Original Research Article

Cardiovascular Diseases and Associated Factors in a Middle-aged Population of Rupa Rural Municipality, Kaski, Nepal: A Community-based Cross-sectional Study

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Abstract

Cardiovascular diseases (CVDs) are the leading cause of mortality, not only posing pressure on health systems but also impeding the socio-economic development of Nepal. This study aims to assess the status of cardiovascular diseases (angina pectoris and myocardial infarction) and its associated factors among the middle-aged population of Rupa Rural Municipality, Nepal. A community-based cross-sectional study was conducted among 525 middle-aged (35-60 years) population of Rupa Rural Municipality, Nepal between August and December 2020 adopting simple random sampling. The WHO STEPS survey tool was used to collect the socioeconomic and behavioural characteristics, and the 10-item validated rose angina questionnaire (RAQ) to assess angina pectoris (AI) and myocardial infarction (MI). A multivariate logistic regression analysis was applied to identify the factors associated with AP and MI. The study respondents' mean (SD) age was 47.29 ($\pm$8.354) years. The prevalence of AP and MI was 9.1% and 2.5% respectively. The prevalence of AP was significantly higher among those aged 55 and above (OR$_A$:3.20, CI:1.41-7.29) and those consuming vegetables less than 4 days a week (OR$_A$:2.15, CI:1.12-4.11) as compared to those aged 35-44 years and consuming vegetables $\geq$4 days a week, respectively. The prevalence of CVD events (MI and AP) has increased in Nepal. The risk of developing AP increases with age and among those respondents consuming vegetables less than four days a week. The findings of this study call for the implementation of CVD risk assessment intervention at the primary healthcare level for the early detection and prevention of cardiovascular disease. The study further emphasizes education initiatives to promote healthy diet habits and lifestyle modifications in rural areas, which may reduce the risks of CVDs.

Introduction

Cardiovascular diseases (CVDs), a group of heart and blood vessel-related disorders, are the leading cause of morbidity and mortality globally(Cardiovascular Diseases, 19). CVD cases have increased significantly within the last few decades, from 271 million in 1990 to 550 million in 2019(Roth et al., 2020). CVDs were the major cause of 32% of global mortality (17.9 million) in 2019(Cardiovascular Diseases, 19). In low- and middle-income countries (LMICs), CVDs are more common accounting for over 75% of global CVD-related deaths[1]. South Asia, home to one-quarter of the global population holds a high burden of CVDs and nearly one-third of mortality in South Asia are related to CVDs (Misra et al., 2017).

Nepal, a South Asian country, has witnessed a higher burden of CVDs in recent years. CVD was responsible for nearly a quarter (24.04%) of total deaths in Nepal and 11.89% of Disability Adjusted Life Years (DALYs) in 2019(Pandey et al., 2023). Risk factors such as lifestyle behaviors (smoking or tobacco use, harmful use of alcohol, unhealthy dietary habits, physical inactivity) and the presence of cardio-metabolic (diabetes, hypertension, obesity dyslipidemia) conditions have been identified as the major cause of CVDs in Nepal (Dhungana et al., 2018; Gyawali et al., 2019). The STEPS survey report of Nepal (2019) revealed that nearly 25% of the Nepalese population had elevated blood pressure, 11% had raised cholesterol, 17% were current smokers, 97% did not consume sufficient fruits and vegetables, average population salt intake was 9.1 grams per day, 6.8% had harmful use of alcohol and 24.3% were overweight or obese(Bista et al., 2021). An analysis of the global burden of disease data in 2017, revealed that the burden of CVD in Nepal increased with age (Bhattarai et al., 2020). According to the NCDs STEPS survey 2019, 1.1% of adults aged 15-69 years reported ever having a heart attack or chest pain from angina pectoris or stroke (Bista et al., 2021).

