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Prevalence and Risk Factors of Hypertension among Rural Adults: A Community-Based Cross-Sectional Study

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ABS TRAC T

***Background*:** Hypertension is the single largest modifiable risk factor for cardiovascular disease and premature mortality worldwide. Despite the escalating burden of non-communicable diseases in rural India, population-level data on hypertension prevalence, awareness, treatment, and control remain inadequate. This study was undertaken to determine the prevalence and identify independent risk factors for hypertension among rural adults in a community-based setting. ***Methods*:** A community-based cross-sectional study was conducted among 800 adults aged 18 years and above residing in a rural block of northern India between January and December 2025. Participants were selected through multi-stage cluster sampling. Blood pressure was measured using a validated digital sphygmomanometer following a standardised protocol. Hypertension was defined as systolic blood pressure of 140 mmHg or more, diastolic blood pressure of 90 mmHg or more, or current use of antihypertensive medication. Sociodemographic, anthropometric, dietary, and lifestyle data were collected using a pre-tested questionnaire. Multivariate logistic regression analysis was performed to identify independent risk factors. ***Results*:** The overall prevalence of hypertension was 28.6% (95% CI 25.5–31.9), with higher rates in males (31.4%) than females (25.4%). Among hypertensive individuals, only 44.1% were previously aware of their condition, 35.9% were receiving treatment, and 19.5% had controlled blood pressure below 140/90 mmHg. On multivariate analysis, age above 45 years (OR 3.62, 95% CI 2.42–5.42, $p < 0.001$), body mass index above 25 kg/m² (OR 2.84, 95% CI 1.92–4.20, $p < 0.001$), co-existing diabetes mellitus (OR 2.46, 95% CI 1.54–3.92, $p < 0.001$), family history of hypertension (OR 2.18, 95% CI 1.42–3.34, $p = 0.006$), tobacco consumption (OR 1.96, 95% CI 1.28–3.00, $p = 0.014$), excessive dietary salt intake (OR 1.82, 95% CI 1.18–2.80, $p = 0.024$), and physical inactivity (OR 1.74, 95% CI 1.14–2.66, $p = 0.032$) were independently associated with hypertension. ***Conclusion*:** Hypertension is highly prevalent in rural India with alarmingly poor awareness, treatment, and control rates. Community-based screening initiatives, salt reduction campaigns, tobacco cessation programmes, and integration of hypertension management into primary healthcare are urgently warranted.

Keywords: *Hypertension, Prevalence, Risk Factors, Rural Population, Awareness, Treatment, Control, Non-Communicable Diseases, India.*

INTRODUCTION

Hypertension constitutes the foremost modifiable risk factor for cardiovascular disease, cerebrovascular accidents, chronic kidney disease, and premature mortality across the globe. The Global Burden of Disease Study 2021 identified elevated systolic blood pressure as the leading attributable risk factor for global disability-adjusted life-years, responsible for an estimated 10.8 million deaths annually [1]. The worldwide prevalence of hypertension among adults aged 30 to 79 years was estimated at 1.28 billion in 2019, with over three-quarters of this burden concentrated in low- and middle-income countries, where access to diagnosis, treatment, and follow-up care remains critically deficient [2].

India is undergoing a rapid epidemiological transition, with non-communicable diseases now accounting for approximately 65% of all deaths. Within this framework, hypertension represents the single most important cardiovascular risk factor in the Indian population [3]. A comprehensive analysis of population-based surveys conducted between 2017 and 2024 estimated the age-standardised prevalence of hypertension among Indian adults to be approximately 28 to 32%, with significant inter-state and urban–rural variation [4]. Notably, rural populations, which comprise nearly 65% of India's total population, have experienced a steeper rise in hypertension prevalence over the past decade compared to their urban counterparts, a phenomenon attributed to the pervasive influence of the nutrition and lifestyle transition even in agrarian communities [5].

The awareness–treatment–control cascade for hypertension in India presents a deeply concerning picture. Data from the fourth and fifth rounds of the National Family Health Survey and the India Hypertension Control Initiative revealed that fewer than 45% of hypertensive individuals in rural India were aware of their condition, fewer than 35% were receiving pharmacological treatment, and fewer than 15% had achieved blood pressure control to target levels [6]. This cascade of attrition results in a vast population of individuals with untreated or inadequately treated hypertension, silently accumulating end-organ damage and contributing disproportionately to the burden of stroke, myocardial infarction, heart failure, and renal failure in the community [7].

