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PREVALENCE OF HYPERTENSION AND ITS ASSOCIATED FACTORS AMONG THE RURAL POPULATION OF PAKHRIBAS MUNICIPALITY IN EASTERN NEPAL

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ABSTRACT

Introduction: *Hypertension (HTN) is a leading cause of preventable mortality globally, with an estimated 46% of the affected people unaware of their condition. Higher burden of HTN has been reported from the limited studies conducted among rural communities. Lifestyle, diet and healthcare access differ between urban and rural populations predisposing them to a greater burden. This study was conducted to assess the prevalence of HTN among the population of a rural Municipality and identify factors associated with it.*

Materials and Methods: *A community based cross-sectional study was conducted after ethical approval. Participants included the residents of all the 10 wards of Pakhribas Municipality with sample proportionate to population size. Pearson Chi-square tests and logistic regression analysis was done at 95 % CI for analysis.*

Results: *The study found a high prevalence of HTN (33.9%) in the rural community and older age, male sex, self-reported salt consumption and body mass index (BMI) were factors significantly associated.*

Conclusion: *The findings of this study highlight a higher burden of HTN in rural community and call for further investigations on the urban-rural differences in HTN to plan for provision of services as per the identified community needs.*

Keywords: *Cross-Sectional Study, High Blood Pressure, Prevalence, Rural Community*

INTRODUCTION

An estimated 1.28 billion adults aged 30-79 years worldwide have hypertension (HTN) with almost two-thirds living in low- and middle-income countries. It is a leading cause of mortality and a serious public health threat with an estimated 46% unaware of their condition. Further, 42% of people with HTN are diagnosed and treated while only 21% (1 in 5 adults) have it under control.[1] In Nepal, 18% of women and 23% of men age ≥15 years have HTN, with 48% of women and 52% of men unaware of their raised blood pressure status. There is a higher prevalence (46% of women and 42% of men) among individuals aged 60 and older.[2]

Hypertension contributes significantly to complications like stroke, cardiovascular diseases, peripheral vascular disease, renal impairment, and visual impairment which are preventable.[1,3,4,5] The risk of cardiovascular disease doubles for each increment of 20/10 mmHg of blood pressure, starting as low as 115/75 mm Hg.[6]

Studies on HTN based in hospitals settings or urban population are abundant in literature, in contrast to studies done in rural population. Rural population have a difference in dietary habits, levels of physical activity, and exposure to environmental factors that influence HTN development than their urban counterparts. They also face challenges like limited access to healthcare facilities, transportation issues, and potentially lower health literacy, which can impact HTN diagnosis and management. A survey done by Centre for Disease Control (CDC) showed that HTN rates in rural areas are higher than in most urban areas by 10% or more.[7] Another recent study from India also identified a higher prevalence in rural areas (40.8%).[8] Research in rural areas can inform

the development of interventions and programs that are culturally appropriate and accessible for improving public health outcomes in these populations.

This study was conducted to assess the prevalence of hypertension in adults of the rural municipality of Pakhribas in Dhankuta district and evaluate the factors associated with the presence of hypertension in the people of that Municipality.

MATERIALS AND METHODS

A community based cross-sectional study was conducted among the residents of Pakhribas Municipality to identify the prevalence of hypertension, adhering to STROBE guidelines for cross-sectional studies. A total of 171 subjects were enrolled in the study after calculating the sample size by the single proportion formula with assumed prevalence of 38.6% based on a study from Dharan,[9] with 95% Confidence Interval (CI), 20% margin of error and 8.0 % non-response rate. Sampling was done proportionate to the population size to ensure a representative sample from all the 10 wards of the municipality.

This study was conducted in accordance with the Declaration of Helsinki, approved by Ethical Review Board of BP Koirala Institute of Health Sciences, Dharan with permission from the local authority prior to the study. A semi-structured questionnaire pretested in 20 individuals not included in the final analysis was used for gathering information. Bathroom weighing scale was used to assess weight and stadiometer for height measurement. Omron® Automatic Blood Pressure Monitor (HEM-7121) was used to measure the blood pressure following standard protocols. Three measurements were done throughout the interview and the median value was used for assessing outcome.

