ORIGINAL ARTICLE

An epidemiological study of prevalence and predictors of Hypertension among adults aged 30-70 years in rural Gurugram, Haryana

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ABSTRACT

Background: Hypertension, often termed the "silent killer," is a leading global health challenge, affecting over 1.3 billion adults worldwide. Despite its high prevalence, awareness and control remain alarmingly low, particularly in low- and middle-income countries such as India, where urban and rural disparities in hypertension rates exist. **Methods:** A cross-sectional, door-to-door survey was conducted in the rural village of Mankrola, Haryana, India, among adults aged 30–70 years (n=300). Hypertension was defined as systolic blood pressure ≥140 mmHg, diastolic blood pressure ≥90 mmHg, or a prior diagnosis. Data on sociodemographic, behavioural risk factors, and perceived stress were collected. Adjusted Odds Ratios with 95% Confidence Intervals were estimated using a multivariable logistic regression model with hypertension as a dependent variable. **Results:** Hypertension prevalence increased with age, peaking at 42% in those 70 years or older. Prevalence was similar among males (22%) and females (21%). Higher rates were observed among those with lower education (illiterate: 30%), and individuals in certain occupations (e.g., semi-professionals: 46%). Significant behavioural risk factors included high salt intake (>20g/day: 38%), obesity (BMI ≥30: 44%), current smoking (28%), and smokeless tobacco use (32%). Alcohol use and higher stress levels also showed positive associations. **Conclusion:** This study highlights the substantial burden of hypertension in a rural Indian population and underscores the critical influence of socio-behavioural factors. Targeted, culturally appropriate interventions addressing salt reduction, tobacco cessation, weight management, and health education are urgently needed to mitigate hypertension's growing impact in similar settings.

KEYWORDS

Hypertension, predictors of hypertension, blood pressure, high blood pressure, risk factors

INTRODUCTION

High blood pressure, or Hypertension is characterized as "silent killer" due to its asymptomatic nature. It is estimated that hypertension affects over 1.3 billion adults globally and nearly one half of this population is unaware of their condition. Recent global reports indicate that only about half of adults with hypertension are diagnosed, less than half receive treatment, and just one in five have their blood pressure adequately controlled. (1)

The prevalence of Hypertension spans across all regions, socioeconomic groups, and age categories. Notably it affects 33% of adults aged 30–79 worldwide (age-standardized estimate) The number of adults with hypertension doubled from 650 million in 1990 to 1.3 billion in 2019 which emphasizes the urgent need for effective prevention and management strategies 1.(2)

The gap in awareness and management magnifies the risk of severe complications, including heart attack, stroke, heart failure, kidney disease, and vision loss.(3)

In India, a lower middle-income country with a population of more than 1 billion (rural population 68.84%), about 33% urban and 25% rural Indians are hypertensive. This disparity may be due to the differences in socioeconomic conditions, risk factors, and quality of healthcare services provided.(4) Main risk factors leading to the development and progression of hypertension include smoking and chewing tobacco, alcohol consumption, obesity, sedentary lifestyle and excessive salt intake. However, factors such as awareness, literacy, neglecting attitude towards health also contribute markedly in inception and progression of the disease. The interplay of these risk factors not only increases the prevalence of hypertension but also complicates its management at both individual and population levels. (5) High BP is one of the factors that elevates the risk of major health problems including heart disease, diabetes and stroke. Undetected and uncontrolled hypertension can damage the walls of blood vessels which induces initiation of a spectrum of complications affecting the heart, brain, kidneys, eyes, and peripheral vasculature. Additionally, in hypertensive crisis, acute complications such as hypertensive encephalopathy, retinal

haemorrhage, and acute kidney injury can develop rapidly, creating life-threatening emergencies. (3)

Given the widespread impact and significant health threats posed by hypertension, this research paper aims to analyse the burden of hypertension, examine the associated risk factors, and highlight the critical need for improved awareness, prevention, and control strategies.

MATERIAL & METHODS

Study Design- A cross-sectional study was conducted among adults aged 30-70 years to assess the burden of hypertension and to estimate the predictors of hypertension.

Study Area- The study was carried out in village Mankrola, the field practice area of Department of Community Medicine, Faculty of Medicine and Health Sciences, SGT University, Gurugram, Haryana.