The risk factor architecture underlying hypertension in rural Indian populations is multifactorial and encompasses both non-modifiable determinants such as age, sex, family history, and genetic predisposition, as well as modifiable behavioural and metabolic factors including excessive dietary sodium intake, tobacco and alcohol consumption, physical inactivity, overweight and obesity, and co-existing diabetes mellitus [8]. A recent nationally representative survey utilising the WHO STEPwise approach reported that dietary salt consumption in rural India averaged 9.8 g per day, nearly double the recommended intake of 5 g per day, positioning excessive sodium intake as a major yet potentially remediable contributor to the hypertension burden [9].

Despite the availability of effective, affordable antihypertensive medications and the proven efficacy of population-level salt reduction and tobacco control policies, hypertension management in rural India remains hampered by fragmented primary healthcare infrastructure, shortage of trained healthcare personnel, lack of standardised screening protocols, poor medication adherence, and limited health literacy among rural populations [10]. Against this backdrop, community-based epidemiological studies that generate locally relevant prevalence estimates, quantify the awareness–treatment–control gap, and identify the predominant risk factor profile are indispensable for informing the design, prioritisation, and implementation of targeted public health interventions. The present study was undertaken with the objective of determining the prevalence and independent risk factors for hypertension among rural adults in a community-based cross-sectional survey conducted during the year 2025.

AIMS AND OBJECTIVES

The present study was undertaken with the primary aim of determining the prevalence of hypertension among adults aged 18 years and above residing in a rural community in northern India. The study further sought to ascertain the rates of awareness, treatment, and blood pressure control among hypertensive individuals identified during the survey, thereby characterising the awareness–treatment–control cascade and quantifying the magnitude of the treatment gap. Additionally, the study aimed to identify the sociodemographic, anthropometric, dietary, and lifestyle factors independently associated with hypertension through multivariate logistic regression analysis, with a view to informing the design of targeted preventive and therapeutic interventions for rural populations.

MATERIALS AND METHODS

Study Design, Setting, and Ethical Approval

This was a community-based cross-sectional study conducted between January and December 2025 in a rural block under the field practice area of the Department of Community Medicine, Government Medical College and Tertiary Care Teaching Hospital, northern India. The rural block comprised 42 villages with a total population of approximately 85,000. The study protocol was reviewed and approved by the Institutional Ethics Committee IEC approval number: IEC/2025/MC/176 prior to commencement, and all participants provided written informed consent in the local language.

Sample Size Estimation

The sample size was estimated using the formula $n = Z^2pq/d^2$, where $Z = 1.96$ for a 95% confidence interval, $p = 0.28$ (expected hypertension prevalence based on published Indian data), $q = 1 - p = 0.72$, and $d = 0.035$ (absolute precision of 3.5%). This yielded a minimum required sample of 633. Applying a design effect of 1.2 to account for the cluster sampling methodology and adding a 5% margin for non-response, the final target sample size was calculated as 800.

Sampling Methodology

A multi-stage cluster sampling strategy was employed. In the first stage, 20 of the 42 villages in the rural block were selected using probability proportional to size sampling. In the second stage, 40 adults aged 18 years and above were selected from each selected village using systematic random sampling from the updated electoral roll, yielding a total target sample of 800 participants. The sampling interval was determined based on the total number of eligible adults listed in the electoral roll for each selected village. Selected individuals were subsequently approached at their households for participation in the study.

Inclusion and Exclusion Criteria

All permanent residents aged 18 years and above of the selected villages who had been residing in the area for a minimum of six months and who provided written informed consent were included. Pregnant women, individuals who were bedridden or critically ill, those with known secondary causes of hypertension such as renal artery stenosis, Cushing syndrome, or phaeochromocytoma, and temporary residents including migrant labourers were excluded.

