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An epidemiological study of prevalence of hypertension and its risk factors in a rural community of Nellore, Andhra Pradesh, India

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ABSTRACT

Background: Hypertension [HTN] is responsible for 57% of stroke deaths and 24% of coronary heart disease [CHD] deaths in India. As per the statistics of Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India, the overall prevalence of hypertension in India by 2020 will be 159.46/1000 population. Hypertension will be the major cause of death and disability by the end of 2020. The prevalence of hypertension is increasing in both rural and urban communities. The objectives of the study were to assess the prevalence of hypertension and its associate risk factors in a rural population.

Methods: A cross sectional study was conducted by the Department of community medicine in the rural field practice area of a Medical college of Nellore from October 2013 to September 2015. The socio demographic variables and risk factors were obtained by interviewing the subjects in the study and collected in a predesigned questionnaire sheet. The sample size was calculated by prevalence of HTN in previous studies and 1025 subjects were included. The blood pressure was assessed and classified using recent JNC 7 and WHO criteria to grade hypertension.

Results: In the study the prevalence of pre-hypertension was 42.63% (437 subjects), stage-I hypertension was 26.15% (268 subjects) and stage-II hypertension was 10.34%. The peak age of prevalence of HTN in both males and females was 60-69 years. Significant association was observed between age, low socio economic index, high salt intake (>10gms/day)) with hypertension. A linear trend of association was seen with tobacco and alcohol use, obesity (BMI>25) and waist-hip ratio more than the cut-off value (p value<0.005).

Conclusions: Indian health system is challenged with increasing prevalence of non-communicable diseases and HTN being one of the major. Prioritization of population based prevention approaches requiring multi sectoral actions and evidence based clinical approaches focusing on early detection and treatment can provide benefit to population health. To increase the awareness on hypertension, information about prevention and control of hypertension can be incorporated in the information education and communication (IEC) components of all national programmes. This can complement overall efforts to increase societal awareness through other approaches.

Keywords: BMI, Hypertension, Pre-hypertension, Risk factor, Waist-hip ratio

INTRODUCTION

As per the Global health statistics 2012, 63% of deaths were due to non-communicable diseases (NCD) and cardio vascular disease (CVD) was the most predominant (48%). 13% of global deaths are attributable for raised blood pressure which is a leading behavioural and physiological risk factor. High blood pressure is ranked

as the third most important risk factor for an attributable burden of NCD in South Asia.² Hypertension [HTN] is responsible for 57% of stroke deaths and 24% of coronary heart disease [CHD] deaths in India as per the studies in 2003.³ The first hypertension prevalence study in India was done by Chopra et al in 1942 with continuation thereafter. Literature search and findings of many of the studies found a regular increase in the prevalence of hypertension. In India with a population estimation of 1.1 billion, the prevalence of HTN has been estimated to be 3% to 34.5% in males and 5.8% to 33.5% in females.^{4,5} By the end of 2025 the projected prevalence of HTN in Indian men and women are 22.9% and 23.6%. As per the statistics of Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India, the overall prevalence of hypertension in India by 2020 will be 159.46/1000 population. ⁷ Hypertension 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 hypertension. The prevalence of HTN has increased in urban communities as well as rural people. The prevalence of hypertension in the last six decades has increased from 2% to 25% among urban residents and from 2% to 15% among the rural residents in India. Recent studies from India have shown the prevalence of HTN to be 25% in urban and 10% in rural adults in India. The prevalence of hypertension increases with age in all populations. This rising trend observed is multifactorial, may be because of increased life expectancy, life style changes, increased salt intake and increased awareness and detection.

