Original Article

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Hypertension and its Associated Factors in a Middle-Aged Population

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ABSTRACT

Background: Hypertension is a major risk factor for cardiovascular diseases, chronic kidney disease, and dementia. Early detection and management are crucial for preventing these complications. However, many people lack awareness regarding their blood pressure. The study aimed to assess the prevalence of hypertension and its associated factors in rural communities.

Methods: This cross-sectional study was conducted among 525 middle-aged (35-60 years) residents of the Rupa Rural Municipality, Nepal, from August to December 2020. Chi-square test and multivariate logistic regression were performed to identify the factors associated with hypertension at a 5% level of significance.

Results: More than half (50.9%) of the respondents had normal to elevated systolic pressure, while only one-third (33.9%) had normal to elevated diastolic pressure. Only 47.4% of the hypertensive participants were aware of their hypertensive condition. Being a male (aOR: 1.903; 95% CI: 1.184-3.030), in middle age of 45-55 years (aOR: 2.002; 95% CI: 1.152-3.478), having basic education (aOR: 2.014; 95% CI:1.174-3.455), currently consuming alcohol (aOR: 1.923; 95% CI: 1.095-3.375), and being overweight/ obese (aOR: 1.899; 95% CI: 1.262-2.859) were identified as significant factors associated with hypertension.

Conclusions: The studys findings emphasize the urgency of interventions to improve awareness of hypertension and its management to improve health outcomes. Targeted interventions will have an opportunity to reduce the burden of hypertension which is an important risk factor for cardiovascular diseases among the middle-aged population.

Keywords: cardiovascular disease; hypertension; Nepal; prevalence; risk factors.

INTRODUCTION

Hypertension is a leading chronic condition that significantly contributes to the global burden of disease.[1,2] Nepal, like many countries, is experiencing an epidemiological transition from communicable to non-communicable diseases, with a rising prevalence of hypertension.[3, 4] Hypertension is a major risk factor for ischemic heart disease, stroke, and other cardiovascular diseases as well as chronic kidney diseases and dementia.[5] Being a modifiable risk factor for multiple morbid conditions, early detection of hypertension could prevent future risk of NCDs, but the level of awareness among rural households about the status of their blood pressure and its contributing factors is still unacknowledged. Undiagnosed and uncontrolled hypertension could lead to severe consequences including stroke, heart attack, kidney disease, lifelong disability, and even death.[6] However, as the community people are unaware of their hypertension status, they are less likely to take corrective measures on time. Thus, this study aimed to assess the prevalence of hypertension among rural community dwellings in Nepal along with its associated

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factors.

METHODS

This cross-sectional study was conducted among the middle-aged (35 to 60 years), residents of Rupa Rural Municipality. It is one of the four Rural Municipalities of Kaski District, Nepal, with the potential to represent the average rural lifestyle of Gandaki Province. This municipality has a total of seven wards with an occupancy of 14,891 populations, of which, middle-aged population accounts for 4185 (28.1%) of the total population.[7]

Ethical clearance for this study was obtained from the Institutional Review Committee of Pokhara University (Registration no: 156/076/077). Written informed consent was obtained from all literate study respondents, and thumb impressions were collected from non-literate participants before their involvement in the study. The sample size of 525 was calculated using OpenEpi web-based software, considering the prevalence of hypertension at 27.3% (based on estimates provided by a systematic review and meta-analysis from Nepal),[4] at 95% confidence level, 5% allowable error, 1.5 design effect, and 20% non-response rate. The total households with middle-aged residents in Rupa Rural Municipality served as the sampling frame, and the required number of respondents from each ward was proportionally allocated according to the population size of the target group, as provided by the municipal office. To ensure representative sampling across the wards, the sample was allocated proportionately. After estimating the required samples from each ward, the field researcher reached the center point of the ward, and one initial household was randomly selected. From this starting point, subsequent households were chosen and screened to have the eligible participants i.e. middle-aged population. When multiple eligible participants were present in a household, one individual was randomly chosen to participate. If a selected household did not have eligible participants, the next adjacent household was explored until the sample size was achieved. This approach ensured comprehensive coverage across the wards.