Data Collection Procedure

Data were collected by a team of four trained medical social workers under the supervision of the principal investigator, using a pre-tested, semi-structured questionnaire administered in the local language through face-to-face interviews during household visits. The questionnaire captured sociodemographic data including age, sex, education, occupation, marital status, and socioeconomic status (classified using the modified BG Prasad scale updated for 2025). Dietary data including self-reported salt intake pattern (assessed using a validated three-item salt behaviour questionnaire), fruit and vegetable consumption, and use of processed foods were recorded. Tobacco consumption (both smoked and smokeless forms) and alcohol use were documented with quantities and duration. Physical activity was assessed using the Global Physical Activity Questionnaire (GPAQ) and classified as active (600 or more MET-minutes per week) or inactive. Family history of hypertension and diabetes mellitus in first-degree relatives was recorded.

Anthropometric and Blood Pressure Measurements

Anthropometric measurements were obtained using standardised techniques. Height was measured to the nearest 0.1 cm using a portable stadiometer (Seca 213) with the participant standing erect without footwear. Weight was measured to the nearest 0.1 kg using a calibrated electronic weighing scale (Omron HN-286). Body mass index was calculated as weight in kilograms divided by the square of height in metres and categorised using the WHO Asian-specific cut-offs: underweight (below 18.5), normal (18.5–22.9), overweight (23.0–24.9), and obese (25.0 and above). Waist circumference was measured at the midpoint between the lower costal margin and the iliac crest using a non-stretchable tape, with central obesity defined as waist circumference of 90 cm or more in males and 80 cm or more in females. Blood pressure was measured in the seated position after a minimum of five minutes of rest in a quiet room using a validated, calibrated, automated oscillometric device (Omron HEM-7156). Two readings were obtained at an interval of two minutes, and the mean was recorded. If the difference between the two readings exceeded 10 mmHg for systolic or 5 mmHg for diastolic pressure, a third reading was taken and the mean of the two closest readings was used. Hypertension was defined as a mean systolic blood pressure of 140 mmHg or more, a mean diastolic blood pressure of 90 mmHg or more, or self-reported current use of antihypertensive medication, in accordance with the 2023 WHO pharmacological treatment guidelines.

Definitions

Awareness was defined as prior knowledge of hypertensive status, either self-reported or documented by a healthcare provider. Treatment was defined as current use of any antihypertensive medication prescribed by a registered medical practitioner. Control was defined as achieving a mean blood pressure below 140/90 mmHg among those currently on antihypertensive treatment. Hypertension staging followed the JNC 8 classification: Stage 1 (140–159/90–99 mmHg) and Stage 2 (160 or more/100 or more mmHg). High salt intake was defined as self-reported addition of extra salt to food at the table or consumption of more than one serving of processed/pickled foods daily.

Follow-Up

As this was a cross-sectional survey, no longitudinal follow-up was undertaken. However, all newly identified hypertensive individuals were referred to the nearest primary health centre or community health centre for confirmation of diagnosis and initiation of appropriate management. A referral card was provided, and follow-up compliance was verified by the field team at one month through telephonic contact.

Statistical Analysis

Data were entered in duplicate in Epi Info version 7.2.5 (CDC, Atlanta, GA, USA) and analysed using SPSS version 28.0 (IBM Corp., Armonk, NY, USA). The prevalence of hypertension was expressed as a percentage with 95% confidence interval, adjusting for the cluster sampling design using Taylor series linearisation. Continuous variables were expressed as mean ± standard deviation and compared between hypertensive and normotensive groups using the independent samples Student t-test or Mann-Whitney U test as appropriate after assessing normality by the Shapiro-Wilk test. Categorical variables were expressed as frequencies and percentages and compared using the Pearson chi-square test or Fisher exact test. All variables showing significance at $p < 0.10$ on univariate analysis were entered into a multivariate binary logistic regression model using backward stepwise elimination (likelihood ratio criterion) to identify independent predictors of hypertension. Adjusted odds ratios with 95% confidence intervals were reported.

Multicollinearity was assessed using variance inflation factors, and model fit was evaluated using the Hosmer-Lemeshow goodness-of-fit test. A two-tailed p-value of less than 0.05 was considered statistically significant throughout.

RESULTS

A total of 800 adults were surveyed during the study period, with 769 providing complete data (response rate 96.1%). The remaining 31 individuals were excluded due to incomplete questionnaires (n = 18), refusal to undergo blood pressure measurement (n = 8), or pregnancy detected at the time of the visit (n = 5). The final analysis included 769 participants.

