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RESEARCH ARTICLE

Prevalence of prehypertension in young adults in South India

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ABSTRACT

Background: Cardiovascular diseases are more common in developing countries, especially in younger age group. Young adults are considered as the healthiest population inevitably adding to the growth of the nation. Obesity and hypertension are the major cause for cardiovascular morbidity and mortality. **Aim and Objective:** This study aims to estimate the prevalence of pre-hypertensives in young adults. **Materials and Methods:** A total of 385 healthy volunteers were randomly selected between 18 and 35 years of age in both genders. Persons with known hypertension, diabetes mellitus, endocrinological disorders and on drugs for any illness were excluded from the study. Anthropometric measurements and basal blood pressure (BP) were recorded. **Results:** The prevalence of prehypertension (systolic BP [SBP]: 120–139 mmHg and diastolic BP [DBP]: 80–89 mmHg) was 25.45%. The difference between the SBP, DBP, and the body mass index (BMI) between the two genders is found to be significant. As the age increases, SBP, DBP, and BMI increase significantly. There is a strong association between BP and BMI. **Conclusion:** This study shows that one-fourth of young adults were pre-hypertensive (25.45%). Individual with parental history of hypertension and those with no physical activity are more prone to become hypertensive in future. As their BP strongly correlates to BMI, lifestyle modification will play crucial role in management.

KEY WORDS: Prehypertension; Young Adults; Prevalence

INTRODUCTION

The occurrence of cardiovascular disease is on the increasing trend in the developing countries. About 17.9 million deaths due to cardiovascular disease occur worldwide in the middle-aged adults.[1] Peculiar concern is that relatively early age of death in developing countries. Hypertension is the most common cardiovascular disorder which accounts for 20–50% of all cardiovascular deaths.[2] The prevalence of hypertension in adults was 31.1% in 2010.[3] In earlier days, hypertension was considered to be as disease of adult, but recent studies show an alarming rise in the prevalence of hypertension in young age group starting from childhood itself.

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Prehypertension is defined as the systolic pressure of 120–139 mmHg and diastolic blood pressure (DBP) of 80–89 mmHg.[4] As per the National Health and Nutrition Examination Survey, prehypertension prevalence was 31%; men more affected than women.[5] The pre-hypertensive prevalence was 39% in ATTICA study (43% in men and 35% in women).[5] The prevalence of prehypertension in India was 40–60%.[6]

Young adults of age 18–35 years are the active and healthy population group. This age is considered as the most salubrious

time of life. Biological function and physical performance reach their pinnacle at 20–35 years of age, waning after 35. Therefore, they invest all their exertion in the amelioration of themselves and to reach their destination. In addition to hypertension, myocardial infarction and cerebrovascular accidents are other devastating conditions that are found to be in increasing trend nowadays among young adults.[7] Not only individual health is affected but also the family and society at large scale suffer because of socioeconomic defects that result from these morbid conditions.

In South India, where the diet is rich in carbohydrate and the practice of eating salted food like salted dried fish increases the risk of becoming hypertensive. As there are very less studies on prevalence of prehypertension in South India, this study was taken up to estimate the prevalence of prehypertension among young adults. If the prehypertension is identified earlier, when they are asymptomatic, suitable measures can be taken by them to bring down their blood pressure (BP) to normal, thereby preventing or delaying themselves in becoming hypertensive in future.

MATERIALS AND METHODS

This cross-sectional study was conducted in Research Laboratory, Physiology Department, Tirunelveli Medical College Hospital, from July to October 2013 after obtaining Institute Research Committee and Institutional Ethical Committee clearance (138/PHYS/IEC/2011). This study was done in healthy volunteers of students, staffs, and the general public of both sexes in the age group of 18–35 years after obtaining written consent. A total of 385 volunteers with no history of symptoms related to cardiovascular system were selected. Any known hypertensive, diabetics, any endocrine disorder, and individuals on any drugs were excluded from the study.

Demographic details such as name, age, sex, personal, and parental history were noted. Anthropometric measurements and BP measurement were done.

Anthropometric Measurements

The volunteers were asked to remove their footwear and females are instructed to remove any hair ornament or braids on the top of the head. The volunteers were made to stand with back against the measuring surface, with feet together flat on the floor, arms at side, and knees and back straight and made sure that their heel of foot, buttock, shoulder blade, and back of head touches the wall. With the head straight ahead, height was measured to the nearest 0.1 cm with help of stadiometer. A portable digital weighing machine (Omron HN-286) was used, to weigh the body weight to the nearest 100 g.

Calculation of Body Mass Index (BMI)

BMI was calculated using the formula weight (kg)/height (m^2) (Quetelet index)

Measurement of BP

Volunteers were seated quietly for at least 5 min in a chair. Caffeine, exercise, and smoking were avoided for at least 30 min before measurement. The measurement was taken in the right arm with the subject in the sitting posture using standardized calibrated mercury sphygmomanometer (Diamond BPMR120). Initially, by palpatory method, the point of disappearance of the pulse is the systolic BP (SBP) that was noted. Then, by auscultatory method, the cuff was inflated 20–30 mmHg above the palpated systolic pressure levels, then deflated at a rate of 2–3 mmHg/s. The first appearance of sound (Phase 1 – clear tapping) is SBP. The disappearance of sound (Phase 5) is the DBP. Average of the two readings separated by 2 min is taken. If the first two readings differ by more than 5 mmHg, additional reading was obtained and averaged.

