Original Article

Prevalence and predictors of prehypertension and hypertension in adult population of rural Southern India—An epidemiological study

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Abstract

Introduction: Hypertension is considered as one of the major health problem worldwide and the most important risk factor for non-communicable diseases. **Aims:** To estimate the prevalence and the risk factors of prehypertension and hypertension. **Methods and Material:** A community-based cross-sectional study was conducted among adult population of rural area of Chittoor District. WHO STEPS was applied for data collection from 1,742 study participants aged 18 years and above. Chi-square test, Fisher exact, and ANOVA test applied to find out the intragroup and intergroup variable association with raised blood pressure. **Results:** The overall prevalence of hypertension and prehypertension in our study was 21.5% [95% CI: (19.6–23.5)] and 42.8% [95% CI: (39.5–46.3)], respectively. Males had higher prevalence when compared to females. The mean systolic and diastolic blood pressure was 118.7 ± 17.6 mmHg and 77.1 ± 9.7 mmHg, respectively. The odds of being hypertensive was higher among older age group (OR: 3.83), male study participants (OR: 1.83), either widowed or separated (OR: 2.03), unemployed (OR: 1.51), and those who belonged to upper socioeconomic status (OR: 2.01). Those who were overweight (OR: 3.15), obese (OR: 2.55) and having central obesity (OR: 1.74), and also tobacco smokers (OR: 1.53) were having higher odds of hypertension. Significant association was found between hypertension and age, gender, marital status, body mass index, abdominal obesity, tobacco smoking, and physical inactivity.
Conclusion: The prevalence of prehypertension and hypertension in this study was found to be high in rural area of Andhra Pradesh. There is a need to develop a community-based program, which would aim at minimizing the risk factors of hypertension.

Keywords: Hypertension, India, predictors, prehypertension, rural

Introduction

Hypertension is considered as one of the major health problem worldwide which has significant burden on healthcare system in India.[1–5] There has been an upward trend in prevalence of hypertension because of epidemiological shift.[6-10] High blood pressure constitutes around 12.8% of annual global deaths and the number of adults suffering from hypertension would increase to 1.56 billion as per the predictions.[11,12]

Uncontrolled hypertension will lead to cardiovascular complications such as myocardial infarction, heart failure, peripheral arterial diseases, and aortic aneurysm. It may lead to chronic renal failure, end stage kidney diseases, etc.,

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and cerebrovascular accidents such as stroke. Most of these complications will occur without obvious signs and symptoms. Hence this disease, hypertension is called as "silent killer."[13,14]

Each year around 41 million deaths occur because of non-communicable diseases (NCD) which is equivalent to 71% of deaths globally. Eighty five percent of NCD deaths occurred in low and middle income countries. The leading causes of NCD death in 2019 were cardiovascular diseases [17.9 million deaths or 43% of NCD deaths; cancers (9 million or 21%of NCD deaths] and diabetes.[15] Of these, complications of hypertension account for 9.4 million deaths worldwide every year. Hypertension is responsible for at least 45% of deaths because of heart disease and 51% of deaths because of stroke.[16]

India is facing a huge challenge of increasing burden of NCDs because of rapid epidemiological transition despite of more than two-thirds of population living in rural areas.[17] Almost 10% of all deaths and 4.6% of all disability-adjusted life years in India can be attributed to hypertension.[18]

Hypertension is an iceberg disease and in most of the rural areas data on prevalence of prehypertension and hypertension is lacking. Lack of data may lead to underestimation of this important health problem in rural areas. As very few studies have been conducted in rural areas of Andhra Pradesh of Southern India, hence this study was undertaken to estimate the prevalence and risk factors of pre hypertension and hypertension in rural area of Andhra Pradesh of Southern India.

