

# An epidemiological study of prevalence of hypertension and its risk factors in a rural community of South India

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## ABSTRACT

**Background:** Chronic non-communicable diseases are important among adult population all over the world. Hypertension (HTN) is the most common cardiovascular disorder accounting for 20-50% of all cardiovascular deaths. The prevalence of HTN is increasing in both rural and urban communities. **Objective:** The objective of this study was to determine the prevalence of HTN and its associated risk factors in a rural population. **Materials and Methods:** A community-based cross-sectional study was conducted at rural areas of South India. The sociodemographic variables and risk factors were obtained by interviewing the participants in a predesigned semi-structured questionnaire. The sample size was calculated by the prevalence of HTN in previous studies and 650 participants were included. The blood pressure was assessed and classified according to the Joint National Committee VII classification. Statistical analysis was done using descriptive statistics and Chi-square test of significance. **Results:** Out of the 650 adults surveyed, 92 individuals (14.1%) were found to be suffering from HTN. Among males, 58 (16.2%) had HTN and 92 (25.7%) were prehypertensives, and among females, 34 (11.6%) had HTN and 71 (24.2%) were prehypertensives. The prevalence rate of HTN shows an upward trend as age advances. The prevalence rate was high among males, higher socioeconomic class, and among the highly educated groups. The risk factors such as tobacco usage, alcohol consumption, additional salt intake, family history of HTN, obesity, high waist-hip ratio, and diabetes mellitus were found to have statistically significant association with HTN. **Conclusions:** There is an increase in the prevalence of HTN in the rural communities of South India. Population-based prevention strategies and evidence-based clinical strategies should focus on early detection and appropriate treatment.


**KEY WORDS:** Hypertension; Risk Factors; Rural Community

## INTRODUCTION

Hypertension (HTN) or high blood pressure, sometimes arterial HTN, is a chronic medical condition in which the blood pressure in the arteries is elevated. HTN is the most common cardiovascular disorder accounting for 20-50% of

all cardiovascular deaths and is a leading cause of stroke, blindness, renal failure, and congestive heart failure.<sup>[1]</sup>

As per the Global Health Statistics 2012, 63% of deaths were due to non-communicable diseases (NCDs) and cardiovascular disease (CVD) was the most predominant cause (48%). Nearly 13% of global deaths are attributable to raised blood pressure which is a leading behavioral and physiological risk factor.<sup>[2]</sup> High blood pressure is ranked as the third most important risk factor for an attributable burden of NCD in South Asia.<sup>[3]</sup> HTN is emerging as a major public health problem. Global Burden of Hypertension 2005 study and Global Burden of Diseases Study 2010 reported an alarming increase in HTN. The prevalence of HTN has

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increased in urban communities as well as in rural people. The prevalence of HTN in the past six decades has increased from 2% to 25% among urban residents and from 2% to 15% among the rural residents in India.<sup>[4]</sup> Recent studies from India have shown the prevalence of HTN to be 25% in urban and 10% in rural adults in India.<sup>[5]</sup> This rising trend observed is multifactorial, may be because of increased life expectancy, lifestyle changes, increased salt intake, and increased awareness and detection.

The rural population constitutes 72.2% of Indian population, and community-based studies to determine the prevalence of risk factors in rural areas are fewer compared to those in urban areas. Epidemiological studies to assess the prevalence of HTN are essential to plan preventive strategies and promote the health of these populations. In this view, the present study was undertaken.

## MATERIALS AND METHODS

This was a community-based cross-sectional study conducted among rural populations of Bengaluru rural, Karnataka, South India. This study was conducted during 2012 among all the adults aged  $\geq 20$  years residing in the study area. The sample size was calculated taking the prevalence of HTN in the rural areas of India as 17%.<sup>[6]</sup> The required sample size was 627 using the formula  $4pq/e^2$ , with absolute error of 3%. However, 650 adults were included in the study. Two villages were selected randomly for the study. The required sample size was taken using systematic random sampling technique. Data were collected by house-to-house visit, and all the family members were included in the study. If any adult aged  $\geq 20$  years was not found in the family or the selected house was found locked, the adjacent family was visited.

### Inclusion Criteria

All the members who had completed 20 years of age at the time of data collection from the selected houses were included in the study.

