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ORIGINAL ARTICLE

A STUDY ON RISK FACTORS FOR HYPERTENSION IN RURAL AREAS OF TAMIL NADU, INDIA

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ABSTRACT: BACKGROUND: The epidemic of hypertension is increasing at an alarming rate. Knowledge about the existing risk factors of hypertension helps in developing prevention programs. Therefore, the present study was designed with the objectives of identifying the prevalence of systemic hypertension in rural area, Tamil Nadu and to identify the risk factors contributing to it. **METHODS:** A cross sectional study was carried out over a period of one year from August 20007 to July 2008 in the field practice area of PSG Rural Health Centre, Neelambur attached to the Department of Community Medicine, PSG Institute of Medical Sciences and Research, Coimbatore. A two stage random sampling method was used to select the households of respondents. The WHO STEPS approach questionnaire which is recommended for eliciting non-communicable disease risk factors (Core and Expanded version 2.0) was used for data collection. **RESULTS:** The overall prevalence of hypertension was found to be 26.9%. Among the hypertensive subjects, Odd's Ratio (OR) was found to be more in those taking extra salt (7.73), inadequate fruit intake (1.41), taking non-vegetarian diet (1.39), moderate physical activity (1.24) and BMI ≥30(12.13). **CONCLUSION:** The burden of hypertension in our study was found to be similar to those in developed countries. For an in-depth analysis of the risk factors of hypertension, a prospective longitudinal follow-up study is required on the true risk factors.

KEYWORDS: Hypertension, Prevalence, WHO STEPS, Cross sectional study, Risk factors.

INTRODUCTION: The epidemic of hypertension is increasing at an alarming rate.[1] The number of adults with hypertension in 2025 is predicted to increase by about 60% to a total of 1.56 billion. According to the Global Burden of Diseases study, by the year 2025, cardiovascular diseases would be the major cause of deaths all over the world including the developing countries.[2] All over the world the life expectancy is increasing as a result of demographic transition. Epidemics of non-communicable diseases (NCD) are emerging or accelerating in almost all developing nations. With India's life expectancy almost doubling since independence and even at the present stage of health transition, India contributes substantially to the global burden of NCDs. In 1990, India accounted for 19 per cent of all deaths, 16 per cent of all NCD deaths, and 17 per cent of all CVD deaths in the world. CVDs in India alone accounted for around 2.4 million deaths, in contrast to nearly 3.2 million deaths due to that cause in all the industrialized countries put together.[3]

The recent World Health Organization figures draws attention to the forbidding economic cost of NCD's in terms of both production losses from disruptions in the work place as well as the escalating cost of treatment which in the very large majority has to be life-long. The economic loss to India from the group of non-communicable diseases is expected to increase from $8.7 billion in 2005 to $54.0 billion in 2015.[4] High blood pressure (BP) is directly related to about 40% of this cardiovascular disease burden.[5]

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A number of studies have been conducted on the prevalence of hypertension in India. These studies have been carried out in different geographic areas and in urban as well as rural area populations. These studies show a prevalence rate of as low as 1.5% in Uttar Pradesh[6] to as high as 33.3% of a rural community in Assam. However, not many studies about the prevalence of hypertension in South India was conducted.[7] More than prevalence data, from public health point of view, knowledge about the existing risk factors of hypertension in the local community helps in developing prevention programs. Only very few studies have been reported which explored the problem of hypertension among adults aged ≥18years and above in rural South India. Hence the present study was planned using the WHO STEPS[8] approach with the objectives of identifying the prevalence of systemic hypertension in rural area, Tamil Nadu and to identify the risk factors contributing to it.

MATERIAL AND METHODS:

Study Design: A cross sectional study was carried out over a period of one year from August 20007 to July 2008 in the field practice area of PSG Rural Health Centre, Neelambur attached to the Department of Community Medicine, PSG Institute of Medical Sciences and Research, Coimbatore.

Sample size was calculated from the results of a pilot study conducted amongst the randomly selected adults aged ≥ 18 years and above to test the questionnaire in a village which was excluded from the study and the required sample size of 1400 was arrived. In order to get 1400 adults aged 18 years and above, it was decided to survey 662 households in the field practice area of Neelambur RHC, consisting of 7 village panchayats with a total of 8634 households with population of 18270 adults.