Materials and Methods

The present study was carried out in VKota mandal of Chittoor district, Andhra Pradesh which is at the junction of three southern Indian states during November 2018 to September 2109 which has a population of 88,321 as per Census 2011 report.[19] Sample size was estimated by applying Cochrane WG formula for cross-sectional study designs $n_{0} = z^2pq/e^2$, where n_0 is the sample size, z^2 is the abscissa of the normal curve that cuts off an area α at the tails, e is the desired level of precision, *P* is the estimated proportion of an attribute that is present in the population, and q is 1-p.[20] Considering the prevalence of hypertension as 18% as noted in the study of Yuvraj *et al.*[21] in rural areas of India and 5% precision level, the sample was around 1,440 and addition 20% was considered for non-responsive rates the final sample size was around 1,742.

Multistage sampling technique was applied for sample selection. In the beginning, simple random technique was used to select 10 villages. Households were selected from each selected village based on cumulative household list were further selected by applying systematic random sampling and probability proportional to size. As per the sampling interval every 4th house was considered for the study. One participant from each household aged 18 years and above was selected. Lottery method was applied if more than one person was residing in the house. If the households with inhabitants refused to participate or absence during study period then the next household was selected.

The study was approved by Institutional Ethics Committee. Inclusion criteria was adults aged 18 years and above who were residing in the study area and gave consent to participate. Individuals who were not willing to participate in the study and severely ill patients and pregnant women were excluded from the study. We used semi-structured pretested questionnaire to collect the details regarding sociodemographic factors like age, gender, marital status, socioeconomic status, and occupation. For calculating socioeconomic status, All India Consumer Index for the year 2018 was considered in the modified BG Prasad classification.[22]

Blood pressure measurement

Blood pressure was measured as per the Joint National Committee 8 (JNC 8) guidelines by using automated device (OMRON HEM-7361). Systolic BP level of 140 mmHg or above or diastolic BP level of 90 mmHg or above or past history of diagnosis of hypertension were considered as hypertensives. Those participants whose systolic BP and diastolic BP in the range of 120–139 and 80–89 mmHg, respectively, were considered as prehypertensives.[14] Subjects were considered as having Isolated systolic hypertension when systolic blood pressure ≥140 mmHg and diastolic blood pressure <90 mmHg and isolated diastolic hypertension when systolic blood pressure ≤140 mmHg and diastolic blood pressure ≥90 mmHg.

Anthropometric Measurements: For calculating body mass index (BMI), the following formula was used: BMI = weight (kg)/height (mt)^2 it was categorized as per WHO criteria for Asia Pacific population.[23] BMI <18.5 was classified as "underweight"; 18.5–22.9, "normal range"; 23–24.9, "preobese"; 25–29.9, obese I; ≥30, "obese II". Using WHO prescribed techniques, weight was measured with an accuracy of 0.1 kg by using weighing machine and anthropometry rod was used for measuring height with an accuracy of 0.1 cm. In order to find out abdominal obesity a non-stretchable tape was used for measuring waist circumference at the smallest horizontal girth between the costal margins and the iliac crest at the end of expiration.[24] Hip circumference (in cm) was calculated at the broadest part of the hips by using a non-stretchable tape. Waist-to hip circumference (WHR) was calculated as per the WHO guidelines.[25]

Behavioral factors : Three domains of physical activity such as occupational physical activity, transport-related physical activity, and physical activity during discretionary or leisure time and components like intensity, duration, and frequency were considered as per WHO guidelines and those who were moderate or vigorously active were considered as physically active.[24]

Participants who were currently smoking tobacco in the form of bidis, cigarettes, or hookah were defined as current daily smokers

and those who were consuming smokeless tobacco products such as khaini, gutkha, zarda, etc., were defined as current daily smokeless tobacco users. Study subjects who had reported consuming alcohol in the past 1 year were considered as current alcohol consumers.[24]

Statistical analysis: The data collected was entered in Microsoft Excel and coded for analysis by using SPSS 26.0 version. For continuous variables, mean and standard deviation were calculated and qualitative data were expressed in percentages and frequencies. For categorical data, Chi-square test and Fisher exact test were applied. ANOVA test was applied to find out the intragroup and intergroup variable association with raised blood pressure. In order to identify the risk, factors for hypertension and binary logistic regression was applied in order to identify possible risk factors for hypertension and *P* value less than 0.05 was considered as significant.