Sample Size: Sample size was calculated by taking the prevalence of hypertension as 26.2% (4) in the age group of 18-69 years from a recent state wide STEPS survey in Haryana with 5% absolute precision, 95% confidence and adding the non-response rate of 10%. The estimated sample size after rounding off the came out to be 300.

Sampling technique: A door-to-door family survey was conducted by visiting every alternative household in the village. All individuals between 30-70 years of age from each household were selected randomly by lottery method. If no adult aged 30-70 years is found in a family or the selected house is found to be locked at the time of interview, then adjacent house was visited. The first household was selected randomly by lottery method. The study participants (aged between 30-70 years and staying in the area more than 6 months) were selected. Informed verbal and written consent were taken from the study participants after explaining the aims and objectives of the study. The eligible study participants were screened for hypertension using a digital BP instrument. Participants who were screened positive for hypertension were advised to visit their nearest health facility for confirmation of the diagnosis and further treatment.

Inclusion Criteria - All men and women aged between 30 to 70 years from the selected households. All existing cases of hypertension in the age group of 30-70 years.

Exclusion criteria- Pregnant females, migrants (those who stayed in the area for less than six months), severely ill and bedridden were excluded from the study.

Data collection tools and procedure

Socio-demographic profile & behavioral risk factors- socio-demographic details of study participants like age, sex, education, occupation, marital status, family income etc. was collected. Information on behavioral characteristics such as family history, substance use-tobacco (smoking and chewing), alcohol usage, physical activity, and details of diet consumed including salt and oil intake gathered from the participants. Self-reported medical history of hypertension.

Anthropometric measurements- The height, weight, waist circumference and hip circumference were recorded. Height was measured in centimeters (cm) using a stadiometer. Weight was measured in kilograms (kg) using a digital weighing scale kept on a flat surface. Waist and hip circumference were measured using non stretchable measuring tape in centimeters.

Blood pressure- The blood pressure was measured in sitting position in the left arm supported at the level of the heart using calibrated digital equipment. Two measurements were recorded at 2 min intervals each and the average of the readings was taken. Any subject with prescription for the disease from a registered medical practitioner and those having Systolic Blood Pressure ≥ 140 mm hg or Diastolic Blood Pressure ≥ 90 mm Hg or both were categorized as hypertensive according to the recommendations of the Joint National Committee 7 report**.**

Measurement of perceived stress- The assessment of perceived stress was done using Perceived Stress Scale - 10 (PSS-10) questionnaire which is a validated tool and is the most widely used psychological instrument for measuring the perception of stress. (6)

Data Analysis- Google form was used to enter data into Microsoft Excel. SPSS version 26 was used to analyze data. The percentage of people with systolic blood pressure (SBP) ≥ 140 mmHg or diastolic blood pressure (DBP) ≥ 90 mmHg who had either a previous medical diagnosis, were taking antihypertensive medication, or had their blood pressure measured during the survey were classified as hypertensive; those with SBP < 140 mmHg and DBP < 90 mmHg were classified as non-hypertensive. Descriptive statistics were expressed by proportion of baseline characteristics and predictors. The distribution of blood pressure by gender was computed for each of the four categories (normal, prehypertension, Stage I hypertension, and Stage 2 hypertension). To evaluate the relationship between different variables and the dependent variable, hypertension, a crude odds ratio with a 95% CI was calculated. Using covariates as independent variables and hypertension as the dependent variable, multivariable logistic regression models were used to determine the factors associated with the prevalence of hypertension. P value ≤ 0.05 was considered significant with 95% confidence interval. The fit of logistic models against actual outcomes was evaluated using the Hosmer-Lemeshaw goodness-of-fit test.

Ethical consideration: Prior ethical approval was taken from the Institutional Ethics Committee (IEC) for the study.

RESULTS

Results: Out of 300 study participants, 61% were females and 39% were males. The mean age of the study participants was 50±12.74 years with one fourth of the participants were in the age group of 30-39 years. The majority belonged to Hindu religion (95.3%), married (75%) and literate (77%). Around half of the study participants (45.4%) belonged to the upper class according to the modified BG Prasad scale.