The baseline sociodemographic and clinical characteristics of the study population are presented in Table 1. The mean age of the participants was 42.8 ± 14.6 years, with ages ranging from 18 to 86 years. Males constituted 53.5% of the sample (n = 411) and females 46.5% (n = 358). The majority of participants were married (82.4%), followed Hindu religion (76.2%), and belonged to the lower or lower-middle socioeconomic strata (61.8%). The most common occupation was agriculture (42.6%), followed by manual labour (18.4%) and homemaking (22.8%). The mean body mass index was 23.8 ± 4.2 kg/m². Central obesity, defined by waist circumference, was present in 284 participants (36.9%). A family history of hypertension in first-degree relatives was reported by 218 participants (28.3%), and co-existing diabetes mellitus was present in 96 (12.5%). Current tobacco use (smoked or smokeless) was reported by 186 participants (24.2%), and current alcohol consumption by 124 (16.1%). Physical inactivity (below 600 MET-minutes per week) was documented in 296 participants (38.5%). High dietary salt intake was reported by 312 participants (40.6%).

Table 1: Sociodemographic and Clinical Characteristics of the Study Population (n = 769)

Parameter	n (%)
Age (years), Mean ± SD	42.8 ± 14.6
Male	411 (53.5%)
Female	358 (46.5%)
Married	634 (82.4%)
Education: Illiterate	142 (18.5%)
Education: Primary/Middle	264 (34.3%)
Education: Secondary and above	363 (47.2%)
Occupation: Agriculture	328 (42.6%)
SES: Lower/Lower-middle	475 (61.8%)
BMI (kg/m²), Mean ± SD	23.8 ± 4.2
BMI ≥ 25 (Overweight/Obese)	286 (37.2%)
Central obesity (WC criteria)	284 (36.9%)
Family h/o hypertension	218 (28.3%)
Diabetes mellitus	96 (12.5%)
Current tobacco use	186 (24.2%)
Current alcohol use	124 (16.1%)
Physical inactivity	296 (38.5%)
High dietary salt intake	312 (40.6%)

The overall prevalence of hypertension was 28.6% (n = 220, 95% CI 25.5–31.9). Prevalence was higher among males (31.4%, n = 129) than females (25.4%, n = 91), although the difference did not attain statistical significance (p = 0.062). A striking age gradient was observed: the prevalence increased from 8.4% in the 18–30 years age group to 24.6% in the 31–45 years group, 42.8% in the 46–60 years group, and 52.4% in those aged above 60 years (chi-square for linear trend = 84.6, p < 0.001). The age-specific prevalence is illustrated in Figure 1.

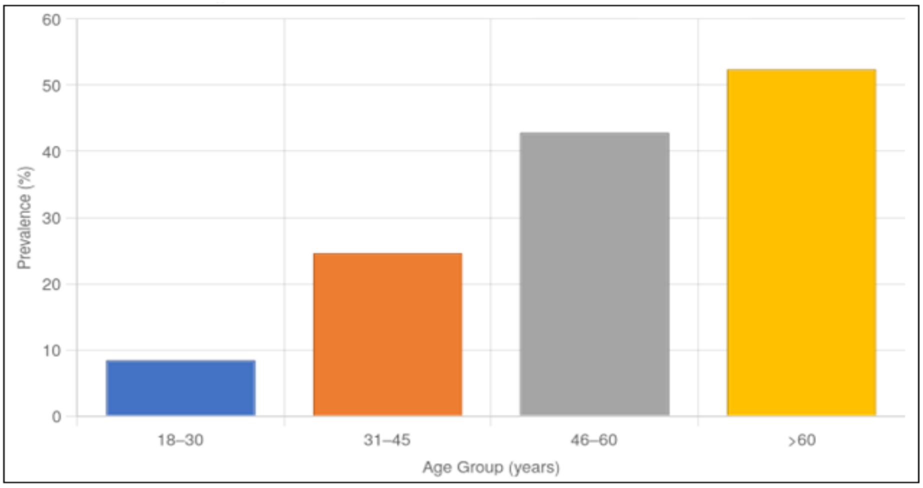

Figure 1: Age-Specific Prevalence of Hypertension (n = 769)

Table 2: Age- and Sex-Specific Prevalence of Hypertension

Age Group (years)	Males HTN/Total (%)	Females HTN/Total (%)	Total HTN/Total (%)	p-value
18–30	8/98 (8.2%)	6/108 (5.6%)	14/206 (6.8%)	—
31–45	32/112 (28.6%)	16/118 (13.6%)	48/230 (20.9%)	—