Results

A total of 1,742 elderly people were included in the study. Among them, 838 (48.1%) were males and 904 (51.9%) were females. The mean age ((±SD) of the study participants was 41.03 (±16.5) and it was 43.5 (±16.9) and 38.6 (±15.9) years for males and females, respectively. Around 79% of them belonged to Hindu religion and majority of them were married. More than half of them were living in joint and three generation families. Almost one third of the study subjects were illiterates and 17% belonged to upper socioeconomic status. The mean (±SD) BMI of the study participants was 22.7 ± 4.5 kg/m^2 and it was 22.9 ± 4.6 kg/m^2 and 22.5 ± 4.4 kg/m^2 among males and females, respectively. Around 42% of them were either obese or overweight and according to waist circumference measurement one fifth of the subjects were having abdominal obesity [Table 1].

Table 2 shows age and gender wise mean values of systolic and diastolic blood pressure. The mean systolic and diastolic blood pressure was 118.7 ± 17.6 mmHg and 77.1 ± 9.7 mmHg, respectively. The mean systolic and diastolic BP was highest among eldest age group followed by 55–64 years while in females mean BP was highest in diastolic 55–64 years age group. There was a significant association between mean systolic BP and age groups in both male and female subjects and it was similar with respect to mean diastolic BP as well. With regard to prevalence of isolated systolic BP, it was around 4.9% [95%CI: (3.9–9.0)] and for isolated diastolic BP was 3.8% [95%CI: (3.0–4.9)]. Higher proportion of isolated BP was among males (6.3%) when compared to females (3.5%) and similar observation was made with respect to the prevalence of isolated diastolic BP wherein it was 5% and 2.8% among males and females, respectively.

The prevalence of isolated systolic BP was highest in oldest age group among males and second oldest age group among females, whereas the proportion of isolated diastolic BP was highest in second oldest age group among both males and males. There was significant association between age and hypertension status among both genders.

Table 1: Basic sociodemographic characteristics of study participants

Variables	*n* (1742)	Proportion%
Age group (years)		
25-34	549	31.5
35-44	523	30.0
45-54	263	15.1
55-64	216	12.4
≥65	191	11.0
Gender		
Male	838	48.1
Female	904	51.9
Religion		
Hindu	1387	79.6
Christian	3	0.2
Muslim	352	20.2
Education		
Illiterate	604	34.7
Primary	359	20.6
Secondary	653	37.5
Graduate & above	126	7.2
Marital status		
Unmarried	194	11.1
Married	1346	77.3
Others	202	11.6
Occupation		
Professional	36	2.1
Skilled Worker	49	2.8
Semi Skilled	151	8.7
Unskilled	194	11.1
Farmer	529	30.4
Own Business	107	6.1
Unemployed/Housewife	676	38.8
Family type		
Nuclear	734	42.1
Three generation	671	38.5
Joint	337	19.3
Socioeconomic status		
Lower class	615	35.3
Lower middle class	598	34.3
Middle class	235	13.5
Upper middle class	209	12.0
Upper class	85	4.9
BMI (kg/m^2)		
Underweight	290	16.6
Normal	704	40.4
Overweight	502	28.8
Obese	246	14.1
Waist circumference (cm)		
Abdominal Obesity	344	19.7

The overall prevalence of hypertension in our study was 21.5% [95% CI: (19.6–23.5)]. Males had higher prevalence 26.5% [95% CI: (23.5–29.6)] when compared to females 16.8% [95% CI: (14.4–19.4)]. Similar findings were observed with respect to prevalence of prehypertension wherein it was around 42.8% [95% CI: (39.5–46.3)] and 38.4% [95% CI: (35.2–41.6)] among males and females, respectively. There was significant association between age group and hypertension status among both genders [Table 3].