Table 1 shows distribution of study participants according to socio-demographic factors and hypertension. Hypertension prevalence increased with age, from 6% in the 30–39 years age group to 42% in those aged ≥70 years, indicating a positive age-related trend. The prevalence of hypertension was similar in both males (22%) and females (21%). The widowed and separated

(36%) individuals had higher hypertension rates compared to married (20%) and unmarried (11%) participants. Hypertension was higher among illiterate (30%) and primary school (28%) participants. It decreased with higher education, being lowest in graduates (5%) and postgraduates (14%). In occupation-wise distribution, the higher prevalence was among semi-professionals (46%) and unemployed (33%), while professionals had the low prevalence (9%).

Table 1: Socio demographic characteristics of the study participants (N=300)

Factor	Category	Hypertension present n (%)	Hypertension absent n (%)	Total N (%)
Age (in years)	30-39	5 (6%)	76 (94%)	81 (27%)
	40-49	10 (14%)	61 (86%)	71 (23.7%)
	50-59	16 (25%)	49 (75%)	65 (21.7%)
	60-69	22 (39%)	35 (61%)	57 (19%)
	>=70	11 (42%)	15 (58%)	26 (8.6%)
Gender	Male	26 (22%)	91 (78%)	117 (39%)
	Female	38 (21%)	145 (79%)	183 (61%)
Marital Status	Unmarried	4 (11%)	32 (89%)	36 (12%)
	Married	46 (20%)	171 (80%)	225 (75%)
	Separated & widowed	14 (36%)	25 (64%)	39 (13%)
Religion	Hindu	62 (22%)	224 (78%)	286 (95.3%)
	Muslim	2 (22%)	7 (78%)	9 (3%)
	Sikh	0	3 (100%)	3 (1%)
	Christian	0	2 (100%)	2 (0.7%)
Education	Illiterate	21 (30%)	48 (70%)	69 (23%)
	Primary	16 (28%)	42 (72%)	58 (19.3%)
	Middle	7 (19%)	29 (81%)	36 (12%)
	High School	11 (19%)	46 (81%)	57 (19%)
	Senior Secondary	6 (18%)	28 (82%)	34 (11.3%)
	Graduate	2 (5%)	37 (95%)	39 (13%)
	Post Graduate	1 (14%)	6 (86%)	7 (2.3%)
Occupation	Unemployed	17 (33%)	35 (67%)	52 (17.3%)
	Unskilled	4 (21%)	15 (79%)	19 (6.3%)
	Semi-skilled	18 (19%)	75 (81%)	93 (31%)
	Skilled	15 (19%)	64 (81%)	79 (26.3%)
	Semi-Professional	6 (46%)	7 (54%)	13 (4.3%)
	Professional	4 (9%)	40 (91%)	44 (14.6%)
Socioeconomic status (Modified BG Prasad scale)	Lower class	1 (100%)	0	1 (0.3%)
	Lower middle class	2 (28.6%)	5 (71.4%)	7 (2.3%)
	Middle class	3 (7.7%)	36 (92.3%)	39 (13%)
	Upper middle class	19 (16.2%)	98 (83.8%)	117 (39%)
	Upper class	39 (28.7%)	97 (71.3%)	136 (45.4%)

Table 2: Predictors of hypertension among study participants (N=300)

Factor	Category	Hypertension Present n (%)	Hypertension Absent n (%)	Total N (%)
Salt Consumption per day(in gm)	0-5	8 (16%)	41 (84%)	49 (16.3%)
	6-10	19 (20%)	75 (80%)	94 (31.3%)
	11-15	18 (19%)	75 (81%)	93 (31%)
	16-20	14 (27%)	37 (73%)	51 (17%)
	>20	5 (38%)	8 (62%)	13 (4.4%)
Perceived Stress	Low Stress	8 (18%)	37 (82%)	45 (15%)
	Moderate Stress	55 (22%)	199 (78%)	254 (84.6%)
	High Stress	1 (100%)	-	1 (0.4%)
Alcohol Consumption	Non-Alcoholic	49 (20%)	196 (80%)	245 (81.7%)
	Ex-Alcoholic	3 (21%)	11 (79%)	14 (4.7%)
	Current Alcoholic	12 (29%)	29 (71%)	41 (13.6%)
Smoking	Current Smoker	22 (28%)	56 (72%)	78 (26%)
	Non-Smoker	42 (19%)	180 (81%)	222 (74%)
Tobacco Consumption (Khaini, Gutka)	Current Consumer	12 (32%)	26 (68%)	38 (12.7%)