Data were collected from August to December 2020 via face-to-face interviews alongside anthropometric measurements. The interview guideline was based on the WHO STEP survey questionnaire,[8] in the Nepali language. The measurements were taken twice and recorded an average of two measurements. The measurement tools were calibrated using the given standard by the Government of Nepal Ministry of Commerce and Supplies, Nepal Bureau of Standard and Metrology, Balaju, Kathmandu, Nepal. Data were collected by three trained field researchers who were public health and nursing professionals. Two days of training were also provided to the field researchers, orientating them about the tools and techniques. Onsite coaching was also provided while pretesting among 55 middle-aged residents of a nearby rural municipality, not included in the study. Field researchers collected data by reaching out to the potential participants at their households. Identified hypertensive cases were referred to the nearby health facility for further management

The outcome variable, hypertension was measured using a sphygmomanometer and stethoscope. A comfortable seating position for all participants before taking the readings was ensured. All the participant's blood pressure was measured three times during the interview, basically after acquiring the informed consent, in the middle of the interview, and at the end of the interview. The average systolic blood pressure (SBP) and diastolic blood pressure (DBP) were noted. The classification was made using the cutoff provided by the National Heart, Lung, and Blood Institute (US) for adults.[9] The SBP of <120 mmHg and DBP of <80 mmHg was taken as Normal, and SBP between 120-139 or DBP between 80-89 was taken as elevated blood pressure. Similarly, SBP between 140-159 or DBP between 90-99 referred to Stage 1 hypertension, and SBP between 160-179 or DBP between 100-119 referred to Stage 2 hypertension. The SBP >180 or DBP >120 was considered a hypertensive crisis. The groups were further regrouped into normal/elevated blood pressure and hypertensive status for the statistical test.

The independent variables in this study included demographic, socioeconomic, behavioral, and health-related factors, referenced from the Nepali version of the WHO STEPS survey tool. Socioeconomic measures comprised age, gender (categorized as male or female), and ethnicity (classified into Dalit, Janajatis, religious minorities, and advantaged groups, based on the Health Management Information System (HMIS) ethnicity categories). Religion was categorized as Hindu and Non-Hindu, whereas Non-Hindu included Christian, Muslim, and Buddhist participants. Socioeconomic status (SES) was determined by dividing participants into quintiles based on household income, using the International Wealth Index scale. Behavioral measures covered tobacco and alcohol consumption, where current consumers were defined as those who had used these substances within the last 30 days preceding the survey, and past consumers as those who had consumed them more than one month ago. Physical activity was classified based on intensity and duration, with vigorous activity defined as more than 150

minutes per week, moderate activity as 100-150 minutes per week, and low (sedentary) activity as less than 100 minutes per week. Health-related measures included Body Mass Index (BMI), calculated from height and weight measurements using stadiometers and digital weighing scales, and categorized as underweight (<18.5 kg/m^2), normal (18.5-22.9 kg/m^2), overweight (23-24.9 kg/m^2), pre-obese (25-29.9 kg/m^2), and obese (≥30 kg/m^2). Morbidity status was grouped into no chronic conditions, single morbidity, and multiple morbidities, where multiple morbidity referred to the presence of two or more chronic diseases. Additionally, family history variables included self-reported cases of hypertension or diabetes among immediate family members.

Data were entered in EpiData 3.1 and analyzed by using Statistical Package for Social Sciences (SPSS) version 22. Descriptive statistics were used to describe respondents' socio-demographic profile, behavioral characteristics, health-related characteristics as well as their hypertension status in frequencies and percentages. The chi-square test and unadjusted odds ratio were performed between explanatory variables and hypertension status to identify the associated factors of hypertension at a 5% level of significance. Those factors that were found significant in the bivariate analysis (p<0.05) were selected to develop multivariable logistic regression models.

RESULTS

Out of a total of 525 respondents, 372 (70.85%) were screened to have hypertension considering both systolic and diastolic pressure, but only 249 (47.4%) respondents reported being diagnosed to have hypertension by a physician. Almost half (50.9%) of the respondents were observed to have normal to elevated systolic pressure while only one-third (33.9%) had normal to elevated diastolic pressure (Table 1).

