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Prevalence of Prehypertension in a Rural District of Southern India

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ABSTRACT

Background: Estimating the prevalence of prehypertension and its risk factors in a population becomes important to design preventive measures and hence reduce the burden of hypertension. The aim of this study was to estimate the prevalence of prehypertension and determine the factors associated with hypertension.

Methods: This is a cross-sectional study and was carried out in a rural population. The study included 402 participants. Data regarding basic demographic characteristics were collected along with anthropometric measurements including height and weight. Information regarding smoking alcohol intake, dietary habits were collected. Prehypertension was defined as systolic blood pressure 120–139 mm Hg and/or diastolic blood pressure 80–89 mm Hg. Chi-square-test was used to find the association of various risk factors; *t*-test was used to compare the means. Multiple linear regression analysis was used to know the relationship of various risk factors.

Results: Prevalence of prehypertension was estimated to be 28.8%. Factors such as salt intake, tobacco consumption, alcohol consumption, stress, family history of hypertension, history of diabetes mellitus had a significant association with prehypertension ($P < 0.05$).

Conclusions: The prevalence of prehypertension was found to be high among the rural population. Early intervention is needed to decrease the burden of hypertension and its complications in future.

Keywords: Prehypertension, risk factors, rural area

INTRODUCTION

Hypertension is one of the established risk factors for cardiovascular diseases.[1] Various studies have demonstrated that people with blood pressure > 120/80 but < 140/90 had an increased risk of hypertension and early death because of cardiovascular causes. Meta-analysis of approximately one million individuals from 61 long-term epidemiological studies demonstrated that for each 20 mmHg increase in systolic blood pressure (SBP) or 10 mmHg increase in diastolic blood pressure (DBP) over 115/75 mmHg, there was a two-fold increase in mortality associated with coronary artery disease, and stroke.[2,3]

Knowing the magnitude of prehypertension and its risk factors becomes imperative to design preventive measures.

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METHODS

This cross-sectional study among rural population of Mysore district was undertaken based on the assumption that prevalence of prehypertension to be 50%.[4,5] With 95% confidence level and 10% allowable error, the sample size was calculated to be 400. A total of 402 subjects were included in the study.

Of the 23 villages coming under rural field practice area of Department of Community Medicine, JSS Medical College, Mysore, 5 villages were selected randomly. Study subjects were selected based on the population proportion to size of the village. Houses that were prenumbered were selected randomly using random number table.

Adults with age more than 30 years were included in the study. Severely morbid subjects, pregnant women, and subjects not giving consent were excluded from the study.

Informed consent was obtained from all participants prior to including them in the study. Information was obtained using a prestructured questionnaire. The study protocol was approved by Institution Ethics Committee of JSS Medical College.

Data regarding various socio-demographic characteristics were collected along with anthropometric measurements such as height and weight. Information regarding smoking alcohol intake, dietary habits were collected. Standing height was measured in centimeters using a nonexpandable measuring tape mounted on the wall approximating to nearest 0.1 cm. A portable weighing machine with a calibrated scale from 0 to 130 kg was used, and weight was measured to nearest 0.1 kg.

Blood pressure was recorded using a mercury sphygmomanometer (Diamond co.) in sitting position in the left arm after 5 min of rest. Average of the two readings was considered. Second reading was taken after an interval of 10 min from the first reading. All blood pressure readings were recorded during forenoon.

Case definition

According to Seventh Joint National Committee prehypertension is defined as SBP 120–139 mm Hg and/or DBP 80–89 mm Hg.

Statistical analysis used

Data analysis was done using SPSS software version 22. (Customer id: 225031, validity: Perpetual, Organisation: JSS university, Authorization code: 6a5bdaee1152f4a62aee) Chi-square-test was used to find the association of various risk factors; *t*-test was used to compare the means. Multiple linear regression analysis was used to know the relationship of various risk factors. Scatter plot was used to show the correlation of risk factors with SBP and DBP.

