A Community Based Cross Sectional Study to Estimate the Prevalence and Associated Factors of Hypertension in Rural Nepal

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ABSTRACT

Background

Hypertension is a major global public health problem because of its high prevalence as it significantly increases the risk of heart attack, stroke, kidney failure and blindness. Epidemiological shift in prevalence of non-communicable diseases have been observed in Nepal and it is also evident that hypertension and related complications are major contributors to death and disability in Nepal.

Objective

To estimate the prevalence and explore the associated factors of hypertension in study population.

Method

A community based cross-sectional study was conducted in rural population of Nepal with multistage sampling design. A total of 422 participants aged 18 to 65 years of age participated in the study. The information was obtained using pretested questionnaire which included demographic information of individuals and other risk factors like alcohol and tobacco use, physical activity. Anthropometric measurements and blood pressure was recorded and hypertension was defined as per JNC VII criteria.

Result

The overall prevalence of hypertension was 27.7% (male: 32.7%, female: 19.8%). Mean systolic and diastolic BP were 123.79 ± 12.46 mmHg and 81.56 ± 8.32 mmHg, respectively. Age (eldest age group, AOR=4.92: CI: 1.24-19.46), participants with lower level of education (higher education, AOR=0.173: CI: 0.05-0.53), ethnicity (Janajatis, AOR=2.85: CI: 1.44-5.65) and smoking (current smokers, AOR=10.30: CI: 4.39-24.16) are found to be significantly associated with hypertension.

Conclusion

This study showed the prevalence of hypertension is high in study population. Increasing age, low level of education, ethnicity and smoking were independent risk factors for hypertension.

KEY WORDS

Hypertension, Prevalence, Risk factor

INTRODUCTION

Hypertension (HTN) is a major global public health problem because of its high prevalence.[1,2] The World Health Organization (WHO) attributes HTN to be a serious medical condition and it is one of the leading causes of premature death worldwide.[3] Of the total estimated people who have hypertension, fewer than one in five have it under control. If HTN is left untreated and uncontrolled it leads to complications of cardiovascular system, and affects the vital organs e.g., heart, kidneys, brain.[4,5]

Hypertension and related complications are major contributors to death and disability in South Asian countries like India, Bangladesh, Nepal, Bhutan and Sri Lanka.[6,7] According to recent WHO estimates 1.13 billion people worldwide have hypertension, most (two third) of them live in low- and middle income countries (LMIC). Epidemiological shift in prevalence of Non-communicable diseases (NCDs) have been observed in Nepal and it is observed that burden of NCDs is rising in the country.[8] Rapid urbanization, change in dietary patterns, behavioral factors and major improvements in prevention of maternal and child health to raise life expectancy are all factors contributing to shift disease patterns in Nepal.[9,10]

Several studies have shown that prevalence of hypertension is increasing in Nepal.[11-14] Prevalence and risk factors may vary according to different populations and comparatively fewer studies are conducted among rural population, moreover there was no study conducted in this population to assess prevalence of hypertension and risk factors. Thus our study intended to estimate the prevalence of hypertension and find its risk factors in the rural area of Nepal. Knowledge on prevalence of hypertension and its risk factors would help in designing the effective preventive measures in the rural population.

METHODS

This was a community based cross sectional study conducted in rural population of Kavrepalanchok district.[15] The participants were adults 18 to 65 years of age and holding permanent resident status at the time of study. Individuals who were unable to give response due to serious physical or mental illness and pregnant women were excluded from the study. The sample size was calculated by taking prevalence of hypertension as 41.5% 8and permissible error (d) as 5% with 95% confidence interval. The final sample size after considering the non-response rate of 15% was found to be 429. Data was obtained from 422 respondents and 7 were considered to be non respondents (1.63% non response rate).

