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Outcomes of a longitudinal research investigation conducted as an integral part of a community-based activity trial in the Nepal region regarding the prevalence, contributing causes, awareness, treatment, and management of hypertension

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A B S T R A C T

Context : One of the most important public health issues in the world is hypertension. Hypertension was responsible for approximately half of the 2008 cardiovascular disease-related deaths. One of the main obstacles to avoiding complications and the future burden of cardiovascular illnesses is bringing blood pressure down to a normal range. Determining the prevalence, awareness, treatment, and management of hypertension and its contributing variables in Nepal is the goal of this study. **Methods :** This community-based cross-sectional study was carried out in Kathmandu, Nepal, as a component of a community-based intervention experiment. 1159 participants who were at least 30 years old were enrolled. Four wards were chosen at random from a total of twelve wards (administrative units). From each chosen ward, three hundred individuals were gathered. Using standard STEPS questions, a trained enumerator gathered clinical, anthropometric, and sociodemographic data. **Results :** Women made up 71% of the total participants, and their mean age was 47±12.6 years. The prevalence of hypertension was 40.6% when age and sex were taken into account, compared to 38.9% (95% CI: 36–41.7) overall. Of the women, 35.2% (95% CI: 32.4–37.9) and 48.1% (95% CI: 45.2–50.9) had hypertension. Significant variables linked to hypertension were found to include male gender (OR = 1.49), older age (OR = 1.04 each year), Dalit caste (OR = 1.71), history of cigarette smoking (OR = 2.78), current alcohol use (OR = 1.75), and elevated body mass index (OR = 1.17 per unit). Of the respondents with hypertension, 53.4% (95% CI: 48.7–58) were aware, 29% (95% CI: 24.8–33.1) were undergoing therapy, and 8.2% (95% CI: 5.6–10.7) had blood pressure under control. **Conclusion :** According to the study, hypertension is quite common in Nepal but is not well understood, treated, or controlled. Hypertension was linked to body mass index, smoking, consuming alcohol, age, gender, and ethnicity. To lessen the burden of cardiovascular diseases in the future, immediate public health and personal actions are necessary.

Keywords: Hypertension, Cardiovascular disease, Community-based, BMI.

INTRODUCTION

One of the main causes of death worldwide and a significant risk factor for cardiovascular illnesses is hypertension [1]. In 2008, cardiovascular diseases were responsible for one-third of all annual deaths. Of them, hypertension was found to be responsible for 9.4 million deaths annually worldwide [2]. Uncontrolled hypertension is the cause of 51% of stroke deaths and 45% of heart disease deaths. Furthermore, diabetes, heart failure, chronic renal disease, and other illnesses can be brought on by elevated blood pressure [3]. In 2014, 22% of persons worldwide who were 18 years of age or older had a diagnosis of hypertension. Compared to high-income countries, prevalence was higher in low-income countries. In the South East Asia Region (SEAR), the WHO reported that 25% of persons had excessive blood pressure [4]. According to a nationally representative sample, 25.7% of people in Nepal, one of the low-income countries, had hypertension in 2013 [5]. In a similar vein, during the previous three years, the percentage of people in Nepal with hypertension was 12.3% in rural Sindhuli [6], 27.7% in Dhulikhel [7], 28% in Pokhara [8], and 32.5% in Kathmandu [9]. In Nepal, hypertension was poorly controlled, with rates ranging from 11.7% [7] to 24% [10], despite its high incidence.

Research demonstrates the health advantages of reducing and managing blood pressure. For example, lowering systolic blood pressure by 10 mm Hg is linked to 22% and 41% lower rates of coronary heart disease and stroke, respectively [11]. Similarly, 41–46% of the decrease in cardiometabolic mortality was attributable to the prevention of several hypertension risk factors [12]. Establishing the gap, planning, and putting into practice programs linked to hypertension prevention and control in communities require population data on prevalence, awareness, risk factors, treatment, and control. On the one hand, however, very little research has been done; on the other hand, these studies were limited to the central and eastern regions of Nepal [7,10], and there is a dearth of data in the midwestern area. Thus, the purpose of this study was to ascertain the prevalence, contributing factors, awareness, management, and control of hypertension in Nepal's Kathmandu region.

Research population, research design, and study structures

This cross-sectional study was carried out in Kathmandu, Nepal, from January to December 2023 as a component of a community-based health education intervention trial (Trial registration number: NPK154321NT). The city, which is almost 600 kilometres west of the capital and is home to 52,137 people, is Nepal's administrative and geographic center and capital [13]. Multiethnic, indigenous, and migrant populations make up the city's population. This diverse population would be associated with the Western region's internal mobility, which accounts for 20% of the region's overall migration [14]. Every ward in the municipality is home to these diverse individuals [13]. The studied population's primary source of income is agriculture, which is followed by employment and self-owned businesses. The study comprised both males and women who were 30 years of age or older. However, the study did not include pregnant women, people who were bedridden, blind or deaf, or those with a diagnosis of kidney disease, cancer, heart disease, or mental illness. We included participants with essential hypertension and no problems because this trial was a component of a program for preventive health education.

Sampling methodology and sample size

We determined the unadjusted sample size to be 530 based on the 36.8% prevalence of hypertension among people aged 30 and over [15], with a precision of 5% and a design effect of 1.5. In order to overcome the drawback (loss of research power) of using clustered sampling as opposed to merely random sampling, we employed design effect [16]. Two strata of men and women were included by doubling the sample size that was obtained. The ultimate projected sample size, after accounting for a 10% non-response rate, was 1179. Wards, the lowest administrative unit, were regarded as clusters in our multistage clustered sampling technique. Four wards were chosen at random from a total of twelve wards. First, we chose at random the first house on the left side of the main street. After that, the data collector went to each successive home to sign up 300 people from the single ward who satisfied the inclusion requirements. In every ward, we used the same sample selection procedure.

Information gathering Twenty medical experts were enlisted, and they received training on the study's instruments and data gathering techniques. To confirm their comprehension, the principal and co-investigators arranged a three-day training session for the data collector, which was followed by pre-testing. Study objectives, procedures, inclusion and exclusion criteria, the informed consent process, and the proper use of data collection instruments and methodologies were all covered in the training sessions. In order to gather data, the data enumerator conducted in-person interviews with research participants and examined their blood pressure and anthropometric measurements. To gather data on age, sex, socioeconomic level, alcohol and tobacco use, consumption of fruits and vegetables, consumption of salt, and physical activity, we employed WHO STEPS questionnaires [17].