RESULTS

The study consisted of participants > 30 years of age. The mean age of the study population was 47.8 (9.65) years. A total of 390 (96.3%) of the study population were married. Male population constituted 183 (45.2%) and female constituted 219 (54.1%). Prevalence of prehypertension and hypertension was 28.8% and 24.6%, respectively [Table 1].

There were no significant differences between the mean blood pressures (systolic and diastolic) between male and female among prehypertensives. Mean body mass index (BMI) among the prehypertensive was found to be 23.55 (3.88) and mean salt intake in grams per day was found to be 10.09 (1.43) [Table 2].

Among prehypertensives, 39 (33.6%) and 11 (9.5%) had family history of hypertension and history of diabetes mellitus, respectively. Totally, 99 (85.3%) had the habit of adding extra table salt. Alcohol consumption was found to be present in 20 (17.2%) of the prehypertensive subjects [Table 3a].

Risk factors were analyzed with respect to the presence of normotension and prehypertension. Various behavioral risk factors such as extra salt intake, alcohol consumption, family history of hypertension, history of diabetes mellitus were found to have significant association [Table 3a and b].

Factors such as age, amount of alcohol consumption, the amount of salt intake per day had moderate positive correlation with the SBP and DBP [Figures 1-3]. Multiple linear regression analysis was applied to various risk factors. Risk factors such as age, amount of alcohol consumption, amount of salt intake showed significant association with the both SBP and DBP [Table 4].

Table 1: Distribution of study subjects based on hypertensive status

	n=402
Normotensive	187 (46.4)
Prehypertensive	116 (28.8)
Hypertensive	99 (24.6)

Table 2: Characteristics of prehypertensive study subjects

	Mean (SD)		
	Male (*n*=57)	Female (*n*=59)	Total (*n*=116)
Age	46 (10.2)	43.64 (8.99)	44.8 (9.65)
SBP	132.75 (4.86)	132 (4.60)	132.37 (4.73)
DBP	84.68 (2.89)	84.12 (2.23)	84.40 (2.58)
BMI	24.03 (4.17)	23.09 (3.5)	23.55 (3.88)
Salt intake/day	10.05 (1.4)	10.12 (1.47)	10.09 (1.436)

SD=Standard deviation, SBP=Systolic blood pressure, DBP=Diastolic blood pressure, BMI=Body mass index

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Table 3a: Distribution based on behavioral risk factors

	Normotensive (*n*=187)	Prehypertensive (*n*=116)	Total (*n*=303)	*P**
Extra table salt				
Absent	88 (47.1)	17 (14.7)	105 (34.7)	<0.001**
Present	99 (52.9)	99 (85.3)	198 (65.3)	
Diet				
Vegetable	110 (58.8)	50 (43.1)	160 (52.8)	0.008**
Mixed	77 (41.2)	66 (56.9)	143 (47.2)	
Tobacco consumption				
Absent	174 (93)	98 (84.5)	272 (89.8)	0.017**
Present	13 (7)	18 (15.5)	31 (10.2)	
Alcohol consumption				
Absent	172 (92)	96 (82.8)	267 (88.1)	0.015**
Present	15 (8)	20 (17.2)	36 (11.9)	
Stress				
Absent	131 (70.1)	30 (25.9)	161 (53.13)	<0.001**
Present	56 (29.9)	86 (74.1)	142 (46.86)	
Family history of hypertension				
Absent	177 (94.7)	77 (66.4)	254 (83.8)	<0.001**
Present	10 (5.3)	39 (33.6)	49 (16.2)	
Past history of diabetes				
Absent	180 (96.3)	105 (90.5)	285 (94.1)	0.04**
Present	7 (3.7)	11 (9.5)	18 (5.9)	

*Chi-square test, **Statistically significant. Figures in parenthesis indicate percentages