Most of the studies performed have concentrated on clinical HTN defined as "systolic blood pressure (SBP) ≥140mm Hg and diastolic Blood pressure (DBP) ≥90 mmHg as per the Joint national committee VII guidelines.⁸ With the introduction of 'pre-hypertension' in the classification by the JNC as per 2004 guidelines, which is defined as SBP of 120-139 mmHg or DBP of 80-89 mmHg made a separate group to study its relation in predicting the risk for development of HTN and it is considered as risk factor for cardiovascular disease. Many of the studies have been done to estimate the prevalence of Pre-hypertension among Indian population and two major studies were by WHO- ICMR as per JNC VI guidelines and IDSP -ICMR which used pre-HTN in its analyses. PReliable information on prevalence of pre-HTN and HTN is necessary for development of National and regional health policies for prevention and control of hypertension. The present study was conducted to estimate the prevalence of pre-hypertension and HTN and its risk factors in rural areas of Nellore district.

METHODS

Place of study: This community-based study was carried out in the rural field practice area of the Department of Community Medicine, Narayana Medical College, covering six villages.

Study population and period: To find out the prevalence of hypertension in the population 20 years and above residing in the six villages. To study the socio demographic risk factors affecting hypertension among the population >20 years of age from October 2013 to September 2015 for period of two years. The population covered in this area was 39,786 of which 8978 were adults >20 years of age.

Study design: A questionnaire containing all the socio demographic data (age, sex, family history, socio economic status, weight, height etc.) and factors affecting hypertension [Tobacco intake, alcohol consumption, salt intake, diabetes mellitus etc.] were included in the study. The data was collected by interviewing the participants. The clinical measurements which were obtained include weight, height and blood pressure. All these were calculated by using standard instruments and following standard guidelines. Socio economic status was defined as per Modified Prasad's Classification. 10

Definitions utilized for various variables

Smoker: A person who has smoked at least 100 cigarettes in his lifetime and has continued to smoke every day or some days in the last 30 days.¹¹

Tobacco chewing: Defined as a person who has consumed smokeless tobacco once a day or nearly every day in any form for the last 12 months.

Alcohol: Present consumer was defined as a person who has consumed alcohol every day or some days in the last 30 days. Past consumer was defined as a person who used to consume alcohol but stopped taking alcohol 12 months ago.

Salt intake: Estimated per capita salt intake was calculated by 24-h dietary recall method for three consecutive days and an average was calculated. 12

Waist- Hip ratio: Waist circumference (WC) was measured to the nearest 0.1 cm at the narrowest point between the lower end of the rib cage and the iliac crest. Hip circumference (HC) was measured to the nearest 0.1 cm at the greatest horizontal circumference below the iliac crest, at the level of greater trochanter. [waist-hip ratio (WHR)>0.85 for females and >0.90 for males]. ¹³

Measurement of blood pressure: Two measurements of blood pressure on each study participant with a mercury column sphygmomanometer were made 30 minutes apart in sitting position. Blood pressure measurements were made on the subject's left arm using a cuff of appropriate size at the level of the heart. The cuff pressure was inflated 30 mm Hg above the level at which radial pulse disappeared, then deflated slowly at the rate of about 2mm per sec and the readings were recorded to the nearest 2 mm Hg. In case where the two readings differed by over 10 mm of Hg, a third reading was

obtained, and the three measurements were averaged. The pressures at which sound appeared and disappeared were taken as systolic blood pressure (SBP) and diastolic blood pressure (DBP) respectively. To obtain accurate readings of Blood pressure WHO guidelines were used. ¹⁴ To avoid inter observer variation, BP was recorded by the authors themselves.

Inclusion criteria: Hypertension was diagnosed when systolic BP (SBP) was ≥140mmHg and/or mean diastolic BP (DBP) ≥ 90mmHg. Isolated systolic hypertension was defined as a systolic BP ≥140mmHg and a diastolic BP < 90mmHg. The recorded blood pressure was graded as normal (SBP <120 and DBP <80 mmHg), prehypertension (SBP = 120-139 and/or DBP = 80-89 mmHg), stage I hypertension (SBP = 140-159 and/or DBP = 90-99 mmHg), and stage II hypertension (SBP > 160 and/or DBP > 100 mmHg) as per US Seventh Joint National Committee on Detection, Evaluation and Treatment of Hypertension (JNC VII) criteria. 15

Sample size: Sample size was calculated estimating the prevalence of hypertension in the region by previous study from the department, which was around 20%. The following formula was used: Sample size = 4PQ/L2. Where, P is Prevalence = 20%, Q = 100 - P = 80% and L is absolute error= 4%. The sample size came out to be 400; however, a total of 1025 participants gave consent for the study. Systematic random sampling was used to select study subjects in the six villages of primary health centre area.

