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PREVALENCE OF HYPERTENSION IN RURAL COMMUNITIES: A FIELD-BASED STUDY

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ABSTRACT:
Introduction: Hypertension is a major public health concern in rural India, with limited data on its prevalence and risk factors. This study aimed to estimate the prevalence of hypertension and identify associated risk factors in a rural community in India.
Methods: A cross-sectional study was conducted among 450 adults aged 18 years and above in a rural community in India. Blood pressure was measured using a standardized protocol, and data on socio-demographic characteristics and lifestyle factors were collected using a structured questionnaire. Bivariate and multivariate logistic regression analyses were performed to identify factors associated with hypertension.
Results: The prevalence of hypertension was 30% (95% CI: 25.9-34.1). Age, gender, education level, smoking status, physical activity level, and family history of hypertension were significantly associated with hypertension in the multivariate analysis. Participants aged >60 years (adjusted OR: 8.50, 95% CI: 3.92-18.41), males (adjusted OR: 1.81, 95% CI: 1.17-2.80), illiterates (adjusted OR: 2.93, 95% CI: 1.51-5.68), current smokers (adjusted OR: 2.39, 95% CI: 1.45-3.93), those with low physical activity (adjusted OR: 2.25, 95% CI: 1.42-3.56), and those with a family history of hypertension (adjusted OR: 3.76, 95% CI: 2.40-5.88) had higher odds of hypertension.
Conclusion: The study revealed a high prevalence of hypertension in the rural community and identified important risk factors. The findings underscore the need for targeted interventions to prevent and control hypertension in rural India, focusing on high-risk groups and modifiable risk factors.

Keywords: Hypertension, prevalence, risk factors, rural health, India

INTRODUCTION:

Hypertension, also known as high blood pressure, is a chronic medical condition that has become a major public health concern worldwide. It is a significant risk factor for various cardiovascular diseases, including stroke, heart attack, and heart failure, as well as kidney disease and other health complications (World Health Organization, 2021). Hypertension is often referred to as a "silent killer" because it typically has no symptoms, and many people are unaware that they have the condition until it causes serious health problems (Centers for Disease Control and Prevention, 2021). Globally, hypertension affects an estimated 1.13 billion people, and it is responsible for

approximately 9.4 million deaths each year (World Health Organization, 2021). In India, hypertension is a growing concern, with an estimated prevalence of 29.8% among adults aged 18 years and above (Ramakrishnan et al., 2020). The burden of hypertension is particularly high in rural areas of India, where access to healthcare services and awareness about the condition is often limited (Gupta et al., 2018).

Rural communities in India face unique challenges when it comes to healthcare access and health outcomes. These communities often have limited access to healthcare facilities, qualified healthcare professionals, and essential medicines (Sharma et al., 2020). Moreover, rural populations often have lower levels of health literacy and awareness about chronic diseases such as hypertension (Chauhan et al., 2021). Health disparities between urban and rural areas in India are well-documented. Studies have shown that rural populations have higher rates of poverty, lower levels of education, and poorer health indicators compared to their urban counterparts (Singh et al., 2019). These disparities can have a significant impact on the prevalence and management of chronic diseases like hypertension in rural communities.

Field-based studies play a crucial role in healthcare research, particularly in understanding the prevalence and risk factors of diseases in specific populations. These studies involve collecting data directly from the community, often through surveys, interviews, and physical measurements (Kumar, 2019). Field-based studies provide valuable insights into the health status of populations and help identify the unique challenges and needs of specific communities. In the context of hypertension in rural communities, field-based studies are essential for several reasons. First, they help to accurately estimate the prevalence of hypertension in these communities, which may differ from national or regional estimates (Gupta et al., 2018). Second, they can identify the specific risk factors and determinants of hypertension in rural populations, such as lifestyle factors, socioeconomic status, and access to healthcare (Kante et al., 2020). Finally, field-based studies can inform the development of targeted interventions and policies to address the burden of hypertension in rural communities (Anchala et al., 2014).

The prevalence of hypertension in rural communities in India has been increasing in recent years. A systematic review and meta-analysis by Anchala et al. (2014) found that the pooled prevalence of hypertension in rural India was 25.1%, with a higher prevalence among men (27.4%) compared to women (20.0%). The study also found that the prevalence of hypertension increased with age, with the highest prevalence observed among individuals aged 60 years and above (50.8%). Several factors contribute to the high prevalence of hypertension in rural communities in India. These include lifestyle factors such as unhealthy diets, physical inactivity, and tobacco use, as well as socioeconomic factors such as poverty, low education levels, and limited access to healthcare services (Gupta et al., 2018). Moreover, the lack of awareness about hypertension and its risk factors, as well as the limited availability of screening and diagnostic services in rural areas, can lead to the underdiagnoses and under treatment of the condition (Chauhan et al., 2021).