Table 3b: Table comparing means of behavioural risk factors

	Mean (SD)		*P**
	Normotensive	Prehypertensive	
Grams of salt intake/day	6.29 (1.68)	8.25 (1.83)	<0.001**
Number of times smoked/day	6.09 (2.7)	8.31 (2.92)	0.067
Duration of tobacco consumption	9.73 (3.19)	9 (3.06)	0.553
Number of drinks per week	3.47 (0.91)	5.81 (2.22)	<0.001**
Duration of alcohol intake	7.93 (4.38)	12.71 (4.31)	0.003**
BMI	23.54 (2.82)	23.55 (3.88)	0.98

*Independent *t*-test, **Statistically significant. BMI=Body mass index, SD=Standard deviation

Table 4: Multiple linear regression analysis of prehypertension with risk factors

	Regression co-efficient	SE	*P**
SBP			
Age	0.30	0.03	<0.001**
Number of alcohol drinks per day	1.52	0.38	0.01**
Number smoked per day	0.78	0.47	0.12
Salt intake per day	2.21	0.15	<0.001**
BMI	−0.12	0.12	0.28
DBP			
Age	0.17	0.02	<0.001**
Number of alcohol drinks per day	0.66	0.14	<0.001**
Number smoked per day	0.49	0.24	0.06
Salt intake per day	0.97	0.11	<0.001**
BMI	−0.07	0.06	0.27

*Multiple linear regression, **Statistically significant. SE=Standard error, BMI=Body mass index, SBP=Systolic blood pressure, DBP=Diastolic blood pressure

DISCUSSION

Prevalence of prehypertension among apparently healthy individuals of rural community was found to be 28.8% which is a cause for worry has these individuals are at a high risk of progressing to hypertension and cardiovascular diseases in the future life. The prevalence of prehypertension in our study is lower than the prevalence in other parts of the country as demonstrated by other studies. In a study done in rural area of Andhra Pradesh[6] demonstrated the prevalence of prehypertension to be 30.1%. In a study among the urban population of North India[4] demonstrated the prevalence of hypertension to be 31%. A study in rural population in Assam[7] demonstrated the prevalence to be 54%. Few other studies have demonstrated the prevalence of prehypertension to be >40%.[4,5,8] Lower prevalence of prehypertension in our study may be due to exclusion of study subjects with h/o hypertension and inclusion of subjects with age >30 years only. Nevertheless, the burden of hypertension and prehypertension as increased in the rural area of Mysore in last few years when compared to

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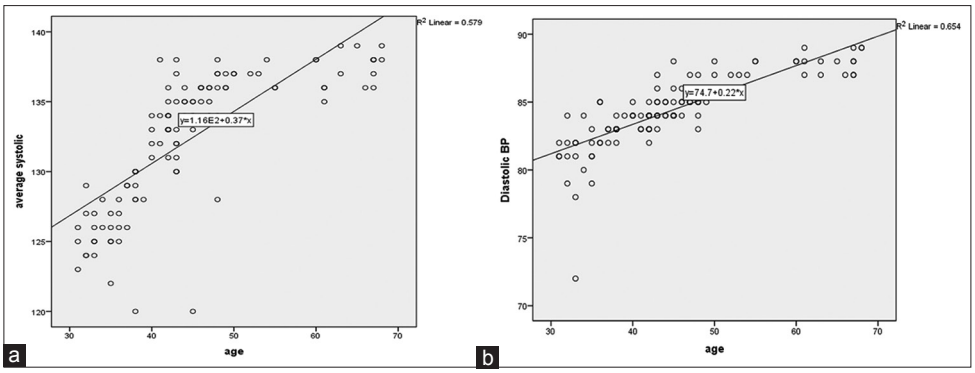

Figure 1: (a) Correlation of systolic blood pressure with age. (b) Correlation of diastolic blood pressure with age

