

**PREVALENCE OF HYPERTENSION AND ITS
CORRELATES IN ELDERLY :
A RURAL URBAN COMPARISON IN
THIRUVANANTHAPURAM DISTRICT, KERALA**

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*Dissertation submitted in partial fulfilment of the requirements
for the award of the degree of
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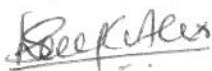
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May 2000.

DECLARATION

I hereby certify that the work embodied in this dissertation entitled 'Prevalence of Hypertension and its' correlates in Elderly: A Rural Urban Comparison in Thiruvananthapuram District, Kerala' is the result of original research and has not been submitted for any degree in any other University or Institution.

Thiruvananthapuram
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CERTIFICATE

Certified that this dissertation entitled 'Prevalence of Hypertension and its Correlates in Elderly: A Rural-Urban Comparison in Thiruvananthapuram District, Kerala' is a record of bona fide original research work undertaken by Ms. Shiney C. Alex, in partial fulfillment of the requirements for the Degree of Master of Public Health, under our guidance and supervision.

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ABSTRACT

Background of the study: Demographic and epidemiologic transition in Kerala state of India has made changes in population structure and disease patterns. Proportion of elderly population is more and thereby increases the burden of chronic diseases and the mortality due to that. Deaths due to cardiovascular diseases ranks first in the world and Kerala is moving to a similar situation. Hypertension is the major risk factor for this, which can be easily prevented and treated. A previous study has found that prevalence of hypertension in Kerala as 52% and there were some limitations for the study and so the present study was carried out.

Objectives:

To estimate the prevalence of hypertension in elderly population in Thiruvananthapuram
To make rural and urban comparison of prevalence of hypertension.

To identify the correlates of hypertension.

To measure the level of awareness, treatment and control of hypertension.

Design: Cross sectional survey of subjects above 60 years of age, using a cluster sampling technique.

Setting: Rural and urban community in Thiruvananthapuram district, Kerala, India.

Participants: 480 individuals (240 urban and 240 rural) and (185 males and 295 females.) with mean age 70.1 ± 7.8 years.

Intervention: Measurement of blood pressure by a nurse specialist and interview.

Main outcome measures: Prevalence of hypertension according to JNC VI /WHO criteria; rural urban comparative statistics; awareness of, treatment for and adequacy of control hypertension.

Results: The overall prevalence of hypertension was 61.9%(95%CI: 57.6-66.3).

Prevalence was higher in urban (68.8%; 95%CI 62.9-74.7) when compared to rural (55%; 95%CI 48.7-61.3). Females were found to have high prevalence (63.1%; 95%CI 52.9-62.1) than males (60%; 95% CI 57.5-68.5). The prevalence of hypertension was increasing with age. Multiple logistic regression identified BMI (OR 2.35; 95% CI 1.36-4.06) and presence of Diabetes Mellitus (OR2.83; 95% CI 1.53-5.22) as significant correlates of hypertension.

Socioeconomic status, level of education, place of residence and BMI showed significant association with hypertension in bivariate analysis. Smoking status, alcohol use and physical activity were not related to hypertension. Among hypertensives 54.5% was aware about hypertension, 45.8% was treated for hypertension and only 15.8% were adequately controlled. 38% was unaware of their hypertension status even after having a minimum of one physician visit in the past one year.

Conclusions: In this community-based sample of elderly population more than two third were hypertensives and less than one fifth were having controlled hypertension in the highly literate state of Kerala, where utilization of health care facilities are high. Findings of the present study emphasize the need for a National Program for Hypertension for early detection and adequate treatment. Through this awareness and regular measurement of BP can be promoted and thereby the morbidity and mortality due cardiovascular diseases and stroke can be reduced to a greater extend.

ABBREVIATIONS

BMI	Body Mass Index
BP	Blood Pressure
CAD	Coronary Artery Diseases
CHD	Coronary Heart Diseases
CI	Confidence Interval
CVD	Cerebrovascular Diseases
DBP	Diastolic Blood Pressure
DM	Diabetes Mellitus
HDL	High Density Lipoprotein
HTN	Hypertension
IHD	Ischemic Heart Diseases
ISH	Isolated systolic Hypertension
JNC	Joint National Committee
KSSP	Kerala Sastra Sahithya Parishad
NHANES	National Health And Nutrition Examination Survey
OR	Odds Ratio
SBP	Systolic Blood Pressure
SD	Standard Deviation
SES	Socioeconomic Status
SHEP	Systolic Hypertension of Elderly Program
SPSS	Statistical Package for Social Studies
WHO	World Health Organization
WHR	World Health Report

CHAPTER I

INTRODUCTION AND BACKGROUND

1.1 Ageing:

The demographic transition and epidemiological transition in Kerala State of India has brought changes in its population structure and disease patterns. Ageing resulted in an increasing proportion of elderly in the population. The proportion of elderly is growing all over the world and in India it was 6.58 and that of Kerala was 8.77 according to 1991 census¹. Elderly is defined as anyone above the age of 60 years. The percentage of elderly population is projected to reach 9.87 and 15.63 in 2021 in India and Kerala respectively. By 2001 there will be 76 million elderly people in India². The proportion of elderly above the age 60 years and 65 years old in Kerala according to KSSP (Kerala Sastra Sahitya Parishad) study in 1996 is 10.4% and 8.25% respectively.³ The life expectancy at birth in Kerala is about 70.2 years for males and 75.8 years for females⁴. It is quite comparable with developed countries. This increase in Life Expectancy and increasing proportion of elderly will certainly raise the burden of chronic diseases and the mortality due to that, on top of the already existing problem of diseases of poverty and infectious diseases. Hypertension is a major risk factor for several chronic diseases like coronary artery diseases, cerebrovascular diseases, peripheral vascular diseases and renal diseases.

1.2 Definition Of Hypertension

According to the older criteria, hypertension was defined as people having Systolic blood pressure more than 160 mmHg and diastolic blood pressure more than 95mm Hg and/ or use of antihypertensive medications (WHO Tech Rep series 1978). This has been revised by the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure, VIth report. This latest definition was used in the present study, which is shown in section 3.1.

As increasing age is considered to be the major risk factor for coronary artery diseases and stroke, the burden of disease will become heavier as large proportion of people are ageing in developing countries. The distribution of deaths in the world shows that in the developed countries deaths due to communicable and non-communicable diseases are 0.7 million and 9.4million respectively while in the developing countries these are 16.6 million and 18.7 million respectively. Thus it is evident that developing countries are facing the double burden of infectious diseases and the chronic non-communicable diseases along with injuries and also the new emerging infectious diseases. Over 80% of deaths from cardiovascular diseases occur in people over 65 years. CHD is going to be the number one burden in 2020 AD.⁶ According to them there is no change in the rank for IHD in 2020 AD.

1.3 The Problem

The prevalence of hypertension increases with age. As more people live longer, more predominantly systolic and combined systolic and

diastolic hypertension will be seen among the elderly people. To a large extent the progressive rise in systolic pressure reflects a loss of compliance within the major arteries due to permanent sclerosis. There is on average, a 20mm Hg systolic and 10 mm Hg diastolic increment increase in Blood Pressure from age 30 to 65 years. Women have lower blood pressures in early adult life when compared to men but their blood pressures increase more steeply with age to reach or exceed those of men beyond the middle age. In United States of America 50 million young people are hypertensives⁵.

Kerala has made tremendous achievements in the field of health. Literacy level of the state is high when compared to other states. According to 1991 census the literacy rate for males and females were 93% and 86% respectively.¹ The analysis of morbidity trends by Panicker and Soman states that even though there is not much change in the morbidity due to infectious diseases, there is a moderate increase in cardiovascular diseases⁷. A similar study was done in Kerala found the prevalence of hypertension as 54.3% and 44.6% in urban and rural areas respectively in the elderly⁸. This study also explored the awareness and treatment of hypertension in elderly but have limitations such as small sample size, life style factors are not measured, and multi variate analysis is not done. The present study was conducted as a part of a multi centric one, with multi stage cluster sampling, where one of the centre was Thiruvananthapuram District of Kerala State.

The classic Framingham Heart Study showed us the strong relationship of hypertension to risk of coronary Heart Diseases, stroke, cardiac failure and

peripheral vascular diseases⁹. In United States it was estimated that approximately one in four adults have high blood pressure according to the 3rd NHANES (National Health And Nutrition Examination Survey)⁵. In Kerala according to the KSSP study 1996 (unpublished), the prevalence of reported hypertension was 22.99 per 1000 population.¹⁰ According to the author it will be double for the adult population alone. An 11.1% increase from the 1987 study by the same group. According to World Health Report 1999, Ischemic Heart Diseases rank first as the leading cause of mortality and morbidity with cerebrovascular diseases in the second place. The coronary heart disease prevalence in Kerala is 5.98%.¹¹ The prevalence of ischaemic heart diseases is 10.3% and that of cerebrovascular diseases is 3%. Ischemic Heart Diseases rank first in the cause of mortality and followed by cerebrovascular diseases, in both males and females. 13.7% and 9.5% of total mortality in all member states of WHO are due to IHD and cerebrovascular diseases. Prevalence of Ischemic Heart Disease according to Ramankutty et al in the rural Thiruvananthapuram was found as 14/1000 who were having definitive evidence of coronary heart diseases. The same group got a prevalence of 188/1000 for hypertension in the rural population in Thiruvananthapuram. The age group was above 25 years.¹² The growing prevalence of hypertension and hypertension related CHD, Heart failure, stroke, end stage renal diseases are making it a major Public Health concern.