Individuals above the age of 18 years and willing to participate in the study were included. Data collection was started at a house located adjacent to the ward office in each ward of the Municipality, and every third house was selected in all four directions until the sample size for that ward was fulfilled. After obtaining informed consent, an interview was conducted with one respondent from each house, along with a general clinical examination and blood pressure measurement.

Blood Pressure was classified based on the JNC-8 guidelines.[10] Ethnicity was categorized based on the Nepal Demographic and Health Survey 2022.[2] Occupation of the subjects were categorized based on level of activity they had to perform and the nature of their work. Socio-economic classification was done based on the Asian Development Bank criteria.[11] Habits and behaviors of the subjects were self-reported during the interview. Body Mass Index (BMI) was based on the WHO classification for Asian Population that considers 23 as trigger point for public health action.[12]

Data was entered into MS Excel 2013 and checked for completeness, coded and labelled clearly. IBM Statistical Package for the Social Sciences (SPSS) v23 was used for statistical analysis. Odds Ratio (OR) with confidence limit was calculated for inferential statistics at 95% CI. Multiple levels of categorical variable were reported for descriptive purposes but analysis was performed as binary values. Logistic regression analysis was performed for all independent variables with p-value <0.20 in the bivariate analysis to identify the factor's associated with hypertension. The probability of significance was set at 95% of CI. Multicollinearity was not assessed directly for the regression model, but was assumed to be absent as large coefficient swings or sign reversals were not seen and CIs were also not too wide.

RESULTS

Among the study subjects, 53.8% comprised the middle-aged population (35-60 years) and 58.5% were females. The major ethnic group residing in the municipality were the Hill Janajati (63.2%) and 39.2% of study subjects had no schooling, while 21.1% had completed higher secondary education or above. The study population living below poverty line comprised 81.9% and 59.7% considered themselves doing moderate intensity activities at their workplaces.

Table 1: Socio-demographic characteristics (n=171)

Characteristics	Categories	Frequency	Percentage (%)
Age	18-35 years	52	30.4
	35 – 60 years	92	53.8
	60 years and above	27	15.8
Sex	Female	100	58.5
	Male	71	41.5
Ethnicity	Hill/Mountain Janjati	108	63.2
	Hill/Mount. Bhramin/Chettri	50	29.2
	Others	13	7.6

Education	No	67	39.2
	Primary/Secondary	68	39.7
	≥ Higher Secondary	36	21.1
Poverty Line	Below (<2.15 $/person/day)	140	81.9
	Above (≥2.15 $/person/day)	31	18.1
Level of activity at work	Vigorous intensity	17	9.9
	Moderate intensity	102	59.7
	Sedentary	52	30.4

Of the total of 171 participants, 29.8% were currently using tobacco in any form, 18.7% of the subjects consumed smokeless tobacco products and 55% had consumed alcohol at least once in their life. Although, 84.8% of the respondents reported doing some form of physical exercise for more than half an hour per day, only 17% of the participants exercised regularly. Majority of the participants (75.4%) reported sleeping for 6-9 hours per day whereas only 31.6% reported consuming 2 or more servings of fruit per day.

Table 2: Behavioral characteristics (n=171)

Characteristics	Categories	Frequency	Percentage (%)
Current tobacco user	No	120	70.2
	Yes	51	29.8
Current smokeless tobacco use	No	139	81.3
	Yes	32	18.7
Ever alcohol drinker	No	94	55.0
	Yes	77	45.0
Physical Activity (time/day)	< 30 min	26	15.2
	30 - 1hr 30 min	69	40.4
	≥ 1hr 30 min	76	44.4
Exercise Regularly	Yes	29	17.0
	No	142	83.0
Hours of sleep/day	< 6 hours	3	1.8
	6 -9 hours	129	75.4
	≥ 9 hours	39	22.8
Fruit servings/day	< 2	117	68.4
	2 or more	54	31.6

Among the surveyed participants, 63.7% self-rated their salt intake to be just the right amount while the rest considered their salt intake to be higher than what is normally required. Knowledge regarding adverse consequences of excessive salt use was present in 77.8% of the participants, whereas 22.2% were either unaware or not sure.