The World Health Survey (2002-2004) data showed that the prevalence of AP in Nepal was 9.31% (diagnosed AP: 5.45% and symptomatic AP: 4.39%) (Alam & Mahal, 2014). A nationwide cross-sectional population-based study revealed that the Gandaki province and Sudurpashchim provinces of Nepal have a higher prevalence (3.6%) of coronary artery diseases among all provinces of Nepal (Dhimal et al., 2019). Similarly, a hospital-based cross-sectional study from Nepal reported that 2% of hospital-admitted patients had MI (Bhandari et al., 2014). Myocardial ischemic heart disease has been reported as a second leading cause among NCDs accounting for 12.3% of total deaths in Nepal(Nepal Health Research Council (NHRC), Ministry of Health and Population (MoHP), Institute for Health Metrics and Evaluation (IHME), Monitoring Evaluation and Operational Research, 19). However, national-level data on the incidence and prevalence of myocardial infarction (MI) in Nepal are not available to date (Bhattarai et al., 2020; Bista et al., 2021).

Target 3.4 of Nepal's SDG roadmap 2016-2030 aims to reduce the premature mortality from NCDs including CVDs by one-third from 2.8 in 2015 to 1.96 by the year 2030. The progress assessment report of SDGs in 2020 reported that the mortality from NCDs in 2017 was 2.8 compared to the target of 2.54 for 2019 (Sustainable Development Goals Progress Assessment Report, 2019). There are ample opportunities in Nepal, concerning the prevention, early detection and management of CVDs before it leads to morbidity and mortality(Bhattarai et

al., 2020; Prajapati et al., 2022; Shrestha et al., 2021). There is a need for community-based studies to better understand the prevalence and associated factors of angina pectoris and myocardial infarction in Gandaki Province, Nepal. Therefore, this study was conducted to assess the prevalence and associated factors of CVD (MI and AP) among the middle-aged population of Rupa Rural Municipality of Gandaki province of Nepal.

Methods and Materials

Study Design

A community-based cross-sectional study was conducted among the middle-aged population (35-60 years) living in Rupa Rural Municipality of Gandaki Province, Nepal. The Rupa municipality represents the average status of the rural parts of Kaski district and other hilly districts of Gandaki Province.

Population and Sample Size

According to the National Population Census 2021, the total population of Rupa rural municipality was 14,891 and the middle-aged (35-60 years) population accounted for 28.1% (4,185 of 14,891). The minimum sample size required for this study was 523 based on the following assumptions: 27.3% prevalence rate of hypertension in Nepal (Huang et al., 2019), 5% sampling error, 95% confidence interval, 1.5 design effect, and 20% non-response rate.

The total middle-aged population residing in Rupa Rural Municipality was 3,285; this information was obtained from the municipality database. A proportionate sample size for each ward was calculated based on the total middle-aged population of individual wards using the 2011 National Census data (Government of Nepal et al., 2014). A simple random sampling was adopted to select the study respondents from the individual ward. Those Nepalese adults aged between 35 and 60 years residing in the Rupa rural municipality for the last six months were invited to participate in the study. Eligible respondents able to provide written consent were enrolled in the study.

Data Collection Tools and Procedure

This study was conducted between August and December 2020. A publicly available standard and validated tool, the World Health Organization (WHO) STEPS Survey Questionnaire version 2.2 (Cluster, 2005)and Rose Angina Questionnaire (Rose, 1962a) were adopted to assess the prevalence of angina pectoris and Myocardial infarction. Questionnaires were translated into Nepali and back-translated to English to check the comprehensibility of the experts on NCDs to ensure their reliability and validity. A face-to-face interview was conducted by the trained research assistants. We trained all research assistants for two days on study objectives, and methods including data collection, management, and entry process.

The study purpose, voluntary participation in the study, and the privacy and confidentiality of the provided information were explained to the study respondents before enrolling them in the study. Before the survey, we obtained written informed consent from the literate respondents, and thumb impressions from the illiterate respondents.