### Exclusion Criteria

Pregnant females, severely ill and bedridden patients, and individuals not willing to participate in the study were excluded from the study.

The data were collected using a pretested, semi-structured questionnaire after obtaining an informed consent. The questionnaire form collected information regarding sociodemographic characteristics such as age, gender, education, occupation, income, family history of HTN, and lifestyle risk factors such as consumption of tobacco and alcohol products, additional salt intake, and obesity. For classifying the population according to socioeconomic status, B.G. Prasad's socioeconomic classification was

adopted and modified as per the All India Consumer Price Index for the year 2012.<sup>[7]</sup> A person was considered to have a family history of HTN if either one or both the parents of the person had HTN. A smoker was defined as a person who currently smoked any tobacco products such as beedi, cigarette, or cigar. Smokeless tobacco intake referred to the consumption of gutka, tobacco-lime, or tobacco in any other form. A person was considered to be an alcohol user if she/he had consumed alcohol everyday or some days in the past 30 days. Additional salt intake was defined as adding salt to cooked food or other food items routinely.<sup>[8]</sup>

Weight was recorded using an electronic weighing machine and was rounded off to the nearest 0.5 kg. Height was measured with the person standing on a level surface with the heels together and toes apart without shoes. Height was recorded to the nearest 0.5 cm. Waist circumference was measured with the person in the standing position using a nonelastic plastic tape midway between the lower rib margin and the iliac crest to the nearest 1 mm. Hip circumference was measured around the widest portion of the buttocks, with the tape parallel to the floor. Body mass index (BMI) was classified according to the standard WHO criteria.

Those with BMI of  $\geq 30$  kg/m<sup>2</sup> were considered to be obese.<sup>[9]</sup> The waist-hip ratio (WHR) cutoff points for the Indian population according to the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Disease and Stroke were followed. Accordingly, those with a WHR of  $\geq 0.95$  for males and  $\geq 0.85$  for females were considered to be a high-risk group for HTN.<sup>[10]</sup>

The Joint National Committee VII criteria were used for the measurement and definition of HTN.<sup>[8]</sup> HTN was defined as systolic blood pressure more than or equal to 140 mmHg and/or diastolic blood pressure more than or equal to 90 mmHg. Those individuals already diagnosed as hypertensive were also labeled as such. Two blood pressure readings were recorded in the sitting position in the right arm using a mercury sphygmomanometer and the mean of the two readings was considered for analysis. The first reading was taken after at least 20 min of rest and the second reading was taken 20 min after the first reading.

### Statistical Analysis

The data were entered in Microsoft Excel and analyzed using SPSS software version 16.0. Chi-square test of significance was performed to find the results. A two-tailed  $P < 0.05$  was considered statistically significant.

## RESULTS

Out of the 650 adults surveyed, 92 individuals (14.1%) were found to be suffering from HTN including known hypertensives. Among 357 adult males, 58 (16.2%), and

**Table 1:** Distribution of study participants as per grades of HTN (JNC-VII)

Gender	n (%)					P value
	Normal	Pre-HTN	Stage I HTN	Stage II HTN	Total	
Males	207 (57.9)	92 (25.7)	38 (10.6)	20 (5.60)	357 (54.9)	0.091
Females	188 (64.1)	71 (24.2)	23 (7.8)	11 (3.75)	293 (45.07)	
Total	395	163	61	31	650	

HTN: Hypertension, JNC-VII: The Joint National Committee VII

among 293 adult females, 34 (11.6%) were found to be suffering from HTN.

Among the 357 males studied, 92 (25.7%) were prehypertensives (systolic pressure 120-139 mmHg and diastolic pressure 80-89 mmHg) followed by 38 (10.6%) who were Stage I hypertensives (systolic pressure 140-159 mmHg and diastolic pressure 90-99 mmHg) and 20 (5.60%) were Stage II (systolic pressure >160 mmHg and diastolic blood pressure >100 mmHg) hypertensives. Of the 293 females, 71 (24.2%) were prehypertensives followed by 23 (7.8%) in Stage I HTN (systolic pressure 140-159 mmHg and diastolic pressure 90-100 mmHg) and 11 (3.75%) were Stage II (systolic pressure >160 mmHg and diastolic blood pressure >100 mmHg) hypertensives (Table 1).