Participants were asked to report how many teaspoons of salt they had consumed during the previous two days by the data collector. We also asked if they were receiving medication for hypertension in the two weeks before to data collection, and if they had ever been informed by a health worker that they had elevated blood pressure or hypertension. In a similar vein, additional inquiries focused on family history of hypertension and known diabetes mellitus. Prior to final deployment, 20 individuals pre-tested the questionnaires.

Evaluations of blood pressure

Using an aneroid sphygmomanometer on the left arm, skilled data collectors took the patient's blood pressure. Based on the respondent's upper arm circumference, the proper cuff size was chosen. After resting in an uncrossed leg for at least fifteen minutes, the first reading was taken. After the individual had rested for at least three minutes following the initial measurement, a second measurement was taken. In the event where two readings differed, the final analysis employed the mean of the two measurements [17, 18].

Socioeconomic and demographic factors.

Age was calculated using completed years and then regrouped into intervals of ten years. In addition to married and unmarried status, divorced, widowed, or widowers were considered single. Caste-based classifications of ethnicity were Brahman, Chettri, Shahi or Thakuri, Dalit, and Janajati. Education was divided into four categories: primary (grades 1–5), secondary (grades 6–10), higher (grade >11), and no formal education (illiterate/informal education). Work was divided into four categories: home work, construction or agricultural labor, unemployment, and employment (working at a job or managing one's own business). Any participant whose annual family income was less than Rupees 16, 355 (US$: 16.3) was considered to be in poor economic position [19].

Control variables, therapy, and awareness of hypertension.
Average systolic blood pressure (SBP) ≥ 140 mm Hg, average diastolic blood pressure (DBP) ≥ 90 mm Hg, and/or a history of antihypertensive medication use during the previous two weeks were considered indicators of hypertension [18]. Self-reported hypertension that had been diagnosed by a physician or other health professional before the data collection was considered awareness of hypertension [20]. Self-reported use of any antihypertensive medication during the two weeks before to the interview was considered treatment of hypertension. For hypertensive subjects, blood pressure control was defined as SBP < 140 mm Hg and DBP < 90 mm Hg [20].

Behaviours-related variables.
In order to determine their current and prior smoking habits as well as how many cigarettes they smoked each day, questions about smoking were posed. Those who smoked cigarettes and those who stopped less than a month before to the interview were considered current smokers. Similarly, current tobacco users were characterized as those who chewed tobacco within the previous 30 days [17]. A respondent was considered a current alcohol user if they had consumed alcohol within the previous 30 days of data collection. The number of standard drinks (10 grams of pure ethanol) was used to calculate the total amount of alcohol consumed. Using a pictogram, the number of servings of fruits and vegetables consumed in a week was determined. A participant was deemed to have a sufficient diet of fruits and vegetables if they consumed at least 400 grams, or five servings, daily [17]. By dividing the total number of teaspoons of salt by the number of family members who shared meals during the previous two days, the salt consumption was calculated. The total amount of salt consumed was calculated by multiplying the average teaspoon by 5.69 grams. A dietary consumption of more than 5 grams of salt was deemed to be excessive [21]. The amount of physical activity was measured in weekly minutes of metabolic equivalents of task (MET). They were divided into three categories based on the local context: light (<3 MET), moderate (3–6 MET), and strong (>6 MET). Each subject was instructed to record questions.

Measurements Anthropometric
The portable stadiometer and weighing machine were used to measure height and weight. In a different room, the waist circumference (WC) was measured while standing, at the conclusion of a typical expiration, with the arms relaxed at the sides, and halfway between the top of the iliac crest (hip bone) and the lower edge of the last perceptible rib. Height and waist circumference were measured in centimetre's (cm), and weight was read to the closest kilogram (Kg). All measurements were obtained without shoes and in light clothing. The participants' body mass index (BMI) was calculated by dividing their weight by the square of their height (in meters). Underweight (<18.5 kg/m2), normal (18.5–24.9 kg/m2), overweight (≥25 kg/m2), and obese (≥30 kg/m2) were the classifications based on BMI [22]. Increased waist circumference of more than 88 cm for women and more than 102 cm for males was considered central obesity [23].

Analysis and Management of Data
Before importing the data into Epidata V 3.1, it was assembled and modified to ensure consistency. After removing duplicates, the data was exported to SPSS V.20.0 for additional examination. The sociodemographic traits of study participants were described using basic descriptive statistics. For categorical variables, the data were displayed as the frequency with percentage (%), and for continuously distributed variables that were normally distributed, the mean with standard deviation (SD). Continuous data that was not normally distributed was presented using a median with an interquartile range. 95% confidence intervals (CI) were used to describe the overall prevalence of hypertension for the entire study population. First, variables linked to hypertension were identified using univariate analysis. For both males and females, the 2013 standard Asian population distribution was used to account for age and sex in the prevalence of hypertension and variables linked to hypertension [24]. The crude and adjusted odds ratios were then calculated by entering all the related covariates into simple and multiple logistic regression models, respectively. All hypertensive participants' awareness, management, and control of their condition were shown proportionately with 95% CIs for age, sex, and socioeconomic level. The proportions of categorical variables and the means of continuous variables were compared using the chi-square and independent t-tests, respectively. Numerical variables that are not normally distributed can have their medians checked using the Mann-Whitney U test. Every test was two-tailed, and a p-value of less than 0.05 was deemed statistically significant.

Ethical Criteria

The Nepal Medical Research Council's Ethical Review Committee gave their approval to the study protocol. Every participant provided written informed consent, or a thumb impression if they were unable to write. Before consent was obtained, each respondent received an explanation of the study's goals, data collection methods, benefit, risk, and confidentiality

RESULTS

The research participants' sociodemographic attributes

After eliminating 21 participants who provided inaccurate or improper information, a total of 1159 participants were included in the study. 71% of these were women. About one-third of the participants were between the ages of 30 and 39, with a mean age of 47±12.6 years. Married people made up the majority of the enrolled residents. Brahman (29.3%) and Dalit (21.4%) made up a larger percentage of all responses than Janajati (18%). The majority of participants (54%) were illiterate, while women (62.5%) had lower levels of education than men (33.1%). A third (26.3%) of the participants were employed, whereas the majority (56.8%) worked around the house. A third (27.3%) of them were in a low-income category (Table 1).