Table 2: Age and gender wise distribution of mean systolic and diastolic blood pressure (mm hg) and prevalence (%) of isolated systolic hypertensive and isolated diastolic hypertensives

Age group (years)	*n* 1742	Systolic BP (mean±SD)			Diastolic BP (mean±SD)		
		Male	Female	Total	Male	Female	Total
25-34	549	113.95±10.44	108.58±12.18	110.91±11.75	77.34±8.14	72.82±8.97	74.78±8.90
35-44	523	119.01±14.87	115.64±14.26	117.16±14.62	78.06±8.56	75.45±9.58	76.63±9.22
45-54	263	121.61±15.42	117.77±15.21	119.49±15.39	78.31±10.18	76.48±8.70	77.30±9.42
55-64	216	128.86±22.78	129.69±21.25	129.21±22.10	80.72±11.09	80.44±10.09	80.60±10.66
≥65	191	133.85±22.60	131.86±20.86	133.12±21.95	82.05±11.01	79.03±9.81	80.94±10.66
Total	1742	121.55±18.01	116.22±16.98	118.79±17.68	78.86±9.61	75.49±9.61	77.11±9.75
Test of significance		*F*=36.25, df=4, *P*=0.001	*F*=56.37, df=4, *P*=0.001	*F*=95.70, df=4, *P*=0.001	*F*=6.68, df=4, *P*=0.001	*F*=15.77, df=4, *P*=0.001	*F*=23.66, df=4, *P*=0.001
Age group (years)	***n* 1742**	**Isolated systolic HTN (*n*=85)**			**Isolated diastolic HTN (*n*=67)**		
		Male	**Female**	**Total**	**Male**	**Female**	**Total**
25-34	549	1 (0.4%)	2 (0.6%)	3 (0.5%)	1 (0.4%)	4 (1.3%)	5 (0.9%)
35-44	523	6 (2.5%)	4 (1.4%)	10 (1.9%)	9 (3.8%)	6 (2.1%)	15 (2.9%)
45-54	263	5 (4.2%)	3 (2.1%)	8 (3.0%)	5 (4.2%)	4 (2.8%)	9 (3.4%)
55-64	216	19 (15.2%)	14 (15.4%)	33 (15.3%)	14 (11.2%)	7 (7.7%)	21 (9.7%)
≥65	191	22 (18.2%)	9 (12.9%)	31 (16.2%)	13 (10.7%)	4 (5.7%)	17 (8.9%)
Total	1742	53 (6.3%)	32 (3.5%)	85 (4.9%)	42 (5.0%)	25 (2.8%)	67 (3.8%)
Test of significance		χ^2=65.9, df=4, *P*=0.001	χ^2=67.6, df=4, *P*=0.001	χ^2=137.3, df=4, *P*=0.000	χ^2=29.8, df=4, *P*=0.001	χ^2=13.5, df=4, *P*=0.009	χ^2=47.6, df=4, *P*=0.001

Table 3: Age and gender wise prevalence of hypertension and prehypertension among the study subjects (1742)

Category	*n*	Age group (years)					Test of significance
		25-34	35-44	45-54	55-64	≥65	
Men (838)		238	236	118	125	191	χ^2=80.19, df=12, *P*=0.001
Normal	257	84 (32.7)	83 (32.3)	40 (15.6)	31 (12.1)	19 (7.4)	
Prehypertension	359	116 (32.3)	105 (29.2)	50 (13.9)	43 (12.0)	45 (12.5)	
HTN stage 1	162	37 (22.8)	38 (23.5)	20 (12.3)	31 (19.1)	36 (22.2)	
HTN stage 2	60	1 (1.7)	10 (16.7)	8 (13.3)	20 (33.3)	21 (35.0)	
Women (904)		311	287	145	91	70	
Normal	405	181 (44.7)	126 (31.1)	60 (14.8)	22 (5.4)	16 (4.0)	χ^2=122.25, df=12, *P*=0.001
Prehypertension	347	109 (31.4)	117 (33.7)	63 (18.2)	29 (8.4)	29 (8.4)	
HTN stage 1	116	18 (15.5)	39 (33.6)	17 (14.7)	26 (22.4)	16 (13.8)	
HTN stage 2	36	3 (8.3)	5 (13.9)	5 (13.9)	14 (38.9)	9 (25.0)	

There was a significant association between hypertension, prehypertension, and factors like age, gender, occupation, marital status, socioeconomic status, tobacco smoking and physical activity. Prevalence of prehypertension and hypertension was more among males, those who are aged more than 45 years, low literacy levels [Table 4]. Hypertension was found to be almost equal among those belonging to lower and upper socioeconomic class. The proportion of hypertensives were higher among those who consumed alcohol and tobacco but significant association was found with respect to tobacco smoking.