It has been observed from Table 2 that the prevalence rate of HTN shows an upward trend as age advances. The difference was found to be statistically significant ( $P < 0.001$ ), which indicates that age has some influence on the association of HTN. Prevalence rate was high among males, higher socioeconomic class, and also among the highly educated groups.

Table 3 shows the prevalence of HTN to be higher among smokers, tobacco chewers, alcohol consumers, those with a family history of HTN and those with additional intake of salt. All these factors showed a statistically significant higher risk for HTN. However, type of diet did not show significant risk.

Table 4 shows higher prevalence of HTN among obese, diabetic, and high WHR individuals. Obese individuals were 15 times at a greater risk for HTN compared to non-obese individuals and the difference was statistically significant. Similarly, diabetic and high WHR individuals were found to have statistically significant higher risk for HTN.

## DISCUSSION

HTN is one of the leading health problems, making its impact on developed and industrialized nations. Lifestyle modifications, rapid urbanization, and dietary changes with increase in life expectancy are also associated with marked rise in the prevalence of HTN. In India, the impact was not yet felt because of the presence of communicable diseases. However, studies in India reported an average prevalence

**Table 2:** Distribution of study participants according to sociodemographic variables

Variables	n (%)		Total	P value
	Hypertensives	Normotensives		
Age in years				
21-30	12 (4.52)	253 (95.4)	265	<0.001
31-40	13 (10.9)	106 (89.07)	119	
41-50	19 (17.9)	87 (82.07)	106	
51-60	18 (22.5)	62 (77.5)	80	
61-70	20 (32.2)	42 (67.7)	62	
>70	10 (55.5)	08 (44.4)	18	
Gender				
Males	58 (16.2)	299 (83.7)	357	0.091
Females	34 (11.6)	259 (88.3)	293	
Socioeconomic status				
Class I	10 (25.0)	30 (75.0)	40	0.065
Class II	11 (21.1)	41 (78.8)	52	
Class III	14 (17.07)	68 (82.9)	82	
Class IV	31 (11.07)	249 (88.9)	280	
Class V	26 (13.2)	170 (86.7)	196	
Education				
Illiterate	36 (11.8)	268 (88.1)	304	0.005
Primary	24 (11.4)	186 (88.5)	210	
Secondary	17 (20.4)	66 (79.5)	83	
Higher secondary	9 (25.7)	26 (74.2)	35	
Graduate +	6 (33.3)	12 (66.6)	18	
Total	92	558	650	

of HTN as 10% in rural and 25% in urban inhabitants.<sup>[11]</sup> In our study, the overall prevalence of HTN in both sexes is 14.1%, with 16.2% among males and 11.1% among females. The prevalence of pre-HTN was 25.07%, with 25.7% among males and 24.2% among females. Our findings were on par with the findings of Kumar et al. who reported the prevalence of HTN as 13.7% from Jaipur, India, Midha et al. from North India (prevalence of HTN as 14.5%), and Ghosh et al. (prevalence of pre-HTN as 32.1% and HTN as 11.8%).<sup>[12-14]</sup> Some of the studies showed higher prevalence of 25.2%, 18%, and 36.5%.<sup>[15-17]</sup> The prevalence rates of HTN are variable from place to place depending on the cutoff point used and the method employed in the measurement of blood pressure.

**Table 3:** Distribution of study participants according to risk factors

Risk factors	n (%)		Total	Odds ratio	P value
	Hypertensives	Normotensives			
Family history of HTN					
Yes	68 (28.4)	171 (71.5)	239	6.4 (3.89-10.6)	<0.001
No	24 (5.8)	387 (94.1)	411		
Smoking					
Smoker	65 (26.2)	183 (73.7)	248	4.9 (3.04-7.9)	<0.001
Non-smoker	27 (6.7)	375 (93.2)	402		
Tobacco chewers					
Yes	47 (26.2)	132 (73.7)	179	3.37 (2.14-5.3)	<0.001
No	45 (9.5)	426 (90.4)	471		
Alcohol					
Alcoholic	59 (25.1)	176 (74.8)	235	3.88 (2.44-6.15)	<0.001
Non-alcoholic	33 (7.9)	382 (92.0)	415		
Type of diet					
Non-vegetarian	67 (14.5)	393 (85.4)	460	1.12 (0.69-1.84)	0.64
Vegetarian	25 (13.1)	165 (86.8)	190		
Additional salt intake					
Yes	43 (21.0)	161 (78.9)	204	2.16 (1.38-3.38)	0.001
No	49 (10.9)	397 (89.0)	446		
Total	92	558	650		