46–60	52/120 (43.3%)	36/82 (43.9%)	88/202 (43.6%)	—
> 60	37/81 (45.7%)	33/50 (66.0%)	70/131 (53.4%)	—
Total	129/411 (31.4%)	91/358 (25.4%)	220/769 (28.6%)	0.062
p for linear trend				< 0.001

The awareness–treatment–control cascade among the 220 identified hypertensive individuals is presented in Table 3 and Figure 2. Only 97 individuals (44.1%) were previously aware of their hypertensive status. Among those aware, 79 (81.4% of aware, 35.9% of all hypertensives) were currently receiving antihypertensive medication. Among those on treatment, only 43 (54.4% of treated, 19.5% of all hypertensives) had achieved blood pressure control below 140/90 mmHg. Thus, 123 hypertensive individuals (55.9%) were entirely unaware of their condition, and the overall control rate was a mere 19.5%. Stage 1 hypertension (140–159/90–99 mmHg) was present in 151 individuals (68.6%) and Stage 2 (≥160/≥100 mmHg) in 69 (31.4%).

Table 3: Awareness, Treatment, and Control among Hypertensive Individuals (n = 220)

Parameter	**n**	**% of All HTN**	**% of Previous Category**
Total hypertensives	220	100.0%	—
Aware of HTN status	97	44.1%	—
Currently on treatment	79	35.9%	81.4% of aware
BP controlled (< 140/90)	43	19.5%	54.4% of treated
Unaware of HTN status	123	55.9%	—
Stage 1 HTN (140–159/90–99)	151	68.6%	—
Stage 2 HTN (≥ 160/≥ 100)	69	31.4%	—

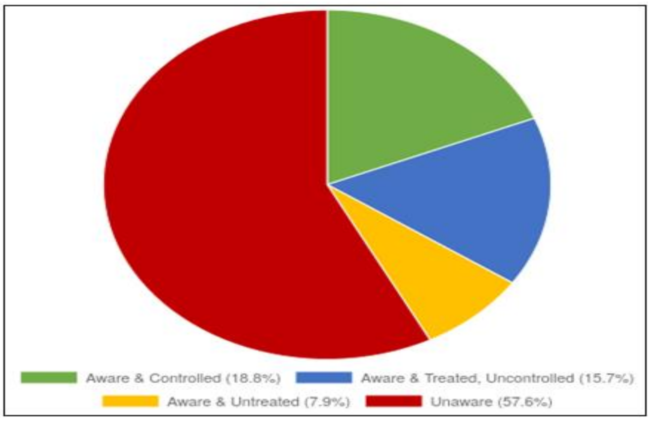

Figure 2: Awareness-Treatment-Control cascade Among Hypertensive (n = 220)

The univariate comparison of sociodemographic, anthropometric, and lifestyle variables between hypertensive and normotensive participants is presented in Table 4. Hypertensive individuals were significantly older (mean age 52.8 ± 12.4 versus 38.8 ± 13.2 years, p < 0.001), had higher BMI (26.4 ± 4.6 versus 22.8 ± 3.4 kg/m², p < 0.001), higher waist circumference (94.8 ± 10.4 versus 82.6 ± 9.2 cm, p < 0.001), and higher prevalence of central obesity (54.5% versus 29.9%, p < 0.001). Tobacco use (35.9% versus 20.0%, p < 0.001), high salt intake (56.4% versus 34.2%, p < 0.001), physical inactivity (52.3% versus 33.0%, p < 0.001), family history of hypertension (42.3% versus 22.7%, p < 0.001), and co-existing diabetes mellitus (20.5% versus 9.3%, p < 0.001) were all significantly more prevalent among hypertensive individuals.