In Framingham Heart Study it appears that there is a continuous graded influence on CHD incidence and mortality in healthy persons; the higher the blood pressure the greater the risk with no critical values. This is further

aggravated by the presence of other risk factors such as cigarette smoking, obesity, hypercholesterolemia, diabetes mellitus and alcoholism.¹³

1.4 RELEVANCE OF THE STUDY

This study was done in the Thiruvananthapuram District of Kerala state, India, among the elderly subjects. Recently there was a published study on the same topic done among the elderly by Kalavathy et al⁸. The limitations of that study was looked into and tried to minimize the limitations in this study. The limitations of that study were small sample size, only one of the corporation wards was taken as the urban area and there was no rural area from the same district. Because of the above reasons the study site was chosen as Thiruvananthapuram district. Both rural and urban areas were taken from the same district. Sampling method used and the study design are explained later.

1.5 Objectives of this study

The objectives of this study were

1. To estimate the prevalence of hypertension in elderly (above 60 years of age), rural and urban population in Thiruvananthapuram.
2. To make a comparison of prevalence of hypertension between urban and rural population.
3. To identify the correlates of hypertension.
4. To measure the level of awareness, treatment and control of hypertension.

CHAPTER II

REVIEW OF LITERATURE

The articles and materials collected for review can be categorized to three. They were mainly on prevalence studies: local, national and global statistics, risk factors of hypertension and its correlation, and the problems associated with hypertension.

2.1 Prevalence of Hypertension: Prevalence studies on hypertension show that it is high and it varies across regions by minimal value. According to WHR1999, from the estimates of 1998, Ischemic Heart Diseases ranks first and the mortality due to IHD is 13.7% and cerebro vascular diseases ranks second and the mortality due to CVD is 9.5%.¹¹ According to WHR 1998, 690million of world population are Hypertensives.¹⁴ According to the JNC V criteria the prevalence of Hypertension in the general US population was 4% in those aged 18-29 years and 65% in those aged above 80 years during 1988-91¹⁵. Prevalence of Hypertension in Rural and Urban Cameroon in the age group of 25-74years shows that it is still uncommon in Cameroon.¹⁶ The prevalence rates are 14% and 5% respectively in urban and rural Cameroon. Here the criterion used is the old WHO criterion that is Systolic Blood Pressure ≥ 160 mm Hg and Diastolic Blood Pressure ≥ 95 mm Hg. A Harlem study (New York City) pointed out that prevalence of hypertension in Harlem is 32% and 31% for men and women respectively in the age group of 18-65 years¹⁷. Prevalence statistics available from Bangladesh pointed out that prevalence of hypertension in Bangladesh Secretariat population

was 13.3% in the above 18 years age group. And in rural Bangladesh it was 6.7% in the above 20 years age group. Around 20% prevalence was reported in the above 60 population in the rural Bangladesh.¹⁹⁻²¹

In India the prevalence of hypertension in the elderly about four years ago was estimated as 40% and isolated systolic hypertension is found in 30%.² A study conducted among women in five cities in India states that prevalence of hypertension is higher among women in Kerala, Thiruvananthapuram city 30.7 % of the adult women are hypertensives.¹⁸ In the same study the overall prevalence of hypertension among women in the age group 25-64 years was 25.6%. And the prevalence in the 55-64 years age group was 49.6%. A meta-analysis of prevalence of hypertension in India states that prevalence of hypertension is increasing in both rural and urban areas of India and the increase is steeper in the urban areas. Different studies used different age groups and different definition for hypertension. This study also found an increase in mean systolic blood pressure and an increasing trend in the prevalence of hypertension.²² The KSSP study conducted in 1996 shows that the reported prevalence of hypertension in Kerala was 22.99/1000 population.¹⁰ In Kerala the prevalence of hypertension in a study conducted in Kerala in 1997 states that it was 51.8%(95%CI 46.8-56.8%) in the elderly. In rural area it was 45% and in Urban it was 59%.⁸

2.2 Isolated systolic hypertension: Combined systolic and diastolic hypertension carries only a marginally greater risk than isolated systolic hypertension. ISH per se is having substantial risk for incidence of CHD, stroke,

cardiac failure, and peripheral vascular diseases, which was evident from Framingham Heart study.¹³ According to them each standard deviation (SD) increase in Systolic Blood Pressure in men increased cardiovascular diseases in 40-50%, whereas for diastolic pressure the increment was 30-35%. 18.9% of ISH were noted in Kalavathy's study on prevalence of hypertension.⁸ Most of the prospective studies have demonstrated that SBP is a stronger predictor of stroke than DBP.²³ Recent findings from SHEP indicated that treatment of Isolated Systolic Hypertension with low dose anti hypertensive medicines reduced stroke incidence by 36% during the five-year follow up.

2.3 Education and blood pressure.

Education and blood pressure shows an inverse relationship in an American study. As years of education goes up the systolic and diastolic blood pressures show a downward trend. The Charleston, South Carolina study reports that, environmental influence such as education and social class affects blood pressure than skin colour or race²⁴. Findings of Three Chicago Epidemiologic studies showed a statistically significant inverse relationship exist between education and blood pressure and also CAD risk factors are more common in people with less education²⁵. The Tromsø Heart study also states that level of education is negatively related to education in all age groups and it was extreme in the case of women²⁶. This is after adjustment for age, body mass index and certain life style variables.

2.4 Socioeconomic status and blood pressure: A high level of education is an indicator of high socioeconomic status. Sir William Osler noted in 1910 that

higher social class has a greater risk of coronary heart diseases. Thus it evolved that, chronic disease such as HTN, CAD, CVD etc. are the diseases of affluent²⁶. This social gradient now shows a reversing trend as evident from some studies. This study also reported that higher socioeconomic status is associated with a lower risk of coronary heart disease and its risk factors. The Czech Republic study grouped people into three categories according to the material conditions and found that material conditions are weakly and inconsistently associated with blood pressure and other CAD risk factors²⁷. The Finnish study also states that education is more strongly associated with hypertension than occupation and income.²⁸

2.5 Smoking and Blood Pressure Cigarette smoking is a powerful risk factor for cardiovascular diseases and other diseases. A significant rise in blood pressure accompanies smoking⁵. But another study done in Mass in Boston shows that blood pressure trends of smoking quitters, differed from those of continuing cigarette smokers. Continuing smokers were declining in pressure with losses of weight and showing increases in pressure with gains in weight. Finally they are reporting that stopping of cigarette smoking is directly related to an increase in blood pressure, even among those who have lost considerable weight²⁹. A study on the relationship between smoking, blood pressure and cholesterol found that there is an inverse relationship between current cigarette smoking and systolic blood pressure. There is no clear relationship with diastolic blood pressure, though smokers have lower levels than non-smokers. In the same study they

found an inverse relation between cigarette smoking and HDL cholesterol. Thus it explains the adverse effect of smoking on CAD³⁰

2.6 Alcohol and Blood Pressure- Several studies have found the positive alcohol- blood pressure relationship. In the Framingham cohort, the prevalence of hypertension in those who drank more than an average of 2 ounce of ethanol or 3 mixed drinks a day was higher than in those who drank less.³¹ Those who drank one or two ounce of alcohol a day have less Coronary Heart Disease than teetotalers or heavy drinkers.³² INTERSALT study which is conducted worldwide in fifty centres prove that there is significant independent relation between heavy drinking and blood pressure, in both men and women and also in both young and old people. After taking in to account, smoking, body mass index and urinary excretion of sodium and potassium, the systolic/diastolic pressure on average 2.7/1.6 mm of Hg higher for men consuming 300-499 ml alcohol per week than for non drinkers and 4.6/3.0 mm Hg higher for men consuming more than or equal to 500 ml/week; for women consuming above 300 ml/week pressures were 3.9/3.1mm Hg higher than for non-drinkers. Another study by Arthur L Klatsky and friends found a continuous relationship of more drinking to higher diastolic pressures at all drinking levels in black men³³. Among white men and among daily drinkers a progressive rise in systolic and diastolic pressure was found that peaked in six to eight drinks per day. Black women also showed a closer association of diastolic than systolic pressure to amount of drinking. In the same study alcohol blood pressure by age groups showed that a slightly stronger

relationship was found in the oldest (above 60 years) persons. Slightly higher blood pressure in daily drinkers may be related to the ethanol per drink.

2.7 Effect of physical activity: Mild and severe weight cyclers appeared to be at significantly higher risk of being diagnosed with hypertension than non-weight cyclers³⁴. A prospective follow up among healthy normotensive men and women found that when compared to the active members, the sedentary individuals with normal blood pressure have a 20-50% increased risk of developing hypertension³⁵. Studies have found that regular aerobic physical activity such as brisk walking for 30-45 minutes daily for most days of a week can reduce blood pressure. IOWA women study found that post-menopausal women who participated in regular physical activity had a lower risk of dying from cardiovascular diseases compared with the physically inactive group³⁶.

2.8 Body weight and blood pressure: A study done among the nurses in 1989-1993 found that weight and weight gain are strong independent predictors for the development of hypertension³⁴. Over weight is defined as a BMI between 25 and 29.9kg/m² and obesity as $\geq 30\text{kg/m}^2$. In this study the risk of being diagnosed with hypertension increased 12% with each one unit increase in BMI and for each 10lb increase in weight risk of hypertension increased 30%. Results of a prospective study show that prevalence of hypertension increased from the lowest category of BMI towards the highest category. The increase in prevalence was from 6.4% to 26.5%. The BMI groups, were from <21 and $\geq 29\text{kg/m}^2$.³⁶

2.9 Dietary Pattern And Blood Pressure: Total and saturated fat intake and food consumption pattern were also significantly associated with hypertension³⁸.