	Non-Consumer	52 (20%)	210 (80%)	262 (87.3%)
Physical Activity	>=150 mins/week	29 (23%)	96 (77%)	125 (41.6%)
	<150 mins/week	35 (20%)	140 (80%)	175 (58.4%)
	<18.5 (Underweight)	0	4 (100%)	4 (1.4%)
	18.5 - 24.9 (Normal)	15 (10%)	130 (90%)	145 (48.3%)
BMI	25 - 29.9 (Overweight)	30 (28%)	78 (72%)	108 (36%)
	>=30 (Obesity)	19 (44%)	25 (56%)	43 (14.3%)

Table 2 shows distribution of risk factors among the hypertensive participants. The study participants consuming >20g of salt per day showed the highest prevalence (38%) of hypertension, while those consuming 0–5g/day had the lowest (16%). The trend indicates a dose-response relationship between salt intake and hypertension risk. Among participants with low stress, the prevalence was 18%, while it was 22% in those with moderate stress. Among alcoholics, about one third of the study participants (29%) had hypertension, as compared to non-alcoholics (20%). Among current smokers, 28% were hypertensive and tobacco (Khaini/Gutka) chewers, 32% were hypertensive. Hypertension prevalence increased sharply with higher BMI. There was 10% hypertensive among normal BMI range (18.5–24.9 kg/m^2), 28% in overweight (25–29.9 kg/m^2), peaking to 44% in the obese group (>30).

Table 3: Distribution of study participants as per blood pressure categories based on JNC VII criteria[7] (n=300)

Category	**Mean SBP & DBP (mm of Hg)**	**Male (n=117)**	**Female (n=183)**	**Total (N=300)**
		n (%)	n (%)	n (%)
Normal	<120 & <80	15 (60%)	10 (40%)	25 (8.3%)
Pre-hypertensive	Between 120-139 and/or 80-89	73 (35.8%)	131 (64.2%)	204 (68%)
Stage I Hypertensive	140-159 or 90-99	27 (39.1%)	42 (60.9%)	69 (23%)
Stage II Hypertensive	≥160 or ≥100	2 (100%)	0	2 (0.7%)

Out of 300 subjects, 204 (68%) were in the pre−hypertension stage, 69 (23%) in stage I, and 2 (0.7%) in stage II of hypertension. More than two third (68%) of the study participants were in pre-hypertensive stage in which 131 (64.2 %) were females and 73 (35.8%) were males.

As age advances the value of OR increases showing increased risk of hypertension with increasing age. Participants aged 30–40 years had 95% lower odds of hypertension (AOR = 0.050, p<0.001), aged 40–50 had 83.8% lower odds (AOR = 0.162, p = 0.005), and those aged 50-60 had 70.8% lower odds (AOR=0.292, p=0.042) as compared to participants aged ≥70. The participants who were separated had 2.4 times higher risk of hypertension as compared to married participants. The odds ratio of illiterate and just literate is 5.2 times higher risk of hypertension as compared to graduate and postgraduate. Among employed participants, OR of 2.1, doubles the risk of hypertension as compared to unemployed participants. The prevalence of hypertension is significantly higher among the participants belonging to lower and middle class as compared to upper class. The table 4 demonstrated acceptable fit (Hosmer-Lemeshow test: p = 0.079) and explained 23.2% of the variance (Nagelkerke R^2 = 0.232) with a classification accuracy of 79%

There is a positive association of BMI and WHR with hypertension. Participants with a BMI of 25–29.9 (overweight) had 85.7% lower odds of hypertension (AOR = 0.143, p<0.001), and those with a BMI of >=30 (obese) had 52.6% lower odds (AOR = 0.474, p = 0.054) compared to participants with BMI <18.5. Participants with high WHR (male>=0.9/female>=0.85) had higher odds of hypertension (AOR =1.045 ,p=.906) as compared to participants with WHR (male<0.9/female<0.85(Ref)). For other risk factors of hypertension such as salt intake, stress, alcohol consumption, smoking, tobacco use and physical inactivity, although the proportions were high in hypertensive participants, but the results were not statistically significant. The final table demonstrated acceptable fit (Hosmer-Lemeshow test: p = 0.094) and explained 15.6% of the variance (Nagelkerke R^2 = 0.156) with a classification accuracy of 78.7%.