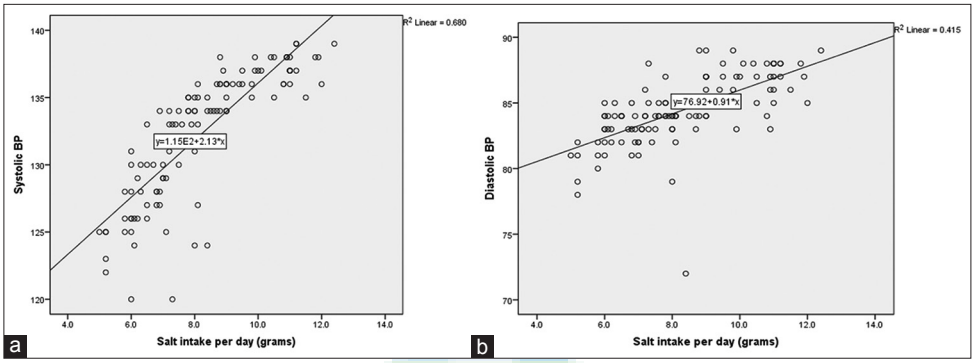

Figure 2: (a) Correlation of systolic blood pressure with amount of salt intake per day. (b) Correlation of diastolic blood pressure with amount of salt intake per day

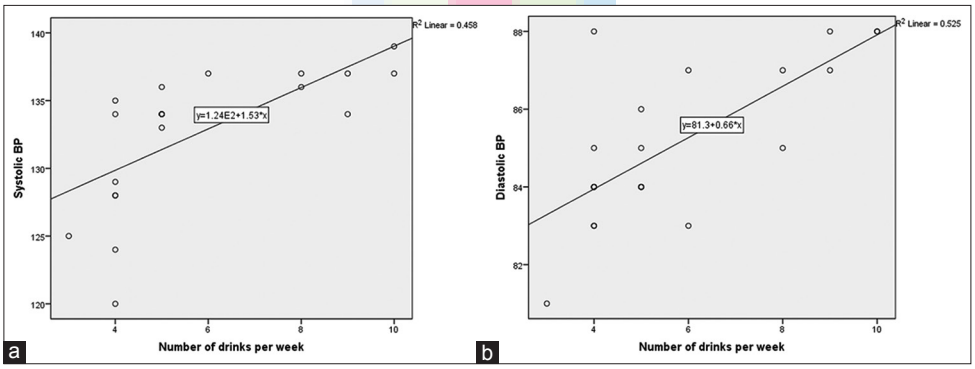

Figure 3: (a) Correlation of systolic blood pressure with amount of alcohol intake. (b) Correlation of diastolic blood pressure with amount of alcohol intake

previous studies.[9] This high burden of prehypertension is an alarm for an impending epidemic of hypertension and its complications if appropriate interventional measures are not taken.

Data from NHANES II from United States revealed that 90% of individuals with prehypertension had one or the other cardiovascular risk factor.[10] Studies from India have also indicated that increasing age, BMI, waist hip ratio, and impaired glucose tolerance/diabetes were independent risk factors for hypertension and prehypertension.[2,5,8] Similarly in our study most of the individuals with prehypertension had one or the other risk factor such as extra salt intake, overweight, alcohol consumption, and others.

Age, alcohol, amount of salt intake had moderate positive correlation with both SBP and DBP. BMI showed positive correlation with DBP. The results corroborate with other study results that above mentioned factors have a positive correlation with blood pressure.[11-13] The majority of prehypertensive study subjects were indulged in habits of extra salt intake at the table. It is well-recognized that higher salt intake is associated with higher blood pressure and reduction in salt intake lowers blood pressure. Inter salt study[14] demonstrated that the reduction in the salt

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intake amounting to 100 mmol/day leads to reduction in SBP in the range from 1 to 6 mm Hg. For diastolic pressure, the estimated reduction is between 0.03 and 2.5 mm Hg. Various studies have demonstrated the efficacy of dietary approaches alone or along with other lifestyle modifications significantly reduce blood pressure both in hypertensive and prehypertensive. Dietary approaches to stop hypertension are known to decrease blood pressure significantly the effect was more impressive with sodium restriction.[15]