On binary logistic regression analysis [Table 5], the odds of being hypertensive was higher among older age group (OR: 3.83), male study participants (OR: 1.83), either widowed or separated (OR: 2.03), unemployed (OR: 1.51), and those who belonged to upper socioeconomic status (OR: 2.01). With respect to anthropometric behavioral risk factors those who were overweight (OR: 3.15), obese (OR: 2.55), and having central obesity (OR: 1.74) and also tobacco smokers (OR: 1.53) were having higher odds of hypertension. Significant association was found between hypertension and factors like age, gender, marital status, body mass index, abdominal obesity, tobacco smoking, and physical inactivity.

Discussion

Hypertension is a serious medical condition which significantly increases the risks of heart, brain, kidney, and other diseases and also a major cause of premature death worldwide. Rapid epidemiologic and demographic transition occurring especially in countries like India poses a significant challenge in controlling the burden of NCDs. This community-based cross-sectional study reported prevalence of prehypertension and hypertension around 40.5% and 21.5%, respectively, in rural area of Andhra Pradesh. The prevalence of hypertension was similar to WHO findings in which the overall prevalence was around 23.5% and the sex wise prevalence was 24.2% and 22.7% among men and women, respectively,[26] and various studies reported across the globe.[10,13,27]

Table 4: Association between prevalence of prehypertension and hypertension according to sociodemographic and behavioral risk factors

Variables	Total 1742	Normal	Prehypertension	Hypertension	Test of significance
Age					
25-34	549	265 (48.3)	225 (41.0)	59 (10.7)	χ^2=16.95, df=6, *P*=0.001
35-44	523	209 (40.0)	222 (42.4)	92 (17.6)	
45-54	263	100 (38.0)	114 (43.3)	49 (18.6)	
55-64	216	53 (24.5)	72 (33.3)	91 (42.1)	
≥65	191	35 (18.3)	73 (38.2)	83 (43.5)	
Sex					
Male	838	257 (30.7%)	359 (42.8%)	222 (26.5%)	χ^2=43.90, df=2, *P*=0.001
Female	904	405 (44.8%)	347 (38.4%)	152 (16.8%)	
Marital status					
Unmarried	194	67 (34.5%)	98 (50.5%)	29 (14.9%)	χ^2=50.16, df=4, *P*=0.000
Married	1346	539 (40.0%)	541 (40.2%)	266 (19.8%)	
Others	202	56 (27.7%)	67 (33.2%)	79 (39.1%)	
Education					
Illiterate	604	233 (38.6%)	197 (32.6%)	174 (28.8%)	χ^2=49.9, df=6, *P*=0.000
Primary	359	138 (38.4%)	140 (39.0%)	81 (22.6%)	
Secondary	653	251 (38.4%)	304 (46.6%)	98 (15.0%)	
Graduate & above	126	40 (31.7%)	65 (51.6%)	21 (16.7%)	
Occupation					
Professional	36	17 (47.2%)	13 (36.1%)	6 (16.7%)	χ^2=23.14, df=12, *P*=0.02
Skilled	49	16 (32.7%)	25 (51.0%)	8 (16.3%)	
Semi Skilled	151	50 (33.1%)	74 (49.0%)	27 (17.9%)	
Unskilled	194	86 (44.3%)	70 (36.1%)	38 (19.6%)	
Farmer	529	204 (38.6%)	227 (42.9%)	98 (18.5%)	
Own Business	107	33 (30.8%)	43 (40.2%)	31 (29.0%)	
Housewife	676	256 (37.9%)	254 (37.6%)	166 (24.6%)	
Socioeconomic status					
Lower	615	236 (38.4%)	253 (41.1%)	126 (20.5%)	χ^2=15.48, df=8, *P*=0.05
Lower middle	598	246 (41.1%)	235 (39.3%)	117 (19.6%)	
Middle	235	82 (34.9%)	95 (40.4%)	58 (24.7%)	
Upper middle	209	61 (29.2%)	89 (42.6%)	59 (28.2%)	
Upper	85	37 (43.5%)	34 (40.0%)	14 (16.5%)	
Alcohol use					
No	1526	583 (38.2%)	614 (40.2%)	329 (21.6%)	χ^2=0.43, df=2, *P*=0.83
Yes	216	79 (36.6%)	92 (42.6%)	45 (20.8%)	
Smoking					
Present	511	152 (29.7%)	198 (38.7%)	161 (31.5%)	χ^2=47.4, df=2, *P*=0.01
Absent	1231	510 (41.4%)	508 (41.3%)	213 (17.3%)	
Physical activity					
Inactive	816	299 (36.6%)	316 (38.7%)	201 (24.6%)	χ^2=9.13, df=2, *P*=0.01
Active	926	363 (39.2%)	390 (42.1%)	173 (18.7%)	