A two stage random sampling method was used to select the households of respondents. In first stage, 3 village panchayats were selected from the list of 7 village panchayats of the field practice area based on the predominant occupational profile of its residents. They were Neelambur (predominantly industrial), MG. Pudur (predominantly agricultural) and Rasipalayam village (predominantly agricultural and industrial) panchayats to examine whether there were differences in prevalence of hypertension between these three villages and thus identify risk factors contributing to the observed difference. In the second stage, the number of households was randomly selected in Neelambur, MG Pudur and Rasipalayam village panchayats. The required sample size of 662 households was arrived at using the probability proportional to size (PPS) sampling technique.

Study Population: The complete list of all residents eligible for the study was drawn from the voters list. All the eligible persons aged ≥18 years were included in the study. House to house visit was made in the morning and in the evening time to enroll all the members of the family. If an adult member of a household was either non-responsive or could not be contacted even after 3 visits, he/she was excluded from the study. Also, pregnant women, those who were unable to stand in erect posture and people with secondary hypertension were excluded from the study.

OPERATIONAL DEFINITION:

Hypertension: In this study, a person either male or female aged 18 years and above is considered hypertensive if his/her Systolic Blood Pressure(SBP) of 140 mm of Hg or greater, Diastolic Blood Pressure (DBP) of 90mm of Hg or greater or taking antihypertensive medications. (JNCVII)[9]

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Data Collection Methods: The WHO STEPS approach questionnaire which is recommended for eliciting non-communicable disease risk factors (Core and Expanded version 2.0) was used for data collection. The survey was carried out by the investigator and his team which received one day training for administering the questionnaire and carrying out the anthropometric (Weight, height, waist and hip circumference) and blood pressure measurements as per the standard protocol recommended by WHO.[8] The same person made the same measurements throughout the study to minimize the inter-observer error. Measurements of weight, height, BMI, waist circumference, hip circumference and waist-hip ratio were taken as per the WHO recommendations.[10,11,12] Data analysis was done using SPSS 17.

Ethical Issues: The study was conducted after getting approval from Institutional Ethical Committee (IEC). Informed written consent was taken from each study subject before administering the questionnaire. Those who were found to be hypertensive were referred to PSG Rural Health Centre, Neelambur. Rest of them were given health education and counselling about the risk factors of hypertension.

RESULTS: The village-wise distribution of the study population is given in Table 1. There were 755 study subjects in Neelambur, 498 were from M. G. Pudur while 211 were from Rasipalayam. In all the three villages, women formed the majority study population. Overall, persons in the age-group 25-34 years constituted the major bulk. Socio-economic statuses were determined by Modified B.G. Prasad's classification 2008. Majority of the adults, studied belonged to socio-economic class III and IV. Three-fourth of the study subjects in all the three villages were married.

The overall prevalence of hypertension was found to be 26.9%. Rasipalayam showed the maximum prevalence with 30.8% followed by MG Pudur at 27.3% and Neelambur at 25.6% (Table 2). Among the hypertensive subjects, extra salt intake was found in 270(68.5%), inadequate intake of fruits was found in 78(19.8%), 270(68.5%) were non-vegetarians. The level of physical activity was found to be sedentary in 158(40.1%) while in 194(49.2%) the level of physical activity was moderate. Only 42(10.7%) among the hypertensive subjects were doing rigorous physical activity. Almost half, 184(46.7%) of them were having BMI more than 25. Positive family history was found in 79(20%) hypertensive subjects. Perceived stress score was found to be 14% higher among hypertensive subjects when compared to normotensive subjects. Results from the study showed there is a 15% less chance of getting hypertension if they sleep more hours/ day.

A multiple logistic regression analysis was done on the risk factors as independent variables and hypertension as dependent variable (Table 3). It shows that the Odd's Ratio (OR) is increasing progressively as age advances. Similarly OR was found to be more in those taking extra salt (7.73), inadequate fruit intake (1.41), taking non-vegetarian diet (1.39), moderate physical activity (1.24) and BMI ≥30 (12.13).

