PREVALENCE OF PRE-HYPERTENSION AND HYPERTENSION IN RURAL TAMIL NADU POPULATION – A PILOT STUDY REPORT FROM MANAMPATHY VILLAGE OF THIRUPORUR TEHSIL, KANCHEEPURAM DISTRICT OF TAMIL NADU, INDIA

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ABSTRACT

Considering the fact that a very narrow dividing line exist between normotension and hypertension and is still a debating topic among the physicians, BP levels of systolic ≥ 140 mm Hg and/or diastolic ≥ 90 mm Hg is accepted as an indicator for the diagnosis of hypertension. At and above this level, an increased mortality risk and association with other diseases have been reported through prospective cohort and case-control studies from most of the developed and developing countries. High fatty diet and body mass index have a positive correlation and physical activity is negatively related with hypertension. Many factors like alcohol consumption and smoking also increase the risk. Prevalence of hypertension in India as reported by various literatures has been on an increasing trend for the last three decades. Most of the studies are reported from urban population. More studies are needed based on rural Indian scenario. The present study was carried out to determine the prevalence of hypertension, its associated risk factors as well as to increase the awareness on importance of life style modifications in a rural population of Tamil Nadu. A greater understanding of the risk factors that account for the increase in hypertension could potentially contribute to its future prevention by addressing its root causes.

KEYWORDS: Hypertension, Pre-hypertension, Risk Factors, Rural Populations of Tamil Nadu

INTRODUCTION

World Health Day is celebrated on 7 April to mark the anniversary of the founding of World Health Organization (WHO) in 1948. Ever year a theme is selected for World Health Day that highlights a priority area of public health concern all over the world. This year in 2013, theme for World Health Day is high blood pressure, also known as raised blood pressure or hypertension.

The epidemiology of hypertension, in terms of both, its importance as a risk factor for cardiovascular and other diseases and of its own etiology, continues to be a major field of investigation with an enormous peer-reviewed literature every year. Elevated blood pressure is the most important cardiovascular risk factor contributing to one half of the coronary heart diseases and approximately two third of the cerebrovascular diseases because, it exerts excessive pressure on the interior wall of arteries, thereby damaging internal endothelial lining of the blood vessels¹.

Hypertension is an important public health problem in developing countries especially in adults, aged 40-55 years². Recent studies among Indians show a high prevalence of hypertension in both urban and rural areas³,⁴,⁵. Though
several reports on the prevalence of hypertension have been extensively carried out in the urban populations, from rural south India very few studies have reported the prevalence and risk factors of hypertension.

Based on these reports, we conducted a pilot study at Manampathy village of Thiruporur Tehsil, Kancheepuram district of Tamil Nadu. The pilot study was done in association with the NSS unit of AVIT and Vinayaka Missions Chennai Hospitals. Systolic and Diastolic values were collected from participants those who attended the study and the prevalence of pre-hypertension and hypertension were estimated. Through this study we also gave general awareness on hypertension, the significance and its association with various diseases such as cardiovascular and kidney diseases.

**METHODOLOGY**

For physical examination, standardized calibrated mercury column type sphygmomanometer and stethoscope, was used. Hypertension was diagnosed as per US Seventh Joint National Committee on Detection, Evaluation and Treatment of Hypertension JNC VII criteria.

<table>
<thead>
<tr>
<th>Blood Pressure Level</th>
<th>Systolic/Diastolic (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal Blood Pressure</td>
<td>&lt;115/80</td>
</tr>
<tr>
<td>Normal Blood Pressure</td>
<td>&lt;120/80</td>
</tr>
<tr>
<td>Pre-Hypertension</td>
<td>120-139/80-89</td>
</tr>
<tr>
<td>Stage 1 Hypertension</td>
<td>140-159/90-99</td>
</tr>
<tr>
<td>Stage 2 Hypertension</td>
<td>&gt;160/100</td>
</tr>
</tbody>
</table>

Measurement of BP was performed after a 5 min period of rest using a mercury sphygmomanometer and two BP readings was taken from both arms at 30 s intervals. In case if the two readings differed by over 10 mm of Hg, a third reading was obtained, and the three measurements were averaged. The Korotkoff sounds phase I (the pressure at which the sounds were first heard) were taken as the Systolic Pressure (SBP) and the phase IV sounds (the pressure at which the sounds were first muffled and then disappeared) were taken as the Diastolic Pressure (DBP).