Bethanchok is one of the seven rural municipalities of Kavrepalanchok district in province 3. The area is mountainous and sees the freezing temperature during winters. It has six wards and total population of 16,777 with an area of 101 km^2. Majority of the population of the study are farmers by occupation.[15]

We used the multi stage sampling for selection of the participants. At first, out of the six wards in Bethanchok, we selected three wards by lottery. The number of sample households from each ward was selected by Proportional to Size of the wards. Then, in ward level, we selected households using systematic random sampling with sampling interval of 5. Out of five households, the first house was chosen by lottery. Finally, at the household level, we selected one eligible participant from each household. If there were more than one eligible participant, lottery was done to select one participant.

WHO-NCD Stepwise approach to surveillance questionnaires was followed for collecting demographic information, behavioral and anthropometric measurements i.e. STEPS approach 1 and 2.[16]

STEP 1 consisted of information on socio-demographic variables and behavioral risk factors which were collected by interview using android based STEPS questionnaire prepared by using Open Data Kit (ODK) toolkit. The translated Nepali version of questionnaires was used from Steps Survey Instrument V 3.2 Nepali Unicode.

Information regarding physical measurements of height, weight, waist circumference, hip circumference and blood pressure were obtained by STEP 2.

Door to door survey was done and the purpose of the study was explained and those eligible participants were recruited in the study that provided the verbal consent. A face to face interview was conducted using a semi structured questionnaires required for the study. Height was measured with a portable standard stature scale, without footwear, with participant standing on a flat surface facing the interviewer with their feet together and heels against the backboard with knees straight. They were asked to look straight ahead. Height was recorded in centimeters.

Weight was measured with a portable digital weighing scale (SAMSO). The instrument was placed on a firm, flat surface. Weight was measured with minimum cloths and no footwear, with participant standing on the scale with one foot on each side of the scale, face forward, place arms at their side and wait until asked to step off. Weight was recorded in kilograms.

Body mass index (BMI) calculated using formula weight in kilograms divided by the square of the height in meters. Obesity was defined as BMI ≥ 25. Non stretchable measuring tape was used to measure length and circumference.

Blood pressure was measured following standard protocol with a digital, automated blood pressure monitor which has the simultaneous display of systololic and diastololic BP with pulse rate (OMRON HEM - 8712). Three readings of the systolic and diastolic blood pressure were obtained.

Participants rested for three minutes between each reading. The mean of the second and third readings was calculated. Hypertension was defined as having systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg during the study as recommended by Joint National Committee 7 and the participants who were taking anti hypertensive medicines were also considered as hypertensive.[17]

Questions related to smoking and alcohol consumption were asked and measured in terms of current users. We could not assess the frequency and amount of either of the variables. Current smoker was defined as those who were smoking cigarettes and those who quit less than one month before the interview. Any participant who drank alcohol within last 30 days of data collection was defined as current alcohol user. Number of servings of fruit and vegetable intake in a week was calculated with the help of pictogram.[16] Sufficient intake of fruit and vegetable was considered if the participant consumed at least 400 grams or at least five servings per day.[16]

Ethical approval was taken from Institutional Review Committee of Kathmandu University School of Medical Sciences. An informed consent was read and explained to the participants and the verbal consent was obtained.

SPSS version 23 was used for descriptive as well as inferential statistics. Sample characteristics were described using mean and standard deviation for continuous variable and percentage for categorical variable. Chi-square test was used to test the differences between proportions. Logistic regression was used to measure the association of hypertension with sociodemographic, behavioral factors and BMI in bivariate and multivariate models. A significance levelof 0.05 was used.