DISCUSSION: The prevalence of systemic hypertension among males was 27.1% and among females it was found to be 26.7%. This is higher than the estimated prevalence of systemic hypertension among males and females in India in 2000 as stated by Kearney et al[1] (20.6% and 20.9% respectively) but lower than that reported by Gupta et al[13] (30% and 33% respectively). The prevalence rate of hypertension also varies widely in rural India because of social, economic and cultural backgrounds.

The study revealed that there is a strong association between the age and the risk of systemic hypertension. [OR: 20.092 (95% CI: 11.77-34.27)]. Sharma et al.,[14] in their study has found that ageing causes changes in arterial blood vessels. Many cross-sectional and prospective observational cohort studies, have also consistently documented a positive relation between age and blood pressure in most populations with diverse geographical, cultural and socio-economic background.

The findings of the present study shows that the risk of hypertension is higher among married and widows/widowers when compared to unmarried and is statistically significant ($p<0.01$). [OR: 9.946(95% CI: 2.33-42.40) and OR: 8.263 (95% CI: 1.86-36.71)]. These findings are in agreement with the findings of Hazarika et al.[15] However, Kalavathy et al.[16] reported lower risk among married group in elderly in Kerala.

The risk of hypertension is marginally higher among subjects who gave a positive family history compared with those who did not. [OR: 1.461(CI: 1.01-2.10)] and the difference is statistically significant ($p<0.05$). Our observations were consistent with that of Mo et al,[17] Kulkarni et al,[18] Stamler et al,[19] Miall et al,[20] who also brought out a significant association between family history and hypertension.

According to the Evidence Report of National Institutes of Health[21]all overweight and obese adults (Aged 18 years or older) with a BMI of 25 are considered at risk for developing associated morbidities or diseases such as hypertension, high blood cholesterol, type 2 diabetes, coronary heart disease, and other diseases. In this study, there is a strong association between BMI and hypertension, with the risk increasing with BMI. The risk is higher among those whose BMI is ≥30 compared to BMI less than 18.5. [OR: 12.137(CI: 5.51-26.70)] and the observed difference is statistically highly significant ($p<0.001$). Similar, observations was made by**,** Deshmukh et al,[22] Santhirani et al,[23] Jajoo et al,[24] Joshi et al,[25] Singh et al,[26] Deswal et al,[27] Malhotra et al[28] and Goel et al.[29]

The present study had also revealed that the risk of hypertension was lower among the formal schooling group compared with no formal schooling. [OR: 0.327 (95%CI: 0.25-0.42)] and is statistically significant ($p<0.001$). The findings correlate well with that of Deshmukh et al.[30] However, Joshi et al and Hazarika et al reported there was no such relationship with level of education.[16,25,31]

In a WHO 1996 report on hypertension control, in countries that are in post-transitional stage of economic and epidemiological change, higher levels of blood pressure and higher prevalence of hypertension has been noted in lower occupational groups. However, in societies that are transitional or pre-transitional stage higher levels of blood pressure and higher prevalence of hypertension has been noted in the upper occupational groups. In this study, highest risk is found among the retired subjects and unemployed who were also unable to work when compared to government employees [OR: 5.280 (95% CI: 1.19-23.31) and OR: 3.09 (95% CI: 1.04-9.21) respectively] and the difference is statistically significant ($p<0.05$). Similar findings was reported by Hazarika et al in Assam and Mufunda et al in Eritrea where the prevalence of hypertension was highest among unemployed people and local merchants and was lowest among students. However, the present study shows there are no hypertensive among the students.[15,32,33]

The implications of socio-economic status as a risk factor for hypertension cannot be ignored as the income decides purchasing power of the individual and family as also access to health care facility. In this study the risk of developing hypertension among class I of modified Prasad's classification is lower compared to class V [OR: 0.721(95% CI: 0.30-1.68)] and the difference is not statistically significant ($p>0.05$). These findings correlate well with that of Whitehall study conducted

by Marmot et al. However, Gilberts et al and Singh et al found that the risk is higher among social class I & II.[26,34,35]