Data entry and statistical analysis were performed using the Microsoft Excel and SPSS windows version 15.0 software. Statistical differences between groups were performed by one-way analysis of variance (ANOVA) for continuous variables and the chi-square test for categorical variables. The baseline characteristics of subjects were expressed as means ± standard deviations for continuous variables. Independent variables tested were age, gender, systolic and diastolic blood pressures. Values of P <0.05 was considered to be statistically significant.

**RESULTS**

A total of 71 subjects participated in the study. Females (55, 77.5%) formed the maximum number of subjects in this study. The number of subjects under the male gender is 16 (22.5%) (p=<0.001**). The mean age ± S.D for males is 55±13.42yrs and for females 45.76±9.93yrs (p = 0.008). The subjects were divided into three groups: Normotensive, Pre-hypertensive & Hypertensive. 46 subjects are normotensive. The proportion of hypertensive (20) is more when compared to pre-hypertensive (5) (p= <0.001**). The proportion of pre-hypertension is higher in females (4) than males (1). The proportion of hypertension is also higher in females (12) than males (8) (p=0.850). The mean age±S.D for normotensive is 45.20±11.248yrs, for pre-hypertensive 49.60±9.93yrs and hypertensive 56.40±7.996 yrs (p=<0.001**). The normality is significantly different with respect to hypertensive but not with pre-hypertensive subjects.

The study sample was categorized into different age groups. There are 3 groups: 20 – 35yrs, 36 – 50yrs, 51 –
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from Manampathy Village of Thiruporur Tehsil, Kancheepuram District of Tamil Nadu, India

75yrs (Table I). The maximum number of participants are in the age group of 51 – 75yrs (33) followed by the age group of 36 – 50yrs (27) (p=<0.004**). Pre-hypertension is highest in the age group of 36 – 50yrs (3). Hypertension is highest in the age group of 51 – 75yrs (16). All differences are statistically significant (p= 0.006**) which indicates that in the present study, age has a greater association with hypertension.

**Table 1: Prevalence of Pre-Hypertension and Hypertension among Different Age Groups**

<table>
<thead>
<tr>
<th>Age Group in Years</th>
<th>Normotensive</th>
<th>Pre Hypertensive</th>
<th>Hypertensive</th>
<th>Chi-Square Value</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>10(90.9%)</td>
<td>0(0%)</td>
<td>1(9.1%)</td>
<td>14.265</td>
<td>0.006**</td>
</tr>
<tr>
<td>36-50</td>
<td>21(77.8%)</td>
<td>3(11.1%)</td>
<td>3(11.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-75</td>
<td>15(45.5%)</td>
<td>2(6.1%)</td>
<td>16(48.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>46(64.4%)</td>
<td>5(7%)</td>
<td>20(28.2%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The value within bracket refers to row percentage

**Table 2: Systolic (SBP) and Diastolic Blood (DBP) Pressure among the Groups**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Groups</th>
<th>Mean ± Std. Deviation</th>
<th>F value</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP in mmHg</td>
<td>Normotensive</td>
<td>106.74±10.965</td>
<td>47.037</td>
<td>0.000**</td>
</tr>
<tr>
<td></td>
<td>Pre Hypertensive</td>
<td>130.00±0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hypertensive</td>
<td>144.50±12.763</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DBP in mmHg</td>
<td>Normotensive</td>
<td>68.91±8.227</td>
<td>54.471</td>
<td>0.000**</td>
</tr>
<tr>
<td></td>
<td>Pre Hypertensive</td>
<td>74.00±5.477</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hypertensive</td>
<td>90.50±6.863</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: denotes significance at 1%. Different alphabets between groups denotes significance at 5% level using Duncan Multiple Range Test (DMRT)

The mean SBP for hypertensive subjects is higher (144.50±12.763) when compared to pre-hypertensive subjects (130.00±0.000) and normotensive subjects (6.74±10.965) (Table II).

Similarly, the mean DBP is also higher (90.50±6.863) when compared to normotensive (68.91±8.227) and pre-hypertensive subjects (74.00±5.477).

These differences between the groups with respect to SBP and DBP are statistically significant (p=<0.000**). Based on DMRT for the variable systolic blood pressure, the normality is significantly different with respect to pre-hypertensive and hypertensive groups at 5%.