They found that higher intake of total visible fat had significant association and total fruits, vegetables, legumes and coconut consumption was inversely associated with hypertension. A randomized control trial conducted by Appel Lawrence et al, found that both in hypertensives and in non-hypertensives the combination diet reduced blood pressure more than the control diet and the fruit and vegetable diet³⁹. A gradient in BP was noted across different diets. The combination diet was rich in fruits, vegetables and low fat dairy products and with reduced saturated and total fat.

2.10 Salt and Hypertension: Sodium chloride is linked to blood pressure levels. Salt Hypothesis of hypertension states that excessive salt ingestion may be an important factor in the development of hypertension. In patients with hypertension moderate or severe salt restriction leads to a fall in blood pressure. This study failed to show excess salt ingestion or excretion in subjects with raised blood pressure within a single population, despite the high prevalence of hypertension. They have detected that relatively high salt excretion is present in people with high blood pressure⁴⁰.

2.11 Diabetes Mellitus and Hypertension: Hypertension in the diabetic individual will markedly increase the risk and accelerates the course of cardiac disease, peripheral vascular disease, stroke and nephropathy. Even though the coexistence is clear the information regarding interaction between hypertension and diabetes mellitus is unclear. For type II diabetes, diabetic nephropathy is the important factor leading to the development of hypertension⁵⁵.

CHAPTER III

METHODOLOGY

3.1 Outcome Variables of the Study

Hypertension as per Joint National Committee VI criteria, i.e. Systolic Blood Pressure greater than or equal to 140mm Hg and/or Diastolic Blood Pressure greater than or equal to 90mm Hg or taking anti hypertensive treatment.

3.2 Predictor Variables

The predictor variables identified for the study were

1. Age
2. Sex
3. The socioeconomic status
4. Educational status of the population.
5. The dietary pattern of the elderly.
6. Use of extra salt
7. Consumption of tobacco -smoking and smokeless tobacco.
8. Alcohol consumption
9. Physical activity pattern of elderly.
10. Body mass index.
11. Awareness, treatment and control of hypertension.

3.3 Sampling Method: Multi stage cluster sampling was used. In order to find out the immunization coverage of children the UNICEF used the criteria of “30 clusters of seven” sampling method. This was with the assumption that the coverage will not be less than 50% and the precision of 10. A similar method was followed in the study also.

3.4 Sample size

Sample size was calculated using the formula

$$n=(Z^2PQ/\Delta^2)*d$$

Here,

n= sample size

Z= Confidence limit factor. This is taken as 1.96 for 95% confidence interval.

P= Prevalence of hypertension. This case it was taken as 52% from a recently reported community based study in Kerala State, India.

Q= 1-P

Δ = Precision factor. (This is the difference between the assumed prevalence and lowest expected prevalence.) Here the lowest expected prevalence was taken as 45%. So $\Delta=0.52-0.45=0.07$

d= design effect. Here it was taken as 1.2

The formula $(Z^2PQ/\Delta^2)*d$ is for random sampling. As we used cluster sampling method, and in order to reduce the design effect 20% of the calculated sample was added to the sample size.

The calculated sample size was

$$n=((1.96)^2 0.52*0.48/(0.07)^2)*1.2= 235$$

With this calculation, in our study we took “30 clusters of eight sampling” and the sample size came as 240. This was done for getting eight elderly people from each cluster to get the sample population of 240 elderly people each from both urban and rural areas, thus adding up to total sample population of 480. The urban clusters are selected from the corporation wards. There are fifty wards in the corporation and the population according to the 1991 census was listed down and cumulative population was calculated. With the help of a random number and sampling interval thirty clusters, which were thirty wards, were identified. The rural clusters were selected from the panchayath wards after listing down the ward population. Same method of cluster sampling was used to identify the rural clusters also (Appendix II).

3.5 Study Site

The study was a part of a multi centric study conducted by five of us and one of the sites was Thiruvananthapuram district of Kerala State.

3.6 Why this site is chosen?

There was a previous study in the same topic but in that study a particular ward of the corporation was taken, as urban sample. Also the parenting institution is situated in the same District and the researcher’s work place is in Thiruvananthapuram. Cost and feasibility of doing the study was also considered.

3.7 Geographical and demographic features of Kerala: Kerala is the southern most state in India and its area comes around 1.2% of India’s and sustains 3% of India’s population. The population as per 1991 census is 29 million². It has 14 districts and Thiruvananthapuram district is the capital. The area of the capital is

1935 sq. km, around 5% of the state. The population of Thiruvananthapuram district was 2.9million according to 1991 Census. It has got both urban and rural population. Administratively, urban area comes under the Corporation and Municipalities and the rural areas under the Panchayath bodies. Thiruvananthapuram Corporation has fifty wards. The population of each ward comes around 6000 to 15000. There are eighty-four Panchayaths in Thiruvananthapuram districts and each Panchayath is divided in to twelve to fifteen wards each with a population between 2000 and 3000.

3.8 Design Of The study: The present study was a cross sectional study. The survey was conducted in a house to house manner. For the rural clusters, the clusters were identified by the directions given from the Panchayath Office and the particular wards were identified by inquiring the local leaders. Urban clusters were nearby and the investigator knew most of them. After identifying the ward, randomly a road was chosen and left track was followed. After introducing the investigator in each household, I explained the purpose of my visit and sought their willingness for this study. I explained them the need for giving the accurate information for the questions. The investigator asked to each household whether an elderly was there and if there, survey was conducted. This was continued till the particular number of sample from the cluster was finished. If eight people were surveyed and there were more than one elderly in the last household, they were not included in the survey, only their Blood Pressure measurements were taken. In all the households advice was given to the clients regarding hypertension and its control and prevention.

3.9 Duration Of The Study

The duration of study was from 18th December 1999 to 21st February 2000.

Every day the study started in the morning at 9 am and finished one cluster in the evening at 5.30 p.m.

3.10 Instruments used for the study

Individuals above the age of 60 years: Majority of the sample population was able to tell their age. The methods used were counting the number of years after their retirement, showing the ration cards (the book that is issued by the government for the Public Distribution System). Some of the Muslims were using the personal diary which was issued from the Mosque in which their life events were documented, counting the number of years after their marriage and also by calculating the age of their elder children. Some times I had to probe questions about some important events in their life and that helped in calculating their actual age. People in the age group of 60 to 70 years were easily remembering their age better compared to the people above 70 years. Still some of the people were telling the approximate figures. Maximum effort was taken to find out whether the person belonged to above 60years age group. Ascertaining the age was much easier in the urban area compared to the rural area.

Questionnaire: Since this was a part of a multi-centric study the questionnaire was prepared by all of the members together after several discussions and very good literature review. This structured questionnaire was pre tested and necessary changes were made. The questionnaire contains fourteen major questions and sub

questions. Questions were mainly to collect information on demographic characteristics, predictor variables such as socioeconomic and educational status, dietary habits, tobacco and alcohol habits, activity pattern, any medical condition, system of medicines used for treatment, mode of control of hypertension for hypertensives. One questionnaire took nearly 25 to 30 minutes to fill up including the Blood Pressure measurement. This also consisted of measuring the systolic and diastolic blood pressure, weight and height of the elderly. Since it was multicentric study and five of us were involved we were given a short training in, how to measure blood pressure by a cardiologist from the institute, SCTIMST.

The socioeconomic status was done by investigator's subjective assessment. Observing the house type, the assets, the surroundings and calculating the per capita expenditure, and accordingly the sample population was classified in to three groups. Information on current and past smoking habits, use of smokeless tobacco, and alcohol use, dietary pattern were collected using the questionnaire. Blood pressure was measured twice and a third measurement was taken when there was 10 mm Hg or more difference between the first and second readings. The average of all these measurements was calculated and that was taken as the person's BP. Individuals were seated and their arms were supported at the heart level and the measurement was taken in the left arm. The first measurement was taken after collecting information on demographic characteristics and thereby building the rapport and the second measurement was taken after finishing the questionnaire. Systolic Blood Pressure was taken at Phase I of Korotkoff's sound and the diastolic was taken at phase V. All measurements were taken by the investigator alone and so inter observer variation is minimized. Blood pressure levels were recorded

to the nearest 2-mm Hg mark on the manometer. Based on a checklist prepared before hand, regarding the physical activity level of each work, the sample population was put into three categories such as mild, moderate and vigorous activities.

Sphygmomanometer: Blood pressure measurements were taken with the help of a sphygmomanometer, which was standardized, with the manometers of the other four members of the group. The manometer was from the Diamond Company. A cardiologist from SCTIMST showed standardization and we followed the same procedure.

Stethoscope: A double-headed stethoscope was used to check the diastolic blood pressure accurately.

Weighing scale: The body weight of the selected individuals was taken with minimal clothing by a weighing scale. The weighing scale was also standardized. Checking a known weight in all five weighing machines did the standardization.

Plum Line: Height of the sample population was measured by an improvised method. This was by using a graduated plum line. The graduations were made according to the measuring tape. Height was measured by making the person to stand against a wall with hip and heel straight and head erect.

3.11 Case Definition:

A case was defined as a person with Systolic Blood Pressure ≥ 140 mm Hg and/or Diastolic Blood Pressure ≥ 90 mm Hg or who was taking anti hypertensive medicines.

