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## A community-based study on the prevalence of hypertension among adults in rural Kerala

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### Abstract

**Background & objectives:** Hypertension is a disorder that has no apparent symptoms but later results in serious health problems can pose great threat to the health of people. Hypertension is a global public health problem. Even though it can be controlled by early diagnosis, lifestyle modifications and adequate treatment; many remain unaware of their hypertension, especially in rural areas where not many studies have been done. Thus, a study was done in rural area, with primary objective to determine the prevalence, and risk factors of hypertension. The secondary objective was to understand the treatment seeking behaviour of known hypertensive cases among adults in rural areas.

**Methods:** A cross-sectional community-based study was conducted from July 2017 to September 2018 among adults above 25 years of age in the rural areas of Palakkad, Kerala, India. The blood pressures (BPs) of 278 adults were recorded at their homes. A detailed history was obtained by interviewing study participants using a pretested and semi-structured questionnaire. Clinical examination was done, BP, height and weight were recorded. Data was entered in Microsoft Excel and analysed using (SPSS) statistical software version 16.0.

**Results:** Out of 278 participants in this study, 191 (68.7%) were women and 87 (32.3%) were men. The prevalence of hypertension was 54%, of which 80 (53.33%) were previously diagnosed hypertensive cases and 70 (46.66%) were newly diagnosed hypertensive cases. Among the 80 previously diagnosed cases 67 (85.9%) were on regular medication, 11 (14.1%) did not adhere to medication schedule and 2 (2.5%) were prescribed any antihypertensive medication. In univariate analysis, the significant risk factors for hypertension were found to be age, diet, cigarette smoking, diabetes and family history of hypertension.

**Conclusion:** This means that Non-Communicable Disease (NCD) control programme should focus on early screening, correct treatment and control of hypertension in rural areas along with education on lifestyle changes, diet modifications, counselling on adherence to antihypertensive medications, frequent blood pressure check-ups for individuals with prehypertension.

**Keywords:** Hypertension, prevalence, rural, Kerala

### Introduction

Globally, the overall prevalence of raised blood pressure in adults aged 25 and over was around 40% in 2008. The proportion of the world's population with high blood pressure, or uncontrolled hypertension, fell modestly between 1980 and 2008. However, because of population growth and ageing, the number of people with hypertension rose from 600 million in 1980 to nearly 1 billion in 2008.

Worldwide, raised blood pressure is estimated to cause 7.5 million deaths, about 12.8% of the total of all annual deaths. This accounts for 57 million DALYs or 3.7% of total DALYs. Raised blood pressure (BP) is a major risk factor for coronary heart disease and ischaemic as well as haemorrhagic stroke. Blood pressure levels have been shown to be positively and progressively related to the risk for stroke and coronary heart disease. In some age groups, the risk of cardiovascular disease doubles for each incremental increase of 20/10 mmHg of blood pressure, starting as low as 115/75 mmHg. In addition to coronary heart diseases and stroke, complications of raised blood pressure include heart failure, peripheral vascular disease, renal impairment, retinal haemorrhage and visual impairment. Treating systolic blood pressure and diastolic blood pressure so they are below 140/90 mmHg is associated with a reduction in cardiovascular complications.

The prevalence of raised blood pressure was highest in the African Region, where it was 46% for both sexes combined. The lowest prevalence of raised blood pressure was in the WHO Region of the Americas, with 35% for both sexes. Men in this region had a slightly higher prevalence than women (39% and 32% respectively). In all WHO regions, men have slightly higher prevalence of raised blood pressure than women, but this difference was only statistically significant in the Region of the Americas and the European Region.

Across the income groups of countries, the prevalence of raised blood pressure was consistently high, with low-, lower-middle- and upper-middle-income countries all having rates of around 40% for both sexes. The prevalence in high-income countries was lower, at 35% for both sexes [1].

Raised blood pressure attributes to the leading risk factor for morbidity and mortality in India. Hypertension is attributable to 10.8% of all deaths in India. In India, Hypertension or raised blood pressure is one of the leading causes of premature deaths in India. Hypertension is directly responsible for 29% of all stroke and 24% of heart attacks in India. This is preventable with lifestyle modifications which include physical activity, yoga and dietary modifications [2]. A national programme for prevention and control of cancer, diabetes, cardiovascular diseases and stroke (NPCDCS) has been launched by Ministry of Health and Family Welfare, focuses for screening of persons above the age of 30 years for diabetes, hypertension and cardiovascular diseases. To plan for interventions, it is important to know the extent of the problem of hypertension in the community and also whether the patients diagnosed as having hypertension are correctly managed and BP is kept at normal levels.