RESULTS

Looking at the proportion of genders, males constituted more than half (61%) of the participants. Most of the participants (57.6%) were in the 45 – 65 years age group, and only 12.5% in the 18 – 29 years age group. Majority of the participants were ever married (92.4%), more than half were Brahmins (53.8%) followed by Chhetri and Janajatis. Of the all participants 16.4% received no formal education, proportion of the people with primary and lower education was 38.9% and rest of them received secondary and higher level of education. Almost three fourth (74.6%) of the study participants were smokers, 28.4% were alcohol consumers, 41% had normal BMI and 59% were obese. None of the participants in our study was found to be consuming recommended fruits and vegetables (≥ 5 servings/ day). Mean number of days of fruits and vegetables consumed per week were 2.59 (±0.6). All the participants in current have physical activity more than WHO recommended physical activity (600 – 1200 MET minutes per week). (Table 1)

Table 1. Sociodemographic and behavioral characteristics of the participants (n=422)

Variables	Number (N)	Percentage (%)
Gender		
Female	162	38.4
Male	260	61.6
Age Groups (Years)		
18 – 29	53	12.5
30 – 44	126	29.9
45 – 65	243	57.6
Marital Status		
Unmarried	32	7.6
Ever Married	390	92.4
Education		
No formal education	69	16.4
Primary and lower	164	38.9
Secondary	92	21.8
Higher secondary	28	6.6
Bachelor and higher	69	16.3
Ethnicity		
Brahmin	227	53.8
Chhetri	90	21.3
Janajati	94	22.3
Dalit	11	2.6
Smoking		
No	315	25.4
Yes	107	74.6
Alcohol consumption		
No	302	71.6
Yes	120	28.4
Obesity (BMI ≥ 25)		
No	173	41
Yes	249	59
Physical activity total METs minutes per week	5565.1 (±3497.2)	
Fruits Intake (Mean±SD)	2.59 (±0.6)	

Prevalence of Hypertension, its classification and mean blood pressure levels

The overall prevalence of hypertension in our study was found to be 27.7% and prevalence was high in males (32.7%) compared to 19.8% in females. (Table 2) According to JNC 7 classification for hypertension, majority (58.3%) of the study participants were classified as pre hypertensive and out of 27.7% of total hypertensive people, 24.4% were classified as having stage I hypertension. (Table 3)

Table 4 depicts the mean values of systolic and diastolic BP according to age and gender. The overall mean systolic BP

Table 2. Prevalence of Hypertension in the study population (n=422)

Hypertension	Male (260) N (%)	Female (162) N (%)	Total N (%)
Yes	85 (32.7)	32 (19.8)	117 (27.7)
No	175 (41.5)	130 (30.8)	305 (72.3)
Total	260 (61.6)	162 (38.4)	422 (100)

Table 3. Classification of hypertension according to JNC 7 (n=422)

Hypertension	Frequency	Percent
Normal	59	14.0
Pre-hypertension	246	58.3
Hypertension Stage I	103	24.4
Hypertension Stage II	14	3.3
Total	422	100.0

Table 4. Mean systolic and mean diastolic blood pressure of the study population (n=422)

Mean Systolic Blood Pressure				
Age Category	**N (%)**	**Male (±SD)**	**Female (±SD)**	**Total (±SD)**
18-29	53 (12.56)	122.32 (±7.76)	117.00 (±12.75)	119.81 (±10.65)
30-44	126 (29.86)	123.87 (±10.86)	116.67 (±11.17)	120.95 (±11.50)
45-65	243 (57.58)	128.09 (±12.59)	122.56 (±12.50)	126.13 (±12.81)
Total (18-65)	422 (100)	126.25 (±11.87)	119.85 (±12.40)	123.79 (±12.46)
Mean Diastolic Blood Pressure				
Age Category	**N (%)**	**Male (±SD)**	**Female (±SD)**	**Total (±SD)**
18-29	53 (12.56)	79.46 (±5.83)	75.00 (±7.22)	77.36 (±6.84)
30-44	126 (29.86)	80.40 (±8.21)	77.84 (±6.95)	79.37 (±7.80)
45-65	243 (57.58)	85.35 (±7.83)	80.47 (±8.18)	83.62 (±8.27)
Total (18-65)	422 (100)	83.29 (±8.14)	78.80 (±7.88)	81.56 (±8.32)