**Table 4:** Distribution of study participants according to obesity and diabetes mellitus

Risk factors	n (%)		Total	Odds ratio	P value
	Hypertensives	Normotensives			
Obese	78 (34.2)	150 (65.7)	228	15.15 (8.3-27.5)	<0.001
Non obese	14 (3.3)	408 (96.6)	422		
WHR					
High ratio	56 (21.6)	203 (78.3)	259	2.7 (1.72-4.27)	<0.001
Low ratio	36 (9.2)	355 (90.7)	391		
Diabetes					
Diabetic	51 (23.2)	168 (76.7)	219	2.8 (1.84-4.52)	<0.001
Non-diabetic	41 (9.5)	390 (90.4)	431		
Total	92	558	650		

WHR: Waist-hip ratio

The peak age of HTN in our study was 61-70 years, and a proportionate increase with age was observed in both sexes. These findings may be due to changes in the vascular system as age advances. Many surveys and cross-sectional studies have demonstrated a positive relation between age and blood pressure in diverse, geographical, and socioeconomic conditions.<sup>[13]</sup>

Findings of our study were in par with the findings of Joshi et al.<sup>[18]</sup> and Chockalingam et al.<sup>[19]</sup> Vasan et al. and Player et al. also reported that there is an increase in the prevalence of HTN with the advancement of age.<sup>[20,21]</sup> The present study showed higher prevalence among males compared to females. Similar findings were found in other studies<sup>[12,16]</sup> In this study, the prevalence of HTN was high among higher

socioeconomic groups and highly educated groups. Similar findings were found in a study done by Ismail et al.<sup>[22]</sup>

The occurrence of HTN was significantly higher among those who had a family history of HTN. The findings were comparable with that of the studies by Singh et al.<sup>[17]</sup> and Ismail et al.<sup>[17,22]</sup> In the present study, among hypertensives, smokers, tobacco chewers, and alcohol consumers had high risk for HTN and the difference was statistically significant compared to non-smokers, non-tobacco chewers, and alcohol consumers. The findings are in par with studies done by Kannan et al.,<sup>[15]</sup> Singh et al.,<sup>[17]</sup> and Ismail et al.<sup>[22]</sup> Studies done by Benovitz Neal L observed that sodium absorption was higher (107 mmol/day) among persons who smoked cigarettes and chewed tobacco as compared to non-tobacco



users.<sup>[23]</sup> This increased sodium absorption in the body due to tobacco use has got some role in the association of HTN. The prevalence of HTN is directly related to the salt intake, and in our study, 21.07% of the individuals were hypertensives with an intake of >6 g/day. Findings of our study were in line with the reports of Radhika et al. who reported an association of HTN with excess salt intake in South Indian urban population.<sup>[24]</sup> The prevalence of HTN did not differ significantly between vegetarians and non-vegetarians. This finding was contrary to the finding of Bhadoria et al. who reported that the prevalence of HTN was more in non-vegetarians than vegetarians.<sup>[25]</sup>

In the present study, obesity, high WHR, and diabetes were significantly associated with HTN. The findings are comparable with studies by Kannan et al.,<sup>[15]</sup> Singh et al.,<sup>[17]</sup> and Ismail et al.<sup>[22]</sup>

The strength of the study is that it was a community-based study in a rural area. Bias was avoided by systematic random sampling technique.

The limitation of the study is that a person was considered diabetic only if he/she had already been diagnosed as diabetic and no screening test was applied.

## CONCLUSION

There is an increasing prevalence of NCD, and HTN being one of the major causes. This urges a strong need to improve health care at all levels incorporating prevention, treatment, and appropriate management. Control of HTN can provide an access point in the reduction of other CVD mortalities. Given the rising burden of HTN in India, population-based interventional approaches such as reduction of salt intake, tobacco avoidance, and regular physical activity can be incorporated in the control programs. Effective screening programs to detect pre-HTN and HTN should be planned at subcenter levels. To increase the awareness on HTN, information about the prevention and control of HTN can be incorporated in the information, education, and communication components of all national programs.

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