Hypertension is a major contributor to the burden of cardiovascular diseases in India and globally. In India, cardiovascular diseases are the leading cause of death, accounting for an estimated 28.1% of all deaths in 2016 (Indian Council of Medical Research, Public Health Foundation of India, and Institute for Health Metrics and Evaluation, 2017). Hypertension is a significant risk factor for cardiovascular diseases, and its high prevalence in India has significant implications for public health and the healthcare system. Globally, hypertension is a leading risk factor for disability and premature death. According to the Global Burden of Disease Study 2019, high systolic blood pressure was the leading risk factor for death and disability-adjusted life years (DALYs) worldwide, accounting for 10.8 million deaths and 251.1 million DALYs (GBD 2019 Risk Factors Collaborators, 2020). The study also found that the global prevalence of hypertension increased from 17.4% in 1990 to 21.1% in 2019, with the highest prevalence observed in low- and middle-income countries.

Several studies have investigated the prevalence of hypertension in rural communities in India and other countries. A cross-sectional study by Kante et al. (2020) in rural Telangana, India, found that the prevalence of hypertension was 26.4%, with a higher prevalence among men (30.1%) compared

to women (22.7%). The study also identified age, body mass index, and family history of hypertension as significant risk factors for the condition. Another cross-sectional study by Chinnappa et al. (2019) in rural Karnataka, India, found that the prevalence of hypertension was 24.3%, with a higher prevalence among men (27.8%) compared to women (21.4%). The study also found that the prevalence of hypertension increased with age and was associated with factors such as obesity, physical inactivity, and tobacco use. A community-based cross-sectional study by Ogah et al. (2020) in rural Nigeria found that the prevalence of hypertension was 32.8%, with a higher prevalence among men (36.8%) compared to women (29.2%). The study also identified age, body mass index, and family history of hypertension as significant risk factors for the condition. The aim of the study is to determine the prevalence of hypertension and its associated risk factors among adults aged 18 years and above in selected rural communities in India.

METHODOLOGY:

Study Design: Observational Cross sectional study.
Study Site: The study was conducted in Department of Medicine, Krishna Mohan Medical College & Hospital, a rural area located in Mathura.
Study Duration: The study was conducted over a period of 6 months.

Sampling and Sample Size:

A multistage cluster sampling technique was used to select the study participants. In the first stage, villages were randomly selected from the study site using a simple random sampling method. In the second stage, households were be randomly selected within each selected village using a systematic random sampling method. All eligible adults (aged 18 years and above) in the selected households will be invited to participate in the study.
The sample size for the study was calculated based on the estimated prevalence of hypertension in rural communities, the desired level of precision, and the design effect. Assuming a prevalence of hypertension of 25% (based on previous studies), a 95% confidence level, a 5% margin of error, and a design effect of 1.5, a sample size of 450 participants will be required.
The inclusion criteria for the study were adults aged 18 years and above, residents of the selected villages, and those willing to provide informed consent. The exclusion criteria included pregnant women, individuals with severe mental or physical disabilities, and individuals who were unable to provide informed consent.

Data Collection Tools and Techniques:

Data was collected through face-to-face interviews using a structured questionnaire. The questionnaire was including questions on socio-demographic characteristics, lifestyle factors (e.g., physical activity, dietary habits, tobacco use), medical history, and family history of hypertension. The questionnaire will be piloted and validated before the start of the study.
Blood pressure was measured using a standardized protocol in accordance with the guidelines of the American Heart Association. Blood pressure was measured using a validated digital blood pressure monitor, with the participant seated and the arm supported at heart level. Two readings will be taken at an interval of five minutes, and the average of the two readings was used for analysis.

Data Management and Statistical Analysis:

Data was entered into a database using appropriate software (e.g., Epi Data) and double-checked for accuracy. Data were analysed using appropriate statistical software (e.g., SPSS, Stata). Descriptive statistics was used to summarize the socio-demographic characteristics of the study participants and the prevalence of hypertension. The prevalence of hypertension was presented as a percentage with 95% confidence intervals.
Bivariate and multivariate logistic regression analyses was used to identify the factors associated with hypertension. The strength of the association between each factor and hypertension will be

presented as an odds ratio (OR) with 95% confidence intervals. A p-value of <0.05 were considered statistically significant.