(±SD) of the participants was 123.79 (±12.46) mmHg and the mean diastolic BP (±SD) was 81.56 (±8.32) mmHg. The mean systolic and diastolic BP in men was 126.25 (± 11.87) mmHg and 83.29 (± 8.14) mmHg, respectively. In women mean systolic and diastolic BP was 119.85 (± 12.40) mmHg and 78.8 (± 7.88) mmHg, respectively. Men had higher mean systolic and diastolic BP compared to women. The mean systolic and diastolic BP of the participants was higher with each successive age group for both the genders.

Factors associated with hypertension

Table 5 shows the prevalence of hypertension in study participants according to sociodemographic and behavioral characteristics. Gender, age, marital status, education level, ethnicity, smoking, alcohol consumption were significantly associated with hypertension status of the participants ($p < 0.05$).

Table 5. Association of socio-demographic characteristics and behavioral factors with hypertension

	Frequency	No Hypertension	Hypertension	p-value
	Number (%)	**Number (%)**	**Number (%)**	
Overall	422 (100)	305 (72.3)	117 (27.7)	
Variables				
Gender				**0.004**
Female	162 (38.4)	130 (80.2)	32 (19.8)	
Male	260 (61.6)	175 (67.3)	85 (32.7)	
Age Groups (Years)				**<0.001**
18 – 29	53 (12.5)	49 (92.4)	4 (7.5)	
30 – 44	126 (29.9)	104 (82.5)	22 (17.5)	
45 – 65	243 (57.6)	152 (62.6)	91 (37.4)	
Marital Status				**0.005**
Unmarried	32 (7.6)	30 (93.8)	2 (6.2)	
Ever Married	390 (92.4)	275 (70.5)	115 (29.5)	
Education				**<0.001**
No formal education	69 (16.4)	38 (55.1)	31 (44.9)	
Primary and lower	164 (38.9)	114 (69.5)	50 (30.5)	
Secondary	92 (21.8)	65 (70.7)	27 (29.3)	
Higher secondary	28 (6.6)	25 (89.3)	3 (10.7)	
Bachelor and higher	69 (16.3)	63 (91.3)	6 (8.7)	
Ethnicity				**<0.001**
Brahmin	227 (53.8)	183 (80.6)	44 (19.4)	
Chhetri	90 (21.3)	66 (73.3)	24 (26.7)	
Janajati	94 (22.3)	49 (52.1)	45 (47.9)	
Dalit	11 (2.6)	7 (63.6)	4 (36.4)	
Smoking				**<0.001**
No	315 (25.4)	269 (85.4)	46 (14.6)	
Yes	107 (74.6)	36 (33.6)	71 (66.4)	
Alcohol consumption				**<0.001**
No	302 (71.6)	254 (84.1)	48 (15.9)	
Yes	120 (28.4)	51 (42.5)	69 (57.5)	
Obesity (BMI ≥ 25)				0.078
No	173 (59)	133 (66.9)	40 (23.1)	
Yes	249 (41)	172 (69.1)	77 (30.9)	
Physical Activity Total MET per week (Mean ±SD)		5406.4 (±3473.9)	5978.8 (±3538.5)	0.133

A total of 27.7% of our study participants were identified as hypertensive, prevalence significantly higher in males (males: 32.7% and females: 19.8%: p=0.004). Prevalence of hypertension shows growing trend with the increase in age with highest prevalence (37.4%) in the eldest age group (p < 0.001). Being ever married (p=0.005), having low level of education (p < 0.001) was found to have significant association with hypertension. Hypertension prevalence was high among the Janajatis (47.9%) and Dalits (36.4%) compared to Brahminms and Chhetris (p < 0.001). Hypertension was more prevalent in the participants who were smokers (smokers: 66.4%, non smokers: 14.6%; p < 0.001), who consumed alcohol (alcohol users: 57.5%, no alcohol: 15.9%; p < 0.001). Higher prevalence of hypertension was found among obese participants (30.9%) compared to non obese (23.1%) but the association was not significant (p=0.078).