However there is no significant difference between pre-hypertensive and hypertensive groups. DMRT for diastolic blood pressure show a significant difference between normotensive and hypertensive but not between normotensive and pre-hypertensive. Among the hypertensive females, 3 subjects have both systolic and diastolic hypertension. A higher proportion of hypertensive females have isolated diastolic hypertension (8). There is only a single female hypertensive subject with isolated systolic hypertension. Among the hypertensive males, 4 have isolated diastolic hypertension. Two of the hypertensive males have isolated systolic hypertension.

There are also two male hypertensive subjects with both systolic and diastolic hypertension.
Table 3: Systolic (SBP) and Diastolic Blood (DBP) Pressure among the Age Groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age groups</th>
<th>Mean ± Std. Deviation</th>
<th>F Value</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP in mmHg</td>
<td>20-35</td>
<td>106.36± 12.863</td>
<td>6.717</td>
<td>0.002**</td>
</tr>
<tr>
<td></td>
<td>36-50</td>
<td>111.48± 14.859</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>51-75</td>
<td>123.33± 17.260</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DBP in mmHg</td>
<td>20-35</td>
<td>69.09± 10.445</td>
<td>5.938</td>
<td>0.004**</td>
</tr>
<tr>
<td></td>
<td>36-50</td>
<td>71.85± 11.107</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>51-75</td>
<td>80.30± 12.115</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: denotes significance at 1%. Different alphabets between groups denote significance at 5% level using Duncan Multiple Range Test (DMRT).

The mean systolic blood pressure (SBP) is found to steadily increase with age, lowest being in age group of 20 – 35yrs (106.36± 12.863) and highest in age group of 51 – 75yrs (123.33± 17.260) (Table III). The mean diastolic blood pressure (DBP) is highest in the age group of 51 – 75yrs (80.30± 12.115). Increasing age is significantly associated with difference in the mean SBP (p = 0.002**) and mean DBP (p=0.004**) among the study samples. The normality for mean SBP is significantly different at 5% with respect to the age group of 20 – 35yrs and 51 – 75yrs but not significant between 20 – 35yrs and 36 – 50yrs. For mean DBP, there is a significant difference at 5% between age group of 20 – 35yrs and 51 – 75yrs but not significant between 20 – 35yrs and 36 – 50yrs.

DISCUSSIONS

Hypertension is an important public health problem in developing countries especially in adults, aged 40-55 years. Correlation of blood pressure (BP) levels with cardiovascular and other mortality associated risks showed that both systolic and diastolic BP have continuous, graded, strong, independent and etiologically significant relationship to the outcome variables such as coronary heart disease, stroke, congestive heart failure and impaired renal function (1,7). Prospective cohort and case-control studies conducted in developed as well as developing countries have supported these findings (2,8,9,10).

Increased life expectancy, urbanization, development and affluence show a strong correlation with increased hypertension prevalence in urban and rural populations of India. These modifying factors operate with other risk factors of hypertension in different combinations in different parts of the world. Majority of the predictive risk factors for hypertension in Indian population includes age (>50 years), male gender, socioeconomic group, body weight especially truncal obesity, increased insulin levels, abnormal lipid profile, metabolic syndrome and lifestyle conditions such as alcohol and cigarette consumption (2). Such socio-demographic and lifestyle changes need to be focused to bring down the hypertension epidemic that is currently sweeping India and other parts of South Asia. The nature of genetic involvement in the development of hypertension also requires more studies.

Though several reports on the prevalence of hypertension have been extensively carried out in the urban populations, from rural south India very few studies have reported the prevalence and risk factors of hypertension. The present study has been undertaken to study the prevalence of hypertension, its associated risk factors as well as to increase the awareness on importance of lifestyle modifications among rural dwellers of Kancheepuram district, Tamil Nadu, south India.