Study Variables
Dependent Variables

The assessment of the prevalence of myocardial infarction and angina pectoris was the primary outcome variable of this study. The experience of any discomfort or pain in the chest was assessed to diagnose cardiovascular diseases (angina pectoris and myocardial infarction). The 10-item validated standard tool, Rose Angina Questionnaire (RAQ) was used to assess the angina pectoris and myocardial infarction. The WHO Rose Angina Questionnaire is a validated tool(Rose, 1962b) and has previously been used in the Nepalese context(Vaidya et al., 2009). There were two items for the myocardial infraction, where "Yes" to question 1 and 2 were considered as "incident case of possible myocardial infraction" whereas 8 items for angina pectoris, where "Yes" to question 1-4, "stops or slow down" for 5, "relieved" for 6, "10 min or less" for 7, "sternum" or "left anterior chest and left arm" for 8 were considered as "incident case of angina pectoris".

Independent Variables

The Nepali version of the WHO STEPS survey tool was introduced to collect the socioeconomic and behavioural characteristics of the study respondents. The socio-economic measures included in the study were age, gender, ethnicity, religion, marital status, types of family, education, and occupation. Similarly, the behavioural measures included tobacco use, alcohol use, dietary intake (consumption of fruits and vegetables), salt intake, and physical activity. In addition, anthropometric information such as height, weight, waist and chest circumference were measured using stadiometers, digital weighing scales, and soft metric tape respectively.

Data Analyses

All the data was entered and analyzed on Statistical Package for Social Sciences (SPSS) version 23. Mean and standard deviations were reported for the continuous variables while frequencies and percentages were reported for categorical variables. The association between the outcome variables and the independent variables was checked using the Chi-square test. The significant variables (p-value<0.05) in the Chi-square test were considered for univariate and multivariate logistic regression analysis to identify the predictors of AP and MI.

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Results

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Socio-Demographic Characteristics of the Respondents

Of 525 study respondents, the majority were female (51.4%), aged 55 years and above (30.3%), belonging to an advantaged ethnic group (36.4%), ascribed to Hindu religion (83.2%), and were from the nuclear family (60.8%). The mean (SD) age of the study respondents was 47.29 (±8.354) years. A higher proportion of study respondents (62.1%) attended formal education and almost half (47.6%) of the respondents were primarily engaged in agriculture occupation (table 1).

Table 1

General Characteristics of Respondents by Angina Pectoris

Characteristics	No. (%)	Presence of angina pectoris		p-value
		No (%)	Yes (%)	
Socio-demographic characteristics				
Gender				
Male	255 (48.6%)	233 (48.8%)	22 (45.8%)	0.690
Female	270 (51.4%)	244 (51.2%)	26 (54.2%)	
Age [47.29 (±8.354)]				
35-44	222 (42.3%)	212 (44.4%)	10 (20.8%)	0.002*
45-54	144 (27.4%)	130 (27.3%)	14 (29.2%)	
55 and above	159 (30.3%)	135 (28.3%)	24 (50%)	
Ethnicity				
Dalits	92 (17.5%)	83 (17.4%)	9 (18.8%)	0.711
Janajatis	174 (33.1%)	159 (33.3%)	15 (31.3%)	
Religious minorities	68 (13%)	64 (13.4%)	4 (8.3%)	
Advantaged groups	191 (36.4%)	171 (35.8%)	20 (41.7%)	
Religion				
Hindu	437 (83.2%)	398 (83.4%)	39 (81.3%)	0.699
Non-Hindu	88 (16.8%)	79 (16.6%)	9 (18.8%)	
Family type				
Nuclear	319 (60.8%)	290 (60.8%)	29 (60.4%)	0.959
Joint	206 (39.2%)	187 (39.2%)	19 (39.6%)	
Education				
Illiterate/non-formal education	199 (37.9%)	173 (36.3%)	26 (54.2%)	0.015*
Formal education	326 (62.1%)	304 (63.7%)	22 (45.8%)	
Occupation				
Housewife	76 (14.5%)	66 (13.8%)	10 (20.8%)	0.586
Agriculture	250 (47.6%)	226 (47.4%)	24 (50%)	
Service/pension	66 (12.6%)	62 (13%)	4 (8.3%)	
Business	74 (14.1%)	69 (14.5%)	5 (10.4%)	
Others (labor/migrant worker/foreign employment)	59 (11.2%)	54 (11.3%)	5 (10.4%)	
Health-related behavioural characteristics				
Tobacco use (Any form)				
Yes	185 (35.2%)	168 (35.2%)	17 (35.4%)	0.978
No	340 (64.8%)	309 (64.8%)	31 (64.6%)	
Ever used tobacco (smoke form)				
Yes	102 (19.4%)	95 (19.9%)	7 (14.6%)	0.373
No	423 (80.6%)	382 (80.1%)	41 (85.4%)	
Ever used tobacco (Smokeless form)				
Yes	124 (23.6%)	111 (23.3%)	13 (27.1%)	0.553
No	401 (76.4%)	366 (76.7%)	35 (72.9%)	
Alcohol use (within the last 30 days)				
Yes	138 (26.3%)	127 (26.6%)	11 (22.9%)	0.578
No	387 (73.7%)	350 (73.4%)	37 (77.1%)	
Fruits intake (No. of days in a typical week)				
<4	471 (89.7%)	426 (89.3%)	45 (93.8%)	0.334
4 and more	54 (10.3%)	51 (10.7%)	3 (6.3%)	
Vegetable intake (No. of days in a typical week)				
<4 days	108 (20.6%)	91 (19.1%)	17 (35.4%)	0.008*
4 or more days	417 (79.4%)	386 (80.9%)	31 (64.6%)	
Addition of salt or salty sauce while eating food				
Always/Often	30 (5.7%)	28 (5.9%)	2 (4.2%)	0.628