Table 4: Multivariable logistic regression analysis of sociodemographic factors associated with hypertension

Variables	Categories	Hypertension			Sig.	AOR	95% CI	
		Yes	No	Total			Lower	Upper
Age groups (in yrs)	30-40	5 (7.8%)	76 (32.2%)	81 (27%)	.005	.118	.026	.533
	40-50	10 (15.6%)	61 (25.8%)	71 (23.7%)	.052	.247	.061	1.010
	50-60	16 (25%)	49 (20.8%)	65 (21.7%)	.446	.598	.159	2.244
	60-70	22 (34.4%)	35 (14.8%)	57 (19%)	.974	.981	.298	3.231
	>=70	11 (17.2%)	15 (6.4%)	26 (8.7%)	*	1	*	*
Gender	Male	26 (40.6%)	91 (38.6%)	117 (39%)	.628	1.272	.480	3.372
	Female	38 (59.4%)	145 (61.4%)	183 (61%)	*	1	*	*
Marital status	Unmarried	4 (6.3%)	32 (13.6%)	36 (12%)	.736	1.263	.325	4.911
	Separated	5 (7.8%)	11 (4.7%)	16 (5.3%)	.179	2.411	.668	8.700
	Widowed (Widower)	9 (14.1%)	14 (5.9%)	23 (7.7%)	.295	1.731	.620	4.833
	Married	46 (71.9%)	179 (75.8%)	225 (75%)	*	1	*	*
Religion	Others	2 (3.1%)	12 (5.1%)	14 (4.7%)	.351	.436	.076	2.491
	Hindu	62 (96.9%)	224 (94.9%)	286 (95.3%)	*	1	*	*
Education	Illiterate & Just literate	30 (46.9%)	73 (30.9%)	103 (34.3%)	.027	5.289	1.214	23.052
	Primary & Middle	14 (21.9%)	46 (19.5%)	60 (20%)	.050	4.397	1.001	19.322
	High school & Senior Secondary	17 (26.6%)	74 (31.4%)	91 (30.3%)	.077	3.571	.872	14.628
	Graduate & post graduate	3 (4.7%)	43 (18.2%)	46 (15.3%)	*	1	*	*
Type of Family	Joint	35 (54.7%)	147 (62.3%)	182 (60.7%)	.416	.758	.389	1.478
	Nuclear	29 (45.3%)	89 (37.7%)	118 (39.3%)	*	1	*	*
Occupation	Employed	18 (28.1%)	69 (29.2%)	87 (29%)	.185	2.148	.693	6.653
	Unemployed	18 (28.1%)	58 (24.6%)	76 (25.3%)	.490	.664	.207	2.128
	Homemaker	28 (43.8%)	109 (46.2%)	137 (45.7%)	*	1	*	*
Income per capita	Lower & middle class	25 (39.1%)	139 (58.9%)	164 (54.7%)	.070	.541	.278	1.051
	Upper class	39 (60.9%)	97 (41.1%)	136 (45.3%)	*	1	*	*

Table 5: Multivariable logistic regression analysis of factors associated with hypertension

Variables	Categories	Hypertension			Sig.	AOR	95% CI	
		Yes	No	Total			Lower	Upper
Salt consumption per day (in gm)	<5 gm/day(Ref)	6 (9.4%)	38 (16.1%)	44 (14.7%)	*	1	*	*
	>=5 gm/day	58 (90.6%)	198 (83.9%)	256 (85.3%)	.510	.720	.271	1.914
Stress	Normal (Ref)	9 (14.1%)	37 (15.7%)	46 (15.3%)	*	1	*	*
	Perceived stress	55 (85.9%)	199 (84.3%)	254 (84.7%)	.935	1.038	.430	2.504
Alcohol consumption	Non-Alcoholic (Ref)	49 (76.6%)	196 (83.1%)	245 (81.7%)	*	1	*	*
	Alcoholic	15 (23.4%)	40 (16.9%)	55 (18.3%)	.673	.840	.375	1.883
Smoking	Non Smoker (Ref)	42 (65.6%)	180 (76.3%)	222 (74%)	*	1	*	*
	Smoker	22 (34.4%)	56 (23.7%)	78 (26%)	.369	.687	.303	1.557
Tobacco consumption	Non consumer (Ref)	52 (81.3%)	210 (89%)	262 87.3(%)	*	1	*	*