Table 4: Univariate Comparison — Hypertensive vs Normotensive Participants

Variable	**HTN (n = 220)**	**Non-HTN (n = 549)**	**p-value**
Age (years), Mean ± SD	52.8 ± 12.4	38.8 ± 13.2	< 0.001
Male sex, n (%)	129 (58.6%)	282 (51.4%)	0.062
BMI (kg/m²), Mean ± SD	26.4 ± 4.6	22.8 ± 3.4	< 0.001
BMI ≥ 25, n (%)	118 (53.6%)	168 (30.6%)	< 0.001
Waist circumference (cm)	94.8 ± 10.4	82.6 ± 9.2	< 0.001
Central obesity, n (%)	120 (54.5%)	164 (29.9%)	< 0.001
SBP (mmHg), Mean ± SD	152.6 ± 16.8	118.4 ± 10.2	< 0.001
DBP (mmHg), Mean ± SD	96.4 ± 10.8	76.2 ± 8.4	< 0.001
Family h/o HTN, n (%)	93 (42.3%)	125 (22.7%)	< 0.001
Diabetes mellitus, n (%)	45 (20.5%)	51 (9.3%)	< 0.001
Current tobacco use, n (%)	76 (35.9%)	110 (20.0%)	< 0.001
Current alcohol use, n (%)	46 (20.9%)	78 (14.2%)	0.022
Physical inactivity, n (%)	115 (52.3%)	181 (33.0%)	< 0.001
High salt intake, n (%)	124 (56.4%)	188 (34.2%)	< 0.001
Illiterate, n (%)	52 (23.6%)	90 (16.4%)	0.018

The results of the multivariate binary logistic regression analysis, identifying independent predictors of hypertension after adjustment for potential confounders, are presented in Table 5. The final model demonstrated adequate fit (Hosmer-Lemeshow chi-square = 6.84, $p = 0.554$; Nagelkerke $R^2 = 0.382$). Age above 45 years emerged as the strongest independent predictor (adjusted OR 3.62, 95% CI 2.42–5.42, $p < 0.001$), followed by BMI of 25 kg/m² or above (aOR 2.84, 95% CI 1.92–4.20, $p < 0.001$), co-existing diabetes mellitus (aOR 2.46, 95% CI 1.54–3.92, $p < 0.001$), family history of hypertension (aOR 2.18, 95% CI 1.42–3.34, $p = 0.006$), current tobacco use (aOR 1.96, 95% CI 1.28–3.00, $p = 0.014$), high dietary salt intake (aOR 1.82, 95% CI 1.18–2.80, $p = 0.024$), and physical inactivity (aOR 1.74, 95% CI 1.14–2.66, $p = 0.032$). Male sex (aOR 1.36, 95% CI 0.92–2.02, $p = 0.126$), current alcohol use (aOR 1.42, 95% CI 0.88–2.28, $p = 0.148$), and illiteracy (aOR 1.28, 95% CI 0.78–2.10, $p = 0.332$) did not retain statistical significance in the adjusted model.

Table 5: Independent Predictors of Hypertension — Multivariate Logistic Regression Analysis

Variable	**Adjusted OR**	**95% CI**	**p-value**
Age > 45 years	3.62	2.42 – 5.42	< 0.001
BMI ≥ 25 kg/m²	2.84	1.92 – 4.20	< 0.001
Diabetes mellitus	2.46	1.54 – 3.92	< 0.001
Family h/o hypertension	2.18	1.42 – 3.34	0.006
Current tobacco use	1.96	1.28 – 3.00	0.014
High dietary salt intake	1.82	1.18 – 2.80	0.024
Physical inactivity	1.74	1.14 – 2.66	0.032
Male sex	1.36	0.92 – 2.02	0.126
Alcohol consumption	1.42	0.88 – 2.28	0.148
Illiteracy	1.28	0.78 – 2.10	0.332

Table 6: Prevalence of Hypertension Stratified by Body Mass Index Category

BMI Category (kg/m²)	**n**	**HTN n (%)**	**Crude OR (95% CI)**	**p-value**
Underweight (< 18.5)	68	5 (7.4%)	Reference	—
Normal (18.5–22.9)	312	56 (17.9%)	2.76 (1.06–7.18)	0.038
Overweight (23.0–24.9)	183	63 (34.4%)	6.62 (2.54–17.26)	< 0.001
Obese (≥ 25.0)	206	96 (46.6%)	11.02 (4.24–28.64)	< 0.001
Chi-square for linear trend	—	—	—	< 0.001

DISCUSSION

The present community-based cross-sectional study, conducted among 769 rural adults in 2025, documented a hypertension prevalence of 28.6%, with markedly deficient awareness (44.1%), treatment (35.9%), and control (19.5%) rates. These findings confirm that hypertension remains a critical and inadequately addressed public health challenge in rural India and carry important implications for the design and implementation of community-level cardiovascular risk reduction strategies.