Others (sometimes, rarely, or never)	495 (94.3%)	449 (94.1%)	46 (95.8%)	
Addition of salt or salty sauce while preparing or cooking food				
Always/Often	511 (97.3%)	465 (97.5%)	46 (95.8%)	0.499
Others (sometimes, rarely, or never)	14 (2.7%)	12 (2.5%)	2 (4.2%)	
Consumption of processed food high in salt				
Always/Often	57 (10.9%)	53 (11.1%)	4 (8.3%)	0.555
Others (sometimes, rarely, or never)	468 (89.1%)	424 (88.9%)	44 (91.7%)	
Perception of salt consumption				
Too much/far too much	54 (10.3%)	50 (10.5%)	4 (8.3%)	0.640
The right amount or less	471 (89.7%)	427 (89.5%)	44 (91.7%)	
Performing Mod-vigorous physical activities at least 5 days a week				
No	86 (16.4%)	76 (15.9%)	10 (20.8%)	0.382
Yes	439 (83.6%)	401 (84.1%)	38 (79.2%)	
Body mass index (BMI)				
Underweight (<18.5 kg/m2)	42 (8.0%)	39 (8.2%)	3 (6.3%)	0.846
Normal (18.5-24.9 kg/m2)	301 (57.3%)	274 (57.4%)	27 (56.3%)	
Overweight and Obesity (≥25 kg/m2)	182 (34.7%)	164 (34.4%)	18 (37.5%)	

* p-values significant at p-value<0.05.

Health-Related Behavioural Characteristics

Tobacco and Alcohol Use

Over one-third, (35.2%) of respondents currently use tobacco either in the smoke (19.4%) or smokeless (23.6%) form. Similarly, over one-fourth (26.3%) of study respondents consumed alcohol within the last 30 days preceding the survey.

Food Habits and Related Characteristics

The proportion of fruit and vegetable intake for at least 4 or more days in a typical week among the study respondents was 10.3% and 79.4% respectively. The majority of study respondents (97.3%) always or often add salt or salty sauce while preparing or cooking food and 5.7% also add salt or salty sauce while eating. Similarly, 10.9% of respondents always or often consume processed food high in salt. In addition, 10.3% believe that they consume far too much or too much salt or salty sauce.

Physical Activity and Body Mass Index

The prevalence of moderate to vigorous physical activity for at least 150 min a week was 83.6%. A higher proportion of study respondents (57.3%) had a normal Body Mass Index, followed by overweight or obese (34.7%) and underweight (8%).

Prevalence of Angina Pectoris and Myocardial Infarction by Gender

The prevalence of angina pectoris and myocardial infarction among the respondents was 9.1% and 2.5% respectively. The gender distribution for the prevalence of angina pectoris and myocardial infarction was almost equal (table 2).