Variable	Men (N = 335)	Women (N = 824)	Total (N = 1159)	
	n (%)	n (%)	n (%)	P value
Age (years)				
30–39	68 (20.3)	315 (38.2)	383 (33.0)	
40–49	91 (27.2)	204 (24.8)	295 (25.5)	
50–59	81 (24.2)	137 (16.6)	218 (18.8)	0.001
≥ 60	98 (28.4)	168(20.4)	263 (22.7)	
Marital status				
Unmarried	11 (3.3)	26 (3.2)	37(3.2)	
Married	314 (93.7)	711 (86.3)	1025 (88.4)	< 0.001
Single	10 (3.0)	87 (10.6)	97 (8.4)	
Ethnicity				
Brahman	100 (29.9)	240 (29.1)	340 (29.3)	
Kshetri	69 (20.6)	155 (18.8)	224 (19.3)	
Shahi or Thakuri	36 (10.7)	102 (12.4)	138 (11.9)	0.906
Dalit	71 (21.2)	177 (21.5)	248 (21.4)	
Janajati	59 (17.6)	150 (18.2)	209 (18.0)	
Level of education				
No formal education	111 (33.1)	515 (62.5)	626 (54.0)	
Primary (grade 1–5)	56 (16.7)	80 (9.7)	136 (11.7)	
Secondary (grade 6–10)	95 (28.4)	144 (17.5)	239 (20.6)	< 0.001

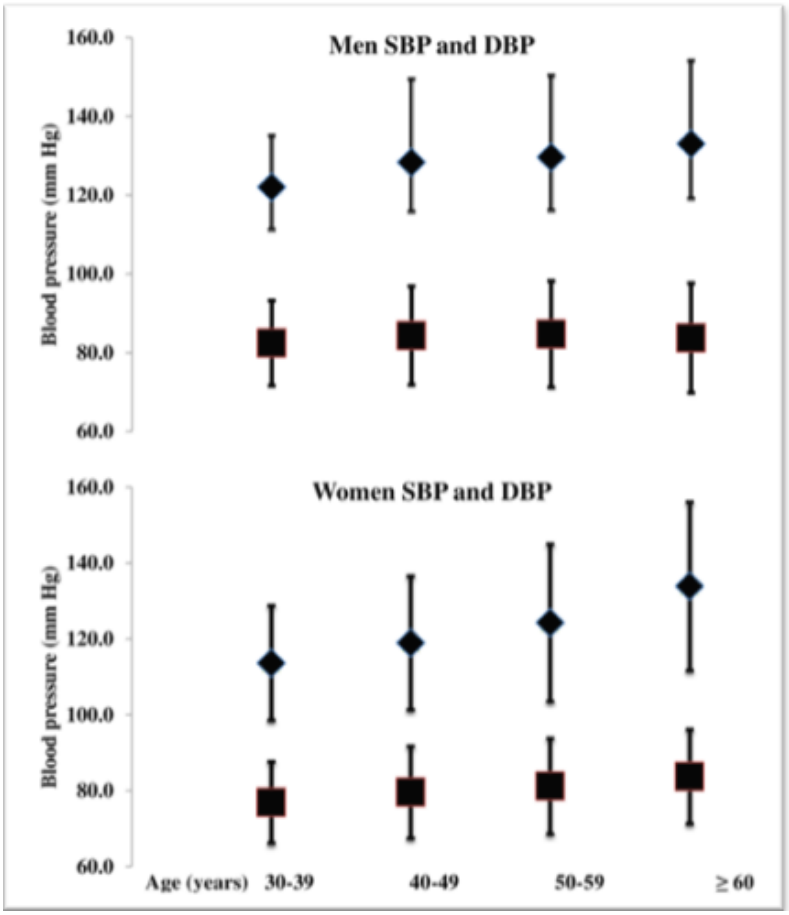
Higher (grade >11)	73 (21.8)	85 (10.3)	158 (13.6)	
Occupation				
Employed or self employed	163 (48.7)	142 (17.2)	305 (26.3)	
Household work	64 (19.1)	595 (72.2)	659 (56.8)	< 0.001
Agriculture or labor	81 (14.2)	61 (7.4)	142 (12.3)	
Unemployed	27 (8.1)	26 (3.2)	53 (4.6)	
Economic status				
Above poverty line	238 (71)	605 (73.4)	843 (72.7)	0.424
Poor	97 (29)	219 (26.6)	316 (27.3)	
Current Smoker	117 (34.9)	92 (11.2)	209 18(18)	
Past smoker	66 (19.7)	114 (13.8)	180 (15.5)	<0.001
Non smoker	152 (45.4)	618 (75)	770 (66.4)	
Current tobacco user	109 (32.5)	30 (3.6)	139 (12.0)	<0.001
Currently drinks alcohol	129 (38.5)	48 (5.8)	177 (15.3)	<0.001
Insufficient use of fruit and vegetable	320 (95.5)	802 (97.3)	1122 (96.8)	0.113
High salt intake (≥ 5 gm/day)	74 (22.1)	162 (19.7)	263 (20.4)	0.352
Inadequate level of physical activity	139 (41.5)	276 (33.5)	415 (35.8)	0.01
BMI				
Overweight	97 (29)	314 (39)	419 (36.1)	0.006
Obesity	15 (4.5)	72 (8.7)	87 (7.5)	
Central Obesity	44 (13.1)	415 (50.4)	459 (39.6)	<0.001
Mean±SD				
Age	50.87±12.39	45.5±12.4	47±12.6	<0.001
BMI	23.23±3.80	24.08±4.35	23.83±4.2	0.002
WC	90.80±12.78	87.52±14.47	88.47±14.08	<0.001
SBP	128.69±19.91	120.82±19.83	123.10±20.16	<0.001

Note : Mass Index (BMI), Waist Circumference (WC), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Standard Deviation (SD)

Table 1. Demographic, socio-economic, behavioural, and anthropometric characters of study subjects by sex.