3.12 Definition of Awareness, Treatment and Control of Hypertension:

Awareness of hypertension was defined as a person who was previously diagnosed as suffering from hypertension by a health personnel and he or she knew about their hypertension status. Hypertension treatment was defined as a person who was previously diagnosed as suffering from hypertension and taking allopathic antihypertensive medicines. A person was called as having controlled hypertension, when the systolic blood pressure was less than 140 and diastolic blood pressure was less than 90 mm Hg with anti hypertensive medicines.

3.13 Data entry and data analysis

Data were entered after making a unified codebook by five of the investigators, in Microsoft Excel Version.4. This data was then cleaned and analyses were done using SPSS for Windows version 6.1. Univariate analysis, bivariate analysis and multivariate analyses using multiple logistic regression were done. For bivariate analyses Chi-square test was used for testing the associations. A p`value of less than 0.05 was taken as the significance level.

CHAPTER IV

RESULTS

4.1 Sample Characteristics:

The sample population consisted of 480 individuals above the age of 60 years, 240 each from the urban area and rural area. The sample consisted of more females than males. In the study sample there were more females than males, 295 females and 185 males. The sex ratio was 1:1.6 (male: female). Age of the sample population ranged from 60 to 100 years. Mean age of the sample population was 70.1 years.

4.1.1 Age Distribution

Age wise distribution of the sample population was as follows. This shows that majority, nearly half of the study sample was in the age group of 60 to 70 years.

Figure 1-Age distribution of total study sample

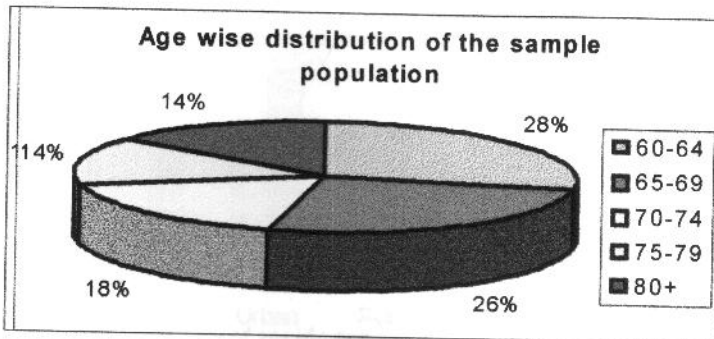


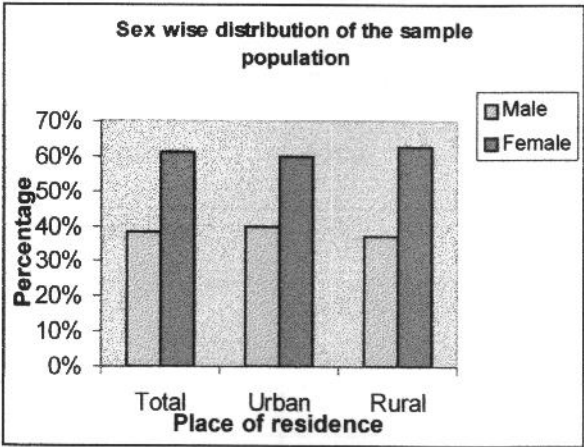
Table-1 Distribution of sample population according to age and place of residence.

Age group(years)	Urban	Rural
60-64	72(30.0%)	60(25.0%)
65-69	62(25.8%)	63(26.3%)
70-74	40(16.7%)	46(19.2%)
75-79	36(15%)	32(13.3%)
80+	30(12.5%)	39(16.3%)

4.1.2 Sex Distribution

38.4%of the total sample population were males and 61.6% were females. In the urban area the proportion of males was 40% and females 60% and in the rural area 37.1% were males and 62.9% were females.

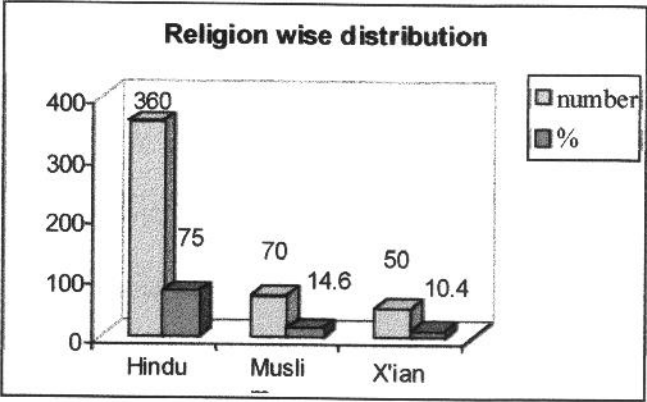
Figure2- Sex wise distribution of study sample



4.1.3 Religion

Majority of the sample population was Hindus.

Figure 3 – Religion wise distribution of the study population



4.1.4 Education

According to the level of education the sample population was categorized in to four groups such as, Not educated, up to fourth class, up to tenth class and above tenth class. In the urban area majority had more than primary education and in the rural area majority were having less than primary education.

Table 2- Education of the sample population

Education	Total	Urban	Rural
Not educated	114(23.8%)	26(10.8%)	88(36.7%)
Upto 4 th	128(26.7%)	48(20%)	80(33.3%)
4-10	158(32.9%)	95(39.6%)	63(26.3%)
≥10 th	80(16.7%)	71(29.6%)	9(3.8%)
Total	480(100%)	240(100%)	240(100%)

4.1.5 Marital Status

Marital status of the study population was categorized in to four groups. They included married, widowed, separated and never married. Around 58% of the sample population were married and staying together and people in the widowed or never married group were comparatively very less.

Table 3- Marital status of the sample population

Marital status	Total	Urban	Rural
Married	278(57.9)	140(58.3)	138(57.5)
Divorced	6(1.3)	2(0.8)	4(1.7)
Widowed	185(38.5)	90(37.5)	95(39.6)
Never Married	11(2.3)	8(3.3)	3(1.3)

4.1.6 Socioeconomic Status (SES)

Socioeconomic status of the sample population was assessed based on the house type, house environment, surrounding, the assets and the per capita expenditure of the household. They were grouped in to three categories and the distribution is given in Table-4.

Table 4- Socioeconomic status of the sample population

SES	Total	Urban	Rural
1(Poor)	102(21.3%)	16(6.6%)	86(35.8%)
2 (Middle)	251(52.3%)	113(47.1%)	138(57.5%)
3 (Rich)	127(26.5%)	111(46.3%)	16(6.6%)
Total	480(100%)	240(100%)	240(100%)

Table 5- Age and sex wise distribution of the sample population

Age	Total		Urban		Rural	
	Male	Female	Male	Female	Male	Female
60-64	42	90	24	48	18	42
65-69	44	81	19	43	25	38
70-74	38	48	20	20	18	28
75-79	28	40	17	19	11	21
≥80	33	36	16	14	17	22
Total	185	295	96	144	89	151

4.1.7 Dietary pattern of the sample population:

Based on the eating habits, the sample population was classified in to vegetarian and non-vegetarian. Information on intake of fish, meat and egg was also collected. The data is presented in Table-6

Table 6-Dietary pattern of the sample population

Diet	Total	Urban	Rural
Vegetarian	63(13.1)	50(20.8)	13(5.4)
Non-vegetarian	417(86.9)	190(79.2)	227(94.6)
Egg	318(66.3)	158(65.8)	160(66.7)
Fish	399(83.1)	181(75.4)	218(90.8)
Meat	265(55.2)	138(57.5)	126(57.5)

4.1.8 Distribution of sample population according to life style habits

We collected information on the life style habits of the respondents, mainly on smoking, consumption of smokeless tobacco and alcohol use. For smoking and alcoholism we found a significantly low proportion among females. Totally the proportion of current smokers in the sample population was 12.5%(60) and past smokers were 17.7%(85). Among males the proportion of smoking and past smoking is 30.3% and 41.6% respectively.

Table 7- Sample population and Life style habits

Lifestyle habits	Total(n=480)		Urban(n=240)		Rural(n=240)	
	Males (n=185)	Females (n=295)	Males (n=96)	Females (n=144)	Males (n=89)	Females (n=151)
Smoking	56(30.3)	4(1.4)	18(18.8)	0	38(42.7)	4(2.6)
Past Smoking	77(41.6)	8(2.7)	41(42.7)	2(1.4)	36(40.5)	6(4)
Smokeless Tobacco	28(15.1)	76(25.8)	7(7.3)	25(17.4)	21(23.6)	51(33.8)
Past Smokeless Tobacco	39(21.1)	48(16.3)	13(13.5)	13(9.02)	26(29.2)	35(23.2)
Alcohol	29(15.7)	2(0.67)	13(13.5)	1(0.7)	16(18)	1(0.67)
Past alcohol	51(27.6)	2(0.67)	23(24.0)	0	26(29.2)	2(1.3)

4.1.9 Occupation

The sample population was engaged in a variety of occupations and information was collected about their past and present occupation. This was listed out and given codes for the occupation according to the physical activity level after five of the investigators came to a consensus. The codes were 1, 2 and 3 which corresponds to mild, moderate and vigorous activities. According to the activity level they were placed in to three groups. Both current occupation and past occupation were coded similarly. Around 6% of the sample population were falling under the category of occupation requiring vigorous

activity. Majority of the sample population (around 76%) was retired and so they are falling under the category of occupation 1, which was according to mild activity level.

4.1.10 Physical Activity

Physical activity of the population shows majority was falling under the category of less active group.

