



PREVALENCE AND RISK FACTORS OF 'UNCONTROLLED HYPERTENSION' IN THE URBAN POPULATION OF KERALA

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ABSTRACT

Introduction: Hypertension is leading risk factor for cardiovascular diseases and stroke, and leads to 12.8% of all deaths in the world. Uncontrolled hypertension doubles the risk of cardiovascular disease among the adults with hypertension.

Globally 65% of the treated hypertensives have uncontrolled hypertension and in Kerala about three fourth of the treated hypertensives have poor blood pressure control. The burden of uncontrolled hypertension is suggestive of the preventable deaths and cardiovascular events.

Methods: A community based cross-sectional study was conducted among the residents of Kochi Corporation of Kerala aged 18 years and above. Sample size was calculated to be 550 using the prevalence of uncontrolled hypertension of 14.9%, 95% confidence and 20% allowable error. Since cluster sampling method was adopted in this study, sample size was multiplied by design effect which was calculated to be 2 and by adding 10% non-response rate, the final sample size was 1210. Clusters were selected using Probability Proportionate to Size (PPS) technique and 30 divisions out of 74 divisions in Cochin Corporation were selected. House to house visit was conducted using a semi-structured questionnaire till 40 houses from each cluster were visited.

Results: The prevalence of uncontrolled hypertension was 13.14% among the study population. Majority of the uncontrolled hypertensives were females (67.3%) and belonged to the age group 45 years and above (92.5%). The independent predictive factors of uncontrolled hypertension in the study population were extra salt intake (aOR 3.62;95%CI 1.36-9.66), not smoking (aOR 6.44;95%CI 1.94-21.42), health education by a doctor (aOR 3.58;95%CI 1.48-8.64), being on single antihypertensive drug (aOR 25.94;95%CI 2.67-251.26), poor adherence to medication (aOR 4.45;95%CI 1.23-16.03) and patients having no other comorbidity (aOR 3.24;95%CI 1.36-7.72).

Conclusion: The burden of uncontrolled hypertension was high in this urban setting. A comprehensive measure involving doctors and healthcare workers have to be adopted to achieve optimum blood pressure among the hypertensives.

KEYWORDS : Uncontrolled hypertension, Complications of Hypertension, Adherence to medication, Cardiovascular diseases, Kerala

INTRODUCTION

Hypertension is the leading risk factor of cardiovascular diseases and stroke, and leads to 12.8% of all deaths in the world.¹ Hypertension is an important public-health challenge worldwide affecting more than a quarter of the world's adult population. According to the WHO, currently around 37% of the population residing in the South East Asian Region is hypertensive. Overall prevalence of hypertension in India, among the age group 15 – 64 years, is around 35.2% with a higher prevalence among the male gender.^{2,3} Studies in Kerala have reported above 30% prevalence of elevated blood pressure with a higher prevalence reported among the urban residents.^{4,5,6}

Uncontrolled hypertension among adults with hypertension doubles the risk of cardiovascular diseases. Studies have reported that, adequate hypertension treatment and control can reduce the incidence of first and recurrent heart attacks and strokes, heart failure, and chronic kidney disease, and can save lives.⁷ Worldwide, more than 7 million deaths can be prevented annually by adequate blood pressure control. About 50% of the treated hypertensive individuals, in India, have uncontrolled hypertension.⁸

Globally around 65% of the treated hypertensive individuals have uncontrolled hypertension. The prevalence of uncontrolled hypertension among the treated hypertensive population in the developed and developing countries are 64.2% and 68.2% respectively.⁹ In India, national data on uncontrolled hypertension is not available, multiple studies conducted in the north (10.5%), south (8%), east (18.1%) and west (13.6%) reported sub optimal blood pressure control.^{9,10} In Kerala, only a quarter of the treated hypertensive patients have controlled hypertension.¹¹ There is difference in prevalence of uncontrolled hypertension between the states and within the states in India due to the diverse profile of socioeconomic growth, demographic change, health care policies and life style practices.

The burden of uncontrolled hypertension is suggestive of the preventable deaths and cardiovascular events. As there is a gap in knowledge regarding the burden and factors leading to poor control of blood pressure, we conducted this study aimed at finding the

magnitude of uncontrolled hypertension and to study the factors associated with it.