Family history of hypertension was present in 21.6% and 9.9% reported themselves to be in a poor health status. Overweight and obese subjects constituted 36.8% and 20.5% of the study population respectively. Prevalence of hypertension was found to be 33.9% (95% CI = 30.3-37.5) in this study.

Table 3: Clinical characteristics (n=171)

Characteristics	Categories	Frequency	Percentage (%)
Self-rated Salt consumption	Very much excess	30	17.6
	Somewhat excess	32	18.7
	Just the right amount	109	63.7
Knowledge of harm of excess salt	Yes	133	77.8
	No	19	11.1
	Don't Know	19	11.1
Family history of high BP	Yes	37	21.6
	No	134	78.4
BMI	Underweight	5	2.9
	Normal	68	39.8
	Overweight	63	36.8
	Obese	35	20.5
Self-Rated health status	Good	54	31.6
	Satisfactory	100	58.5
	Poor	17	9.9
Hypertension	Present	58	33.9
	Absent	113	66.1

Bivariate analysis (Figure 1) showed that participants above 35 years of age were 3.3 times more likely to have HTN compared to the age group below 35 [OR=3.34(1.5-7.5), p value=0.002], which was statistically significant. Similarly, male sex was 3.6 times more at odds of developing HTN than females that was statistically significant [OR=3.6 (1.9-7.1), p=0.0001]. Current tobacco users were 2.3 times more likely [OR=2.3 (1.1-4.4), p=0.018], while those who had ever used alcohol were 2.6 times at odds of developing HTN [OR=4.2 (1.8- 9.6), p=0.0001], which were statistically significant. Those subjects who slept for less than 9 hours per day had 2.9 times higher chances of having hypertension than others

[OR=2.9 (1.2-7.1), p=0.017], which was statistically significant.

Similarly, those who perceived that their salt consumption was not the right amount were 1.9 times more at odds of having hypertension [OR=1.9 (1.01-3.7), p=0.045], and subjects with BMI more than the cut-off for Asian population (≥ 23) were 4.5 times more likely to be hypertensive [OR=4.5 (2.2-9.4), p=0.0001] which was statistically significant.

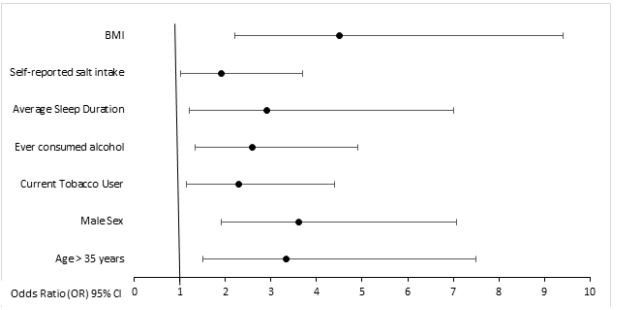

Figure 1: Bivariate Analysis of factors associated with hypertension by Forest Plot (n=171)

Legend: The figure above depicts the factors associated with hypertension in this study, with the small black circles (●) as unadjusted OR, and lines on either side as 95% CI.

Age > 35 years [adjusted OR (aOR) = 2.8; 95%CI (1.1-6.7); p-0.023], male sex [aOR = 4.2; 95%CI (1.9-8.9); p-0.0001], self-perception of not eating the right amount of salt [aOR = 2.5; 95%CI (1.2-5.4); p-0.016] and BMI > Asian cut-off of 23 [aOR = 4.4; 95%CI (1.9- 9.9); p-0.001] were significantly associated with HTN in logistic regression analysis after adjusting for other variables.

Table 4: Logistic Regression Analysis (n=171)

Characteristics	Category	Adjusted OR (aOR)	95% CI		Significance (p-value)
			Lower	Upper	
Age	18-35 years	1			
	> 35 years	2.8	1.1	6.7	0.023
Sex	Female	1			
	Male	4.1	1.9	8.7	0.0001
Self-reported salt consumption	Right Amount	1			
	Others	2.5	1.2	5.4	0.016
BMI	< 23	1			
	≥ 23	4.4	1.9	9.9	0.0001

Goodness of fit: Chi-square = 5.13, df = 8, p =0.744 aOR-Adjusted Odds Ratio

Variable(s) entered on step 1: Age, Sex, Current Tobacco User, Ever consumed alcohol, Average Sleep Duration, Self-reported salt consumption, Body Mass Index (BMI)