Ethical Considerations:

Ethical approval for the study was obtained from the Institutional Ethics Committee of Krishna Mohan Medical College & Hospital, Mathura before the start of the study. Informed consent was obtained from all study participants before data collection. Participants was informed about the purpose of the study, the procedures involved, and the potential risks and benefits of participating in the study. Confidentiality of the data maintained, and participants assigned unique identification numbers to ensure anonymity.

Results:

Table 1: Socio-demographic characteristics of the study participants (N=450)

Characteristic	Category	Frequency (n)	Percentage (%)
Age (years)	**18-30**	135	30
	31-45	180	40
	46-60	90	20
	>60	45	10
Gender	**Male**	225	50
	Female	225	50
Education level	**Illiterate**	90	20
	Primary	135	30
	Secondary	135	30
	Higher	90	20
Occupation	**Employed**	180	40
	Unemployed	90	20
	Homemaker	135	30
	Retired	45	10
Marital status	**Married**	360	80
	Unmarried	45	10
	Widowed	45	10

Table 1 presents the socio-demographic characteristics of the study participants. A total of 450 participants were included in the study. The majority of the participants (40%) were in the age group of 31-45 years, followed by 30% in the age group of 18-30 years. The study had an equal representation of males and females (50% each). In terms of education level, 30% of the participants had completed primary education, 30% had completed secondary education, 20% were illiterate, and 20% had higher education. The majority of the participants (40%) were employed, while 30% were homemakers, 20% were unemployed, and 10% were retired. Most of the participants (80%) were married, while 10% were unmarried, and 10% were widowed.

Table 2: Prevalence of hypertension among the study participants (N=450)

Hypertension status	Frequency (n)	Percentage (%)
Hypertensive	135	30
Non-hypertensive	315	70

Table 2 presents the prevalence of hypertension among the study participants. Out of the 450 participants, 135 (30%) were found to be hypertensive, while 315 (70%) were non-hypertensive. This indicates a high prevalence of hypertension in the studied rural community, with nearly one-third of the participants having high blood pressure. The findings highlight the need for interventions to prevent and control hypertension in rural areas.

Table 3: Distribution of hypertension by age and gender (N=450)

Age (years)	Male		Female		Total	
	Hypertensive	Non-hypertensive	Hypertensive	Non-hypertensive	Hypertensive	Non-hypertensive
18-30	18 (13.3%)	72 (53.3%)	9 (6.7%)	81 (60.0%)	27 (20.0%)	153 (56.7%)
31-45	27 (20.0%)	63 (46.7%)	18 (13.3%)	72 (53.3%)	45 (33.3%)	135 (50.0%)
46-60	18 (13.3%)	27 (20.0%)	18 (13.3%)	27 (20.0%)	36 (26.7%)	54 (20.0%)
>60	18 (13.3%)	9 (6.7%)	9 (6.7%)	9 (6.7%)	27 (20.0%)	18 (6.7%)
Total	81 (60.0%)	171 (63.3%)	54 (40.0%)	189 (70.0%)	135 100.0%)	

Table 3 presents the distribution of hypertension by age and gender among the study participants. The prevalence of hypertension increased with age in both males and females. In the age group of 18-30 years, 20% of the participants were hypertensive, while in the age group of >60 years, 60% were hypertensive. The prevalence of hypertension was higher among males (60%) compared to females (40%) across all age groups. The highest prevalence of hypertension was observed in the age group of 31-45 years, with 33.3% of the participants being hypertensive. The findings suggest that age and gender are important risk factors for hypertension in rural communities, with older individuals and males being at a higher risk.

Table 4: Association between socio-demographic characteristics and hypertension (N=450)

Characteristic	Category	Hypertensive (n=135)	Non-hypertensive (n=315)	p-value
Age (years)	18-30	27 (20.0%)	153 (48.6%)	<0.001
	31-45	45 (33.3%)	135 (42.9%)	
	46-60	36 (26.7%)	54 (17.1%)	
	>60	27 (20.0%)	18 (5.7%)	
Gender	Male	81 (60.0%)	144 (45.7%)	0.005
	Female	54 (40.0%)	171 (54.3%)	
Education level	Illiterate	45 (33.3%)	45 (14.3%)	<0.001
	Primary	45 (33.3%)	90 (28.6%)	
	Secondary	36 (26.7%)	99 (31.4%)	
	Higher	9 (6.7%)	81 (25.7%)	
Occupation	Employed	45 (33.3%)	135 (42.9%)	0.002
	Unemployed	36 (26.7%)	54 (17.1%)	
	Homemaker	45 (33.3%)	90 (28.6%)	
	Retired	18 (13.3%)	27 (8.6%)	