MATERIAL AND METHODS

Study Design and Sample: This cross sectional community based study was conducted in Kochi Corporation in the southernmost part of India, Kerala. Kochi Corporation has 74 divisions with a population of 6,01,574 with a female to male sex ratio of 1027 and average literacy rate of 97.36%. The study was conducted during September 2014 to September 2016. The study population included adults aged 18 years and above, who were residents of Kochi Corporation. Patients with severe conditions and pregnant women were excluded from the study.

The sample size was calculated with a prevalence of 14.9% reported in an urban population in Trivandrum. The sample size was estimated to be 550 with 95% confidence and 20% allowable error using the formula $(Z\alpha)^2 pq/d^2$.⁵ Since the study adopted cluster sampling, the obtained sample was multiplied by design effect. Assuming an Intra cluster correlation (ICC) of 0.02 and cluster size of 40 the design effect is calculated to be 2. We assumed a non-response rate of 10% and calculated the final sample size as 1210. Using probability proportional to size technique, 30 divisions out of the 74 divisions in Kochi Corporation was selected and 40 houses from each cluster were visited.

Each house was visited starting from the centre point of every cluster. At the centre point, one of the direction to which houses were visited was selected by lottery method. From the first house, every house on the same side was visited. From the end of every side or row of houses visited the first right direction was chosen to continue data collection. Those houses found locked at the time of the visit were excluded after revisiting on three consecutive days and the next house was chosen for data collection. One of the adult members of every house was randomly selected using lottery method as study participants.

Data collection and measurements:

After obtaining informed consent, a pre-tested semi structured questionnaire obtained from WHO STEPS, IDSP Kerala Survey 2007

and Four items Morisky Medication Adherence Scale, was administered to the person directly or through an informant, the head of the family by the Principle Investigator, who is a trained medical professional.

Four items Morisky Medication Adherence Scale has reported sensitivity of 88% and specificity of 44% in measuring the adherence to antihypertensive medication. This scale consists of four questions with each question weighing one mark.

BP was measured in the sitting position, after a resting period of 5 minutes, with the feet on the floor and arm supported at the heart level using a calibrated mercury sphygmomanometer. If the subjects had caffeine, smoking or exercise, BP was measured after 30 minutes. Systolic BP was the point at which the first of two or more Korotkoff sound was heard, and the disappearance of Korotkoff sound was used to define diastolic BP. Two other BP measurements were taken on each participant within 30 minutes and the mean value of the recorded BP was considered as the BP of the participant.

Anthropometric factors such as height of the eligible individual participant were taken in centimeter by using Constant tension tape and weight was measured in kilogram using a portable analogue weighing scale.

Socio Economic Status was assessed using Kuppuswamy classification for 2014 and Demographic factors such as Age, Sex, Occupation, Education and Marital Status was recorded. Behavioural factors such smoking, alcohol intake, physical activity and dietary factors were collected using STEPS Questions.

According to Joint National Committee Report,

- **Hypertension** is defined as a systolic BP of at least 140mmHg and/or diastolic BP of at least 90mmHg and/or self-reported current use of BP lowering medication.
- **Known case of hypertension or known hypertensive** is defined as a self-reported prior diagnosis of hypertension by a doctor or nurse.
- **Treated hypertension** is defined as self-reported current use of antihypertensive medication.
- **Uncontrolled hypertension** is defined as having systolic BP of more than equal to 140mmHg and/or diastolic BP more than equal to 90mmHg, in the context of taking pharmacological treatment.

Statistical analysis:

The values obtained were tabulated on a Microsoft excel sheet and the analysis was done on Statistical Package for Social Sciences software version 20. Percentage prevalence rate of hypertension, treated hypertension and uncontrolled hypertension was calculated. To test the statistical significance between various factors and uncontrolled hypertension, Chi square test was done. Logistic regression analysis was done for finding the independent risk factors of uncontrolled hypertension.

Ethical approval:

Written informed consent printed in Malayalam or English was obtained from the respondents prior to the interview. The study was ethically approved by Institutional Ethical Committee.