Exclusion criteria: patients on anti-hypertensive medication, who refused to participate and who didn't provide reliable information were excluded from the study.

Ethical consideration: The study was approved by the Institutional and Hospital research committee and ethical

committee of Narayana Medical College and Hospital. Written informed consent was obtained and referral services were provided to necessary cases if required.

Statistical analysis: The data was entered in Microsoft excel and analysed using SPSS version 14.0. Chisquare's test of significance was performed to find out the results. A two tailed P value <0.05 was considered significant.

RESULTS

A total of 8978 people above 20 years of age were surveyed in the rural field practice area of Narayana medical college, Nellore which included two primary health centres and six villages covering a total population of 39,786. 3475 people were willing to participate in the study and 1025 could provide reliable information and were included in the study. People already on antihypertensive medication were excluded from the study.

Among 625 males, 186 (29.76%) and among 400 females, 188 (47%) were found to be suffering from hypertension (stage I and II). Among 625 males, 353 (56.48%) were pre-hypertensive, 136 (21.76%) were stage-I hypertensive and 50 (8%) were stage-II hypertensive. Of the 400 females, 84 (21%) were prehypertensive, 132(33%) were stage I hypertensive and 56(14%) were found to be stage II hypertensive. In the study the prevalence of pre-hypertension was 42.63% (437 subjects) [SBP- 120-139 and DBP- 80-89 mmHg], stage-I hypertension was 26.15% (268 subjects) [SBP -140-159 and DBP- 90-99 mmHg] and stage-II hypertension was 10.34% (106 subjects) [SBP >160 and DBP > 100 mmHg]. All the cases diagnosed with stage-II HTN were asymptomatic and were started on antihypertensive medication (Table 1).

Table 1: Distribution of cases as per grades of hypertension (JNC-VII).

Sex	Normal	Pre- hypertensive	Stage-I hypertensive	Stage-II hypertensive	Total
Male	86	353	136	50	625
Female	128	84	132	56	400
Total	214	437	268	106	1025

In addition to BP recordings the socio demographic characteristics and laboratory investigations (Blood glucose levels, Lipid profile) were recorded and analysed from the subjects in the study. In our study the peak age was at 60 – 69 years in both males and females. The prevalence of HTN in males at 60 -69 years was 87.50% and in females at 60-69 years was 71.05%. The difference observed was statistically significant (p value<0.005) and signifies the association between age

and sex in hypertension (Table 2). The prevalence of HTN was high among households with 3-5 members (34.22%) compared to other groups with >6 members, living alone and with husband and wife only. Greater prevalence of HTN was observed in labourer (23.53%) and professional (20.32%) than in unemployed (12.83%), skilled (10.16%), farmers 914.97%) and house wife (18.18%). Statistical significance was associated between the variables and association of hypertension.

Association of risk factors with HTN

The prevalence of HTN among smokers was 53.06% (286 subjects) and in non-smokers 18.11% (88 subjects) which was found statistically significant (p value<0.001). Among 467 alcoholics in the study, 59.53% (278) were hypertensive and 26.16% (146 subjects) among non-alcoholics. Out of 467 alcoholics, 278 were hypertensive and 189 were normal. Statistical significance was associated with this risk factor. Among the 416 diabetic subjects in the study, 198 subjects (47.6%) were found to be in stage – I & II hypertension. Among non-diabetics only 176 (28.9%) were hypertensive.