Table 8- Physical Activity of the sample population

<i>Physical Activity</i>	<i>Total</i>	<i>Urban</i>	<i>Rural</i>
Mild	328(68.3)	159(66.3)	169(70.4)
Moderate	148(30.8)	80(33.3)	68(28.3)
Vigorous	4(0.8)	1(0.4)	3(1.3)

4.1.11 Body Mass Index

Weight and height of the individuals were collected and body mass index was calculated as $\text{Weight (kg)} / \text{height (m)}^2$. The calculated BMI of the total population ranged from 11.07 to 49 kg/m^2 . The mean and median BMI of the sample population was 21.94 and 20.05 respectively. The sample population was categorized into three groups, low, moderate and high according to tertiles such as less than or equal to 19.6 kg/m^2 , 19.6 to 23.8 kg/m^2 and more than or equal to 23.8 kg/m^2 . Place of residence and sex wise distribution of BMI is shown in the table. The mean BMI of the total sample was 21.94 kg/m^2 and that of urban and rural population was 22.8 and 21.04 respectively. Mean BMI of males' (20.51) was less compared to females' (22.84).

Table 9- BMI of the sample population

BMI group	Total		Urban		Rural	
	Male	Female	Male	Female	Male	Female
Low	74(40.4)	83(28.8)	24(25.5)	27(19)	50(56.7)	56(38.4)
Moderate	72(39.3)	85(29.5)	43(45.7)	42(29.6)	29(32.6)	43(29.5)
High	37(20.2)	120(41.7)	27(28.7)	73(51.4)	10(11.2)	47(32.2)

4.2 Prevalence of Hypertension.

Of the total sample population, the prevalence of hypertension was found as 61.9%(95% CI 57.55%-66.25%). When separate analysis was done for urban and rural population the prevalence of hypertension in urban sample was 68.8% (95%CI 62.9-74.7) and that in rural sample was 55%(95% CI 48.7-61.3). Females were found to have higher prevalence than males. 63.1%(95% CI 57.5-68.5) Vs 60%(95% CI 52.9-62.1). The mean SBP and DBP of the total sample population was 140 and 82 mm Hg respectively. (95%CI 137.9-147.4mm Hg systolic and 80.7-82.9mm Hg diastolic) The mean DBP and SBP vary between males and females. Females were having a higher SBP than males. The following table shows the details about the prevalence and the mean SBP and DBP of the sample population

Table 10-Mean SBP, DBP and Prevalence of hypertension

	Total		Urban		Rural	
	Males	Females	Males	Females	Males	Females
SBP(mm Hg)	138.5	141.2	141.1	143.5	136.6	139.1
DBP(mm Hg)	81.2	82.2	81.8	81.7	80.6	82.6
HTN(%)	60	63.1	69.8	68.1	49.4	58.3

4.2.1 Rural And Urban Difference

There is a significant difference between the prevalence of hypertension in urban area and rural area. (p value<0.001)

Table 11-Prevalence of hypertension according to the place of residence

Place of residence	Hypertension	Non Hypertension	χ^2 p- value
Urban(n=240)	165(68.8%)	75(31.2)	0.00193
Rural(n=240)	132(55%)	108(45%)	

4.2.2 Reported Morbidity

Information was collected about the reported morbidity of hypertension and other diseases such as Diabetes Mellitus, Asthma and Joint Pain. The following Table shows the prevalence of reported morbidity of these diseases.

Table 12- Reported morbidity -Prevalence

Diseases	Total	Urban	Rural
Hypertension	178(37.1)	86(35.8)	92(38.3)
DM	95(19.8)	60(25)	35(14.6)
Asthma	58(12.1)	17(7.1)	41(17.1)
Joint Pain	114(23.8)	49(20.4)	65(27.1)

Values given in the brackets are the percentages.

Among the reported morbidities also, the prevalence of hypertension was higher than the other diseases. The prevalence of stroke in the total sample was 4.16% and that of IHD was 6.78%.

4.3 Correlates of Hypertension

4.3.1 Age group and Hypertension

Table 13- Age group and prevalence of hypertension

Age group	Total(%)		Urban		Rural	
	Non-HTN	HTN	Non-HTN	HTN	Non-HTN	HTN
60-64yrs	40.2	59.8	37.5	62.5	43.3	56.7
65-69yrs	35.2	64.8	32.3	67.7	38.1	61.9
70-74yrs	38.4	61.6	30	70	45.7	54.3
75-79yrs	30.9	69.1	19.4	80.6	43.8	56.3
80+yrs	46.4	53.6	30	70	59	41

All values are in percentages.

Prevalence of hypertension by age group showed a different trend. The senior citizens were showing a decreasing prevalence trend compared to the age group of 75-79 years. There was no significance in the difference between the prevalence in different age groups. Even when the lowest age group was taken as the reference category and done the χ^2 test, it was not significant.

Prevalence of Isolated Systolic Hypertension was found as 25.4%. Isolated Systolic Hypertension was defined as systolic blood pressure more than or equal to 140 mm Hg and the diastolic blood pressure less than 90 mm Hg.

4.3.2 Sex and hypertension

Sex wise distribution of hypertensive people in the sample showed that the prevalence of hypertension was more among females than males. The chi square p value was 0.50. In urban sample hypertension prevalence was more in males compared to females. The Odds Ratio was 1.14.

Table 14- Sex and Hypertension

Sex	Total		Urban		Rural	
	Non HTN	HTN	Non HTN	HTN	Non HTN	HTN
Males	74(40)	111(60)	29(30.2)	67(69.8)	45(50.6)	44(49.4)
Females	109(36.9)	186(63.1)	46(31.9)	98(68.1)	63(41.7)	88(58.3)

4.3.3 Education and Hypertension

Education wise the sample population was categorized into four groups. The prevalence of hypertension also showed an increasing trend as education increased. The p value is 0.005.

Table 15- Education and Hypertension

	1(not educated)	Up to 4 th std	4-10 th std	Above 10 th std
HTN	58	74	108	57
Total	114	128	158	80
Percentage	50.9%	57.8%	68.4%	71.3%

4.3.4 Socioeconomic Status and Hypertension

Socioeconomic status and prevalence of hypertension is having an inverse relation, as per several studies. In the present study the relation is shown as follows. Chi-square p value for trend is 0.006.

Table 16- Socioeconomic status and Hypertension

	SES 1	SES 2	SES 3
HTN	50	157	90
Total	102	251	127
Percentage	49%	62.5%	70.9%

4.3.5 BMI and Hypertension

Hypertension by BMI group shows that there is an increasing trend as BMI increases. p value is 0.001.

Table 17-Relationship of Hypertension to BMI

BMI group(kg/m ²)	Non HTN	HTN	Total	P value
Low	80(50.6%)	78(49.4%)	158	<0.0001
Moderate	59(37.6%)	98(62.4%)	157	
High	41(26.1%)	116(73.9%)	157	

For the total 480 cases BMI were calculated for 472 case and were divided in to tertiles and from the table it is evident that as BMI increases there is an increase in the prevalence of hypertension. If we are categorizing the sample population to two groups

with BMI less than and greater than 25kg/m^2 then it gives a highly significant value. p value 0.001

4.3.6 Smoking and Hypertension

Another variable we studied was smoking status and prevalence of hypertension. The people were grouped in to three according to the smoking status, smokers, nonsmokers and ex- smokers.

The prevalence of hypertension is shown in the table. An increasing trend is seen from past smokers to smokers to non-smokers. Chi-square p value for trend is 0.047.

The mean Blood Pressure of current smokers and non-smokers were 136.8/80.4 and 141.4/82.5mm Hg respectively.

Table 18- Smoking status and prevalence of hypertension.

	Numbers	Hypertension	Percentage %
Smokers	60	30	50
Ex-smokers	85	52	61.2
Non-smokers	335	215	64.2

P value of this came as 0.11.

4.3.6.1 Smoking Pattern and BMI

The following table shows that the smoking status of males alone and proportion in each BMI group. Out of 185 males BMI was not calculated for one. Out of the rest 184, in the past and current smokers, proportion of people in the third tertile was less compared to non-smokers.

Table 19- Smoking and BMI

Smoking Status	Low	Moderate	High
Non smokers	10(13.3%)	24(33.3%)	17(45.9%)
Past Smokers	31(41.3%)	34(47.2%)	12(32.4%)
Current Smokers	34(45.3%)	14(19.4%)	8(21.6%)

P value is <0.001

In this study sample a significant relation ship was seen between smoking status and body mass index. Non smokers tend to have more BMI compared to past smokers and current smokers.

Table-20 Smoking and mean and median BMI

Smoking status	Mean BMI	Median BMI
Non smokers	22.15	22.29
Past Smokers	20.28	20.34
Current Smokers	19.33	18.66

4.3.7 Alcohol use and hypertension

The total current alcoholics in the sample population were 31 and past alcoholics were 53. Prevalence of hypertension decreased in past alcoholics than in the current alcoholics but the prevalence in the non-alcoholics is still higher than both the groups. Chi-square p value is .07. When the analysis was done for males alone the chi square p value was 0.051. Analysis was also done for hypertensives who were not aware of the disease status and the OR came as protective, but this was not significant.

Taking non-alcoholics as the reference group, the OR for current and past alcoholics are 0.85(95% CI of OR 0.45-1.64) and 0.76(95% CI of OR 0.44-1.29)

respectively. These Odds ratios are not statistically significant based on the p value.