RESULTS

A total of 1210 adults belonging to the age group 18 years and above were included in this study. Around equal number of participants were there in the age group below and above 45 years with a higher proportion being females (57.44%). Majority (77.76%) of the participants were married at the time of the study.

Figure 1 shows the prevalence of hypertension among the participants. The overall prevalence of hypertension was 40.8% (95%CI 39.4-42.2) among which the prevalence of uncontrolled hypertension among the participants was 13.14% (95% CI 12.2-14.1). About 1% (12) of the participants aged 60 and above did not qualify as uncontrolled hypertensive under JNC VIII. A notable proportion (22%) of the individuals was not aware of their hypertension.

Majority of the hypertensive participants in this study had a stage I systolic (62.8%) and diastolic (35%) hypertension. Among the study participants with uncontrolled hypertension a higher proportion of them had stage II systolic (51.6%) and diastolic (34.6%) hypertension. Figure 2 shows the age and sex wise distribution of uncontrolled

hypertension. The prevalence of uncontrolled hypertension among the males and females was higher after 45 years and it further peaked after 60 years of age. The rise in prevalence was markedly higher among females compared to males.

Table 1 shows the association of socio-demographic and economic factors with uncontrolled hypertension. A significantly higher proportion of the individuals were females (OR 1.8;95%CI 1.03-3.25) and were married (OR 1.8;95%CI 1.0-3.5) as compared to males and those staying alone respectively.

The illiterates (OR 4.6;95%CI 0.93-23.37) were more at risk of developing uncontrolled hypertension as compared to those who were literates. The non-working group, consisting of housewives, unemployed and retired individuals, showed significantly higher proportion of (OR 2.27;95%CI 1.24-4.17) uncontrolled hypertension as compared with the working group.

Table 2 shows the association of uncontrolled hypertension with dietary factors, physical activity, alcohol consumption and smoking. A high proportion (81.5%) of individuals with uncontrolled hypertension had habit of intake of additional salt while eating and the difference was found to be statistically significant (OR 2.41; 95%CI 1.19-4.88). About 78% of them were moderately active, that causes small increases in breathing or heart rate such as brisk walking or carrying light loads (<20kg loads) for at least 10minutes continuously. Nearly (91.1%) all those who did moderate physical activity did it for more than 3 days a week. About half (57.9%) of the study population, with uncontrolled hypertension, used to go for walk or cycling regularly. The risk of Uncontrolled hypertension was found to be more among the non-smokers (OR 2.27;95%CI 1.06-4.87) as compared to those who ever smoked..

Table 3 shows the association of health seeking behavior, medication, health education, family history and adherence to medication. Hypertensive patients on monotherapy with Angiotensin receptor blocker (OR 3.68;95%CI 1.21-11.19) was found to be a significant risk factor for uncontrolled hypertension. Being educated by doctor alone about uncontrolled hypertension was found to be a risk factor as compared to educated by any other health care staffs(also included doctor and other healthcare staff teams)(OR 2.6;95%CI 1.37-4.92). A significantly higher proportion of uncontrolled hypertensive patients had (81.4%) poor adherence to antihypertensive medication (OR 2.18;95%CI 0.95-4.99).

Using backward conditional method, logistic regression was done after adjusting for all possible confounders, such as age, BMI, socioeconomic status and physical activity, in this study. All variables with a p value less than 0.2 were considered for the logistic regression model. The final model had 13 variables of which additional salt intake (aOR 3.62;95%CI 1.36-9.66),health education by a doctor (aOR 3.58;95%CI 1.48-8.64), on monotherapy (aOR 25.94;95%CI 2.67-251.26), poor adherence to medication (aOR 4.45;95%CI 1.23-16.03) and patients having no other comorbidity (aOR 3.24;95%CI 1.36-7.72) were found to be the independent predictors of uncontrolled hypertension. Table.4 shows the multivariate analysis for finding independent predictors of uncontrolled hypertension.