272 of the subjects in the study were obese with BMI >25 and 92 subjects (33.82%) were suffering from stage I & II hypertension. 140 subjects (28.06%) with BMI < 25 were found to be hypertensive and 499 were having normal blood pressure. 55.46 % (264 subjects) were diagnosed as hypertensive among 476 subjects with high salt intake and 20.04% (110 subjects) among 549 with normal salt intake. This difference in individuals was found to be statistically significant. 26.6% of vegetarians and 42.97% of non-vegetarians were found hypertensive. Socio economic index showed that HTN was more common (52.05%) in subjects with low economic index, followed by high (30.52%) and medium economic index (30.17%) (Table 3). 50.97% (210 subjects) above cut off

value of waist-hip ratio were hypertensive and 26.75% (164 subjects) with less than cut off value for waist-hip ratio was hypertensive (Table 4). The risk factors which were found statistically significant were excess salt intake (>10gms/day), alcohol and tobacco consumption, diabetes mellitus and BMI. Less significance was seen with non-vegetarian diet and waist hip ratio.

Table 2: Gender and age wise distribution of cases in study.

Sex	Age in	Total	Hypertension	
Sex	years	surveyed	(n) (%)	
	20-29	104	12 (11.54%)	
	30-39	212	20 (9.43%)	
	40-49	147	22 (14.97%)	
Male	50-59	78	60 (76.92%)	
	60-69	48	42 (87.50%)	
	>70	36	30 (83.33%)	
	Total	625	186 (29.76%)	
	20-29	64	8 (12.5%)	
	30-39	60	18 (30%)	
	40-49	98	48 (48.98%)	
Female	50-59	78	44 (56.41%)	
	60-69	76	54 (71.05%)	
	>70	24	16 (66.67%)	
	Total	400	188 (47%)	

Table 3: Socio demographic variables and prevalence of hypertension.

Variables		Hypertensive no (n=374)	Non hypertensives (n= 651)	Odds-ratio	P value
	Unemployed	48	48 76		
	Professional	76	91		
Occupation	Labourer	88 144			0.063
Occupation	Skilled	38	79		0.003
	Unskilled/farmer	56	110		
	House wife	68	151		
Cmalring	Smoker	286	253	5.11	< 0.0001
Smoking	Non-smoker	88	398	3.11	
Alcohol	Alcoholic	278	189	4.15	< 0.0001
Alcohol	Non-alcoholic	146	412	4.13	
Diabetes	Diabetic	198	218	2.23	< 0.0001
mellitus	Non-diabetic	176	433	2.23	
	<18.5	68	367		
Body mass	18.5 - 24.99	72 246			< 0.0001
index	25.0-29.99	64	168		<0.0001
	≥30	28	12		
Dietary habit	Vegetarian	108	298	- 0.48	<0.0001
Dietal y nabit	Non vegetarian	266	353	0.46	
Salt intake	Intake >10gms	264	212	4.97	< 0.0001
Sait iiitake	Intake <10gms	110	439	4.57	
Socio economic	Low	152	140		<0.0001
status	Medium	146	338		
status	High	76	173		
Family history	Yes	296	164	4.55	< 0.0001
of HTN	No	80	487	4.33	<0.0001

Table 4: Gender distribution of cases by waist hip ratio.

Hypertensives Non- hypertensives					Odds	P		
Gender	Male	Female	Total	Male	Female	Total	ratio	value
<cut-off< td=""><td>108</td><td>56</td><td>164</td><td>286</td><td>163</td><td>449</td><td>0.35</td><td>< 0.0001</td></cut-off<>	108	56	164	286	163	449	0.35	< 0.0001
>Cut- off	120	90	210	116	86	202	0.33	<0.0001