Univariate analysis showed that gender, age, marital status, education level, ethnicity, smoking and alcohol consumption were significantly associated with hypertension in study participants but multivariate logistic regression analysis revealed that age, education level, ethnicity, smoking are significant predictors of hypertension whereas gender, marital status and alcohol use are not significantly associated with hypertension (Table 6).

This study reveals that participants of elder age group (45 – 65 years) are 4.92 times (95% CI: 1.247 – 19.468) more likely to be hypertensive compared to the participants of younger age group (18 – 29 years). The odds of hypertension among Janajatis were 2.85 (95% CI: 1.44 – 5.65) higher compared to Brahmins. Our study found that participants with the highest level of education had inverse relationship with hypertension (AOR=0.17: 95% CI: 0.05 – 0.53). Association between smoking and hypertension is significantly high in our study because the participants who smoke are 10.30 times (95% CI: 4.39 – 24.16) more likely to be hypertensive than those who do not smoke (Table 6).

Table 6. Risk factors for hypertension: Multivariate Logistic regression

Variables	COR	95% CI	p value	AOR	95 % CI	p value
Gender						
Female	Ref.			Ref.		
Male	1.973	1.239 – 3.143	0.004	0.866	0.467 – 1.607	0.648
Age group (Years)						
18-29	Ref.			Ref.		
30-44	2.591	0.847 – 7.928	0.095	1.218	0.289 – 5.131	0.788
45-65	7.334	2.562 – 20.995	<0.001	4.926	1.247 -19.468	0.023
Marital Status						
Unmarried	Ref.			Ref.		
Ever married	6.273	1.475 – 26.683	0.013	2.225	0.359 – 13.803	0.391
Education						
No formal education	Ref.			Ref.		
Primary and lower	0.521	0.293 – 0.926	<0.026	0.527	0.257 – 1.077	0.079
Secondary	0.475	0.247 – 0.914	<0.026	0.624	0.272 – 1.431	0.266
Higher secondary	0.143	0.039 – 0.516	<0.003	0.943	0.210 – 4.246	0.939
Bachelor and higher	0.113	0.043 – 0.295	<0.001	0.173	0.056 – 0.532	0.002
Ethnicity						
Brahmin	Ref.			Ref.		
Chhetri	1.512	0.854 – 2.678	0.156	1.085	0.536 – 2.199	0.820
Janajati	3.820	2.267 – 6.435	<0.001	2.859	1.444 – 5.659	0.003
Dalit	2.377	0.666 – 8.478	0.182	1.132	0.232 – 5.512	0.878
Smoking						
No	Ref.			Ref.		
Yes	11.750	7.036 – 19.025	<0.001	10.304	4.393 – 24.167	<0.001
Alcohol consumption						
No	Ref.			Ref.		
Yes	7.159	4.450 – 11.519	<0.001	1.081	0.448 – 2.612	0.862
Obesity (BMI ≥ 25)						
No	Ref.			Ref.		
Yes	1.489	0.955 – 2.321	0.079	1.599	0.910 – 2.807	0.102

DISCUSSION

In this study of 422 adults aged 18 to 65 years, the prevalence of hypertension was 27.7%. Prevalence was higher among male participants, older age group, ever married, participants with no formal education, smokers and alcohol consumers and participants with higher BMI. Our study sought to estimate the prevalence and associated factors of hypertension among rural population of Nepal as hypertension is recognized as one of the major public health problem globally as well as in the developing countries.[18] It is now evident that it has a potential contribution for heart attacks, strokes and kidney failure.[19] Systemic review and meta-analysis of hypertension in Nepal found the prevalence of hypertension ranging from 15.1 to 38.9%.[20]