Table 21- Alcoholic Use and Prevalence of Hypertension

<i>Alcoholism</i>	<i>Number</i>	<i>HTN</i>	<i>Prevalence %</i>
Current	31	17	54.8
Past	53	26	49.1
Non alcoholics	396	254	64.1

When separate analysis was done for everdrinkers and never drinkers among males it was found that prevalence of hypertension was more among non drinkers. p value 0.02

4.3.8 Physical Activity Pattern and Hypertension

Physical activity is related to blood pressure and now it is advised that it can reduce the risk of IHD. In the present study where elderly were only considered, majority was coming under the category of doing light activity. Very minimum were coming under the group of doing vigorous physical activity. So a trend calculation is not possible.

Table 22- Hypertension and Physical activity

Physical activity	HTN	Non-HTN	%age	Odds Ratio	P value
Mild	210	118	64%	1	
Moderate	85	63	57.4%	2.4(95%CI-1.6-3.6)	<0.0001
Vigorous	2	2	50%	1.8(95%CI-0.8-17.9)	**0.62

** Fishers exact test was done.

4.3.9 Dietary Pattern And Hypertension Status

According to the dietary pattern of the sample population prevalence of hypertension is more common in vegetarians. Total vegetarians in the sample are 63 and 45 out of them are hypertensives. P value was not significant.

Table 23-Dietary Pattern and Hypertension

Dietary pattern	HTN	%	P value
Vegetarian	45	71.4	0.09
Non vegetarian	252	60.4	

4.3.10 Specific Food Items and Hypertension

The prevalence of hypertension among those who were taking meat, fish and egg is given below. A significant association was found between egg eating and hypertension.

Table-24 Hypertension and specific food items

Food habit	Meat	Fish	Egg
HTN	156	242	182
Total	265	399	318
Percentage	58.9	60.7	57.2

4.3.11 Use of extra salt and hypertension

Use of extra salt was not found as a significant predictor variable for hypertension. Around 59% of the extra salt users were found as hypertensives.

Table - 25 Use of extra salt and hypertension

Use of Extra salt	Hypertension	No Hypertension	χ^2 value	P value
Yes	41	28	0.21, df 1	0.65
No	256	155		

4.3.12 Diabetes Mellitus and Hypertension

Diabetes Mellitus is also a risk factor for hypertension. The prevalence of hypertension among diabetic people showed that 80% of the diabetics were hypertensives. (p value 0.00005). The prevalence of hypertension among diabetic people was less in urban area than in the rural area. 78.3%Vs 82.9%. This was the reported morbidity of diabetes mellitus.

Table 26-Diabetes Mellitus and Hypertension

	HTN present	HTN absent	Total
DM present	76(80%)	19(20%)	385
DM absent	221(57.4%)	164(42.6%)	95
Total	297	183	480

4.3.13 Awareness, Treatment and Control of hypertension

The percentage of sample population aware of hypertension was 37.1% and among them those who are under treatment for hypertension was 76.4%. Out of these 76.4% people who were taking treatment for hypertension, 34.6% were having controlled hypertension. Among those who were diagnosed as hypertensives by the JNC VI criteria, those who were taking treatment were 45.8%. Out of those who were taking anti hypertensive treatment, 34.8% were having controlled hypertension. There was not much difference between urban and rural samples (35.4% and 34.3% respectively). Uncontrolled and severe hypertension was defined as people having SBP greater than or equal to 180mm

Hg and DBP greater than and equal to 110mm Hg and who were taking antihypertensive medicines.

Table -27 Awareness, treatment and control of hypertension

Group	Hypertensives(n=297)			Treated Hypertensives (n=136)	
	Aware	Treated	Controlled	Controlled	Uncontrolled & severe HTN
Total(n= 297)	162(54.5)	136(45.8)	47(15.8)	47/136(34.6)	34/136(25)
By Gender					
Males (n=111)	49(44.1)	41(36.9)	15(13.8)	15/41(36.58)	9/41(21.95)
Females(n=186)	113(60.8)	95(51.1)	32(17.2)	32/95(33.68)	25/95(26.32)
P value	0.0078	0.02	0.49	0.89	0.75
By place of residence					
Urban(n=165)	81(49.1)	65(39.4)	23(13.9)	23/65(35.38)	17/65(26.15)
Rural(n=132)	81(61.4)	71(53.8)	24(18.2)	24/71(33.8)	17/71(23.94)
P value	0.046	0.018	0.4	0.99	0.92
By age groups					
<70yrs(n=160)	81(50.6)	67(41.9)	28(17.5)	28/67(41.8)	15/67(22.4)
70-79yrs(n=100)	61(61)	52(52)	16(16)	16/52(30.8)	12/52(23.1)
≥80yrs(n=37)	20(54)	17(45.9)	3(8.1)	3/17(17.6)	7/17(41.2)
P value	0.24	0.28	0.37	0.13	0.26

Values in parentheses are percentages.

4.3.14 System of Treatment

Out of total hypertensives (n=297) 44.8% were using allopathic medicines for the treatment of hypertension and 1% were using ayurvedic medicines.

Out of total 297 hypertensives 83.5% had a visit to the physician in the previous one-year and of these only 62% were aware of their hypertensive status.

4.3.15 Multiple Logistic Regression

Multiple logistic regression was done for variables, which were found statistically significant and clinically important.

Table- 28 Results of multiple logistic regression

Variable	p value	Odds Ratio	95%CI of OR
AGE GROUP			
60-64yrs		1	
65-69yrs	0.41	1.26	0.72-2.19
70-74yrs	0.88	1.05	0.57-1.93
75-79yrs	0.33	1.39	0.7-2.78
≥80yrs	0.51	0.79	0.4-1.6
SES			
SES1		1	
SES2	0.16	1.45	0.86-2.45
SES3	0.21	1.55	0.77-3.1
BMI(KG/M²)			
≤19.59		1	
19.6-23.79	0.13	1.45	0.88-2.38
≥23.8	0.001	2.35	1.36-4.06
Physical Activity level			
Physical Activity 1		1	
Physical Activity 2	0.07	0.66	0.42-1.05
Physical Activity 3	0.66	0.62	0.07-5.36
Smoking status			
Non smokers		1	
Past smokers	0.53	0.79	0.37-1.68
Current Smokers	0.98	0.99	0.47-2.08
Alcohol use			
Non alcoholics		1	
Past alcoholics	0.14	0.58	0.28-1.21
Current alcoholics	0.58	0.77	0.3-1.98
Place of residence			
Rural		1	
Urban	0.23	1.32	0.83-2.09
Gender			
Male		1	
Female	0.48	0.8	0.42-1.51
Non Diabetics			
Diabetics	0.001	2.83	1.53-5.22

Interaction (smoking status* BMI) and (smoking status *sex) were also included in the regression. When adjusted for age, sex, place of residence, socioeconomic status and physical activity, hypertension was significantly related to BMI and presence of Diabetes Mellitus. Even if in bivariate analysis urban dwellers were having significantly higher prevalence of hypertension, in multivariate regression analysis it is not significant.

CHAPTER V

DISCUSSION

This study has examined the prevalence of hypertension and its correlates among the elderly in rural and urban areas of Thiruvananthapuram District of Kerala State. A perusal of the literature shows that it is an area of public health concern, as Hypertension is the easily preventable and reversible risk factor for cardiovascular events. This is applicable to the state of Kerala also where the proportion of elderly is high compared to other Indian states. Epidemiological transition brings about the added burden of chronic degenerative diseases as the elderly population is increasing.

5.1 Sample Characteristics

The distribution of sample population according to age group pointed out that majority was falling under the age group 60 to 70 years. The mean age of the sample population was 70.05yrs. According to 1991 Census Of Kerala among the above 60 population around 61% were in the 60-69 years age group and above 80 population were 11%¹. In the study population it was around 54% and 14% respectively. The sex ratio of the sample population was around 1:1.6(male: female) and the sex ratio of the above sixty population in 1991 census was 1:1.16. The nine years after the last Census might have brought changes in the sex ratio. The higher female sex ratio in the sample population might be mainly because of the non-availability of males at the time of the study, as they were going for job/ outdoor activities or dead. According to the religion the sample population was 75% Hindus, 15% Muslims and 10% Christians. The same according to 1991 census was 60% Hindus, 20% Muslims and 20% Christians. For Thiruvananthapuram District it was 60% Hindus, 13% Muslims and 17% Christians in

1991 Census. According to the socioeconomic status the sample population was grouped in to three categories such as poor, middle class and upper class. Categorization in to three groups was purely on the investigators subjective assessment, by looking at the housing conditions, assets, surroundings and the monthly expenditure of the family. In the study sample majority were in the middle class, about 52%. The KSSP survey of 1996 categorized people in to four groups and this also pointed out that proportion of people in the middle class was 39.5%. Around 77% of the sample population had some education and there is a significant difference between urban and rural population. In urban area more than $2/3^{\text{rd}}$ of the sample population had more than primary education while in the rural area only $1/3^{\text{rd}}$ had more than primary education.

In the case of smoking and alcohol use female population was negligibly less in using both. But use of smokeless tobacco was more among females.