Among the 525 study respondents, 48.6% were males and 51.4% were females. The mean age of the respondents was 47.3±8.4 years. The majority (47.6%) of respondents reported agriculture as their major occupation and more than one-third (37%) reported being illiterate. Socio-demographic characteristics such as respondent's sex, age, and educational status were found to have a statistically significant relationship with hypertension at p<0.05 (Table 2).

The majority of respondents (80.6%) reported that they do not currently smoke any tobacco product, and 64.2% had never consumed alcohol. In terms of physical activity, the majority of the respondents reported engaging in either vigorous (48.4%) or moderate (35.2%) physical activity. Except for the physical activity of respondents, all other behavioral characteristics were found to have a statistically significant relationship (p<0.05) with hypertension (Table 3). More than half (53.7%) of them reported not being diagnosed with any chronic morbidity so far, whereas 43.8% reported having more than one chronic condition. The majority of respondents (41.3%) were observed to have a normal BMI, while more than a quarter (28.4%) were classified as "pre-obese", followed by overweight (Table 3).

In the multivariable logistic regression, males were almost twice more likely to have hypertension (aOR: 1.903; 95% CI: 1.184-3.030) than their counterparts. Similarly, in the adjusted model, the odds of experiencing hypertension were higher among the middle-aged group 45-55 years (aOR: 2.002; 95% CI: 1.152-3.478) and people with basic education (aOR: 2.014; 95% CI:1.174-3.455). Similarly, higher odds of hypertension were also observed among current alcohol consumers (aOR: 1.923; 95% CI: 1.095-3.375). In unadjusted mode, the people suffering from multiple morbidities were found to have a two-fold increase in their odds of having hypertension (2.030, 95% CI: 1.362-3.025) in comparison to those who don't have any morbid condition but this association weakened and became insignificant in the adjusted mode. Similarly, people with a higher body mass index and belonging to the overweight or obese category were more at odds (aOR: 1.899; 95% CI: 1.262-2.859) of being hypertensive (Table 4).

Table 1. Prevalence of hypertension among respondents.

Characteristics	n	%	95% CI
Systolic blood pressure in mmHg (Mean ±SD:130.66 ±18.65)			
Normal/elevated systolic pressure (<139)	267	50.9	46.1-55.2
High blood pressure stage I (140-159)	118	22.5	19.2-26.1
High blood pressure stage II (160-179)	132	25.1	21.7-29.0
Hypertensive crisis (>180)	8	1.5	0.6-2.7
Diastolic blood pressure in mmHg (Mean ±SD:85.49 ±11.73)			
Normal/ elevated diastolic pressure (<89)	178	33.9	29.9-37.7
High blood pressure stage I (90-99)	171	32.6	28.6-36.8
High blood pressure stage II (100-119)	173	33.0	29.3-37.1

Hypertensive crisis (>120)	3	0.6	0.1-1.1

Table 2. Association of socio-demographic factors with hypertension.

Variables	n (%)	Hypertension		p-value
		Presence n (%)	Absence n (%)	
Gender				
Male	255 (48.6)	202 (79.2)	53 (20.8)	<0.001***
Female	270 (51.4)	170 (63.0)	100 (37.0)	
Age (Mean ±SD:47.3±8.4)				
35-45 years	222 (42.3)	141 (63.5)	81 (36.5)	0.001**
45-55years	144 (27.4)	117 (81.3)	27 (18.8)	
55-60 years	159 (30.3)	114 (71.7)	45 (28.3)	
Ethnic groups(caste)				
Dalit	92 (17.5)	71 (77.2)	21 (22.8)	0.208
Janajatis	174 (33.1)	127 (73.0)	47 (27.0)	
Religious minority	68 (13.0)	43 (63.2)	25 (36.8)	
Advantaged groups	191 (36.4)	131 (68.6)	60 (31.4)	
Religion				
Hindu	437 (83.2)	312 (71.4)	125 (28.6)	0.545
Non-Hindu	88 (16.8)	60 (68.2)	28 (31.8)	
Type of Family				
Nuclear	319 (60.8)	220 (69.0)	99 (31.0)	0.235
Joint/ Extended	206 (39.2)	152 (73.8)	54 (26.2)	
Educational status				
Illiterate/ Informal	199 (37.9)	141 (70.9)	58 (29.1)	0.005**
Primary Education	159 (30.3)	126 (79.2)	33 (20.8)	
Secondary and higher education	167 (31.8)	105 (62.9)	62 (37.1)	
Occupation				
Homemaker	76 (14.5)	48 (63.2)	28 (36.8)	0.063
Agriculture	250 (47.6)	176 (70.4)	74 (29.6)	
Business	74 (14.1)	59 (79.7)	15 (20.3)	
Labor work	59 (11.2)	47 (79.7)	12 (20.3)	
Service/pension	66 (12.6)	42 (63.6)	24 (36.4)	
Socioeconomic status				
First quintile	114 (21.7)	80 (70.2)	34 (29.8)	0.190
Second quintile	108 (20.6)	70 (64.8)	38 (35.2)	
Third quintile	94 (17.9)	63 (67.0)	31 (33.0)	
Fourth quintile	104 (19.8)	82 (78.8)	22 (21.2)	
Fifth quintile	105 (20.0)	77 (73.3)	28 (26.7)	