Studies conducted by Karmacharya et al. and Koju et al. in suburban population found prevalence to be 27.8% and 28.9% respectively.[21,22] Which is consistent with our findings and nationwide study on urban and rural population by Aryal et al. found prevalence to be 25.7%.[23] Which is lesser

than our findings whereas many studies from other part of Nepal reported prevalence of hypertension more than 30% which is higher than our findings.[12-14,24-26] These studies however differed in terms of sample size, participant's age, residence and ethnicity. Mean prevalence of hypertension in our study is consistent with the mean prevalence of hypertension found in the different systemic reviews and meta-analysis studies of Nepal (27.3%).[20] Member countries of South Asian Association for Regional Cooperation(27%) and Arabian countries (29.5%).[27,28]

The prevalence of pre hypertension in our study is 58.3% which is very high compared to findings from other studies done in different parts of Nepal.[22,25,29-35] The prevalence rate of prehypertension was found to be ranging from lowest of 22.1% to highest of 48%.[20] Participants in the pre hypertension category are the individuals at high risk of developing hypertension and should be advised to practice lifestyle modification in order to reduce their risk of developing hypertension in the future.[17]

Although prevalence rates in males was higher than females, but the difference was not significant and our result can be matched with other studies.[12,34-38] but there are findings which revealed that male gender is significantly associated with hypertension.[12,30,39,40]

Our study confirms that the prevalence of hypertension increased with age and is significant risk factor for hypertension and is consistent with findings from other studies from different part of the world.[6,12,30,37,39-44]

Our study revealed that participants who had education level of bachelor or higher have significantly lesser odds of hypertension compared to people with no formal education. Our finding is consistent with other studies which proved that low level of education is significantly associated with hypertension.[11,43,45] In contrast to our finding there are studies which show that prevalence of hypertension is higher among participants who had higher level of education.[6,46]

Current study found ethnicity to be significantly associated with hypertension and revealed that Janajati participants had the higher odds of hypertension compared to Brahmins. In the past, studies have shown the association of ethnicity with hypertension and mostly it was found high in Janajati population as they are more exposed to risk factors of hypertension like alcohol and smoking.[12] This reason alone is not sufficient to explain association between ethnicity and HTN and it needs to be explored in the future.

Unlike many studies whose findings suggested that smoking is not a significant contributor to hypertension.[34,36,42,43] This study showed that the association between smoking and hypertension is significant.[11,26,37,40,44,47,48]

The present study could not determine alcohol consumption as a significant risk factor for hypertension and our results are in line with other findings.[37,42,43,49] However there are studies that found alcohol as significant contributor to hypertension.[11,12,26,38,40,44,47,50] The different amount and concentration of the alcohol consumed might have lead to the different findings in the above mentioned studies. In present study we were unable to measure the frequency and concentration of alcohol that might have some effect on the final outcome.

Our study have showed that there is no significant association between BMI and hypertension which is similar to other findings.[34,49] But there are several studies which suggested that high BMI is a significant predictor of hypertension.[12,36,37,40,41,44]

The study is cross-sectional and with this design we cannot establish causal relationship between the risk factors and development of hypertension. Bias cannot be ruled out because our findings are based on self reporting of several variables. Although we adjusted for the multiple confounding factors but we were unable to measure the variables like psychological stress and biochemical parameters, which may act as confounding factors in establishing the association between risk factors and outcome. Despite the efforts to eliminate the chances of white-coat hypertension, possibility of the same could not be excluded in some of the participants.

CONCLUSION

Based on the findings from the current study we can conclude that prevalence of hypertension and prehypertension is high in the study area. It also revealed that increasing age, low level of education, ethnicity and smoking are significant risk factors for hypertension. We found that 58.3% of the participants were classified as prehypertensive, which adds to the overall future risk of developing hypertension. Measures for early detection of hypertension are required and health education regarding increase in fruits and vegetables intake and reduction in smoking are recommended.

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