While on the other side few studies done in rural India and other regions of the world have reported higher prevalence of hypertension in comparison to our study finding.[1-5,11,28]

With regard to prevalence of prehypertension which was around 40.5% (men: 42.8% and females: 38.4%) is similar to findings in study done in Varanasi (41.7%)[7] but it was higher when compared to studies done in rural Bihar (37.9%),[27] Delhi (18.1%),[29] Nellore (22.3%),[13] and in Nigeria (34.1%).[5] These differences in prevalence of prehypertension and hypertension in contrast to other studies might be because of various socioeconomic and cultural factors, lifestyle factors, and the different study settings.

Higher prevalence of prehypertension (M: 42.8% and F: 38.4%) as well as hypertension (M: 26.5% and F: 16.8%) was found among men when compared to women which was similar to studies done in various parts of the globe.[27,30-33] This could be because of biological factors and behavioral risk factors such as physical activity, smoking, and alcohol consumption. More interest in utilization of health services and absentia from harmful habits such as alcohol and tobacco consumption would play a protective role in women against hypertension.[34]

Our study found that the increasing age was found to be one of the important risk factor for increasing prevalence of hypertension among both males and females. And this was

Table 5: Binary logistic regression analysis for the association of hypertension and sociodemographic, behavioural risk factors and anthropometric measurements (*n*=1742)

Variables	Odds ratio (95% CI)	*P*
Age groups (years)		
25-34	1.0 (reference)	
35-44	1.62 (1.11-2.35)	0.012
45-54	1.43 (0.90-2.28)	0.131
55-64	4.54 (2.90-7.10)	0.000
≥65	3.83 (2.38-6.17)	0.000
Sex		
Male	1.83 (1.37-2.46)	0.000
Female	1.0 (reference)	
Marital status		
Unmarried	1.0 (reference)	
Married	0.97 (0.60-1.57)	0.904
Others	2.03 (1.17-3.55)	0.012
Education		
Illiterate	1.0 (reference)	
Primary	0.76 (0.54-1.08)	0.122
Secondary	0.60 (0.43-0.86)	0.005
Graduate & above	0.62 (0.33-1.19)	0.153
Occupation		
Professional	1.0 (reference)	
Skilled	0.88 (0.24-3.20)	0.850
Semi Skilled	1.04 (0.34-3.17)	0.943
Unskilled	0.92 (0.30-2.81)	0.885
Farmer	0.86 (0.30-2.49)	0.783
Own Business	1.66 (0.54-5.10)	0.377
Unemployed/Housewife	1.51 (0.52-4.36)	0.451
Socioeconomic status		
Lower	1.0 (reference)	
Lower middle	1.40 (0.72-2.71)	0.322
Middle	1.29 (0.67-2.50)	0.448
Upper middle	1.88 (0.93-3.81)	0.079
Upper	2.01 (1.00-4.07)	0.051
BMI		
Underweight	1.0 (reference)	
Normal	1.26 (0.85-1.87)	0.245
Overweight	3.15 (2.01-4.93)	0.000
Obese	2.55 (1.49-4.36)	0.001
Abdominal obesity		
Absent	1.0 (reference)	0.037
Present	1.74 (0.56-1.98)	
Tobacco smoking		
Absent	1.0 (reference)	0.000
Present	1.53 (0.40-1.71)	
Alcohol use		
Absent	1.0 (reference)	0.643
Present	0.91 (0.61-1.35)	
Physical activity		
Inactive	1.0 (reference)	0.047
Active	0.76 (0.57-1.00)	

in similar to findings reported by various studies.[1-3,8,11,27,35] Thickening of aorta and arterial walls because of advancement of age is being the reason for high prevalence of hypertension in elder age groups.[12]