The frequency of high blood pressure

123.1±20.6 mm Hg was the mean systolic blood pressure (SBP). Men had a higher mean SBP (128.6±19.9 vs. 120.8±19.8 mm Hg) than women. Similarly, 80.8±12.4 mm Hg was the overall mean diastolic blood pressure (DBP). The mean blood pressure was lower in women (79.6±12 mm Hg) than in men (83.6±12.8 mm Hg) [Table 1 and Fig 1]. The mean systolic blood pressure was 123.6±20.1 mm Hg and the mean diastolic blood pressure was 80.9±12.5 mm Hg after adjusting for age and sex. Systolic and diastolic blood pressure were substantially greater in men than in women ($p<0.001$). 38.9% of people had hypertension overall (95% CI: 36–41.7). The prevalence of hypertension, adjusted for age and sex, was 40.6%. Men were substantially more likely than women to have hypertension [48.1% (95% CI: 45.2–50.9)] as opposed to [35.2% (95% CI: 32.4–37.9)]. When age and sex were taken into account, 37.1% of women and 48.6% of men had hypertension. The age group with the lowest prevalence, when stratified by age, was those aged 30 to 39 (21.7%). 59.3% was the highest occurrence among those who were older than 60. When comparing the final two age groups, the prevalence was nearly equal for men and women (Fig 2). With and without controlling for age and sex, there was a significant difference in the prevalence of hypertension across age groups ($p<0.001$) and between men and women ($p<0.001$) (Table 2).



Abbreviations: *SBP, systolic blood pressure and DBP, diastolic blood pressure.*

Figure 1. Mean SBP and DBP stratified by age and sex bars represent the standard deviation (SD).

Socioeconomic traits and high blood pressure

The widow or widower had the highest rate of hypertension (59%). Participants from the Dalit (50%) and Janajati (41%) castes showed higher blood pressure than those from the Brahman and Chettri castes. Participants with no formal education had the highest percentage of hypertension (46.3%). The likelihood of hypertension was higher among respondents who were unemployed. Compared to individuals who were above the poverty line, the prevalence was higher among those with a lower economic level (44%). According to univariate analysis, there were significant differences in hypertension across education level ($p = <0.001$), marital status ($p = <0.001$), ethnicity ($p = 0.001$), occupation ($p = 0.026$), and economic position ($p = 0.03$). Furthermore, after controlling for age and sex, hypertension was substantially correlated with occupation ($p = 0.02$), economic status ($p = 0.012$), married status ($p<0.001$), ethnicity ($p = 0.001$), and educational attainment ($p = 0.001$) (Table 2).

Variable	Normotensive	Hypertensive	P value	Age sex adjusted P value
	n (%)	n (%)		
Sex				
Male	174 (51.9)	161 (48.1)	<0.001	<0.001
Female	534 (64.8)	290 (35.2)		
Age (years)				
30–39	300 (78.3)	83 (21.7)		
40–49	185 (62.7)	110 (37.3)		
50–59	116 (53.2)	102 (46.8)	<0.001	<0.001
≥ 60	107 (40.7)	156 (59.3)		
Marital status				
Unmarried	22 (59.5)	15 (40.5)		
Married	648 (63.2)	377 (36.8)	<0.001	<0.001
Single	38 (39.2)	59 (60.8)		
Ethnicity				
Brahman	222 (65.3)	118 (34.7)		
Kshetri	150 (67.0)	74 (33.0)		
Shahi or Thakuri	89 (64.5)	49 (35.5)	0.001	0.001
Dalit	124 (50.0)	124 (50.0)		
Janajati	123 (58.9)	86 (41.1)		
Level of education				
No formal education	336 (53.7)	290 (46.3)		
Primary (grade 1–5)	92 (67.6)	44 (32.4)		
Secondary (grade 6–10)	170 (71.1)	69 (28.9)	<0.001	<0.001
Higher (grade >11)	110 (69.6)	48 (30.4)		
Occupation				
Employed	185 (60.7)	120 (39.3)		
Household work	412 (62.5)	247 (37.5)	0.026	0.020
Agriculture or labor	89 (62.7)	53 (37.3)		
Unemployed	22 (41.5)	31 (58.5)		
Economic status				
Above poverty line	531 (63.0)	312 (37.0)	0.03	0.012
Poor	177 (56.0)	139 (44.0)		

Table 2 : Socio-demographic factors associated with hypertension.

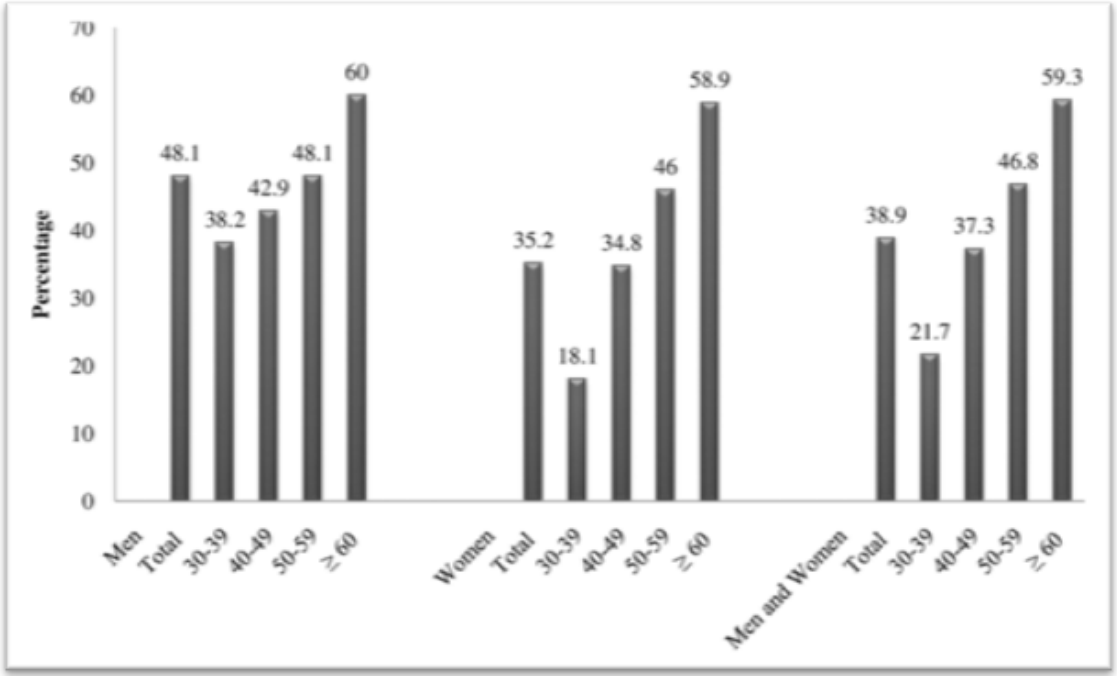


Figure 2 : Prevalence of hypertension by sex and age.