Using the JNC VII criteria (6), we found hypertension to be of 28.16% prevalence among the study sample. Pre-hypertension was found to be prevalent at 7%. A high prevalence value obtained from our study indicates alarming increase in the prevalence of hypertension in the rural population. A higher prevalence for pre-hypertension and
hypertension has been reported from similar regional studies on different urban and rural population backgrounds. Gilberts et al\(^{[1]}\) carried out a study in rural Tamil Nadu in the age group of 20 years and above and found a prevalence of 12.5%. Shanthirani et al\(^{[2]}\) reported a 47% prevalence of pre-hypertension among urban residents in Chennai who were >18 years. In a survey on industrial population, Prabhakaran et al\(^{[3]}\) reported pre-hypertension in 44% of their study subjects. Subburam et al\(^{[4]}\) reported the prevalence of hypertension in rural areas of Tamil Nadu in the age group of 45 – 60 years as 33%. The prevalence rate of hypertension was 25.2% in a rural household community study from Kancheepuram district of Tamil Nadu\(^{[5]}\). From other parts of India, similar prevalence rate has been reported using the JNC VII Criteria. Gupta et al\(^{[6]}\) reported a prevalence of 24% in males and 17% in females in the age group of 20 years and above from rural Rajasthan. The prevalence of hypertension was 4.5% in the age group of 16 – 70 years in rural Haryana\(^{[7]}\). From eastern India, Hazarika et al\(^{[8]}\) reported a prevalence of 33.3% in the age group of 30 years and above among the native population of Assam. Among the age group of 30 years, Kokiwar et al\(^{[9]}\) found a prevalence of 19.04% in the rural population of Central India. Overall there is a significant increase in hypertension prevalence in rural areas.

In the present study, we observed female gender (12, 60%) more susceptible to hypertension than the male gender (8, 40%). The prevalence of pre-hypertension was also more in females (80%) when compared to males (20%). Significant results in terms of prevalence among females were reported by Malhotra et al\(^{[10]}\), Hazarika et al\(^{[11]}\), Bharathi et al\(^{[12]}\) and Koriwakar et al\(^{[13]}\). The prevalence rate was higher among females (27.4%) when compared to males (22.6%)\(^{[14]}\). Bharathi et al\(^{[12]}\) reported pre-hypertension to be more prevalent among females than males. This indicates a changing trend among females and increased stress may be credited for this change.

The mean age of hypertensive patients was found to be 56.40±7.99 and for pre-hypertensive subjects 49.60±7.95. Kokiwar et al\(^{[9]}\) reported the mean age of hypertensive to be 53.11±12.46. Radhika et al\(^{[7]}\) reported the mean age to be 44.9±12.9. Mean age of hypertensive patients, as reported by the CURES study\(^{[15]}\) was 44.9±12.9 for males. Our findings are in accordance with the above studies. There is an increasing trend of hypertension as age advances\(^{[16,21,22,23]}\). Similar results were observed in our study. The prevalence of hypertension increased with age till the age group of 51 – 75yrs. The rise of BP with age is said to be an ageing process resulting in atherosclerotic changes\(^{[23]}\).

In the present study, the mean systolic and diastolic pressures were found to have high significance of class variance. We also observed isolated systolic and diastolic hypertension in the present study. Diastolic hypertension was more when compared to systolic hypertension. This is in contrast to similar study reports where systolic hypertension is more closely present in hypertensive subjects (our own unpublished data). Community based analysis from central India\(^{[19]}\) showed an overall prevalence of isolated systolic hypertension as 4.3% (2.3% males and 5.6% females) while prevalence of isolated diastolic hypertension was low (0.9% males and 1.04% females). In the CURES study\(^{[4]}\) the overall prevalence of isolated systolic hypertension as 6.6% among the study subjects while the overall prevalence of isolated diastolic hypertension was 4.2%. The significance of a higher prevalence of systolic blood pressure as reported by these studies has to be addressed as systolic blood pressure is more closely related to hypertension and increased cardiovascular risk\(^{[24]}\). A 10mmHg rise in systolic hypertension was observed to have more correlation with a 10% increase in all fatal and non-fatal cardiovascular complications\(^{[25]}\).

**CONCLUSIONS**

Overall, our study documented high prevalence of both pre-hypertension and hypertension among the study subjects. The important correlates analyzed such as age, gender, systolic and diastolic blood pressures were significantly different among normotensive, pre-hypertensive and hypertensive subjects. The high prevalence of hypertension and
pre-hypertension in the present study supports the increasing trend in the rural communities of India which are under the epidemiological transition. Hence epidemiological studies to assess the prevalence of pre-hypertension and hypertension are urgently needed in rural areas to have a base line data about the prevalence of pre-hypertension and hypertension and its association with the risk factors for cardiovascular and chronic kidney diseases.

REFERENCES