	Consumer	12 (18.8%)	26 (11%)	38 (12.7%)	.806	.890	.351	2.254
Physical activity	<150min/week(Ref)	37 (57.8%)	140 (59.3%)	177 (59%)	*	1	*	*
	>=150min/week	27 (42.2%)	96 (40.7%)	123 (41%)	.277	.711	.384	1.316
Waist Hip ratio	male<0.9/female<0.85(Ref)	13 (20.3%)	64 (27.1%)	77 (25.7%)	*	1	*	*
	male>=0.9/female>=0.85	51 (79.7%)	172 (72.9%)	223 (74.3%)	.906	1.045	.530	2.173
BMI (kg/m²)	<18.5(Ref)	0	4 (1.7%)	4 (1.3%)	*	1	*	*
	18.5-24.9	15 (23.4%)	130 (55.1%)	145 (48.3%)	.999	.000	.000	-
	25-29.9	30 (46.9%)	78 (33.1%)	108 (36%)	.000	.143	.061	.335
	>=30	19 (29.7%)	24 (10.2%)	43 (14.3%)	.054	.474	.222	1.012

DISCUSSION

In our study, the overall prevalence of hypertension among adults was approximately 21%, a figure that aligns closely with current nationwide estimates. Analysis from the National Family Health Survey-5 (2019–21) reported a similar prevalence: 24.0% among men and 21.3% among women aged 15 and above.(8) Additionally, a meta-analysis focusing on rural India published in 2024 estimated pooled hypertension prevalence at 24% (95% CI: 19–29%).(9) These consistent findings across both national and rural community settings suggest that hypertension has become a substantial and stable public health burden in India

Age: The prevalence of hypertension in our study increased sharply with age, rising from 6% in individuals aged 30–39 to 42% among those aged 70 and above, consistent with national NFHS-5 data showing the condition becomes progressively more common with age and affects around 48.4% of adults 60 years and older.(8) A regional study in urban Bagalkot reported a hypertension prevalence of 27% in the 35–40 age group compared to only 5.3% among those aged 20–24.(10) Altogether, these observations emphasize that the risk for hypertension starts to climb significantly from the mid-30s and accelerates in subsequent decades, highlighting the critical need to begin early screening and preventive lifestyle measures.

Sex: In our study, hypertension rates were nearly the same among men (22%) and women (21%). Mohanty et al. (2022) found that men generally had higher hypertension prevalence at younger ages, while women overtook men after age 50, likely due to post-menopausal factors.(11) Therefore, while this study indicates little sex difference overall, broader national evidence suggests that these disparities depend on age.

Marital Status: In our study, widowed or separated individuals showed a much higher prevalence of hypertension (36%) than their married (20%) or unmarried (11%) counterparts. Supporting this, NFHS-5 data from Tamil Nadu found increased rates of self-reported hypertension among widowed, separated, or divorced participants (36.5% for women; 38.8% for men) as compared to those who were married.(12) These consistent patterns across different Indian settings suggest that losing a marital partner—whether through widowhood or separation—is linked to a greater chance of developing hypertension, probably due to ongoing psychosocial stress, limited social support, and possibly less proactive health behaviours.

Education: In our study, hypertension was most common among those with no education (30%) and only primary schooling (28%), but dropped to 5% in graduates and 14% among postgraduates. This inverse association points toward higher education as a protective factor. Similar trends were documented in rural Varanasi, where Singh et al.(13) found hypertension in 28.7% of illiterates vs. 12.4% with education beyond high school, and in rural Tamil Nadu, where illiterates had almost twice the prevalence of those with higher secondary education or more.(14) Increased education likely supports healthier lifestyles and better health awareness, reducing hypertension risk.

Socio-economic status: In our study, hypertension was more prevalent among individuals from the upper socioeconomic class (28.7%) compared to those in lower and middle classes. This aligns with findings from a rural Indian community study that linked higher socioeconomic status to increased hypertension, partly due to greater adiposity in wealthier populations.(15) Contrary to the global trend, in India, increasing affluence is often linked to lifestyle changes that raise the risk of hypertension.