We conducted the study in rural area because most of the studies are conducted in urban areas. The overall aim of this study was to estimate the prevalence of hypertension among adults in the community and to understand the various risk factors associated with the hypertension among the adults and also to seek information on current treatment seeking behaviour of known hypertensive cases.

**Materials and Methods**

**Study design:** The present study was a community-based cross-sectional study.

**Study setting:** It was conducted in the rural area of Palakkad district.

**Study period:** This study was conducted from June 2017 to September 2018. Data was collected over the period of three months (June - July 2017 and October 2017).

**Study subjects:** Adult household members of both sexes, aged above 25 years.

**Inclusion criteria**

- i. Adults willing to participate in the study.
- ii. Adults aged 25 years and above, residing in the rural areas of Palakkad district.

**Exclusion criteria**

- i. Adults not willing to participate in study.
- ii. Adults between 18 to 24 years.
- iii. Chronically ill and bed ridden patients.

**Sample size:** With an anticipated population prevalence of hypertension as 50% and a relative precision of 0.1 (10%) and 95% Confidence Interval, the sample size worked out to be 384. The sample size was calculated using WHO tables of sample size calculations.

However, the total sample size in this study was 278. This was based on convenient sampling. During the clinical posting hours, 30 students could cover 278 households in 3 days (data collection days). Total of 106 samples were falling short, to meet the WHO recommend sample size.

**Sampling Method:** A random sampling method was used to select household for data collection. The data was collected by house to house visit with the help of health inspectors and assistant professors of community medicine department.

**Data collection tools:** A detailed history was obtained by interview method using a pretested and semi-structured questionnaire. The data was collected on socio-demographic factors and risk factors for hypertension. Blood pressure was measured and anthropometric measurements like height and weight were collected to calculate BMI.

**Blood pressure measurements**

Blood pressure was measured for eligible participant using Blood Pressure Monitor, to determine the prevalence of hypertension. Blood pressure measurements for each respondent were taken two times with an interval of five minutes between readings.

**Operational definition**

A study participant was classified as having hypertension if he/she has an average systolic blood pressure level greater than or equal to 140 mmHg, or an average diastolic blood pressure greater than or equal to 90 mmHg, or he/she is currently taking antihypertensive medication to lower his/her blood pressure [3].

An average diastolic blood pressure greater than or equal to 90 mmHg

Category	Systolic blood pressure (mmhg)		Diastolic blood pressure (mmhg)
Normal	<120	And	<80
Prehypertension	120 – 139	or	80-90
Hypertension		or	
Stage1	140 -159	or	90-100
Stage2	≥160		≥100

Classification of weight by using BMI for adult Asians [4]

Classification	BMI (kg/m <sup>2</sup> )	Risk of co-morbidities
Underweight	<18.5	Low (but increased risk of other clinical problems)
Normal range	18.5-22.9	Average
Overweight	≥23	
At risk	23-24.9	Increased
Obese 1	25-29.9	Moderate
Obese II	≥30	Severe

**Data analysis:** Data was collected, coded and entered in Microsoft Excel sheet, windows version 2010, re-checked and analysed using an excel sheet and Statistical Package for Social Sciences (SPSS) statistical software version 16.0.

**Statistical Analysis**

Proportions (Percentages) were calculated on excel sheet. For assessing difference between proportions, Pearson's chi-square test was used as a test of significance. SPSS was used for calculating the association between various variables.

**Ethical consideration:** Verbal consent was taken from each participant. Strict confidentiality was maintained so that the information obtained will not be used for purposes other than the objectives of the study. Hypertensive subjects were referred to the nearest primary health centre for appropriate management. All participants were advised on the need for regular BP check- up and lifestyle modifications.

**Results**

Data was obtained from a total of 278 persons above the age of 25 years. The demographic characteristics of the study population are depicted in Table 1. Majority of the subjects (93.17%) were between ages 30 and 70 years and 6.83% below the age of 30 years. Out of 278, 191 (68.7%) were females and 87 (31.29%) were males. This difference should be due to the fact that many of the males were out of the house for work during the day time. Majority of the study participants belong to the age group 61-105 years. Majority 91.72% were Hindus by religion, 88.84% were married, 98% were literate and only 2% were illiterate. Fifty Seven percent of participants belonged to Above Poverty Line (APL) and 42.08 belong to Below Poverty Level (BPL) category of socio- economic status.