Table 2

Prevalence of Angina Pectoris and Myocardial Infarction by Gender

Characteristics	No. (%)	Gender	
		Male (n=255)	Female (n=270)
Angina pectoris			
Yes	48 (9.1%)	22 (8.6%)	26 (9.6%)
No	477 (90.9%)	233 (91.4%)	244 (90.4%)

Myocardial infarction

Yes	13 (2.5%)	7 (2.7%)	6 (2.2%)
No	512 (97.5%)	248 (97.3%)	264 (97.8%)

Factors Associated with the Angina Pectoris

In a univariate analysis, the age of the respondents, education, and vegetable intake were associated with angina pectoris. However, in multivariate analysis, only age and vegetable intake were significantly associated with angina pectoris. Study respondents aged 55 and above (OR_A:3.20, CI:1.41-7.29) and those consuming vegetables less than 4 days a week (OR_A:2.15, CI:1.12-4.11) were more likely to develop angina pectoris as compared to those aged 35-44 years and consuming vegetables 4 and more days a week, respectively (table 3).

Table 3

Multiple Regression Analysis Considering Various Predictors of Angina Pectoris

Characteristics	Presence of angina pectoris		
	Model I [a]	Model II [b]	Model III [c]
Age [47.29 (±8.354)]			
35-44	Ref	Ref	Ref
45-54	2.28 (0.99-5.29)	2.10 (0.90-4.93)	2.10 (0.89-4.95)
55 and above	3.77 (1.75-8.13)	3.20 (1.41-7.23)	3.20 (1.41-7.29)
Education			
Illiterate/non-formal	2.08 (1.14-3.78)	1.47 (0.78-2.80)	1.36 (0.71-2.61)
Formal education	Ref	Ref	Ref
Vegetable intake (No. of days in a typical week)			
<4 days	2.33 (1.23-4.39)		2.15 (1.12-4.11)
4 or more days	Ref		Ref

[a] Unadjusted odds ratio: Age and presence of angina pectoris; education and presence of angina pectoris and vegetable intake and presence of angina pectoris

[b] Adjusted odds ratio: Age and education with the presence of angina pectoris

[c] Adjusted odds ratio: Age, education and vegetable intake with the presence of angina pectoris

Overall, only 2.5% of study respondents were found to be suffering from myocardial infarction, and therefore not analyzed using logistic regression, as it may lead to biased estimates and inaccurate inferences.

Discussion

This study is the first to assess the prevalence of angina pectoris and myocardial infarction and their associated factors among the middle-aged population of Rupa Rural Municipality of Kaski district, Nepal. In the community, 9.1% and 2.5% of middle-aged people were found to be suffering from angina pectoris and myocardial infarction respectively. The socio-demographic characteristics of the respondents such as age and education and the number of days of vegetable consumption in a typical week were significantly associated with angina pectoris.

The prevalence of AP noted by this study (9.1%) is higher than the prevalence of AP in Nepal reported by the World Health Survey data of 2002-2004 (4.39%) (Alam & Mahal, 2014)

however, it is similar to the prevalence of AP in India (10.89%) and Bangladesh (10.34%). A possible explanation for the higher prevalence of AP in this study is that CVDs have significantly increased over the decades in Nepal (Bhattarai et al., 2020) and the CVD risks such as physical inactivity, tobacco and alcohol use, insufficient intake of fruits and vegetables, and overweight and obesity have highly prevailed in Nepal (Dhungana et al., 2014). The prevalence of MI among the study respondents was 2.5%. This finding is consistent with the previously conducted study from Nepal that reported myocardial infarction among 2% of people (Bhandari et al., 2014). This highlights the need for CVD intervention that aims at screening, prevention of management of CVD conditions such as AP and MI to avoid preventable mortality and morbidity.