Salt Intake: Our data showed a dose–response: hypertension rose from 16% in the lowest salt intake group (0–5 g/day) to 38% in the highest (>20 g/day). Community-based assessments in India similarly confirm consistently high salt intake, exceeding WHO-recommended levels (~5 g/day) across all sociodemographic groups, with average intake around 11 g/day.(16,17)This supports the salt–BP relationship observed in our study.

Perceived Stress: We observed a slight increase in hypertension with moderate stress (22% vs 18% in low stress), while the single high-stress participant was hypertensive (100%). In rural Indian settings, perceived stress is associated with hypertension, though often BMI shows no independent effect.(18) This underscores stress as a modest but relevant determinant in community settings.

Alcohol Consumption: In our study, current alcoholics had 29% hypertension compared to 20% in non-alcoholics. Large-scale data from India likewise show that alcohol consumption independently increases hypertension risk; one study found a 43% higher risk of measured hypertension among alcohol users (AOR 1.43).(19)

Occupation: In our study, hypertension prevalence was highest among semi-professionals (46%) and unemployed (33%), while professionals had the lowest prevalence (9%). A cross-sectional study among industrial workers in Hyderabad also highlighted occupational influences, showing that semi-skilled and skilled workers had poorer self-care practices such as low adherence to diet and inadequate physical activity, which predispose to hypertension and its complications.(20)These findings suggest that individuals in semi-skilled and semi-professional groups may be more vulnerable due to lifestyle and occupational constraints, whereas professionals, with better health awareness and resources, show lower hypertension prevalence.

Smoking & Smokeless Tobacco: Our findings: current smokers had 28% hypertension, and current users of smokeless tobacco (khaini/gutka) had 32%. Indian studies corroborate that both smoked and smokeless tobacco significantly elevate hypertension risk due to acute nicotine effects on BP. (21,22)

Physical Activity: We found a marginally lower hypertension prevalence among those engaging in ≥150 min/week (23%) versus <150 min/week (20%). A community-based study conducted by Yadav et al in rural India confirms that physical activity is significantly inversely associated with hypertension, even where BMI is not independently related.(23)

Body Mass Index: Hypertension rose sharply with increasing BMI: 10% in normal, 28% in overweight, and 44% in obese participants. National and community evidence link BMI/obesity robustly with hypertension, affirming our gradient as characteristic of Indian risk profiles.(24,25)

Conclusion

Our findings reaffirm that hypertension is a significant and growing public health challenge in India, influenced by a complex interplay of socio-demographic, lifestyle, and behavioral determinants. The observed associations with age, marital status, education, occupation, tobacco use, alcohol, salt consumption, physical inactivity, and obesity are consistent with national evidence and highlight the multifactorial nature of hypertension in community settings. The significance of this study lies in its contribution to local evidence on hypertension epidemiology, particularly in identifying vulnerable groups such as the elderly, less educated, unemployed, and those with high-risk lifestyle behaviour.

Recommendation

The high prevalence of hypertension and its risk factors in the rural adult population poses a serious public health concern that calls for focused interventions and policy. The burden of hypertension in rural populations can be lessened by healthcare professionals by addressing common risk factors, raising awareness, and facilitating access to healthcare services. For this expanding health issue in rural India to be successfully addressed, more research and teamwork are required. By providing community-level data, our study supports the design of more targeted interventions such as early screening, health education, lifestyle modification programs, and strengthened primary care services. In the present study, risk factors such as advancing age, high salt intake, overweight, obesity, smoking, alcohol consumption, and use of smokeless tobacco showed a higher burden. This indicates potential targets for lifestyle modification and community-based intervention in the focused population.

Limitation of the Study

The cross-sectional design limits the ability to establish causal relationships between hypertension and the associated risk factors. The study was conducted in a single rural village, which may limit the generalizability of the findings. Additionally, information on behavioural risk factors such as salt intake, alcohol consumption, tobacco use, and physical activity was based on self-reporting, making it susceptible to recall bias and social desirability bias. The blood pressure measurements were taken during a single visit, as for definitive diagnosis of hypertension, blood pressure is to be taken on multiple visits.

Authors Contribution

All authors have contributed equally.

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Nil

Conflict of Interest

There are no conflicts of interest.

Declaration of Generative AI and AI Assisted Technologies in the Writing Process

The authors haven't used any generative AI/AI assisted technologies in the writing process.

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