, 64 were from 19 to 20 years age groups.

No one had a current smoking habit of any type. There was no smokeless tobacco habit also, and one student had a past history of smoking. Only one student had current alcohol habit. Passive tobacco exposure risk was present in 7 students. This shows the students of this institute were having less bad habits and therefore less risk factors. It may be because of institute was situated at district place so there was less exposure to Metropolitan's life style and habits, which may be good for health.

One study in Udupi[12] showed a higher proportion of smokers (7.7%) among pre-hypertensives than 2 % in normotensives and proportion of subjects who consumed other forms of tobacco was observed to be higher among pre-hypertensives 9.0% as compared to normotensives

3.2%. Consumption of alcohol was found to be significantly higher 15.4% among pre-hypertensives as compared to normotensives 4.4%.

In another study conducted by Ray et al.[13] showed that of the smokers, 12% had more than 20 cigarettes/day. Proportion of personnel that reported consuming alcohol more than 3 times a week was only 2.3% with a higher proportion observed in officers than other ranks.

In our study, mean systolic reading of all MBBS students was 115.37 ± 8.21 and mean diastolic reading of all MBBS students was 75.70 ± 7.00. Similar findings were in one study[14] mean systolic reading was 116.9 ± 12.4 and mean diastolic reading was 68.0 ± 8.7 in primary school children. In another study[11] among medical students in Davangere, mean SBP was 117.68 ± 7.16 and mean DBP was 77.3 ± 7.93.

In our study out of 58 pre-hypertensives, 46 had high SBP (34 males and 12 females) and 33 had high DBP (20 males and 13 females). In another way among 58 pre-hypertensives, 12 had normal SBP (5 males and 7 females) and 25 had normal DBP (19 males and 6 females).

In one similar study[6] among 277 students (55.4%) pre-hypertensives, out of which 145(29%) students had a high SBP and 132(26.4%) had high DBP.

CONCLUSION

Our study included 222 medical students, 58 students (26.1%) had pre-HTN; 39 (33.3%) male students and 19 (18.1%) female students were pre-hypertensives out of total 117 male and 105 female students. Smoking and smokeless tobacco habit were nil. Mean SBP was 115.37 ± 8.21 and mean DBP was 75.70 ± 7.00.

REFERENCES

1. Patnaik A, Choudhury KC. Assessment of risk factors associated with hypertension among undergraduate medical students in a medical college in Odisha. Adv Biomed Res. 2015;4:38.
2. World Health Organization. A Global Brief on Hypertension. Geneva: WHO; 2013. p. 9-17.
3. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. The seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure: The JNC 7 report. JAMA. 2003;289(19):2560-72.
4. Rehman A, Rehman T, Shaikh MA, Naqvi SA. Awareness of hypertension among the medical students and junior doctors - A multicenter study from Pakistan. J Pak Med Assoc. 2011;61(11):1153-7.
5. Anand T, Ingle GK, Meena GS, Kishore J, Kumar R. Hypertension and its correlates among school adolescents in Delhi. Int J Prev Med. 2014;5 Suppl 1:S65-70.
6. Shetty SS, Nayak A. Prevalence of prehypertension amongst medical students in coastal Karnataka. J Evol Med Dent Sci. 2012;1(6):975-80.
7. Chitrapu RV, Thakkallapalli ZM. Prehypertension among medical students and its association with cardiovascular risk factors. J NTR Univ Health Sci. 2015;4(1):8-12.
8. Kelishadi R, Heshmat R, Ardalan G, Qorbani M, Taslimi M, Poursafa P, et al. First report on simplified diagnostic criteria for pre-hypertension and hypertension in a national sample of adolescents from the Middle East and North Africa: The CASPIAN-III study. J Pediatr (Rio J). 2014;90(1):85-91.
9. Das P, Basu M, Chowdhury K, Mallik S, Dhar G, Biswas A. Observational assessment and correlates to blood pressure of future physicians of Bengal. Niger J Clin Pract. 2013;16(4):433-8.
10. Joshi MD, Ayah R, Njau EK, Wanjiru R, Kayima JK, Njeru EK, et al. Prevalence of hypertension and associated cardiovascular risk factors in an urban slum in Nairobi, Kenya: A population-based survey. BMC Public Health. 2014;14:1177.
11. Kulkarni MM, Hemagiri K, Malavika, Patil RS. Prehypertension and associated factors among medical students of SSIMS and RC, Davangere - A cross-sectional study. J Indian Med Assoc. 2011;109(10):733-4, 736.
12. Kini S, Kamath VG, Kulkarni MM, Kamath A, Shivalli S. Pre-hypertension among young adults (20-30 years) in coastal villages of Udupi district in Southern India: An alarming scenario. PLoS One. 2016;11(4):e0154538.
13. Ray S, Kulkarni B, Sreenivas A. Prevalence of prehypertension in young military adults and its association with overweight and dyslipidaemia. Indian J Med Res. 2011;134(2):162-7.
14. Kidy F, Rutebarika D, Lule SA, Kizza M, Odiit A, Webb EL, et al. Blood pressure in primary school children in Uganda: A cross-sectional survey. BMC Public Health. 2014;14:1223.

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