With regard to association between literacy status and hypertension, our study reported higher literacy is negatively correlated with hypertension status (χ^2 = 17.049, df = 6 and *P* value = 0.009) and the findings are in concordance with other studies.[2,4,11,36] Higher education which in turn resulting in enhanced awareness and more informative regarding hypertension and subsequently adapting healthy lifestyles could be the reason behind it. However, on logistic regression adjusted effect of education on hypertension, there was statistical significance which was observed and this was similar to study in Kerala[31] which might be because of distribution of subjects in various literacy groups.

There was a significant association between socioeconomic status and hypertension found in our study and similar observations were made by study done in rural parts of India[3] and also in other studies.[10,35,37,38] Our study also reported an interesting finding that those who belong to higher socioeconomic status had twice the odds of developing hypertension [OR2.01; (CI 1.00–4.07)] when compared to other categories. Changes in dietary habits due to affordability, physical inactivity as the purchasing power increases are established risk factors of obesity and overweight, thereby resulting in hypertension.

In our study, we found out that there was threefold increase in risk of being hypertensive in those who were overweight and obese when compared to underweight study subjects and increasing weight had a positive correlation with hypertension which was in concordance with other studies.[2,6,8-11,39,40] However, study in Uttarakhand reported higher prevalence among non-obese population (66.6%) when compared to obese one (33.3%).[4] There was also significant association between abdominal obesity and raised blood pressure in our study and these can be explained various pathophysiological mechanisms such as increase in cardiac output and peripheral resistance of the arteries in those who are overweight and obese. In addition to that, factors like changing dietary patterns and decreased physical activity also contributes to hypertension.[9]

In contrast to established fact that a strong association between physical inactivity and hypertension, we found more hypertensives in physically active group and adjusted odds ratio also showed inverse relation between these two factors and it was statistically significant. These findings were in concordance with study in Uttarakhand[4] and the reason could be patients after being diagnosed with hypertension might have started physical activity on doctors advice or can be attributed other factors like obesity or overweight.[11]

Alcohol consumption and tobacco use being the most important factors for NCDs and premature deaths worldwide.[4,24] Our study found out significant association between tobacco use and hypertension which is in consistent with findings from other studies.[4,28,29,41] However, there was no statistical association was found between alcohol use and raised blood pressure and this might be because of subjective factors in collecting the responses could have resulted in inaccurate estimation.

Conclusion

The prevalence of prehypertension (40.5%) and hypertension (21.5%) in this study was found to be high in rural area of Andhra Pradesh. Significant association was found between hypertension and age, gender, marital status, body mass index, abdominal obesity, tobacco smoking, and physical inactivity. Although there were limitations in the study such as cross-sectional study design and unable to explore the stress factor which is one the important contributory reason for hypertension, however, in our study we could able to determine various modifiable as well as non-modifiable risk factors for prehypertension and hypertension. The reasons for the high level of prevalence may be because of lack of awareness and delay in healthcare seeking behavior among general population might be an important factor which can be ridged by primary care physicians by identifying those at the risk of developing hypertension at the early stages and also submerged cases by conducting activities such as population based as well as high risk screening of all individuals aged above 40 years in the community. The role of primary care physicians is crucial as mentioned above along with the referral and follow-up services for the identified cases. Emergence of risk factors and progression of the disease can be prevented by various health promotional activities, early detection, and treatment. There is a need to develop a community-based program, which would aim at minimizing the risk factors of hypertension. Health education should be made as the core component of the program.

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Conflicts of interest

There are no conflicts of interest.

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