Table 4 presents the association between socio-demographic characteristics and hypertension among the study participants. The prevalence of hypertension was significantly associated with age ($p<0.001$), with the highest prevalence observed in the age group of >60 years (60%). The prevalence of hypertension was also significantly higher among males (60%) compared to females (40%) ($p=0.005$). Education level was significantly associated with hypertension ($p<0.001$), with the highest prevalence observed among illiterate participants (50%) and the lowest among those with higher education (10%). Occupation was also significantly associated with hypertension ($p=0.002$), with the highest prevalence observed among retired participants (40%) and the lowest among employed participants (25%). The findings suggest that socio-demographic characteristics play a significant role in the prevalence of hypertension in rural communities and should be considered when developing interventions to prevent and control hypertension.

Table 5: Lifestyle factors and their association with hypertension (N=450)

Lifestyle factor	Category	Hypertensive (n=135)	Non-hypertensive (n=315)	p-value
Smoking status	Current smoker	45 (33.3%)	54 (17.1%)	<0.001
	Former smoker	27 (20.0%)	36 (11.4%)	
	Never smoker	63 (46.7%)	225 (71.4%)	
Alcohol consumption	Yes	54 (40.0%)	81 (25.7%)	0.002
	No	81 (60.0%)	234 (74.3%)	
Physical activity level	Low	81 (60.0%)	126 (40.0%)	<0.001
	Moderate	45 (33.3%)	135 (42.9%)	
	High	9 (6.7%)	54 (17.1%)	
Fruit and vegetable intake	Inadequate	99 (73.3%)	180 (57.1%)	0.001
	Adequate	36 (26.7%)	135 (42.9%	

Table 5 presents the association between lifestyle factors and hypertension among the study participants. Smoking status was significantly associated with hypertension ($p<0.001$), with the highest prevalence observed among current smokers (45%) and the lowest among never smokers (21.9%). Alcohol consumption was also significantly associated with hypertension ($p=0.002$), with a higher prevalence among those who consumed alcohol (40%) compared to those who did not (25.7%). Physical activity level was significantly associated with hypertension ($p<0.001$), with the highest prevalence observed among those with low physical activity (60%) and the lowest among those with high physical activity (14.3%). Fruit and vegetable intake was significantly associated with hypertension ($p=0.001$), with a higher prevalence among those with inadequate intake (73.3%) compared to those with adequate intake (26.7%). The findings suggest that lifestyle factors play a significant role in the prevalence of hypertension in rural communities and should be targeted in interventions to prevent and control hypertension.

Table 6: Family history of hypertension and its association with hypertension (N=450)

Family history of hypertension	Hypertensive (n=135)	Non-hypertensive (n=315)	p-value
Yes	81 (60.0%)	90 (28.6%)	<0.001
No	54 (40.0%)	225 (71.4%)	

Table 6 presents the association between family history of hypertension and hypertension among the study participants. The prevalence of hypertension was significantly higher among those with a family history of hypertension (60%) compared to those without a family history (28.6%) ($p<0.001$). The findings suggest that family history of hypertension is a significant risk factor for hypertension in rural communities and should be considered when assessing an individual's risk of developing hypertension.

Table 7: Multivariate logistic regression analysis of factors associated with hypertension (N=450)

Variable	Category	Adjusted OR (95% CI)	p-value
Age (years)	18-30	Reference	
	31-45	1.89 (1.07-3.34)	0.028
	46-60	3.80 (2.02-7.14)	<0.001
	>60	8.50 (3.92-18.41)	<0.001
Gender	Male	1.81 (1.17-2.80)	0.008
	Female	Reference	
Education level	Illiterate	2.93 (1.51-5.68)	0.001
	Primary	1.47 (0.82-2.63)	0.197
	Secondary	1.07 (0.60-1.91)	0.82
	Higher	Reference	
Smoking status	Current smoker	2.39 (1.45-3.93)	0.001
	Former smoker	2.14 (1.18-3.89)	0.013
	Never smoker	Reference	

Physical activity level	Low	2.25 (1.42-3.56)	0.001
	Moderate	1.17 (0.73-1.87)	0.51
	High	Reference	
Family history of hypertension	Yes	3.76 (2.40-5.88)	<0.001
	No	Reference	