DISCUSSION

The prevalence of uncontrolled hypertension among the adult population aged 18 years and above residing in Kochi Corporation was found to be 13.14%. Similar prevalence of uncontrolled hypertension was reported by studies conducted in Kerala;14.9% in a study conducted by Vimala et al and 10.8% by Zachariah et al.⁵ In a nationwide study conducted in India among 35- 70 years old women, estimated prevalence rate was 11%, while Prince MJ et al reported a prevalence rate of 12% in urban India.^{12,13} Similarly, a study conducted in an urban setting in Srilanka showed 13% prevalence rate.¹⁴ However, prevalence was low in a study conducted in Chennai in which only 2.51% had uncontrolled hypertension.¹⁵ The difference of rate may be attributed to the difference in methodology adopted in each study, as well as other factors like socio-cultural factors, healthcare facility in the community, awareness among the study population etc.

Predictive factors of uncontrolled hypertension

The present study reported a significant association of uncontrolled hypertension and adding extra salt to food (aOR 3.62;95%CI 1.36-9.66). Studies conducted in China also reported high salt intake among the population with uncontrolled hypertension.¹⁶ Excessive salt intake

and consequently, water retention by the kidneys leads to hypertension in an apparently normovolemic individual. Taking anti-hypertensive medication was found to be protective against uncontrolled hypertension. Individuals on single anti-hypertensive medication showed significantly high risk of uncontrolled hypertension (aOR 25.96; 95% CI 2.67-251.26). Correspondingly, a study conducted in Nepal reported two important factors that lead to upright hypertension control. One was the use of more than one antihypertensive medication and the second one was good adherence to medication.¹⁷

According to the present study, educating about the ill effects of uncontrolled hypertension and the importance of control of hypertension by a doctor alone was a significant predictor for poor blood pressure control (aOR 3.58; 95% CI 1.48-8.64). This significant observation may be pointing towards the inadequacy in time spent with each patient during consultation in view of high patient load. Similarly, a study conducted by Surya et al in Nepal reported high proportion of individuals with uncontrolled hypertension have had no advice from the healthcare provider.¹⁷ A study conducted by Berlowitz et al reported that spending more time with patients was a significant factor for effective management of blood pressure.¹⁸

This study found that patients having no other comorbidities were significantly at more risk of uncontrolled hypertension as compared to those with one or more comorbidities (aOR 3.24; 95% CI 1.36-7.72). Whereas a study conducted by Hathiail et al reported high blood pressure among individuals with other comorbidities.¹⁹ This unforeseen correlation may be because, uncontrolled hypertension is rarely symptomatic and such patients with no other comorbidities tends to have poor follow up and health seeking behavior leading to poor blood pressure control. Poor adherence to antihypertensive medication was found to be a significant predictive factor for uncontrolled hypertension in the present study (aOR 4.45; 95% CI 1.23-16.03). Similarly, a study conducted in Jodhpur reported noncompliance to medication as a predictive factor of uncontrolled hypertension.²⁰ Other studies conducted in other parts of the world by Li YT et al and Sandhu A et al showed significant association between poor adherence to anti-hypertensive medication and uncontrolled hypertension.^{21,22}

Other important risk factors of uncontrolled hypertension

Some of the potential risk factors such as gender, education, occupation, physical activity and intake of fruits and vegetables were not significant in the regression model. This was primarily due to the small sample size which was calculated only to determine the prevalence of uncontrolled hypertension.

The prevalence of uncontrolled hypertension was significantly high among females (OR 1.8; 95% CI 1.03-3.25). Similarly a study conducted in Kollam reported significantly higher risk of uncontrolled hypertension among females (OR 2.17; 95% CI 1.10-4.29).²³ High prevalence of uncontrolled hypertension was reported among females in studies conducted by Gupta R et al.¹² This disparity in incidence among the gender may be because females are prone for hypertension after they attain menopause as premenopausal women are protected by natural estrogens and progesterone. Data from National Health and Nutrition Examination Survey shows that women are less likely to achieve blood pressure control compared to men. Life style modifications have shown little effect on blood pressure control in women which may be because it is more difficult to obtain weight reduction among post-menopausal women.²⁵