The individuals were classified according to hypertension classification given in JNC 7[4] and BMI classified as per the South Asian BMI classification.[7]

Data Analysis

Statistical analysis of the data was carried out using SPSS v16 software. Unpaired *t*-test was done to study the difference between two groups and ANOVA to study the difference between three groups. Chi-square analyses were done to determine the association between BMI, age, and systolic and diastolic BP. $P < 0.05$ was considered statistically significant.

RESULTS

Among 385 volunteers studied, 98 (25.45%) of them were in the pre-hypertensive range (SBP >120–139 mmHg and DBP >80–89 mmHg) and 51 (13.2%) (SBP >140 mmHg and DBP >90 mmHg) were hypertensive [Figure 1]. In pre-hypertensives, 63 were male and 35 were female. Among 51 hypertensive subjects diagnosed, 38 were male and 13 were female. The difference between the SBP, DBP, and the BMI between the two genders is also found to be significant [Table 1]. As the age increases, there was an increase in SBP, DBP, and BMI and the difference is highly significant [Table 2]. The average BMI of prehytensives was found to be 23.38 and that of hypertensives was 25.56 [Figure 2]. Among 98 pre-hypertensives, 22 (22.45%) had family history of hypertension and 51 (52.04%) with nil daily physical activity. In hypertensive subjects, 21 (41%) had family history of hypertension and 22 (43.13%) with nil physical activity [Tables 3-5]. Among 98 pre-hypertensive subjects, 53 (54.08%) had BMI more than 23 kg/m^2. Among 51 hypertensive subjects, 40 subjects (78.43%) had BMI more

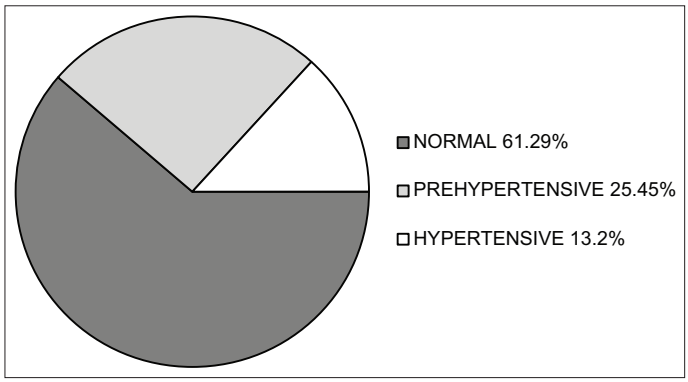

Figure 1: Prevalence of prehypertension and hypertension in the study population

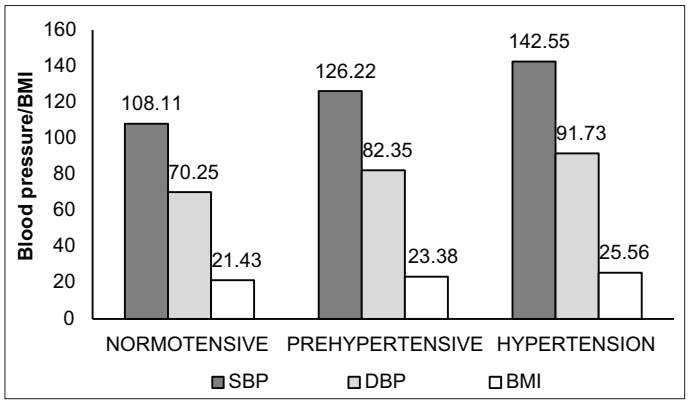

Figure 2: Mean values of systolic and diastolic blood pressure and body mass index in the study group

Table 1: Gender difference in BP and BMI (male *n*=190; female *n*=195)

Variables	Gender	Mean±SD	*P*-value
SBP	Male	123.07±12.86	<0.0001
	Female	111.64±14.35	
DBP	Male	79.03±9.06	<0.0001
	Female	73.39±9.17	
BMI	Male	23.11±3.86	*P*=0.0019
	Female	21.86±3.98	

Unpaired *t*-test analysis was applied. *P*<0.05 was considered statistically significant. SBP: Systolic blood pressure, DBP: Diastolic blood pressure, BMI: Body mass index, BP: Blood pressure

than 23 kg/m^2 [Table 4]. In a study population with normal BP (236), only 71 (30.08%) had their BMI more than 23 kg/m^2, 14 (5.93%) had parental history of hypertension, and only 60 (25.42%) with nil physical activity [Tables 3-5].

Chi-square test was used to assess the association between groups in Tables 3-5.