The observed prevalence of 28.6% is concordant with the 27.4 to 32.5% range reported by the India Hypertension Control Initiative across multiple states during 2022–2024 [11]. A nationwide analysis by Prabhakaran *et al*., [12] utilising Global Burden of Disease data estimated the age-standardised hypertension prevalence in rural India at 29.2% in 2021, closely approximating the present finding. However, the prevalence in the current study is higher than the 21.4% reported by a community-based survey in rural Tamil Nadu by Mohan *et al*., in 2022 [13], likely reflecting geographic variation in dietary sodium consumption and lifestyle patterns between northern and southern Indian states.

The awareness rate of 44.1% observed in the present study represents a modest improvement over the 25.3 to 38.8% reported by earlier rural Indian surveys [14] and may reflect the impact of national programmes including the India Hypertension Control Initiative and the operational guidelines for non-communicable disease screening under the Comprehensive Primary Health Care programme. Nevertheless, the finding that more than half of all hypertensive individuals remained entirely unaware of their condition underscores the continued need for systematic community-based screening. The control rate of 19.5% is comparable to the 18.2% reported by the PURE study in low-income countries [15] and highlights the persistent challenge of translating diagnosis into effective long-term blood pressure management in resource-constrained settings.

Age above 45 years was the strongest independent predictor (aOR 3.62), consistent with the well-established pathophysiological effects of vascular aging, including progressive arterial stiffness, endothelial dysfunction, and increased peripheral vascular resistance [16]. The strong dose–response relationship between BMI and hypertension, with the prevalence rising from 7.4% in underweight individuals to 46.6% in those with BMI of 25 or above, reinforces the critical role of the obesity epidemic as a driver of hypertension even in rural settings. This finding is consistent with the analysis by Ramakrishnan *et al*., [17] from the Great India Blood Pressure Survey, which documented a continuous positive association between

BMI and blood pressure across urban and rural strata.

The significant association with high dietary salt intake (aOR 1.82) is particularly relevant given the finding that 40.6% of the study population reported excessive salt consumption. A systematic review by Mente *et al*., [18] demonstrated that dietary sodium reduction of 1 g per day was associated with a 2.5 mmHg reduction in systolic blood pressure, an effect that would translate into meaningful reductions in stroke and coronary events at the population level if achieved through community-wide salt reduction strategies.

The association between tobacco use and hypertension (aOR 1.96) is consistent with the acute sympathomimetic effects of nicotine and the chronic vascular damage induced by tobacco-related oxidative stress and endothelial injury. This finding has important policy implications given the high prevalence of smokeless tobacco use (gutka, khaini) in rural India, which is frequently underestimated in conventional cardiovascular risk assessment frameworks [19].

The present study has several strengths, including its community-based design with probability sampling, the use of a validated automated blood pressure measurement device with a standardised protocol, and the comprehensive assessment of multiple risk factors. However, certain limitations merit acknowledgment. The cross-sectional design precludes establishment of causal relationships. Blood pressure was measured at a single visit, which may overestimate true hypertension prevalence due to the white-coat effect, although the use of automated devices mitigates this to some extent. Dietary salt intake was assessed by questionnaire rather than 24-hour urinary sodium excretion, which is the gold standard. Finally, the findings from a single rural block in northern India may not be generalisable to all rural populations across the country [20].

CONCLUSION

The present study documented a hypertension prevalence of 28.6% among rural adults, with an alarming awareness–treatment–control gap: 55.9% of hypertensive individuals were unaware of their condition, and only 19.5% had achieved blood pressure control. Advancing age, overweight and obesity, co-existing diabetes mellitus, family history, tobacco use, high dietary salt intake, and physical inactivity were independently and significantly associated with hypertension. These findings underscore the urgent need for systematic community-based hypertension screening programmes integrated into primary healthcare, population-level salt reduction strategies including regulation of processed food sodium content, intensified tobacco cessation initiatives targeting smokeless tobacco, promotion of physical activity through community-based exercise programmes, and strengthening of the primary care infrastructure to ensure long-term medication access, adherence support, and follow-up. Addressing the rural hypertension burden demands a multisectoral approach encompassing health, agriculture, food industry regulation, and community mobilisation to achieve meaningful reductions in cardiovascular morbidity and mortality.

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