Variables	Normotensive	Hypertensive	P Value	Age Sex adjusted P Value
	n (%) or Mean±SD or Median (interquartile range)	n (%) or Mean±SD or Median (interquartile range)		
Smoking				
Non smoker	115 (55.0)	94 (45.0)		
Current smoker	64 (35.6)	116 (64.4)	<0.001	<0.001
Past Smoker	529 (68.7)	241 (31.3)		
No of sticks per week	7.37±24.7	7.38±21.6	0.994	
Current tobacco use				
Yes	71 (51.1)	68 (48.9)	0.010	0.005
No	637 (62.5)	383 (37.5)		
No of packets per week	1.48±6.5	2.27±9.1	0.090	
Currently drinks alcohol				
Yes	77 (43.5)	100 (56.5)	<0.001	0.001
No	631 (64.3)	351 (35.7)		
Standard drink per day	3.00±1.55	3.65±2.25	0.032	0.020
Fruit and vegetable intake				
Sufficient	20 (54.1)	17 (45.9)	0.372	0.413
Insufficient	688 (61.3)	434 (38.7)		
Number of Servings	2.28 (1.17)	2.42 (1.71)	0.039*	
High salt intake (> 5 gm/day)				
Yes	148 (62.7)	88 (37.3)	0.566	0.427
No	560 (60.7)	363 (39.3)		
Level of physical activities				
Inadequate	224 (54.0)	191 (46.0)	<0.001	<0.001
Adequate	484 (65.1)	260 (34.9)		
Total METs-Minutes per Week	1590 (3375)	1060 (4040)	0.036*	
Diabetes mellitus				
Yes	30 (37.5)	50 (62.5)	<0.001	0.001
No	678 (62.8)	401 (37.2)		
Family history of hypertension				
Yes	91 (53.5)	79 (46.5)	0.020	0.037
No	617 (62.4)	372 (37.6)		
Body Mass index (BMI)				
Underweight	82 (76.6)	25 (23.4)		
Normal	417 (65.9)	216 (34.1)		
Overweight	176 (53.0)	156 (47.0)	<0.001	<0.001
Obesity	33 (37.9)	54 (62.1)		
BMI	23.07±3.99	25.03±4.27	<0.001	<0.001
Waist circumference (WC)				
Normal	466 (66.6)	234 (33.4)	<0.001	<0.001
Raised	242 (52.7)	217 (47.3)		
WC	86.12±13.14	92.16±14.7	<0.001	<0.001

Mann-Whitney U test was used to compare non-normally Sdistributed data.
Table 3 : Behavioural and anthropometric factors associated with hypertension.

Anthropometric and behavioural variables linked to hypertension smoking
In total, 18.5% and 15.5% of individuals, respectively, had smoked in the past and present. At the time of data collection, a greater percentage of men (35%) smoked cigarettes than women (11%). 64.4% of those who currently smoked had high blood pressure. The average weekly cigarette consumption for both hypertension and normotensive subjects was roughly seven. Thirty percent of former smokers have hypertension. Hypertension was substantially correlated with smoking status ($p<0.001$), both with and without age and sex adjustment. Twelve percent of the participants chewed tobacco, and around half of them suffered from high blood pressure. Both hypertension with and without hypertension were substantially ($p = 0.01$) correlated with current tobacco usage (non-smoking tobacco) (Tables 1 and 3).

Consumption of alcohol
15.3% of participants reported actively using alcohol, with over one-third of men (38.5%) and 6% of women doing so (Table 1). Hypertension was seen in the majority of research participants who drank alcohol (56.5%). Current alcohol use was linked to hypertension both with and without age and sex adjustment ($p<0.001$ and $p = 0.001$, respectively). Hypertensive respondents had a substantially greater mean daily consumption of standard drinks ($p = 0.032$) (3.6 vs. 3) (Table 3).

Consumption of fruits and vegetables
The majority of participants (96.8%) did not consume enough fruits and vegetables, and 38.7% of them had high blood pressure. Both hypertensive and normotensive participants had significantly different median intakes of fruit and vegetable servings ($p = 0.039$) (Tables 1 and 3).

Consumption of salt
Five grams or more of salt were consumed by one fifth of the participants overall. Males were more likely than females to consume large amounts of salt (22.1%) compared to 19.7%. 37.3% of participants with high blood pressure were those who drank a lot of salt. Tables 1 and 3 show that there was no significant difference in salt intake between respondents with and without hypertension.

Physical exercises
Overall, 35.8% of individuals had lower levels of physical activity. Males had lower levels of physical activity (41.5%) compared to females (35.8%) (Table 1). Of these people who were less active, 46% had high blood pressure. Median level of physical activities was 1060 METs-minutes per week among hypertension while it was 1590 METs-minutes per week among normal participants ($p = 0.036$). Low levels of physical activity were linked to hypertension both with and without age and sex adjustment ($p<0.001$) (Table 3).

Overweight and obese
Overweight and obese people made up 36% and 7.5% of the total participants, respectively. Compared to men (29% and 4.5%), women were more likely to be overweight and obese (39% and 8.7%, respectively) (Table 1). Respondents with and without overweight and obesity had significantly different proportions of hypertension ($p<0.001$). Participants with hypertension and those with normotension had significantly different mean BMIs ($p<0.001$) and waist circumferences ($p<0.001$). Even after controlling for age and sex, there was a substantial ($p<0.001$) difference between the hypertensive and normotensive patients (Tables 1 and 3).

Diabetes mellitus and hypertension history in the family
Seven percent of respondents said they have a first-degree relative with high blood pressure. Of these, 46.5% of participants with a positive family history had hypertension, and this family history was substantially linked to hypertension both with and without age sex adjustment ($p = 0.037$ and $p = 0.02$, respectively). In total, almost 7% of participants self-reported having diabetes. Without ($p<0.001$) and with ($p = 0.001$) age and sex adjustment, it was substantially linked to hypertension (Table 3).

Factors linked to high blood pressure
To determine the factors linked to hypertension, univariate and multivariate logistic regression models were employed. In univariate logistic regression, hypertension was strongly correlated with age, gender, marital status, ethnicity, education, occupation, economic status, smoking, alcohol use, physical activity level, history of diabetes, family history of hypertension, and BMI. However, there was no significant correlation between eating a lot of fruits and vegetables and consuming a lot of salt. Only BMI, smoking, current alcohol consumption, age, gender, and ethnicity were found to be significant factors linked to hypertension when all of these variables were included in a multivariate logistic model. After controlling for all other variables, a one-year increase in age increased the risk of developing hypertension by 4% (adjusted OR = 1.04, 95% CI: 1.03–1.06).