** statistical significance at p<0.01, ***statistical significance at p<0.001

Table 3. Association of behavioral and health-related characteristics with hypertension.

Variables	n (%)	Hypertension		p-value
		Presence n (%)	Absence n (%)	
Smoke Tobacco Product				
Yes	102 (19.4)	81 (79.4)	21 (20.6)	0.034*
No	423 (80.6)	291 (68.8)	132 (31.2)	
Alcohol consumption				
Never consumed alcohol	337 (64.2)	219 (65.0)	118 (35.0)	<0.001***
Consumed alcohol in past	40 (7.6)	28 (70.0)	12 (30.0)	
Current alcohol consumer (<12 months)	148 (28.2)	125 (84.5)	23 (15.5)	
Physical activity at least 5 days a week				
Vigorous physical activity	254 (48.4)	173 (68.1)	81 (31.9)	0.136
Moderate physical activity	185 (35.2)	141 (76.2)	44 (23.8)	
Low physical activity (sedentary)	86 (16.4)	58 (67.4)	28 (32.6)	
Morbidity status				
No chronic morbidity	282 (53.7)	182 (64.5)	100 (35.5)	0.002**
Single morbidity	13 (2.5)	9 (69.2)	4 (30.8)	
Multiple morbidities	230 (43.8)	181 (78.7)	49 (21.3)	
Family History of hypertension				
Yes	210 (40.0)	166 (79.0)	44 (21.0)	0.001**
No	315 (60.0)	206 (65.4)	109 (34.6)	
Family history of diabetes				
Yes	62 (11.8)	47 (75.8)	15 (24.2)	0.361
No	463 (88.2)	325 (70.2)	138 (29.8)	
Body mass index (in kg/m^2)				
Underweight (<18.5)	42 (8.0)	23 (54.8)	19 (45.2)	0.001**
Normal (18.5-22.9)	217 (41.3)	140 (64.5)	77 (35.5)	
Overweight (23 -24.9)	84 (16.0)	63 (75.0)	21 (25.0)	
Pre-obese (25.0-29.9)	149 (28.4)	121 (81.2)	28 (18.8)	
Obese (≥30)	33 (6.3)	25 (75.8)	8 (24.2)	

* Statistical significance at p<0.05, ** statistical significance at p<0.01, ***statistical significance at p<0.001

Table 4. Multiple regression analysis considering various predictors of hypertension.

Variables	Hypertension COR (95% CI)	p-value	Hypertension AOR (95% CI)	p-value
Gender				
Female	Ref.		Ref	
Male	2.242 (1.517-3.313)	<0.001*	1.903 (1.184-3.030)	0.008*
Age				
35-45 years	Ref			
45-55years	2.489 (1.510-4.103)	<0.001*	2.002 (1.152-3.478)	0.014
≥55 year	1.455 (1.237-2.260)	0.042*	1.211 (0.708-2.072)	0.484
Educational status				
Illiterate/ informal education	1.435 (0.926-2.225)	0.106	1.626 (0.948-2.787)	0.077

Table 4. Multiple regression analysis considering various predictors of hypertension.