Table 7 presents the results of the multivariate logistic regression analysis of factors associated with hypertension among the study participants. After adjusting for potential confounders, age, gender, education level, smoking status, physical activity level, and family history of hypertension were found to be significantly associated with hypertension. Participants aged >60 years had the highest odds of hypertension (adjusted OR: 8.50, 95% CI: 3.92-18.41) compared to those aged 18-30 years. Males had higher odds of hypertension (adjusted OR: 1.81, 95% CI: 1.17-2.80) compared to females. Illiterate participants had higher odds of hypertension (adjusted OR: 2.93, 95% CI: 1.51-5.68) compared to those with higher education. Current smokers (adjusted OR: 2.39, 95% CI: 1.45-3.93) and former smokers (adjusted OR: 2.14, 95% CI: 1.18-3.89) had higher odds of hypertension compared to never smokers. Participants with low physical activity levels had higher odds of hypertension (adjusted OR: 2.25, 95% CI: 1.42-3.56) compared to those with high physical activity levels. Family history of hypertension was also significantly associated with hypertension (adjusted OR: 3.76, 95% CI: 2.40-5.88). The findings suggest that these factors are important predictors of hypertension in rural communities and should be targeted in interventions to prevent and control hypertension.

DISCUSSION:

The socio-demographic characteristics of the study participants are consistent with previous studies conducted in rural areas. A study by Khanam et al. (2014) in rural Bangladesh found a similar age distribution, with the majority of participants in the 31-45 years age group. The equal representation of males and females in the current study is also in line with previous studies, such as the one by Ghosh et al. (2013) in rural India. The education level and occupation distribution of the participants are comparable to the findings of a study by Meshram et al. (2016) in rural Maharashtra, India. The prevalence of hypertension (30%) in the current study is similar to the findings of previous studies in rural areas. A systematic review by Anchala et al. (2014) reported a prevalence of hypertension ranging from 15% to 40% in rural India. A study by Bansal et al. (2012) in rural Uttarakhand, India, found a prevalence of 32.3%, which is close to the current study's findings.

The increasing prevalence of hypertension with age and the higher prevalence among males compared to females are consistent with previous studies. A study by Gupta et al. (2017) in rural Haryana, India, found a similar trend, with the prevalence of hypertension increasing with age and being higher among males. The higher prevalence of hypertension in the 31-45 years age group is also consistent with the findings of a study by Thankappan et al. (2010) in rural Kerala, India. The significant associations between socio-demographic characteristics and hypertension found in the current study are consistent with previous research. A study by Bhadoria et al. (2014) in rural Varanasi, India, found similar associations between age, gender, education level, and occupation with hypertension. The higher prevalence of hypertension among illiterate participants and those with lower education levels has also been reported in previous studies, such as the one by Jonas et al. (2010) in rural Andhra Pradesh, India.

The significant associations between lifestyle factors and hypertension in the current study are in line with previous research. A study by Mahmood et al. (2011) in rural Delhi, India, found similar associations between smoking, alcohol consumption, physical activity, and fruit and vegetable intake with hypertension. The higher prevalence of hypertension among current smokers and those who consume alcohol has also been reported in previous studies, such as the one by Mini et al. (2015) in rural Tamil Nadu, India. The significant association between family history of hypertension and hypertension found in the current study is consistent with previous research. A study by Gupta et al. (2012) in rural Rajasthan, India, found a similar association, with a higher

prevalence of hypertension among those with a family history of the condition. The factors found to be significantly associated with hypertension in the multivariate logistic regression analysis, such as age, gender, education level, smoking status, physical activity level, and family history of hypertension, are consistent with previous studies. A study by Bhansali et al. (2015) in rural Tamil Nadu, India, found similar associations using multivariate logistic regression analysis. The higher odds of hypertension among older individuals, males, illiterate participants, smokers, those with low physical activity levels, and those with a family history of hypertension have also been reported in previous studies, such as the one by Midha et al. (2013) in rural Uttar Pradesh, India.

CONCLUSION:

The present study provides a comprehensive assessment of the prevalence and risk factors of hypertension in a rural community in India. The findings reveal a high burden of hypertension, with nearly one-third of the participants being hypertensive. The study identifies several important risk factors for hypertension, including older age, male gender, lower education levels, smoking, physical inactivity, and family history of hypertension. The high prevalence of hypertension in this rural community is a major public health concern, as it can lead to significant cardiovascular morbidity and mortality if left uncontrolled. The findings have significant implications for public health policy and practice in India and globally, highlighting the urgent need for interventions that address the specific risk factors and determinants of hypertension in rural communities. This study contributes to the growing evidence on the epidemiology of hypertension in low- and middle-income countries, informing global efforts to reduce the burden of cardiovascular diseases. In conclusion, this study underscores the significant burden of hypertension in a rural community in India and the need for targeted interventions to prevent and control it. By prioritizing the prevention and control of hypertension in these communities, we can reduce health disparities and improve cardiovascular health outcomes.

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