Males were 1.49 (95% CI: 1.00–2.22) times more likely than females to have hypertension. When comparing Dalits to Brahmans, the odds of developing hypertension were 1.71 (95% CI: 1.41–2.56). Likewise, compared to non-smokers, the odds of having hypertension were 2.78 (95% CI: 1.87–4.14) higher for former smokers. Similarly, currently drinking alcohol increased the risk of high blood pressure by 75% (adjusted OR = 1.75, 95% CI: 1.13–2.71) as compared to those who do not drink. Even after controlling for all other variables, the chance of developing hypertension rose by 17% for every unit rise in BMI (adjusted OR = 1.17, 95% CI: 1.13–1.21) (Table 4).

Understanding, Controlling, and Treating Hypertension
Of all individuals, 37 had regulated blood pressure, 131 were receiving therapy, and 241 were aware that they had hypertension (Fig 3). For individuals with hypertension, the awareness rate was 53.4% (95% CI: 48.7–58). Males had an awareness level of 55.9% (95% CI: 51.3–60.4), while females had a level of 52.1% (95% CI: 47.4–56.7). Compared to younger age groups, older age groups were more conscious of hypertension in both sexes. Males over 60, however, were

less conscious than those between 40 and 60. Of individuals with hypertension, 29% (95% CI: 24.8–33.1) were taking antihypertensive drugs as directed by their doctor. Among people with hypertension, the percentage of men receiving therapy was 27.3% (95% CI: 23.1–31.4), whereas the percentage of women receiving treatment was 30% (95% CI: 25.7–34.2). Among all hypertensive subjects, the treatment proportion was lower in younger age groups. Out of all hypertensive participants, only 8.2% (95% CI: 5.6–10.7) kept their blood pressure under control (140/90 mm Hg). Males had a blood pressure control rate of 7.5% (95% CI: 5–9.9), while females achieved an 8.6% (95% CI: 6–11.1). Younger people had lower blood pressure management. The age groups differed significantly in awareness ($p = 0.003$), treatment ($p<0.001$), and control ($p = 0.039$). Meanwhile, there were no appreciable differences in hypertension individuals' knowledge, therapy, or control according to their gender, ethnicity, educational attainment, occupation, or economic standing (Table 5).

DISCUSSION

About two-fifths of the participants in the current study, who lived in the Kathmandu area of the Suburban Municipality in the-part of Nepal, had hypertension. Significant correlations were found between hypertension and age, sex, ethnicity, smoking status, alcohol usage, and BMI. Even while the prevalence of hypertension was significant, only half of them knew they had it, only one-third were getting treatment, and only 10% had blood pressure under control. For those aged 30 and older, the current study's prevalence of hypertension (38.9% and 40.6% without and with age/sex adjustment) was similar to the 2013 STEPS survey in Nepal (36.8%) [15]. The current study group had more hypertension patients than other Nepali populations, including those in the Eastern area (34%), the capital (32.5%), the western region (28%), Dhulikhel (27.7%), and rural Sindhuli (12.3%) [6–9,25]. These discrepancies in results could result from other research included participants who were younger (even as young as 15 years old). Our study found that the older age group had a greater prevalence of hypertension, which was in line with other research done in Nepal [25–27].

Our results were also in line with research conducted in India; for example, the prevalence of elevated blood pressure, including that of antihypertensive medicine users, was nearly identical to Kerala's (40%) [28]. The prevalence of hypertension was highest among people aged 60 years or older (59.3%), and age was substantially correlated with the condition. 56.1% of people in the same age group had hypertension, according to a study done in Kathmandu, Nepal [9]. In a similar vein, hypertension affected 45% of responders over 50 [26]. Age-related increases in blood pressure are linked to arterial, arteriolar stiffness, and increased salt retention [29].

Variables	Crude Odds Ratio (95% CI)	Odds Ratio (95% CI)
Sex		
Female	Reference	Reference
Male	1.70 (1.31–2.20)**	1.49 (1.00–2.22)*
Age in years	1.05 (1.04–1.06)**	1.04 (1.03–1.06)**
Marital status		
Unmarried	Reference	Reference
Married	0.85 (0.43–1.66)	0.92 (0.43–1.99)
Single	2.27 (1.05–4.93)*	1.50 (0.61–3.66)
Ethnicity		
Brahman	Reference	Reference
Kshetri	0.92 (0.65–1.62)	0.86 (0.57–1.29)
Shahi or Thakuri	1.03 (0.68–1.56)	0.87 (0.53–1.41)
Dalit	1.88 (1.34–2.62)**	1.71 (1.41–2.56)*
Janajati	1.31 (0.92–1.87)	0.96 (0.63–1.46)
Education		
Higher (grade >11)	Reference	Reference
No formal education	1.97 (1.36–2.87)**	1.31 (0.79–2.17)
Primary (grade 1–5)	1.09 (0.66–1.79)	0.92 (0.52–1.65)
Secondary (grade 6–10)	0.93 (0.59–1.44)	0.89 (0.54–1.49)
Occupation		
Employed	Reference	Reference
Household work	0.92 (0.69–1.22)	0.97 (0.66–1.42)
Agriculture or labor	0.91 (0.60–1.38)	0.64 (0.39–1.06)
Unemployed	2.17 (1.20–3.93)*	1.47 (0.72–3.00)
Economic status		
Above poverty line	Reference	Reference
Poor	1.33 (1.02–1.73)*	1.14 (0.84–1.57)
Smoking		
Non smoker	Reference	Reference
Current smoker	1.79 (1.31–2.45)**	1.25 (0.84–1.86)
Past Smoker	3.97 (2.82–5.59)**	2.78 (1.87–4.14)**
Current alcohol consumption		
No	Reference	Reference
Yes	2.33 (1.68–3.23)**	1.75 (1.13–2.71)**
Physical activity		
Adequate	Reference	Reference
Inadequate	1.58 (1.24–2.02)**	1.26 (0.94–1.67)
Diabetes Mellitus		
No	Reference	Reference
Yes	2.81 (1.76–4.50)**	1.24 (0.73–2.11)
Family history of hypertension		
No	Reference	Reference
Yes	1.43 (1.03–1.99)*	1.17 (0.79–1.72)
Body Mass Index	1.12 (1.08–1.15)**	1.17 (1.13–1.21)**

* P value <0.05 and
** P value <0.001

Table 4. Multivariate analysis for factors associated with hypertension.