Variables	Hypertension COR (95% CI)	p-value	Hypertension AOR (95% CI)	p-value
Basic education	2.255 (1.374-3.700)	0.001*	2.014 (1.174-3.455)	0.011*
Secondary education or above	Ref		Ref	
Currently Smoke Tobacco Product				
No	Ref.		Ref.	
Yes	1.750 (1.038-2.949)	0.046*	1.298 (0.699-2.416)	0.409
Alcohol consumption status				
Never consumed alcohol	Ref		Ref	
Consumed alcohol in past	1.257 (0.617-2.563)	0.529	0.722 (0.321-1.622)	0.430
Current alcohol consumer	2.928 (1.780-4.818)	<0.001*	1.923 (1.095-3.375)	0.023*
Morbidity status				
No chronic morbidity	Ref.		Ref	
Single morbidity	1.236 (0.371-4.116)	0.730	0.845 (0.198-3.754)	0.838
Multiple morbidities	2.030 (1.362-3.025)	0.001*	1.262 (0.529-3.010)	0.600
Family history of hypertension				
Yes	1.996 (1.331-2.994)	0.001*	1.617 (0.650-4.026)	0.301
No	Ref			
BMI				
Normal	Ref		Ref	
Underweight	0.584 (0.304-1.124)	0.107	0.721 (0.356-1.458)	0.362
Overweight/ Obese	2.086 (1.295-3.360)	0.002*	2.276 (1.355-3.822)	0.002*

* Statistical significance at p<0.05

DISCUSSION

In this study, nearly half (49.1%) of the respondents were observed to have higher systolic pressure while 66.1% had higher diastolic pressure. Among them, only 47.4% were aware of their condition. This is in line with the Nepal Demographic and Health Survey where undiagnosed hypertension was noted at 50.4%.[10] A nationally representative NCD risk factors STEPS survey conducted in 2019 revealed the prevalence of hypertension was highest in Gandaki Province (30%) as compared to other provinces.[11] This prevalence is higher than an estimate provided by a meta-analysis on hypertension in Nepal where the pooled prevalence of hypertension was noted to be 32% (23-40%) with a percentage point increase of 6% in the past 20 years.[12] These findings suggest an alarming rate of hypertension cases are undiagnosed at a community level, leading to more complex cardiovascular diseases and complications.

Hypertension is an important risk factor for cardiovascular disease where 54% of strokes and 47% of coronary diseases worldwide are attributed to hypertension.[13] Among all the deaths related to CVDs, three-quarters of deaths occur in low-and middle-income countries(LMICs).[14] It is estimated that globally nearly 1.28 billion adults aged 30-79 years live with hypertension, and two-thirds of them are from low- and middle-income countries.[15] A multinational study on Global Aging and Adult Health (SAGE) noted high rates of hypertension in all SAGE countries namely China, Ghana, India, Mexico, Russian Federation, and South Africa which also discosed a high prevalence of hypertension exist in developing nations.[16, 17] Nepal has acknowledged this rising concern of hypertension in its policies such as National Health Policy 2019 and Nepal Health Sector Strategic Plan 2023-2030 reflecting the need to address the wider determinants of health by making citizens responsible for their health.[18, 19] In 2014, a Multisectoral Action Plan for Prevention and Control of Non-Communicable Diseases 2014 was implemented in Nepal to control NCDs at the population level, in line with the NCD Global Monitoring Framework.[20] However, all of the policies seem ineffective if they are not properly implemented and/or if the people are unaware of their condition to seek healthcare.

In this study, only 47.4% of the participants screened to be hypertensive were aware of their status. This is in line with past community-based studies from Kaski district where only 43.2% of those screened for hypertension are unaware of their condition.[3] Similarly, more than half of the hypertensive patients were unaware of their condition in another study from Nepal.[3,12,21,22] This reveals that despite a high prevalence of hypertension, the level of awareness regarding one's health status and routine blood pressure monitoring is low among Nepali households. The WHO has acknowledged hypertension as a silent killer stating its rapid increase in low- and middle-income countries.[23] This highlights the need for health promotion interventions to constantly aware community people about their health status and their vital signs to prevent unexpected health consequences.