In this study, being illiterate was found to be a significant risk factor for uncontrolled hypertension (OR 4.6; 95% CI 0.93-23.37). In a study conducted by Surya et al in Srilanka and Sadegi et al in Iran, showed similar results with higher proportion of uncontrolled hypertensive individuals having primary and lower education.^{17,27} Uncontrolled hypertension was associated with unemployment in this study (OR 2.27; 95% CI 1.24-4.17) and was found to be statistically significant. The high expenses attached to regular treatment and follow-up of hypertension may lead to heavy out of pocket expenditure for the unemployed individuals. This may result in discontinuation of medication and less frequent visit to the doctor. Similarly, a study conducted in Nepal reported that higher proportion of unemployed individuals had uncontrolled hypertension.¹⁷

The risk of uncontrolled hypertension was found to be 2.27(1.06-4.87) among the non-smokers as compared to the smokers. This unanticipated finding in this community based study may be because, smokers who have uncontrolled hypertension have the highest risk of mortality or getting hospitalized at the time of data collection. In this study, majority of the uncontrolled (73%) and controlled hypertensive (80%) individuals were involved in moderate level physical activity. Whereas, studies conducted in Nepal and China reported majority of uncontrolled hypertensives leading sedentary life style.^{16,17} The association between decreased physical activity and uncontrolled hypertension was also reported by E Degli et al and Ahmed N et al in Italy and Abbottabad respectively.^{28,29}

According to the National Institute of Nutrition (NIN), the recommended daily allowance of fruits and vegetables for Indians is 1 serving of 100grams and 3 servings of 100 grams respectively. Potassium, fibers and antioxidants present in fruits and vegetables provides protection from developing hypertension. This study found that a major part of the study population with uncontrolled hypertension had inadequate intake of fruits (97%) and vegetables (86%). These findings were similar to the studies conducted in West indies which showed a lesser intake of fruits and vegetables among uncontrolled hypertensive.³⁰ Therefore policy makers should plan to create awareness about the benefits of consuming fruits and vegetables. Fruits like banana, grapes, papaya and water melon can be made available for those who can't buy expensive fruits.

Limitations:

Blood pressure of all the study participants was recorded three times on the same day of visit. As the sample size for this study was calculated to find the prevalence of uncontrolled hypertension, some of the risk factors were not found significant.

Recommendations:

Based on the knowledge gained from this study it is recommended that it would be upright to launch a comprehensive program involving health care professionals including health workers and the general public with the aim of providing awareness to the patients about the ill effects of uncontrolled hypertension, diet with less salt and importance of compliance to therapy once diagnosed as hypertensive. Taking medications regularly as prescribed by the doctor and going for regular check-ups is very important for achieving blood pressure control. Doctors must also regularly ensure patient's knowledge regarding blood pressure control and medications. In our country it is important that we keep the cost of medicines sufficiently low in order that patients have minimum out of pocket expenditure.

CONCLUSION

The prevalence of uncontrolled hypertension in this study conducted among the adult population aged 18 years and above residing in Kochi Corporation was 13.14%. The mean age of the study population with uncontrolled hypertension was 62.43 ± 11.33 years. Majority of them were females (67.3%), married at the time of study (62.3%), unemployed (77.4%), obese (47.2%) and belonged to lower middle class families (47.8%). Habit of intake of extra salt (aOR 3.62), getting health education by doctor alone (aOR 3.58), being on antihypertensive monotherapy (aOR 25.94), poor adherence to medication (aOR 4.45) and patient having no other comorbidity (aOR 3.24) were independent risk factors of uncontrolled hypertension.

Table 1. Association of socio-demographic and economic factors with uncontrolled and controlled hypertension

Variables	Treated Hypertension (n=229)		OR(95%CI)#
	Uncontrolled (n=159)	Controlled (n=70)	
AGE			
<50 years	20 (58.8%)	14 (41.2)	1
>51 years	139 (71.3%)	56 (28.7%)	1.73 (0.821-3.67)
SEX			
Female	107(74.3%)	37(25.7%)	1.8 (1.03-3.25)
Male	52(61.2%)	33(38.8%)	1
Marriage			
Staying with spouse	60(77.9%)	17(22.1%)	1.8(1.0-3.5)
Without spouse	99(65.1%)	53(34.9%)	1