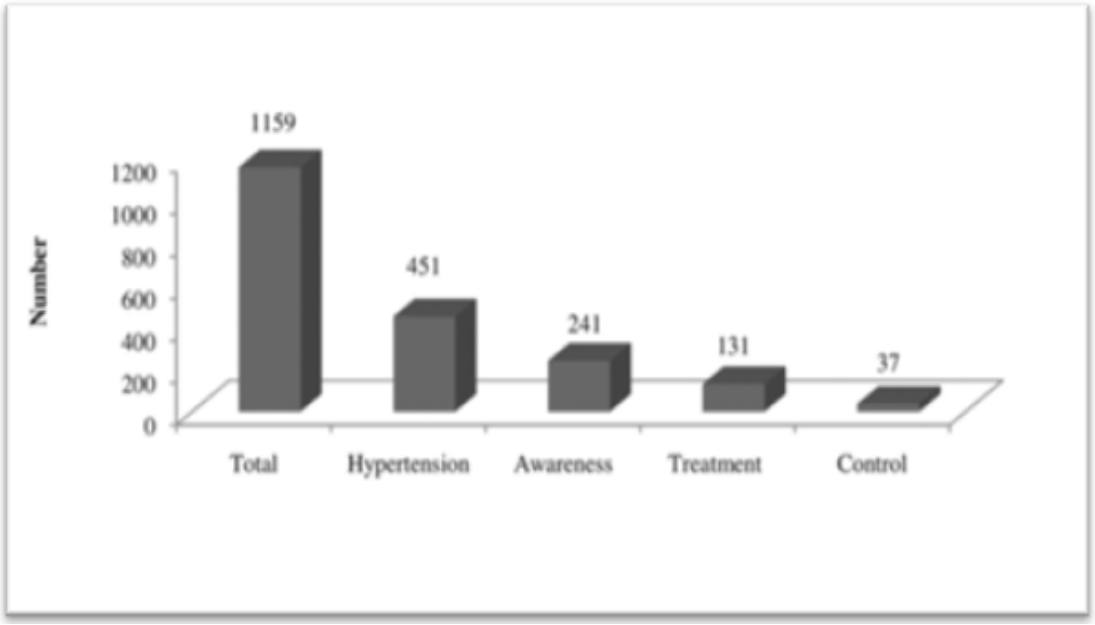


Figure 3: Summary of hypertension prevalence, awareness, treatment, and control.

In our sample, men had considerably greater rates of hypertension (48%) than women (35%) (OR:1.49). The prevalence of hypertension was 37.1% in women and 48.6% in men, adjusted for age and sex. The results were in line with the most recent STEPS study, which found that the odds ratio for men was 1.16 for women [5]. The study in Kathmandu (38.4% of men compared to 28.4% of women) [9], that central development zone (32.3% vs 15.3%) [27], and rural Nepal (30.6% versus 13.8%) [30] all reported similar results. Men were more likely than women to have hypertension, according to data compiled from 46 population-based studies conducted in various nations [31]. Men may have greater rates of hypertension due to health behaviours including smoking, drinking, and not exercising, all of which were consistently higher among male participants in our study. Another factor that contributed to hypertension was ethnicity.

According to our findings, the largest burden of hypertension was found among Jana-Jati, followed by Dalit. According to the majority of research done in Nepal, the Janajati community has higher rates of hypertension. According to recent and earlier research, the Dalits and Janajati community are more likely to engage in harmful habits including smoking and drinking alcohol, which may be a contributing cause to hypertension [7,9,27]. To clarify how race and ethnicity affect the prevalence of hypertension in Nepal, more research is necessary.

Both past and present smoking were linked to hypertension in our study using univariate analysis. When other factors were taken into account, however, only prior smoking emerged as a significant predictor of hypertension. Although it is commonly known that smoking cigarettes raises the risk of hypertension [32,33], several cross-sectional epidemiological studies [34], such as the one we conducted, found that regular smokers typically have lower blood pressure than non-smokers. This could be because many individuals quit smoking after
receiving a diagnosis of hypertension.

Variables	Awareness	Treatment	Control
	% (95% CI)	% (95% CI)	% (95% CI)
Overall			
Total	53.4 (48.7–58.0)	29.0 (24.8–33.1)	8.2 (5.6–10.7)
30–39 yrs	36.1 (31.6–40.5)	13.3 (9.9–16.2)	4.8 (2.8–6.7)
40–49 yrs	52.7 (48.0–57.3)	22.7 (18.8–26.5)	8.2 (5.6–10.7)
50–59 yrs	56.9 (52.3–61.4)	30.4 (26.1–34.6)	6.9 (4.5–9.2)
≥ 60 yrs	60.9 (56.3–65.4)	41.0 (36.4–45.5)	10.9 (8.0–13.7)
P values	**0.003**	**<0.001**	0.039
Men			
Total	55.9 (51.3–60.4)	27.3 (23.1–31.4)	7.5 (5.0–9.9)
30–39 yrs	26.9 (22.8–30.9)	0.0 (0.0–0.0)	0.0 (0.0–0.0)
40–49 yrs	64.1 (59.6–68.5)	28.2 (24.0–32.3)	10.3 (7.4–13.1)
50–59 yrs	64.1 (59.6–68.5)	25.6 (21.5–29.6)	2.6 (1.1–4.0)
≥ 60 yrs	57.9 (53.3–62.4)	40.4 (35.8–44.9)	12.3 (9.2–15.3)
P value	**0.011**	**0.002**	0.121
Women			
Total	52.1 (47.4–56.7)	30.0 (25.7–34.2)	8.6 (6.0–11.1)
30–39 yrs	40.4 (35.8–44.9)	19.3 (15.6–22.9)	7.0 (4.6–9.3)
40–49 yrs	46.5 (41.8–51.1)	19.7 (16.0–23.3)	7.0 (4.6–9.3)
50–59 yrs	52.4 (47.7–57)	33.3 (28.9–37.6)	9.5 (6.7–12.2)
≥ 60 yrs	62.6 (58.1–67.0)	41.4 (36.8–45.9)	10.1 (7.3–12.8)
P value	0.038	0.004	0.861
P values for men and women	0.434	0.549	0.665
Ethnicity			
Brahman	47.5 (38.4–56.5)	22.9 (15.3–30.4)	9.3 (4.0–14.5)
Kshetri	54.1 (42.7–65.4)	24.3 (14.5–34.0)	5.4 (0.25–10.5)
Shahi or Thakuri	63.3 (49.8–76.7)	36.7 (23.2–50.1)	16.3 (5.9–26.4)
Dalit	58.9 (50.2–67.5)	32.3 (24.0–40.53)	6.5 (2.1–10.8)
Janajati	47.7 (37.1–58.2)	32.6 (22.6–42.5)	7.0 (1.6–12.3)
P value	0.183	0.238	0.204
Education			
Illiterate/Informal education	55.5 (49.7–61.2)	32.1 (23.6–40.5)	8.3 (3.3–13.2)
Primary (grade 1–5)	59.1 (44.5–73.6)	29.5 (19.1–39.8)	4.5 (0.0–9.2)
Secondary (grade 6–10)	47.8 (36.0–59.5)	26.1 (13.8–38.3)	11.6 (2.6–20.5)
Higher (grade >11)	43.8 (29.7–57.8)	14.6 (8.3–20.8)	6.3 (2.0–10.5)
P value	0.289	0.091	0.556
Occupation			
Employed	52.5 (43.5–61.4)	23.3 (15.7–30.8)	4.2 (0.61–7.7)
Household work	52.6 (46.3–58.8)	31.2 (25.4–36.9)	10.1 (6.3–13.8)
Agriculture or labour	56.6 (43.2–69.9)	34.0 (21.2–46.7)	7.5 (0.4–14.5)
Unemployed	58.1 (40.7–75.4)	25.8 (10.3–41.2)	9.7 (0.0–20.1
P value	0.899	0.359	0.27
Economic status			
Above poverty line	51.9 (46.3–57.4)	28.2 (23.2–33.1)	8.7 (5.5–11.8)
Poor	56.8 (48.5–65.0)	30.9 (23.2–38.5)	7.2 (2.9–11.4)
P value	0.334	0.555	0.602