**Table 1:** Socio- Demographic characteristics of the study participants.

Variables	Responses	Frequency (N)	Percentage (%)
Age Distribution	≤30	19	6.83
	31-40	40	14.38
	41-50	72	25.89
	51-60	54	19.42
	≥61	93	33.45
Gender	Male	87	31.29
	Female	191	68.70
Religion	Hindu	255	91.72
	Christian	23	8.27
	Others	0	0
Marital Status	Married	247	88.84
	Not married	15	5.39
	Separated	5	1.79
	Widow	11	3.95
Educational Status	Illiterate	6	2.15
	Primary School	40	14.38
	Middle School	29	10.43
	High School	110	39.56
	Diploma	40	14.38
	Graduate	51	18.34
	Post Graduate	2	0.72
Socio-economic status	APL	161	57.91
	BPL	117	42.08
Family History of Hypertension	Yes	83	29.85
	No	195	70.14

ii. Life style factors and Co- Morbidities (see table 2): Majority (83.81%) of the study participants have non - vegetarian diet and majority (91.3%) are non- smokers (see

Table. 2). Majority (77.6%) of the study participants were non -diabetic and had no hypercholesterolemia (83.09%).

**Table 2:** Lifestyle factors and Co-morbidities in the study population (N=278)

Variables	Responses	Frequency (N)	Percentage (%)
Diet	Vegetarian	45	16.18
	Non-Vegetarian	233	83.81
Smoking	Smokers	24	8.63
	Non- smokers	254	91.36
Alcohol Consumption	Alcoholics	33	11.87
	Non- Alcoholics	245	88.12
Diabetes Mellitus	Known Diabetic	62	22.30
	Non- Diabetic	216	77.69
Hypercholesterolemia	Known cases Hypercholesterolemia	47	16.90
	No Hypercholesterolemia	231	83.09

**iii. Prevalence of hypertension**

Out of 278, 184 participants had prehypertension, 150 (54%) participants had hypertension, 97 (34%) were prehypertensive and 31 (11%) participants had normal blood

pressure (see Table. 3). Out of the 150 hypertensive subjects, 70 (25.17%) were newly diagnosed at the time of the study and the remaining 80 (28.77%) were known cases of hypertension. Among those found hypertensive, 72

participants had either isolated high systolic or isolated high diastolic blood pressure. Rest of the participants had both high systolic and high diastolic blood pressure. Out of 278

study participants, 94(34%) had high systolic blood pressure and 128 (34%) had high diastolic blood pressure.

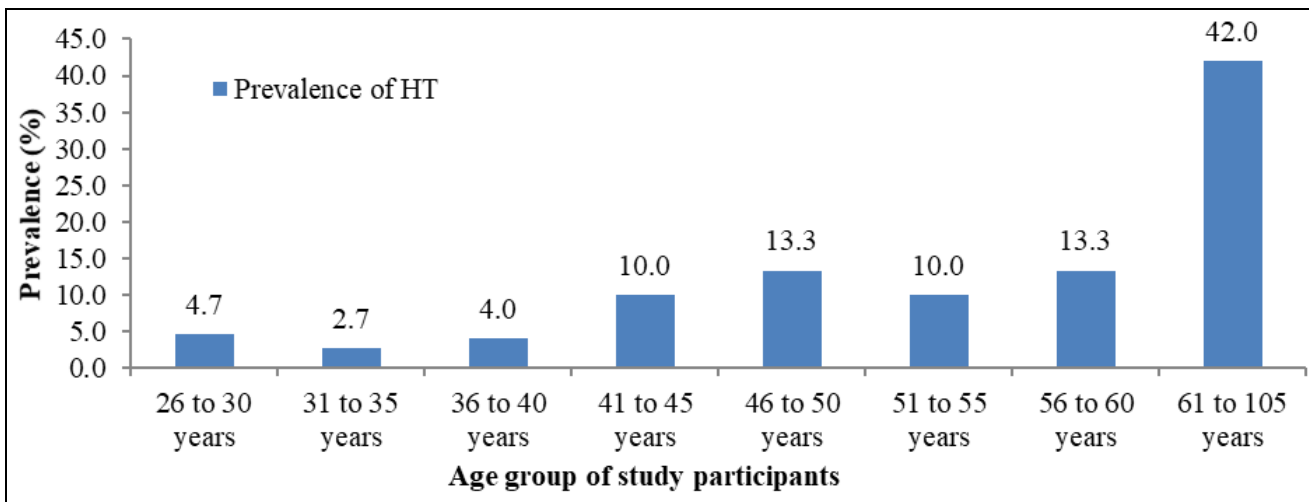
**Table 3:** Prevalence of hypertension and treatment status