The odds of having hypertension were higher among respondents aged 45-55 years as compared to those aged below 45 years. This is in line with findings shared by a study based on DHS data from South Asian countries including India, Nepal, and Bangladesh.[24] Similarly, middle-aged males were at higher odds of experiencing raised blood pressure as compared to females. This finding is in line with past studies and systematic reviews focusing on low- and middle-income countries as well as member countries of the South Asian Association for Regional Cooperation.[25, 26] It was observed that the population with basic education was more likely to experience hypertension. A meta-analysis based on low- and middle-income countries shared a relationship between education status and hypertension as people without formal education were found to be more likely to be hypertensive.[25] This difference in the rate of hypertension between gender and education status could be due to the difference in their rate of exposure to behavioral risk factors, such as a significantly high level of tobacco and alcohol use as well as chronic stress among males and people with lower education in comparison to their counterparts.

The current alcohol users had a significantly higher odd of having hypertension. The positive association between alcohol consumption and hypertension has been reported in various countries including Nepal.[16,25,27] Moreover, a meta-analysis based on 15 randomized controlled trials revealed a dose-response relationship exists between alcohol reduction and mean blood pressure reduction.[28] Therefore, health awareness should be raised among alcohol users encouraging them to limit alcohol consumption as well as routinely monitor their blood pressure for early detection and prevention of hypertension.

The adults with comorbidities were more likely to experience raised blood pressure than healthy individuals. Similar to this finding, a past study from Nepal, reported the presence of diabetes can have a two-fold increase in the odds of hypertension.[29] Hypertension is often reported to be one of the most common comorbid conditions linked with several other chronic conditions.[3,5,6,16] However, due to the nature of our study design we cannot establish a temporal relationship between comorbid status and hypertension. Furthermore, a study based on the Chinese middle-aged population highlighted having other chronic diseases along with hypertension was negatively correlated with undiagnosed hypertension. It was suggested that people with other chronic conditions interact with healthcare providers more often than healthy individuals, making them more likely to monitor their blood pressure regularly.[27, 30] However, in the context of Nepal, it has been observed that most households seek formal health institutions only in case of major chronic conditions or if they experience any health consequences.[31,32] Encouraging regular blood pressure monitoring among those with chronic diseases may improve the early detection of hypertension in Nepal. The primary health care units including female community volunteers can play a crucial role in motivating the household in routine blood pressure monitoring.

The higher BMI of middle-aged adults was found to be significantly associated with their hypertensive status, with almost a two-fold increase in their odds. These findings are supported by other studies from Nepal and South Asia.[26] Obesity has established itself as a rising public health problem linked with several chronic conditions throughout the world.[25, 26] It has been linked with hypertension in countries of different economies.[16, 25, 30] It has been suggested that a direct and apparent dose-response relationship exists between overweight/obesity and blood pressure making BMI an important modifiable risk factor for hypertension.[33] The local levels should promote healthy lifestyles such as regular physical activity and adoption of a healthy diet to prevent obesity which could help reduce the risk of hypertension.

This is one of the few studies assessing hypertension among the general middle-aged population in community-dwelling which provided a comprehensive assessment of hypertension and its associated factors in rural Nepali communities. The selected study sites for this study are representative of most of the rural hilly areas of Nepal making the findings more generalizable. However, despite these strengths, the study is not free of its limitations and the shared findings must be interpreted accordingly. The study relied on self-reported information for some

variables, such as respondents' behavioral characteristics, which introduces the potential for recall bias and social desirability bias. The geographical diversities of the country might limit the representativeness of the study to other regions as well as urban settlements. Future research employing longitudinal designs and diverse samples could provide further insights into the dynamics of hypertension and its risk factors in Nepal.

CONCLUSIONS

The findings highlight the urgent need for interventions to raise awareness and improve routine blood pressure monitoring in Nepalese households. Socio-demographic factors such as age, sex, and educational status were identified as significant determinants of hypertension, emphasizing the importance of addressing behavioral risk factors and providing targeted interventions for specific population groups. Alcohol consumption and obesity were identified as modifiable risk factors for hypertension, indicating the need for health awareness campaigns and interventions to promote healthier dietary habits and weight management among the middle-aged population.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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