This study found a significant association between age and AP. Studies have revealed that the prevalence of AP increases with age (Ahmed et al., 2023; Task Force Members et al., 2013). Consistent with this, our study found that people aged 55 and above are more likely to develop AP when compared to those aged 35-44 years. The higher prevalence of AP among older adults can be described by various factors such as atherosclerosis, other medical conditions such as diabetes and hypertension, and decreased physical activity (Duprez, 1996; Lin et al., 2004; Quashie et al., 2019), putting older adults at more risk of developing CVDs.

A high intake of fruits and vegetables is crucial for preventing CVDs. A systematic review and meta-analysis of 95 cohort studies in 2017 reported that fruit and vegetable intakes were associated with reduced risk of CVDs (Aune et al., 2017). This study also demonstrated that vegetable intake is strongly associated with AP such that those consuming vegetables for less than 4 days a week are more likely to develop AP than their counterparts. However, the association between fruit intake and AP was insignificant in our study. A possible explanation for these differences might be that vegetables are the main component of daily meals (Rice, legumes, and vegetables), while fruits are usually taken mostly in certain circumstances of illness and during festive or ritual celebrations in the Nepalese population. In addition, inaccessibility, unavailability, unaffordability, and low dietary diversity are significant factors determining the lower intake of fruits and vegetables among the Nepalese population (Bista et al., 2021; S. Pandey et al., 2021). This implies the need for designing and implementing culturally tailored and contextual interventions focusing on encouraging the use of healthy diets, improving nutritional literacy and promoting the concept of kitchen gardening that could prevent the occurrence of CVD events such as AP or MI.

Physical inactivity, tobacco use, unhealthy diet and harmful use of alcohol are the major behavioural risk factors causing cardiovascular diseases (*Cardiovascular Diseases (CVDs)*, n.d.). Our study revealed that 35.2% of study respondents had consumed tobacco in either form (smoke form: 19.4% and smokeless form: 23.6%), 26.3% had consumed alcohol in the past 30 days, and 16.4% of participants performed insufficient physical activity. This proportion of tobacco use, alcohol consumption and insufficient physical activity are higher than the findings reported by the WHO STEPS survey of Nepal in 2019 (17.1% smoking and 18.3% smokeless form, 20.8% alcohol use and 7.4%)(Bista et al., 2021). It is surprising to note that no association was found between these variables with angina pectoris within this study. This might be because

of under or over-estimation of health behaviours by our study participants as these domains were assessed using self-report tools. This implies the need for subsequent longitudinal study in a larger sample to assess the relationship between the behavioural health aspects and angina pectoris.

The study further illustrates how crucial health promotion and education are in combating cardiovascular disease. In addition to local initiatives like vegetable or kitchen gardens and education on nutrition, targeted programs on physical activity, diet improvement, and alcohol and tobacco reduction can encourage healthier living. By promoting regular checkups and increasing knowledge of CVD risks, early detection and prevention can help reduce mortality as well as morbidity.

Strengths and Limitations of the Study

Strengths of the study included: (i) community-based study, (ii). Use of pre-tested WHO STEP Survey and rose angina questionnaire, a widely accepted epidemiological research tool(Rahman et al., 2013) and (iii) data was collected by trained enumerators. Some limitations need to be e considered. As the study was cross-sectional in design, a causal relationship between the explanatory and outcome variables cannot be established. The measures of AP and MI were based on self-reported data and, thus, are subject to informant bias. In addition, this study was conducted in one of the rural municipalities of Nepal, therefore, might not be generalizable to the larger population. There is a need for nationally representative population-based longitudinal studies to estimate the prevalence of CVD events and understand their associated factors in Nepal.

Conclusion

The prevalence of CVD events (MI and AP) has increased in Nepal. The risk of developing AP increases with age, lower educational level and among those respondents consuming vegetables less than 4 days a week. The findings of this study call for the implementation of CVD risk assessment intervention at the primary healthcare level and argue the need to co-design and implement people-centered health promotion intervention to minimize CVD events in the future. Additionally, including a focused health education and promotion initiative that emphasizes dietary modifications and cardiovascular risk factor awareness could help people make knowledgeable decisions, promoting long-term behavioral changes in rural communities.

Conflict of Interest

The authors declare that they have no competing interests.

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