Variables	Frequency (N)	Percentage (%)	
Prehypertensive cases	97	34.89	N=278
Newly diagnosed hypertensive (during the study)	70	25.17	
Previously diagnosed hypertensive cases	80	28.78	N=278
Total Hypertensive (New + previously diagnosed)	150	54.0	
Treated without medicines (with lifestyle modifications)	2	2.5	N=80
On regular medication	67	85.9	N=78
On irregular medication	11	14.1	
On treatment and BP within	3	3.75	N=80
On treatment but BP is high	77	96.25	

Among the 278 study participants, 83 (30%) had family history of hypertension (see figure 6.5) and 41 (15%) were known cases of hypercholesterolemia.

**Age and Hypertension:**

After the age of 35 years, there is rising trend of prevalence of hypertension among the study participants. As age increases hypertension increases. Prevalence of hypertension was 42% among the participants in the age group >61 years and above (see figure 1).



**Fig 1:** Age-wise prevalence of HT among the study participants

**Univariant Analysis was done to check association of various factors with hypertension.** For assessing difference between proportions, Pearson's chi-square test was used as a test of significance. In univariant analysis, the

significant risk factors for hypertension were found to be age, diet, cigarette smoking, diabetes and family history of hypertension (See table 4).

**Table 4:** Association between age and hypertension

Variables	Hypertension				Total
	Present		Absent		
Age Group	N	%	N	%	
26 to 30 years	7	36.84	12	63.1	19
31 to 35 years	4	19.04	17	80.95	21
36 to 40 years	6	31.57	13	68.4	19
41 to 45 years	15	51.72	14	48.27	29
46 to 50 years	20	46.51	23	53.48	43
51 to 55 years	15	68.1	7	31.81	22
56 to 60 years	20	62.5	12	37.5	32
61 to 105 years	63	67.7	30	32.2	93
Total	150	53.9	128	46.04	278
	Value		Df		P Value
Pearson Chi-Square	28.102		7		0

**Table 5:** Association between various risk factors and hypertension

	Hypertension					P Value
	Present		Absent		Total	
Gender	N	%	N	%	Total	
Male	51	58.6	36	41.37	87	0.292
Female	99	51.8	92	48.16	191	
<b>Occupational Classification based on physical activity</b>						
Sedentary Worker	130	52.6	117	47.36	247	0.235
Moderate Worker	8	53.3	7	46.6	15	
Heavy Worker	8	80	2	20	10	
<b>Socio Economic Status</b>						
APL	91	56.52	70	43.4	161	0.314
BPL	59	50.42	58	49.57	117	
<b>Type of Diet</b>						
Vegetarian	31	68.8	14	31.1	45	0.028
Non- Vegetarian	119	51.07	114	48.92	233	
<b>History of Smoking</b>						
Smokers	20	83.3	4	16.66	24	0.003
Non- Smokers	130	51.18	124	48.81	254	
<b>History of alcohol consumption</b>						
Consume Alcohol	23	69.7	10	30.3	33	0.053
Do not consume alcohol	127	51.8	118	48.2	245	
<b>History of Diabetes</b>						
Yes	45	72.5	17	27.41	62	0.001
No	105	48.6	111	51.38	216	
<b>Family history of hypertension</b>						
Family History of Hypertension present	53	63.9	30	36.1	83	0.031
No History of Family Hypertension	97	49.7	98	50.3	195	
<b>Family history of hypercholesterolemia</b>						
History of hypercholesterolemia present	26	55.3	21	44.7	47	0.837
No history of hypercholesterolemia	124	53.7	107	46.3	231	
<b>Body Mass Index (BMI) (Asian Classification)</b>						
Under nutrition	9	56.25	7	43.75	16	0.502
Normal Nutrition	52	54.17	44	45.83	96	
Over Weight	28	56	22	44	50	
Obesity Class I	30	45.45	36	54.55	66	
Obesity Class II	31	62	19	38	50	

**Discussions**

This study concludes that prevalence of hypertension is high (54%). The prevalence increases with age. The observation that even though 85.9% of known hypertensive are taking regular medications only very few among them have controlled blood pressure.