DISCUSSION

This study identified a high prevalence of hypertension [33.9% (95% CI = 30.3-37.5)] in the adult population of Pakhribas municipality, comparable to a study done in nearby city of Dharan (38.6%).[9] Studies done in South Asian countries and around the world have reported similar prevalence of Hypertension.[4,13-14] However, the prevalence identified in this study (33.9%) is higher than that reported for rural populations (24.4%) by a systematic review and meta-analysis based on twenty-three studies performed in Nepal.[15] This study used JNC 8 criteria to classify hypertension due to its simplicity, although newer classifications do exist currently. Fewer categories and treatment thresholds make JNC 8 easier to adopt in busy or low-resource settings. However, the prevalence estimates calculated may differ if alternative classification criteria had been applied.

Subjects more than 35 years were 3.3 times more likely to be hypertensive on bivariate analysis that remained significant on logistic regression analysis (aOR=2.8). This is in accordance with the findings in South Asian population, and from around the world.[4,8,9,15-17] With increasing age, structural and functional changes in the cardiovascular system predispose a person to HTN.[17]

Males were 3.6 times more likely to be hypertensive than females on bivariate analysis, which remained significant after adjusting for other variables (aOR=4.1) in this study. This is consistent with the findings of other research from Nepal and around the world.[4,8,9,15] Blood pressure is not similar in males and females of same age due to the effects of androgens, with higher BP levels in men, as defined in literature.[4,8,15,18]

Self-reported excess salt intake was found to be associated with hypertension in this study. Those subjects reporting excess intake had 1.9 times more odds of having hypertension in the bivariate analysis that remained significant after adjusting for other variables (aOR=2.5). This finding is consistent with existing literature on risk factors for hypertension from around the world.[4,8,9,15,19] Salt intake has been implicated as one of the important risk factors for hypertension. However, the self-reported nature of this variable in this study is prone to recall and social desirability bias and is a limitation. Similarly, other self-reported measures in this study like average sleep duration, alcohol/tobacco use, physical activity may not actually capture the intended psychological construct, creating a construct-irrelevant variance (noise) that attenuates correlations (biased toward zero).[20] However,

this lack of significance in this study does not imply loss of public-health importance of that variable.

Subjects with BMI of 23 or more (Asian standards) were found to be 4.5 times more likely to be hypertensive compared to those with BMI less than 23, that remained statistically significant after adjusting for other variables (aOR=4.4). Similar results have been shown by various studies around the world.[4,8,9,12,21,22] BMI is one of the measures of obesity that can be calculated by simple methods, and is considered to be a risk factor for hypertension.

Package of Essential NCD's (PEN) program for non-communicable diseases (NCD) has been incorporated in the primary health care system of Nepal and includes hypertension along with diabetes, chronic lung diseases and cancers which is a positive initiation to improve access to standard care even outside urban areas.[23] However, at its incipient stage, it still faces many hurdles. Building up on the findings of this study, routine, community-based hypertension screening starting at age 35 would benefit the community immensely. Training community health workers (CHWs) and volunteers to deliver lifestyle education and support with proven, cost-effective models, especially for rural areas, is also one of the prerequisites for prevention and control of hypertension.[24] Involvement of a multidisciplinary team along with the local community to identify hidden cases with a "top-down and bottom-up" planning approach to combine national guidelines with local adaptation is the need of the hour.

Habits and lifestyle were self-reported information that were not measurable. Biochemical parameters would have added valuable information on their disease status, but was not feasible. The cross-sectional design limits temporal inference so we should differentiate between association seen in this study and causation given by longitudinal studies.

CONCLUSION

This study found a high prevalence (33.9%) of hypertension in the rural municipality of Pakhribas in Dhankuta district. Age more than 35 years (aOR=2.8), males (aOR=4.1), self-reported excess salt consumption (aOR=2.5), and BMI more than 23 (aOR=4.4) were significantly associated with presence of hypertension after adjusting for other variables. These findings stress the need for more urban-rural longitudinal comparison studies to assess the differences and plan for services as per the identified needs in rural communities.

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CONFLICT OF INTEREST: None

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