Religion			
Hindu	58(65.2%)	31(34.8%)	1
Christian	63(72.4%)	24(27.6%)	1.40(0.73-2.6)
Muslim	38(71.7%)	15(28.3%)	1.35(0.64-2.83)
Education			
Graduates & Professionals	24(63.2%)	14(36.8%)	1
+2 & 10	55(65.5%)	29(34.5%)	1.10(0.49-2.45)
Secondary & Primary	64(71.9%)	25(28.1%)	1.5(0.66-3.34)
Illiterate	16(88.9%)	2(11.1%)	4.6(0.93-23.37)
Occupation			
Working	36(56.3%)	28(43.8%)	1
Not working	123(74.5%)	42(25.5%)	2.27(1.24-4.17)
SES			
Upper	5(71.4%)	2(28.6%)	1.18(0.21-6.39)
Upper middle	49(73.1%)	18(26.9%)	1.28(0.65-2.52)
Lower middle	76(67.9%)	36(32.1%)	1
Upper lower & lower	29(67.4%)	14(32.6%)	1(0.46-2.07)

*p value <0.05 is significant #Odds ratio with 95% Confidence Interval

Table 2. Association of dietary factors, Physical activity, alcohol consumption and smoking with uncontrolled and controlled hypertension

Variables	Treated Hypertension (n=229)		OR(95%CI)#
	Uncontrolled (n=159)	Controlled (n=70)	
No of days of intake of fruits/week			
0 days	25(80.6%)	6(19.4%)	1.29(0.44-3.79)
1-4 days	89(64%)	50(36%)	0.55(0.27-1.10)
>4 days	45(76.3%)	14(23.7%)	1
No of servings of fruit taken per day (n=198)#			
>3 servings	4(80%)	1(20%)	1
1-3	130(67.4%)	63(32.6%)	0.51(0.05-4.71)
No of days of intake of vegetables/week			
≤3 days	36(78.3%)	10(21.7%)	1.75(0.81-3.77)
>3 days	123(67.2%)	60(32.8%)	1
No of servings of vegetables taken per day			
<5	137(69.2%)	61(30.8%)	0.92(0.40-2.11)
≥5	022(71%)	09 (29.0%)	1
Intake of extra salt			
Yes	53(81.5%)	12(18.5%)	2.41(1.19-4.88)
No	106(64.6%)	58(35.4%)	1
Physical Activity			
Vigorous	10(76.9%)	3(23.1%)	1.6(0.42-6.07)
Moderate	116(67.4%)	56(32.6%)	1
No Physical Activity	33(75%)	11(25%)	1.44(0.68-3.07))
Walking/cycling			
Yes	93(68.4%)	43(31.6%)	1
No	66(71%)	27(29%)	1.13(0.63-2.00)
BMI			
Underweight	7(58.3%)	5(41.7%)	0.50 (0.14-1.80)
Normal	50(73.5%)	18(26.5%)	1
Overweight	27(61.4%)	17(38.6%)	0.57(0.25-1.28)
Obese	75(71.4%)	30(28.6%)	0.90(0.45-1.78)
No of people who drinks alcohol			
Yes	21(61.8%)	13(38.2%)	0.66(0.31-1.42)
No	138(70.8%)	57(29.2%)	1
No of people ever smoked			
Yes	17(53.1%)	15(46.9%)	1
No	142(72.1%)	55(27.9%)	2.27(1.06-4.87)

*p value <0.05 is significant #Odds ratio with 95% Confidence Interval # Servings of fruit is not analysed for those who don't eat fruits.

Table 3. Association of health seeking behavior, medication, health education, family history and adherence to medication with uncontrolled hypertension (n=229)