DISCUSSION

Hypertension is one of the leading health problems making its impact on developed and industrialized nations. Life style modifications, rapid urbanization, dietary changes with increase in life expectancy are also associated with marked rise in prevalence of hypertension. In India, the impact was not yet felt because of presence of communicable diseases. However, studies in India reported an average prevalence of HTN is 10% in rural and 25% urban inhabitants. ¹⁷ In our study the overall prevalence of HTN in both sexes is around 36.5% with 29.76% among males and 47% in females. Our study reported a significant rise in the prevalence when compared to other studies by Bharadwaj et al, who reported the prevalence of 30% among rural inhabitants.¹⁸ Our findings were on par with findings of Yadav et al who reported the prevalence of hypertension as 32.2% and pre- hypertension as 32.3% from Lucknow, Mohan et al from Chennai (Prevalence of HTN was 20% and prehypertension was 36.1%) and Ghosh et al (Prevalence of Pre-HTN 32.1% and HTN 11.8%). 19-21 The prevalence rates of HTN are variable from place to place depending on the cut-off point used and the method employed in measurement of blood pressure. In our study a rise in prevalence was observed because of double reading and recording of blood pressure. The peak age of HTN in our study was 60-69 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, cross sectional studies have demonstrated a positive relation between age and blood pressure in diverse, geographical and socio economic conditions.²² Findings of our study were in par with findings of Joshi et al and Shakuntala Chockalingam et al. 23,24 Vasan et al et al. and Player et al also reported that there is increase in prevalence of hypertension with the advancement of age. 25,26

In our study, only 92 subjects (9%) were overweight and obese as per BMI (>25) and 20.5% of subjects were having waist-hip ratio above cut-off (0.9 for males and 0.8 for females). The prevalence of HTN in obese subjects with BMI was 33.82% and with waist –hip ratio was 51%. Similar findings were observed in the studies of Vimala et al and Rodger et al who reported a significant association between HTN and BMI. 27,28 Prevalence of hypertension was significantly higher in tobacco users and alcoholics in our study. These two are already independent risk factors as mentioned in many studies. Prevalence of hypertension is directly related to

the salt intake and in our study 55.46% were hypertensive with an intake of >10gm/day. Findings of our study were in line with reports of Radhika et al who reported an association of HTN with excess salt intake in south population.²⁹ urban The prevalence hypertension did not differ significantly between vegetarians and non-vegetarians'. This finding was contrary to finding of Bhadoria et al who reported prevalence of HTN more in non-vegetarians than vegetarians.³⁰ The prevalence of HTN in our study was 52.05% in low socio economic index families and 30.17% and 30.52% in medium and high socio economic index families. High prevalence in low socio economic index families is an inconsistent finding in our study.

The strength of the study was that it is a cross sectional study highlighting the prevalence of hypertension in rural field practice area in Nellore. Bias was avoided by Systematic random sampling technique. Errors in recording of BP were avoided by double reading and recording of SBP and DBP by the authors itself. The lack of awareness and positive attitude could be an important barrier in early diagnosis of hypertension.

The limitation of our study was the sample size was limited to one geographic area, localized to Nellore where it could not be applied to all over the nation. The study had limited explorative value. Literacy and psychological barriers were again a problem in data collection. Lack of data on stress levels which is a significant risk factor in hypertension is lacking and could be an important limitation.

CONCLUSION

Indian health system is challenged with increasing prevalence of non-communicable diseases and HTN being one of the major. This urges a strong need to improve health care at all levels incorporating prevention, surveillance, treatment and appropriate management. One factor which can help is by regular re-training, regular enhancement and upgrading skills of health care professionals providing hypertension related care. Prioritization of population based prevention approaches requiring multi sectoral actions and evidence based clinical approaches focusing on early detection and treatment can provide benefit to population health. Thus, control of HTN can provide an access point in reduction of other cardio vascular disease mortality. Given the rising burden of HTN in India, population based interventional approaches like reduction of salt intake, tobacco avoidance and regular physical activity can be incorporated in the control programmes.

Effective screening programmes to detect Pre-HTN and HTN should be planned at sub center levels by providing support tools to health care workers to detect, refer and follow up patients and facilitate surveillance system by developing information system in tracking HTN and its outcomes. To increase the awareness on hypertension, information about prevention and control of hypertension can be incorporated in the information education and communication (IEC) components of all national programmes. This can complement overall efforts to increase societal awareness through other approaches.

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Institutional Ethics Committee

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