According to WHO 1996 report, several studies from the developed and developing world have reported no relationship between smoking and levels of blood pressure. Even though nicotine and smoking raise blood pressure acutely, hypertension does not seem to be more prevalent among smokers, and blood pressure changes little when people quit smoking**.** In the present study the risk of hypertension was marginally higher among smokers [OR: 1.253(95% CI: 0.92-1.69), p>0.05] compared to non-smokers. The difference is not statistically significant (p>0.05). Similar findings were observed by Hazarika et al. However, Gupta et al found smoking to be independently associated with hypertension. Similar view also shared by Jajoo et al and Bhat et al.[22,24,26]

According to WHO 1996 report, many cross-sectional and prospective observational studies in different populations have shown that alcohol consumption has been consistently related to high blood pressure. But the present study shows that the risk of hypertension is lower among alcoholics compared to non-alcoholics. [OR: 1.008 (95% CI: 0.724, 1.404)].The difference is not statistically significant (p>0.05). In a similar cross-sectional study by Deshmukh et al[22]. The risk of hypertension did not differ significantly in alcohol users. However, Hazirika et al, Gopinath et al, and Singh et al. found alcohol consumption had a significant association with hypertension.[15,31]

Diet plays a role in the causation of hypertension. The present study also explored the association between hypertension and intake of fruits. In general fruits have high amount of dietary fibre. The risk of hypertension is less when compared with those who did not consume fruits. [OR: 0.418 (95% CI: 0.30, 0.57)]. The difference is statistically significant (p <0.001).

Studies also suggest the likelihood of lower blood pressure levels among vegetarians. Vegetarian diet has high amount of fibre. On the contrary, this study shows that risk of being hypertensive is lesser among those consuming non-vegetarian diet. [OR: 0.513 (95% CI: 0.39, 0.66)]. This difference is also statistically significant (p <0.001). Similar view shared by Joshi PP et al[25] and Gilbert EC et al.[34] However, Patnaik et al.[36] found higher risk in persons taking non-vegetarian diet.

Experimental and observational studies have shown that the intake of sodium chloride, in excess of physiological requirements, is associated with high blood pressure. The strength of association between urinary sodium excretion and blood pressure increases with age. In our study, contrary to other studies, the risk of hypertension was found to be lower among those who said they added extra table salt when compared with those who said they did not add extra table salt.[OR: 0.336 (95% CI: 2.255, 0.443)]. The difference is found to be statistically significant (p <0.001). A finding supported by Malhotra[37] that salt intake has inverse relation to hypertension explaining, that North Indians who consume more salt have lower prevalence than South Indians who consume less salt. However, Hazarika et al[15] and Singh et al[26] observed that extra salt intake in both sexes is associated with hypertension.

The role of physical activity has been widely analyzed in association with hypertension in adults. Existing studies using cross-sectional study designs show consistent findings. Paffenbarger in his Harvard study showed that people not involved in any physical activity had higher incidence of developing hypertension. In our study the risk of hypertension is lower among heavy/ rigorous activity workers when compared to sedentary workers. [OR: 0.265 (95% CI: 0.17, 0.39)]. The difference is also statistically significant (p <0.001). Similar, findings were reported by Deshmukh et al., Jajoo et al. and Shanthirani et al in her Chennai Urban Population Study (CUPS).[22,23,24]

This study shows that the risk of developing hypertension is lesser among those who declared they are stressed, compared to those who perceived they are not stressed. But, the difference is statistically significant. ($p < 0.001$)[38] The present study shows that there is a lesser chance of getting hypertension if they sleep more hours/day and the difference is statistically significant. ($p<0.001$).[39]

The risk factors which were statistically significant in univariate analysis were subjected to Multivariate logistic regression modeling to adjust all risk estimates for covariates. Possible covariates considered were age, sex, education, occupation, socio-economic status, marital status, alcohol, extra table salt intake, intake of fruits, non-vegetarian diet, level of physical activity, body mass index, family history, stress and duration of sleep. In addition, we included those variables frequently associated with hypertension in other epidemiological studies. Our final model included age, education, marital status, extra table salt intake, intake of fruits, non-vegetarian diet, level of physical activity, body mass index, stress, duration of sleep, and family history.