5.2 Hypertension Prevalence and Correlates

Prevalence of Hypertension, a disease that is closely related to life style was found to be approximately 62% in the sample population based on JNC VI criteria. Studies have shown that prevalence in developing countries vary between 40-60%¹ and in developed countries it vary between 50-80%^{1,17,40,41}. When separate analysis was done for rural and urban areas, prevalence was higher in urban than rural areas. This difference was significant. When adjusted for age, sex, BMI and physical activity, place of residence was not significant. In a previous study by Kalavathy et al, found that prevalence of hypertension among the elderly was 51.8%. Around ten percent increase from that study was found in the present one. From the major risk factors identified through Framingham Heart Study and those listed in the JNC VI criteria we

selected to study age, sex, education, socioeconomic status, dietary habits, smoking, chewing and alcoholic habits, physical activity and body mass index. There is minimal rural urban difference in Kerala and this will also reflect in the study results that a major difference may not be there in the variables studied in urban and rural Kerala.

Among the two sexes, prevalence was more in the females, (males- 60%[95%CI 56.4,63.6] and females 63.1%[95%CI 60.2,65.8]) but in the urban areas it was more in males. The mean systolic and diastolic blood pressure was also higher for females around 2mm Hg and 1 mmHg respectively. A study by R Beegom and R B Singh¹⁸ found that prevalence was higher among males but the age group was different in that study. Females in the postmenopausal age are having the higher risk of being hypertensives. This will bring difference in the prevalence. As age increases there was an increase in blood pressure. Here also there was an increasing trend up to the eighth decade and thereafter a decreasing trend. But this was not significant. Kalavathy also reported the same trend.

Both education and socioeconomic status were having a significant positive relationship with hypertension prevalence. This also when adjusted for age, sex and BMI, became insignificant. The prevalence of hypertension was increasing according to the increasing socioeconomic status. In this study it was found that the higher the education the greater was the prevalence of hypertension. It was same for both urban and rural areas. This also stressed the Osler's note that these are the diseases of the affluent²⁶. Unlike other studies where an inverse relation was found between education, socioeconomic status and hypertension, the prevalence increased as education and

socioeconomic status increased, in this study²⁴⁻²⁸. The reason for this may be the unhealthy practices or sedentary and stressful life of the educated or high SES group.

Smoking and past smoking were not showing any relation to High Blood pressure. This might be because of the cross sectional nature of the study. Also a strong relationship was found between smoking status and BMI. Current smokers were found to have low mean BMI when compared to past smokers and non smokers. Miami Community Health study reports that smoking may increase the tissue sensitivity to leptin and subsequently lead to lower weight commonly observed among smokers⁵⁸. This may be the reason for the lower mean SBP and DBP found for smokers. Framingham study and other studies have showed that smoking is directly related to hypertension. Some studies also reported lower mean BP for current smokers.²⁹

Several studies have shown that alcohol will raise the blood pressure but the exact mechanism by which alcohol raises blood pressure is still unknown^{29,30,48,54}. Ravi Maheswaran's study on this, support the evidence that slow pressor effect of alcohol is quite reversible. In the present study such an association could not be found. One study reported that consumption of one single drink of alcohol may cause an acute rise in BP that resolves within 2 hours and that over several days may cause a sustained rise over several days. This might be because of the rapidly reversible pressor effect of alcohol, as the study was conducted in the daytime and how recently they had the alcohol was not enquired.

BMI showed a significant relationship with hypertension. Prevalence of hypertension was increasing as the BMI increased. The increased prevalence of hypertension in females may be attributed to BMI that female population had higher BMI

than male population, which needs further research. Both the rural and the urban sample showed the same results. Epidemiological findings on body mass and blood pressure also supported this findings, this database conclude that there is a cause and effect relationship existing between BMI and Blood Pressure.^{31,33,43}

In the present study prevalence of hypertension was found high among vegetarians. This refutes the available studies which support that mean Blood Pressures are lower in people who are taking lacto-ovo or lacto vegetarians^{48,49}. This might be because of the fact that some have shifted to vegetarian diet after diagnosing as hypertensives and another finding was among the vegetarians majority of the hypertensives were falling in the third tertile of BMI group ($\geq 23.8\text{kg/m}^2$). This was significant. So the interaction of BMI may be playing here in getting the result as in the present study, which needs further research. Prevalence of hypertension was not showing any significant relationship with specific food items such as intake of meat,egg and fish.

Observational studies on salt and hypertension revealed that excess sodium intake was related to high blood pressure and high 24 hour sodium excretion was demonstrated in hypertensive population than in non hypertensives^{5,35,36,50}. Randomized controlled trial on the effect of reduced salt on hypertension found that low sodium diet reduces the blood pressure. From the present study it was evident that prevalence of hypertension was high in extra salt users. It was not significant. Quantification of sodium intake was not done in the present study.

Prevalence of hypertension was seen as reducing as moving from mild to vigorous activity level. Several cross sectional and prospective studies have proved that aerobic physical activity is associated with lower risk of hypertension^{31,32}.

Presence of Diabetes Mellitus was significantly related to hypertension. When adjusted for age, sex, BMI and physical activity significant association was found. Epidemiological studies have proved that Diabetes Mellitus is related to hypertension⁵⁵.

5.3 STRENGTHS OF THE STUDY

The most important strength of the study was its community-based nature. Multi stage cluster sampling gave more coverage of the district under study. All Blood Pressure measurement was done by a single investigator so inter observer variation was minimized.

5.4 LIMITATIONS OF THE STUDY

Blood Pressure measurements were done in the same day and no repeated visits were made to the household because of time and money constraints. Mainly people in the rural area were finding it difficult to ascertain their exact age. We had to probe several question related to major events and also look in to documents for the same. Physical activity was assessed based on a checklist and it was not measured. Quantification of sodium intake was not done. Blood sugar level was not checked for the participants for confirming the diagnosis of Diabetes Mellitus, because of economic constraints, only information on the reported morbidity was collected.

5.5 CONCLUSION

1. The prevalence of hypertension of the study population was found as 61.9%. There was a gender difference noticed in the prevalence with the value higher among females. But it was not statistically significant.

2. There was a significant difference in the prevalence of hypertension between the urban and rural population of Thiruvananthapuram District. The prevalence of hypertension in urban area was 68.8% and that of rural area was 55%.
3. The predictor variables studied were age, sex, education, socioeconomic status, religion, occupation, dietary habits and patterns, BMI, smoking, alcoholism, use of smokeless tobacco and physical activity pattern. Awareness, control, treatment and the system of treatment followed for treatment was also studied. A difference in the prevalence was noted in different age group. A statistically significant association was noted between hypertension and education, socioeconomic status, intake of egg, BMI and reported morbidity of Diabetes Mellitus.
4. Out of 297 hypertensives detected from the study 55% were aware of their Hypertensive status and 46% were taking treatment for hypertension. Control of Hypertension could be achieved by only 16% of the hypertensives. Among the hypertensives 38% were unaware of their hypertension status even after having at least one physician visit in the previous one year.

5.6 POLICY IMPLICATIONS

Findings of this study state that hypertension prevalence is very high (62%) and this problem has to be looked into as a major disease in the public health arena. Hypertension is the major preventable and reversible risk factor for CHD and stroke. By detecting the cases very early and modifying the life style and use of pharmacological agents properly can effectively reduce the burden of CHD and stroke. It is been reported by a study in Eastern Asia that there is a strong association between hypertension and stroke, when compared to the West⁶⁰. In

the present study it is evident that the proportion of people with controlled hypertension is very less, even in this literate state of Kerala, where utilization of health care is very high. So it is felt that this is high time to give equal emphasis for non-communicable diseases also along with communicable diseases. In the state of Kerala where the Primary Health Care set up is well established the Primary Health Care workers can be motivated to detect this condition and give proper guidance. It is good to incorporate Continuing Education Programme for health personnel in the proper diagnosis according to the latest criteria, at the earliest and to give counseling to the patients regarding practice of necessary life style modifications and regular medications. An elderly Health Programme can be started with emphasis to cardiovascular diseases, as it is the major killer in the present era. A collaborative research group for cardiovascular health can be established which can extend further research in the field to find out the major risk factors, intervention studies etc. and give timely suggestions. This all can lead to a National Program for Hypertension.

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APPENDIX I
QUESTIONNAIRE

Prevalence Of Hypertension And Its Correlates In A Sample Of Elderly

A Rural Urban Comparison

Achutha Menon Centre For Health Science Studies

Investigators Name:

Cluster No & Name:

Code No:

Ward No:

Ward Name:

Date:

Name:

Age:

Sex:

Address:

1. Total House hold size:
2. Information On SES:
 - a. What is your house hold expenditure in the last month? Rs.
- b. Type of house: Kucha/ Semipucca/ Pucca
 - c. Assets: Bike/ Car/ TV/ AC/ Fridge/ VCR/ Phone/ Computer/ Washing Machine/ Gas/ Stove
3. Religion: Hindu/ Muslim/ Christian
4. Marital Status: Married/ Divorced/ Widowed/ Never Married
5. Occupation:
 - a. Current: Duration:
 - b. Past: Duration:
6. Education:
7. Past Medical History:
 - a. Any major illness: DM/ HTN/ Asthma/ REND/ Others
 - b. Did you visit a doctor in the last one year? Yes/ No
 - c. If yes, the doctor you visited belongs to which system of medicine?
Allopathy/ Ayurveda/ Homeopathy/ Naturopathy/ Sidha/ Others
 - d. Did he or she measure your blood pressure? Yes/ No
 - e. Are you on pills for lowering cholesterol? Yes/ no
 - f. Did you undergo a blood test for identifying DM? Yes/ No

g. Did you undergo a blood test for identifying cholesterol status? Yes/ No

h. Have you been told to have heart failure by a doctor? Yes/ No

8. a. Do you have hypertension? Yes/ no

b. Are you on treatment for hypertension? Yes/ No

c. System of medicine used for the treatment of hypertension:

Allopathy/ Ayurveda/ Homeopathy/ Naturopathy/ Others

d. Currently used allopathic anti hypertensive drugs:

9. Dietary Habit:

a. Veg/ Egg/ Fish/ Meat

b. Frequency: Egg: /day, /week, /month

Fish: /day, /week, /month

Meat: /day, /week, /month

c. Use of extra salt: Yes/ No

10. Smoking:

a. Do you smoke? Yes/No

b. If yes, since how long?

c. Type: Cigarette/ Beedi/ Others

d. Frequency: /day, /week, /month

e. If no, Did you ever smoke? Yes/ No

f. If yes: How long did you smoke?

g. Duration of quitting:

h. Reason for quitting:

i. Type: Cigarette/ Beedi/ Others

j. Frequency: /day, /week, /month

11. Chewing/Smokeless Tobacco

a. Do you chew tobacco: yes/ No

b. If yes, since how long?

c. Type: Khaini/ Betel quid/ Panmasala/ Others

d. Frequency: /day, /week, /month

e. If no, Did you ever chew? Yes/ No

f. If yes, How long did you chew?

g. Duration of quitting:

h. Reason for quitting

i. Type: Khaini/ Betel quid/ Panmasala/ Others

j. Frequency: /day, /week, /month

12. Alcohol

a. Do you drink alcohol? Yes/ No

b. If yes, since how long?

c. Brand: Whisky/ Brandy/ Rum/ Vodka/ Toddy/ Arrack/ Others

d. Frequency: : /day, /week, /month

e. If no, Did you ever drink alcohol? Yes/ No

f. If yes, how long did you drink?

g. Duration of quitting

h. Reason for quitting

i. Brand: Whisky/ Brandy/ Rum/ Vodka/ Toddy/ Arrack/ Others

j. Frequency: : /day, /week, /month

13. Physical Activity: Vigorous/ Moderate/ Light

14. Any other relevant information:

15. Measurement:

Body weight:

Height:

Blood Pressure measurement (mm Hg):

Blood Pressure	SBP(mm of Hg)	DBP(mm of Hg)
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1st Measurement

2nd Measurement

3rd Measurement

APPENDIX II

IDENTIFICATION OF URBAN CLUSTERS

Total Urban Population Of Thiruvananthapuram District:524006

Sampling Interval: 524006/30=17467

Random Number: 5032

WARDS	POPULATION	CU.POP	Clusters	5032
1 Medical College	9318	9318	C1	22499
2 Pattom	15844	25162	C2	39966
3 Kesavadasapuram	12390	37552		57433
4 Kuravankonam	12087	49639	C3	74900
5 Kowdiar	10085	59724	C4	92367
6 Vattiyoorkavu	15008	74732		
7 Pangode	10777	85509	C5	109834
8 Thirumala	10396	95905	C6	
9 Sasthamangalam	11978	107883		
10 Kanjirampara	12795	120678	C7	127301
11 Nanthencode	9170	129848	C8	144768
12 Kunnukuzhi	8751	138599		
13 Kannanmoola	10329	148928	C9	162235
14 Palayam	7663	156591		179702
15 Vazhuthacaud	8093	164684	C10	
16 Jagathy	9123	173807		
17 Poojappura	13763	187570	C11	197169
18 Thrikannapuram	13269	200839	C12	214636
19 Mudavanmughal	14072	214911	C13	232103
20 Karamana	14595	229506		
21 Nedumcaud	11898	241404	C14	249570
22 Attukal	7825	249229		
23 Valiachala	7407	256636	C15	267037
24 Thycaud	8369	265005		
25 Thampanoor	10552	275557	C16	284504
26 Secretariat	8068	283625		
27 Rishimangalam	9284	292909	C17	301971
28 Sreekanteswaram	10508	303417	C18	319438

WARDS	POPULATION	CU.POP	Clusters	5032
29 Palkulangara	8792	312209		
30 Pettah	8870	321079	C19	336905
31 Chackai	11008	332087		
32 Titanium	9083	341170	C20	354372
33 Veli	6371	347541		
34 Sankumughom	13796	361337	C21	371839
35 Vallakkadavu	8522	369859		
36 Perumthanni	10136	379995	C22	389306
37 Fort	7266	387261		
38 Chenthitta	5489	392750	C23	406773
39 Chalai	9010	401760		
40 Puthen Street	7394	409154	C24	424240
41 Manacaud	14085	423239		
42 Sreevaraham	10607	433846	C25	441707
43 Kamaleswaram	13116	446962	C26	459174
44 Valiathura	6929	453891		
45 Bheemapally	15353	469244	C27	476641
46 Manickavilakom	13931	483175	C28	494108
47 Poonthura	12898	496073	C29	511575
48 Ambalathara	9953	506026		
49 Kalippankulam	7344	513370	C30	529042
50 Kalady	10636	524006		

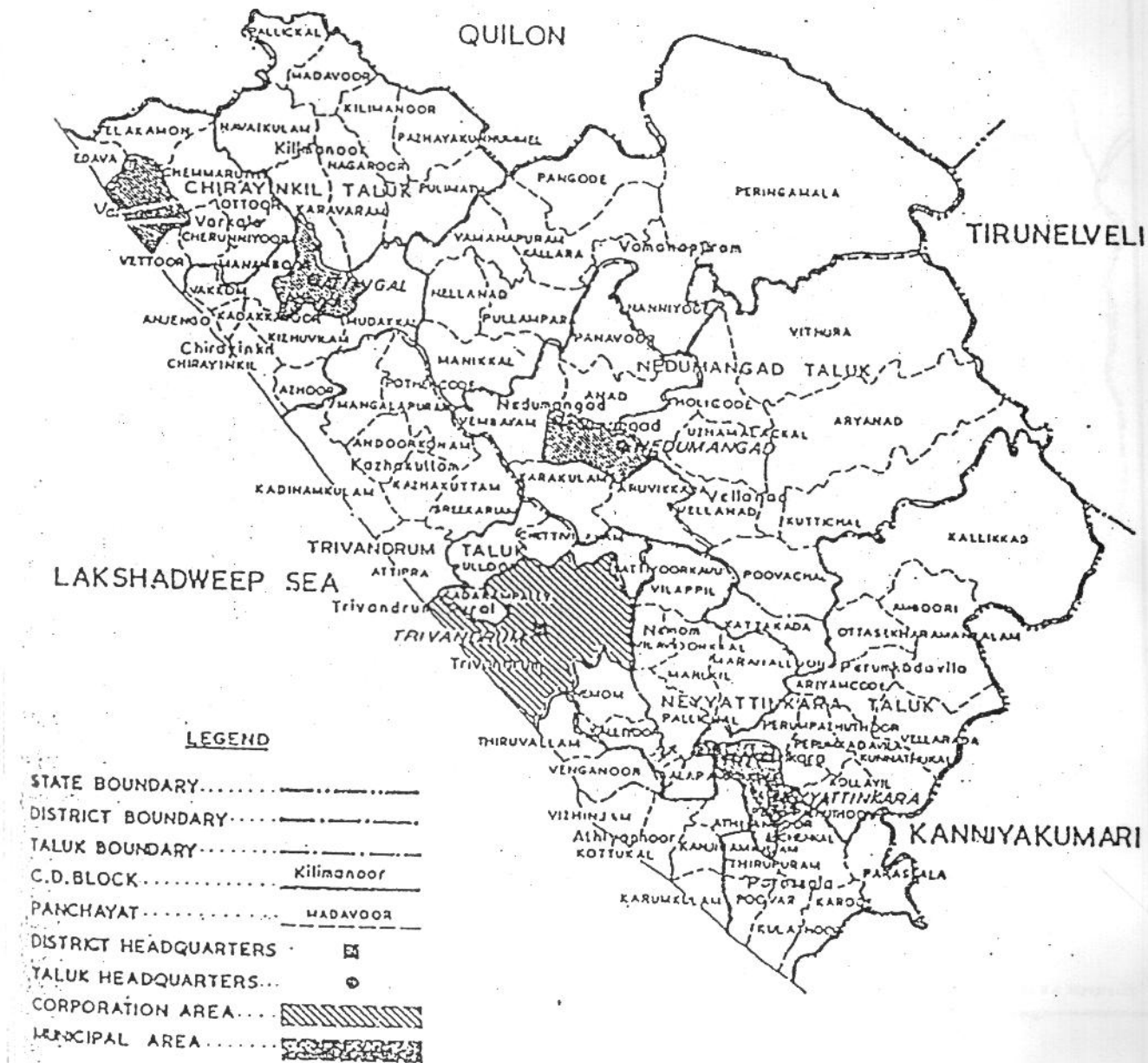
Similarly the rural clusters are also identified using the ward wise population of each panchayat out of eighty-three panchayats.

APPENDIX III

CHECK LIST FOR PHYSICAL ACTIVITY CATEGORIZATION

Physical Activity Categories		
1 .Vigorous activities	2. Moderate activities	3 .Light activities
Agricultural work	Home maintenance of garden	Walking
Pulling Riksha/ Cart	Maintenance of cattle	Walking to office
Digging	Fetching water	Desk work at office
Breaking stone	Carrying Wood	Watching TV
Exercise : By bicycle, rowing	Cooking:	Reading Books
Carpentry work/ Masonry work	Washing cloths	Others specify:
Others specify	Others specify	

TRIVANDRUM DISTRICT



THIRUVANANTHAPURAM CORPORATION

WARDS

1 Km