Table 5 : Awareness, treatment, and control of hypertension among hypertensive participants at 95% confidence interval.

Hypertension was also linked to current alcohol use. Alcohol use has been shown to be positively and significantly correlated with the risk of hypertension in recent epidemiological research [35, 36]. About 16% of all hypertension conditions were linked to alcohol use in 2003, according to the global burden of disease [37]. Alcohol use has also been linked to hypertension in other Nepalese research [6,9]. But according to certain research, drinking alcohol has a protective effect on blood pressure [38, 39], and this benefit was shown in women who drank light to moderate amounts of alcohol [35, 36]. Our investigation indicated that mean standard drink was greater among hypertension individuals, which was consistent with a meta-analysis of 15 randomised controlled trials [40]. It showed a dose-response association between blood pressure and alcohol intake [41]. In line with the results of earlier research carried out in comparable circumstances in Nepal, our investigation found a positive correlation between blood pressure and body mass index [6, 9]. Increased fat stores, insulin resistance, increased salt retention, and decreased physical activity are all associated with higher BMIs, and they all raise blood pressure levels [42, 43]. According to the current study, about half (53.4%) of the participants with hypertension knew they had the illness. Comparing our study to other research on Nepal and elsewhere, we found a higher level of awareness. In Nepal, between 41% and 46% of participants were aware [7,8,45].

Furthermore, 46.5% of 628 communities in high-, middle-, and low-income countries were found to be aware of hypertension in a cross-sectional survey [20]. Additionally, our study revealed that older groups had a relatively higher awareness of hypertension. It may be as a result of senior groups' regular visits to healthcare institutions. Similarly, in the

current study, antihypertensive medication was being taken by one-third (29%) of all hypertensive individuals. This percentage was in line with previous research conducted in Nepal (31–33%) [7,8] and outside (32.5%) [20]. The percentage of participants with untreated hypertension, however, was lower than that of a research conducted in Kathmandu's municipalities [10] and the subsequent national STEPS survey of Nepal (88.3%) [15]. The results of the current study are in contrast to those of prior studies that found that males and females had different levels of awareness and treatment proportion [7, 10]. According to Devkota et al., participants' low treatment status may be caused by their low socioeconomic position, limited health literacy, and long-standing misconceptions about antihypertensive medication [10]. Similarly, only 8.2% of the hypertensive participants in the current study had regulated blood pressure, which was less than the percentages seen in prior studies conducted in Nepal's Kathmandu (13%) [10], Dhulikhel (11%) [7], and Pokhara (15%) [8]. There were significant differences in Nepal's awareness, management, and control of hypertension when compared to the results of wealthy nations [20,46]. Our findings also demonstrated that, like in earlier research [7,10], the control status of hypertension differed significantly with age groups. Based on the aforementioned results, it can be concluded that the study population has a significant gap in hypertension awareness, treatment, and management, necessitating an immediate public health intervention that focuses on the population at risk, especially the younger generation. There were various restrictions on our investigation. The study was carried out in a single municipality with a total population of roughly 52,000 people in Nepal's midwestern area. Due to the fact that many men were traveling outside of their communities or countries in order to make a living, a large number of women participated in the study. We did not record the official participation rate, even though we had adjusted the sample size for the non-response rate. In a single visit, we took two blood pressure readings at three-minute intervals, and the average of the two readings was utilized for analysis. The use of a single visit measurement may lead to an overestimation of hypertension status. Furthermore, subclavian steal syndrome might be ruled out by bilateral measurement. Because individuals with documented heart and renal diseases were excluded from the study, the results may not be as reliable in approximating population parameters. Errors in self-reported behaviour may have occurred even with the use of standardised questionnaires and extensive training for the enumerator. It's possible that our study overestimated the amount of physical activity and underestimated the amount of salt consumed. A 24-hour urine sodium excretion test to measure salt consumption [48] and a log book or other direct way to determine physical activities [47] would have been preferable. Diabetes was diagnosed based on participant reports without a blood sugar test. Additionally, this study was unable to measure cholesterol levels. This study has a number of advantages in spite of these drawbacks. This study was the first to report the prevalence of hypertension by age, gender, and socioeconomic position in the midwestern region of Nepal. Our study's other strengths were random participant selection, thorough training for data collectors, participant enrolment at their homes, age-sex stratified data analysis, and estimation of the age-sex adjusted (by standard Asian population) prevalence of hypertension.

CONCLUSION

According to this study, hypertension is very common in the midwestern part of Nepal, however its awareness, treatment, and control status are lacking. The following factors were shown to be linked to hypertension: body mass index, cigarette smoking, alcohol use, age, sex, and ethnicity. Current research points to Nepal's future burden of kidney and cardiovascular disorders. To stop hypertension from developing and becoming worse, immediate planning and execution of both individual and public health interventions are required.

Conflicting interests

According to the writers, there aren't any.

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