CONCLUSION: A comprehensive approach involving lifestyle modifications including a healthy diet, weight reduction, alcohol consumption, and exercise and stress management will improve the control of hypertension in the community. The control of hypertension should fit into the overall policy of health promotion and health education programs. The burden of hypertension in our study was found to be similar to those in developed countries. However, although prevention and control measures followed in developed countries cannot be directly applied to our population because of lack of infrastructure, level of education, awareness and large population, a tailor-made intervention program addressing modification of lifestyle as well as need for drug compliance should be designed for the specific needs of the local population. For an in-depth analysis of the risk factors of hypertension, a prospective longitudinal follow-up study is required on the true risk factors.

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Sl. No.	Socio-demographic data		Neelambur Number (%)	M.G. Pudur Number (%)	Rasipalayam Number (%)
1.	Gender	Male	319(42.3)	224(44.9)	94(44.5)
		Female	436(57.7)	274(55.1)	117(55.5)
2.	Age group	18-24	88(11.7)	59(11.8)	32(15.2)
		25-34	172(22.8)	104(20.9)	42(19.9)
		35-44	144(19.1)	104(20.9)	38(18.0)
		45-54	123(16.3)	94(18.9)	47(22.3)

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		55-64	99(13.1)	69(13.9)	30(14.2)
		≥ 65	129(17.1)	68(13.7)	22(10.4)
3.	Education	Illiterate	184(24.4)	134(26.9)	35(16.6)
		Literate	571(75.6)	364(73.1)	177(83.4)
4.	Occupation	Unemployed/ House wife	402(53.2)	258(51.8)	93(44.1)
		Employed	353(46.8)	240(48.2)	118(55.9)
5.	S-E status	1	75(9.9)	34(6.8)	24(11.4)
		2	172(22.8)	109(21.9)	43(20.4)
		3	313(41.5)	174(34.9)	73(34.6)
		4	179(23.7)	171(34.3)	66(31.3)
		5	16(2.1)	10(2.0)	5(2.3)
6.	Marital status	Unmarried	94(12.5)	48(9.6)	32(15.2)
		Married	560(74.2)	394(79.1)	156(73.9)
		Divorced	2(0.3)	0(0.0)	0(0.0)
		Widowed	95(12.6)	54(10.8)	23(10.9)
		Separated	4(0.6)	2(0.4)	0(0.0)

Table 1: Distribution of study population according to socio-demographic data (N=1464)

Name of the village	Percentage %
Neelambur	25.6
MG Pudur	27.3
Rasipalayam	30.8
Total	**26.9**

Table 2: Village wise Prevalence of Hypertension

Contributing Risk factors	Odds Ratio	95% CI		P value
		Lower	Upper	
Age group (In years)				
18-44	1			
44-54	5.743	3.881	8.498	<0.001
55-64	8.726	5.609	13.573	<0.001
≥65	20.092	11.777	34.279	<0.001
Education				
No formal schooling	1			
Formal schooling	0.901	0.626	1.297	0.576
Marital status				
Unmarried	1			
Married	9.946	2.333	42.402	0.002
Widows/Widowers	8.263	1.860	36.710	0.006

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Extra salt Intake (on the table)				
No	1			
Yes	0.543	0.382	0.773	<0.001
Fruits				
No	1			
Yes	0.946	0.635	1.411	0.786
Non Vegetarian Diet				
No	1			
Yes	0.986	0.635	1.411	0.786
Level of Physical Activity				
Sedentary	1			
Moderate	0.866	0.601	1.248	0.053
Heavy/Rigorous	0.613	0.374	1.007	0.439
BMI(kg/m^3)				
<18.5	1			
18.5-22.99	3.239	1.694	6.193	<0.001
23-24.99	4.238	2.109	8.516	<0.001
25-29.99	7.821	3.972	15.403	<0.001
≥30	12.137	5.515	26.709	<0.001
Stress (Perceived stress score)				
Normotensives	1			
Hypertensives	1.031	0.954	1.114	0.441
Sleep				
Normotensives	1			
Hypertensives	1.012	0.899	1.139	0.839
Family History				
No	1			
Yes	1.461	1.013	2.108	0.043

Table 3: Correlates of hypertension–multiple logistics regression

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