Limitations of the study

Firstly the study does not provide any inference regarding causal relationship of the variables with prehypertension. Secondly various other factors such as socioeconomic status, knowledge attitude practice regarding hypertension and biochemical markers such as triglyceride, high-density lipoprotein, hyperuricemia are not evaluated which are known to influence hypertensive status. Thirdly, extrapolation of the prevalence of prehypertension determined from this small sample size to entire rural population remains a query.

CONCLUSIONS

Our study highlights the increasing prevalence of prehypertension and emphasizes that early intervention is needed to decrease the burden of hypertension and its complications in future. The study also gives important information regarding various risk factors associated with prehypertension. Simple lifestyle modifications such as low intake of salt, reducing alcohol can reduce overall blood pressure. Education regarding lifestyle and dietary practices at individual and family level is needed to bring about effective changes.

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REFERENCES

1. World Health Organization. Global Burden of Disease: 2004 Update. Geneva: World Health Organization; 2008.
2. Robinson SC, Brucer M. Range of normal blood pressure: A statistical and clinical study of 11,383 persons. Arch Intern Med 1939;64:409-44.
3. National Nutrition Monitoring Bureau (NNMB). Diet and nutritional status of population and prevalence of hypertension among adults in rural areas, NNMB Technical Report 24. Hyderabad: NNMB; 2006. p. 35-7.
4. Yadav S, Boddula R, Genitta G, Bhatia V, Bansal B, Kongara S, *et al.* Prevalence and risk factors of pre-hypertension and hypertension in an affluent North Indian population. Indian J Med Res 2008;128:712-20.
5. Deepa R, Shanthirani CS, Pradeepa R, Mohan V. Is the 'rule of halves' in hypertension still valid? – Evidence from the Chennai Urban Population Study. J Assoc Physicians India 2003;51:153-7.
6. Srinivas S, Satyavaraprasad K, Ramdas R, Krishna CP, Tjuddin T, Rao RP. Prevalence of prehypertension in adult population of rural Andhra Pradesh. Asian J Biomed Pharm Sci 2013;3:45-8.
7. Hazarika NC, Narain K, Biswas D, Kalita HC, Mahanta J. Hypertension in the native rural population of Assam. Natl Med J India 2004;17:300-4.
8. Prabhakaran D, Shah P, Chaturvedi V, Ramakrishnan L, Manhapra A, Reddy KS. Cardiovascular risk factor prevalence among men in a large industry of northern India. Natl Med J India 2005;18:59-65.
9. Madhu B, Srinath KM, Ashok NC. Hypertension: Prevalence and associated factors in rural South Indian population. Indian J Public Health Res Dev 2012;3:105-9.
10. Mainous AG 3rd, Everett CJ, Liszka H, King DE, Egan BM. Prehypertension and mortality in a nationally representative cohort. Am J Cardiol 2004;94:1496-500.
11. Zachariah MG, Thankappan KR, Alex SC, Sarma PS, Vasan RS. Prevalence, correlates, awareness, treatment, and control of hypertension in a middle-aged urban population in Kerala. Indian Heart J 2003;55:245-51.
12. Madhukumar S, Gaikwad V, Sudeepa D. An epidemiological study of hypertension and its risk factors in rural population of Bangalore rural district. Al Ameen J Med Sci 2012;5:264-70.
13. Marley J, Curram J. Body mass index and diastolic blood pressure. Br Med J 1989;299:1102.
14. Stamler J. The INTERSALT Study: Background, methods, findings, and implications. Am J Nutr 1997;626s-42s.
15. Appel LJ, Moore TJ, Obarzanek E, Vollmer WM, Svetkey LP, Sacks FM, *et al.* A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. N Engl J Med 1997;336:1117-24.

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