Variables	Treated Hypertension (n=229)		OR(95%CI)#
	Uncontrolled (n=159)	Controlled (n=70)	
System of medicine utilized for treatment			
Modern medicine	64(30.0%)	149(70.0%)	1
Homeopathy and Ayurveda	6(37.5%)	10(62.5%)	1.39(0.48-4.00)
Type of medicine (n=213)**			
CCB	70(68%)	33(32%)	1.72(0.77-3.82)
B Blocker	32(76.2%)	10(23.8%)	1.36(0.95-6.73)
ARB	28(82.4%)	06(17.6%)	3.68(1.21-11.19)
Combination	19(55.9%)	15(44.1%)	1
Frequency of regular follow up(n=216)#			
Monthly	47(73.4%)	17(26.6%)	1.74(0.88-3.43)
3 months	65(61.3%)	41(38.7%)	1
≥6 months	38(82.6%)	8(17.4%)	3.00(1.27-7.05)
Education by Healthcare personnel (n=205)##			
Doctor alone	110(74.3%)	38(25.7%)	2.6(1.37-4.92)
Not doctor	30(52.6%)	27(47.4%)	1
Relatives with hypertension			
yes	98(66.2%)	50(33.8%)	1
no	61(75.3%)	20(24.7%)	1.55(0.84-2.86)
Knowledge about effects of uncontrolled hypertension			
Poor knowledge	132(69.8%)	57(30.2%)	1.11(0.53-2.31)
Good knowledge	27(67.5%)	13(32.5%)	1
No of people who discontinued treatment			
Yes	34(79.1%)	9(20.9%)	1.84(0.83-4.08)
No	125(67.2%)	61(32.8%)	1
Adherence to medication			
Poor adherence	35(81.4%)	8(18.6%)	2.18(0.95-4.99)
Good adherence	124(66.7%)	62(33.3%)	1
Presence of Other comorbidity			
yes	72(64.9%)	39(35.1%)	1.52(0.86-2.676)
No	87(73.7%)	31(26.3%)	1

*p value <0.05 is significant #Odds ratio with 95% Confidence Interval **only those who depend on modern medicine was analysed #only those who regularly went for follow up was analysed. ##only those who received health education was analysed.

Table 4. Multivariate logistic regression analysis for independent predictors of uncontrolled hypertension

Sl no	Variable	Adjusted OR**	95% CI	P-Value
1	Extra Salt intake			
	Yes	3.62	1.36-9.66	0.01
	No	1		
2	Education by Health professional(N=205)			
	Doctor	3.58	1.48-8.64	0.005
	Not doctor	1		
3	Type of medicine			
	Single medication	25.94	2.67- 251.26	0.00
	Combination	1		

4	Adherence to medication Poor Good	4.45 1	1.23-16.03	0.02
5	Presence of any other comorbidity Yes No	1 3.24	1.36-7.72	0.008

*p value <0.05 is significant

**OR – Odds Ratio

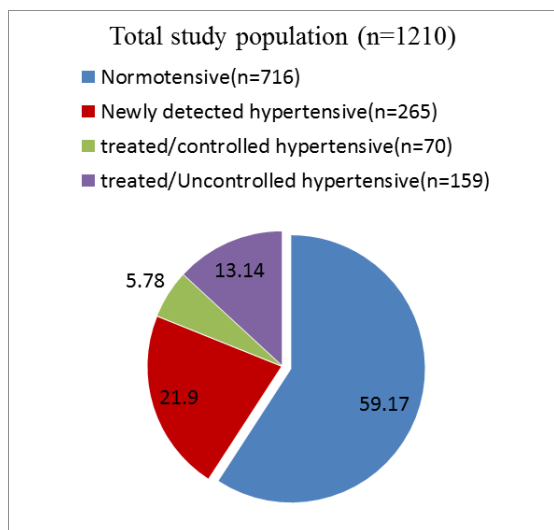


Fig 1. Pie chart showing the distribution of hypertension in the study population (n=1210)

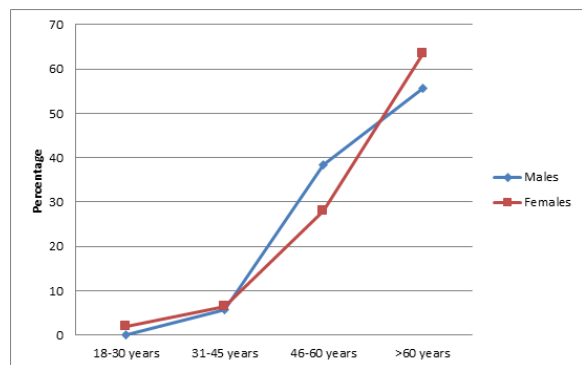


Fig 2. Age and gender wise distribution of uncontrolled hypertension (n= 159)

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