A minor fraction was found to be treated without medicines that is with life style modifications. In our study, age, diet, smoking, diabetes and family history of hypertension were found significant risk factor for hypertension in univariant analysis.

The prevalence of hypertension as per the Sentinel Surveillance Project, in India is 28. Including 10 regions of the country in the age group 20-69 [5]. A community-based survey carried out by ICMR during 2007 -08 identify the risk factors for non-communicable diseases under state based Integrated Disease Surveillance Project Phase I. According to this report the prevalence of hypertension was from 17 to 21% in all the states of with there were marginal rural -urban differences.

This means that NCD control programme should focus on correct treatment and control of hypertension in rural areas along with education for lifestyle changes, diet modifications and regular and strict medication, frequent blood pressure check-ups for individuals with pre-hypertension.

In a study conducted at Perinthalmanna, North Kerala prevalence of hypertension was found to be 32.3%, which is

lower as compared to our study [6]. Another study in a rural community of Kannur district of Kerala, the prevalence of hypertension among people above 25 years was 18.5% and it is lesser than compared to our study. This difference could be because of small sample size of only 151 participants, in a Kannur study. However, in this study as the age advances prevalence of hypertension also increases with age [7]. Thus, finding of this study resembles the finding of our study to conclude age as a risk factor for hypertension.

Out of 100 individuals of rural area of Vencode in Kerala the prevalence of hypertension was 44% [8] and this study was conducted among 423 participants in Thrissur district, prevalence of hypertension was 43.4% [9]. which is also lesser than the prevalence reported in our study, but higher than prevalence quoted by other states.

In a Thrissur study, among the hypertensives, 98 (53.6%) were previously diagnosed cases of hypertension while 85 (46.4%) were new cases detected in this study. These findings are concordant with our study. In our study we found that 55% were already diagnosed and 45% newly diagnosed during the study.

The prevalence of hypertension was 14.1% among 1005 population of Delhi [10]. In this study 42.6% of subjects who were known hypertensives were taking antihypertensive medications. In our study 86% of known hypertensives were taking anti- hypertensive drugs. This is due to comparatively better education and living standard among the people of Kerala. Also, people are having a better awareness.

According to a study in a rural area of Karnataka among 300 participants prevalence was only 18% which was very less compared to our study. It may be because of majority of them are involved in some kind of physical activities, healthy diet. However, the proportion of hypertension was more among males, people aged >45 years and illiterates [11].

A large study conducted among 1500 participants in Andhra Pradesh (2018), the prevalence of hypertension and pre-hypertension in the age group of 18-65 years was reported to be 27.7% and 24.3% respectively. The prevalence of hypertension was significantly higher with increasing age, BMI, positive family history and low physical activity [12].

In a study conducted at Northeast India out of 1348 people in village, prevalence was 32.3% [13]. Which is lesser than that of our study due to better health care facilities, screening programme, lifestyle, dietary habits, appropriate drug intake.

In a study conducted at Central Maharashtra though the study population was very large (2196 participants), the prevalence was very low. Overall prevalence of hypertension was found to be 12.75% and it increased significantly with the age. Sex-wise prevalence was slightly higher in males i.e.13.10% compared to females (12.52%) and it also increased in both sexes with age [14]. Prevalence of high BP was higher among old people, urban areas, cigarette smokers and obese people similar to that of our study.

As large population-based District Level Household & Facility Survey (DLHS-4), done in year 2012- 13, the overall prevalence of hypertension was 25% in Maharashtra, and a huge variation in the prevalence of hypertension was found across the districts [14].

According to a study of a rural population of West Bengal, among 27,589 adult individuals (13 994 males and 13 595 females), aged  $\geq 18$  years. The prevalence of hypertension was found to be 12.5% among men and 11.3% among women. The reported prevalence is very low compared to our study. In this study, over 39% of the men and 25% of the women were pre-hypertensives.