DISCUSSION

The prevalence of prehypertension and hypertension is on a rising trend in younger population. The Joint National Committee 7 describes prehypertension as a SBP of 120–139 mmHg and DBP of 80–89 mmHg. In our study population of 385 volunteers, 51 (13%) of the individuals were hypertensive and of these 38 were male and 13 were female. Our study shows that hypertension was prevalent more in males than female. In our study, association of age with SBP and DBP and BMI was significant that is as age

Table 2: Comparison of age with systolic and diastolic BP and BMI

Age	Number (*n*)	Mean±SD	*P*-value
Age groups		SBP	<0 .0001
18–25 years	211	115.22±13.07	
26–30 years	112	116.18±14.46	
31–35 years	62	126.29±17.4613**$$	
Age groups		DBP	
18–25 years	211	74.34±8.74	< 0.0001
26–30 years	112	76.36±9.53	
31–35 years	62	82.09±9.82**$$	
Age groups		BMI	
18–25 years	211	21.46±3.24	< 0.0001
26–30 years	112	22.44±3.87	
31–35 years	62	26.01± 4.40**$$	

One-way ANOVA test applied to compare between groups. *P*<0.05 was considered statistically significant, **represents *P*<0.001 in comparison to 18–25 age group and $$represents *P*<0.001 in comparison to 26–30 age group. SBP: Systolic blood pressure, DBP: Diastolic blood pressure, BMI: Body mass index, BP: Blood pressure

Table 3: Family history of hypertension versus study population

Variables	Family h/o hypertension	No family history	*P*-value
Hypertension	21	30	Chi-square – 31.77 *P*<0.0001
Prehypertension	22	76	
Normotension	23	213	

Table 4: BMI versus study population

Variables	BMI >23	BMI <23	*P*-value
Hypertension	40	11	Chi-square – 41.17 *P*<0.0001
Prehypertension	53	45	
Normotension	71	165	

BMI: Body mass index

Table 5: Physical activity (mild to moderate) versus study population

Variables	H/o physical activity	No h/o physical activity	*P*-value
Hypertension	29	22	Chi-square – 18.66 *P*<0.0001
Prehypertension	47	51	
Normotension	170	66	

advances there is increase in SBP, DBP, as well as BMI. Apart from this, family history of hypertension was also found to be associated with higher incidence of hypertension and prehypertension in our study. Lack of physical activity also seems to be associated with greater risk of hypertension and prehypertension.

The prevalence of prehypertension was found to be 26.9% in rural area of Nalgonda district, which is close to our study result.[8] The prevalence of prehypertension has been observed to be more in male by various studies.[9-11] Even though both men and women develop hypertension, distinct gender difference is noted till the sixth decade of life.[10] Thereafter, the incidence is almost similar, this may be because of the effect of estrogen.[12] Menopausal rise in the prevalence of hypertension in women suggests a protective role of estradiol.[13] Usually for Asian populations, BMI ≥23 kg/m^2 represented increased risk, and BMI ≥27.5 kg/m^2 represented high risk. Increasing age was significantly associated with increase in BMI and systolic and diastolic BP. The BP rises steadily with age group showing the dependence of BP on age. A similar result was observed in a study on Tangkhul Naga Tribal Males of Northeast India, in which overweight/obese was more prone to hypertension than those with normal BMI.[14] Aging is associated with structural changes in the arteries, especially with large artery stiffness.[15] Other mechanisms such as inflammation, oxidative stress, and endothelial dysfunction play major role in the development of hypertension.[16] Several researches concluded that BMI is one of the most important predictors of BP. Pan *et al.* found out that mean SBP and DBP were higher at successive ages and with higher BMI in both the genders.[17,18] Dua *et al.* observed that underweight people were less prone to have high BP than those with normal BMI. He also stated that overweight or obese subjects were more prone to hypertension than people with normal BMI.[19] The prevalence of hypertension was high in participants with positive family history.[20,21] This may be because a positive family history of hypertension is usually associated with a positive family history of obesity, central obesity, or metabolic syndrome. Physical activity is the commonly recommended lifestyle intervention for the prevention of hypertension.[22] Regular physical activity lowers the BP and cardiovascular risk in addition to reduction of cardiac remodeling.[23] In hypertensive patients, physical activity prevents as well as regresses the left ventricular hypertrophy.[23]

As this was a cross-sectional study, we did not follow these subjects. A follow-up study could detect the incidence of hypertension among them. Other limitations include the smaller sample size as this study only focussed on one district of the state. A multicentric study in varied population group and different ethnic character could yield better result. An intervention at this level can be planned in a future study and look for reversal of prehypertension.

As this population is in their active productive life, mostly remain asymptomatic or hidden. Health education among young adults about lifestyle modification, abstinence from smoking and alcohol, early intervention like daily physical activity, and DASH diet could bring a significant change in these young adult for a productive life.

CONCLUSION

The prevalence of prehypertension and hypertension was 25.45% and 13.2%, respectively. BP is also associated with rising age independently. Mean SBP and DBP levels were higher among subjects with elevated BMI, especially among males. Subjects with family history of hypertension were more prone to hypertension. Individuals with no physical activity were at a higher risk of developing hypertension.

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