As per National Family Health Survey (NFHS) -4, the prevalence of hypertension sharply rises with age in the state of Kerala. It is about 25.2% and 23.1% in the 45-49 age group of men and women respectively [15]. But it is 23% and 27% in overall India in the same age group of men and women respectively. However, in our study, the overall prevalence of hypertension is higher among men (58.6) than women (52%), though the study is from Kerala.

As per National Family Health Survey (NFHS) -4 (2015-2016) report based on blood pressure measurement during the survey, 11 percent of women age 15-49 have hypertension, almost one-third (30%) of women in India, are pre-hypertensive. One percent of women are currently taking antihypertensive medicine and have their blood pressure in the normal range. In our study, the prevalence of hypertension is 52% among the women, almost 4 times of the prevalence of hypertension in NFHS-4 (Community Based Survey). These, differences are due to difference in variation in age groups involved in these studies.

Gender differences and higher prevalence in older age group were key findings in NFHS 4 India report. For both women and men, the prevalence of hypertension increases sharply with age. This increase is for all categories of hypertension, including pre-hypertension, for both women and men.

About one-fourth of women and men age 40-49 have hypertension. Even at an earlier age, one in eight women and more than one in five men age 30- 39 have hypertension.

There is a consistent and steep increase in the prevalence of hypertension with increases in body mass index (BMI) for both women and men. Twenty-nine percent of obese women and 38 percent of obese men are hypertensive. The prevalence of hypertension among women age 15-49 ranges from 8 percent in Bihar to 18 percent in Sikkim [16].

According to a study in China prevalence of hypertension was just 18.01% this is very low compared to our study prevalence of 54% [17]. This difference could also be because of difference in the sample size, of the study. The Chinese study was conducted among 1009 participants in our study only 278 participants. In our study, majority were in older age group. In Chinese study, mean age of participant was 35 years.

When we compared the prevalence of our study with other studies in Kerala, other states and national prevalence, this is huge difference in the prevalence of hypertension. However, these differences are due to different study population, different cut-off marks in determining the level of hypertension and also differing age.

### Limitations

The study, gives information on the hypertension. However, it has certain limitations. The study design was cross sectional, thus limits our ability for drawing causal inferences. There was no follow up with the study participants. Blood pressure was measured only on one day. Two reading were taken 5 minutes apart. Many of the participants were women, the accurate data of the males were not obtained. Men were at their workplace during the day time, when the data collection was done. Chronically ill and bed ridden patients were excluded from the study. We did not collect any information on amount of consumption of salt per day, physical activity, exercise, yoga and meditation done by the participants. Lack of specific data on stress levels is a major limitation of the study.

### Conclusions

In our study, the prevalence of hypertension was high compared to all large surveys done in India. In our study, age, diet, smoking, diabetes and family history of hypertension were found significant risk factor for hypertension in univariate analysis. Even the known cases of hypertension have poor control of blood pressure. A minor fraction was found to be treated without medicines that are life style modifications. This means that NCD control programme should focus on correct treatment and control of hypertension in rural areas. Health education is the key intervention required in this population. Even the rural population needs to change lifestyle (avoid sedentary lifestyle). The counselling on adherence to antihypertensive medication, frequent blood pressure check-ups for individuals with prehypertension should be provided by ASHA workers in the community. Community based longitudinal studies will provide further exploration of the risk factors for hypertension.

### Recommendations

Screening, all adults above the age of 30 years at the regular interval will help to detect the cases of hypertension and

pre- hypertension at the earlier age / stage i.e better implementation of national program to control diabetes, cardiovascular diseases. Majority of the known cases of hypertension need consultation with specialist i.e physician for correct doses and combination of antihypertensive drugs to control the blood pressure. In our study many, participants with diabetes are also having hypertensive, indicating the modification in the lifestyle to control both diabetes and hypertension in the study populations. The diet modifications e.g. to cut down on salt intake and reduce intake of fried food, cut down on fat and sugar will go long way to control NCD in given population. This should be the part of routine health education. Reduction in consumption of alcohol and stop smoking tobacco can reduce the blood pressure. The health education is also required for lifestyle changes, diet modifications and to regularly take medication, must go for frequent blood pressure check-ups (for known cases of hypertension) and prehypertension cases. Further community-based studies should be carried out to assess the other risk factors e.g diet and physical inactivity among study participants to better understand high prevalence of hypertension.

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