

## Risk Factors According to Ethnicity among Coronary Artery Disease Patients

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### Abstract

**Background:** This study was conducted out to evaluate the risk factors according to ethnicity among coronary artery disease patients. **Methods:** A retrospective study was conducted at Shahid Gangalal National Heart Centre (SGNHC) in Kathmandu, Nepal. Data from the

hospital's database, which included 837 patients, was utilized to collect information on the disease over a one-year period. Statistical analysis was performed using SPSS version 20.

**Results:** The most common preexisting risk factors were Hypertension (65%), smoking (56.4%) and dyslipidemia (32.1%). More than 70% of Muslims, Newars and Dalits among the recruited population had the history of hypertension. More than 55% of Brahmin/ Chhetris, Newars, Dalits, Madhesi other castes people were current or previous smokers. More than 25% of the people from all six ethnic groups had Dyslipidemia and it was statistically significant ( $p=0.000$ ) with the ethnicity among the sample population. The Newar (4.8%) and Tarai/Madhesi (4.8%) ethnic groups exhibited the highest prevalence of four or more simultaneous risk factors, while the Brahmin/Chhetris and Janajatis had the lowest rates (0.8% and 0%, respectively). Additionally, the absence of conventional risk factors was most commonly observed among Brahmin/Chhetris (9.6%) and Dalits (3.3%). The relation between the 4 or more risk factors and Ethnicity was statistically significant ( $P$  value=0.009).

**Conclusions:** Hypertension, smoking, and dyslipidemia emerged as the most prevalent preexisting risk factors among the studied population, with hypertension affecting 65% and smoking impacting 56.4% of participants. Notably, over 70% of Muslims, Newars, and Dalits reported a history of hypertension, while more than 55% of various ethnic groups were identified as current or former smokers. Dyslipidemia was present in over 25% of individuals across all six ethnic groups, demonstrating a statistically significant correlation with ethnicity. Four or more simultaneous risk factors were most common among the Newar and Tarai/Madhesi groups, whereas they were least common among the Brahmin/Chhetris and Janajatis. Interestingly, a lack of conventional risk factors was most common among Brahmin/Chhetris (9.6%) and Dalits (3.3%), highlighting important ethnic disparities in health risk profiles within the population.

**Keywords:** Risk factors, Ethnicity, Coronary artery disease, Nepal

## Introduction

Coronary artery disease continues to be a major global public health concern (Hussain, Khan et al. 2014). Coronary heart disease (CHD) is one of the leading causes of preventable deaths, ranking second for males and third for females over 15 years of age based on Disability-Adjusted Life Years lost (Mackay, Mensah et al. 2004). Cardiovascular diseases account for the largest share of non-communicable disease (NCD) deaths, with 17.7 million fatalities annually, followed by cancers (8.8 million), respiratory diseases (3.9 million), and diabetes (1.6 million). Together, these four diseases are the leading contributors to premature NCD-related deaths (Organization 2015, Collaborators 2016). Despite numerous studies examining the epidemiology of coronary artery disease and identifying various risk factors, the incidence and risks associated with CAD have not significantly declined, especially in low- and middle-income countries (Programme 2017).

Risk factors for non-communicable diseases (NCDs) are divided into modifiable behavioral risk factors and metabolic risk factors. Modifiable behaviors, such as tobacco use, lack of

physical activity, poor diet, and harmful alcohol consumption, all contribute to the increased risk of NCDs. Traditional cardiovascular disease risk factors, including hypertension (Federation 2016) (Maskey, Sayami et al. 2003, Shakya, Sharma et al. 2013), smoking (Maskey, Sayami et al. 2003, Federation 2016), dyslipidemia (Maskey, Sayami et al. 2003, Li, Wang et al. 2012, Yu, Castillo et al. 2012, Shakya, Sharma et al. 2013, Federation 2016), obesity (Li, Wang et al. 2012, Collaborators 2016), and diabetes mellitus (DM) (Maskey, Sayami et al. 2003, Li, Wang et al. 2012, Shakya, Sharma et al. 2013), are causally linked to the development of cardiovascular disease (Li, Wang et al. 2012). Excessive salt/sodium intake is responsible for 4.1 million deaths annually (Collaborators 2016). Over half of the 3.3 million deaths caused by alcohol consumption are attributed to NCDs, including cancer (Organization 2017). Lack of physical activity is responsible for 1.6 million deaths each year (Collaborators 2016). The most significant metabolic risk factor contributing to global deaths is elevated blood pressure, which accounts for 19% of global fatalities (Collaborators 2016), followed by overweight and obesity and elevated blood glucose.

In the US, cardiovascular disease (CVD) risk factors are more prevalent among non-Hispanic Blacks with low socioeconomic status. Both Mexican Americans and non-Hispanic Blacks face a higher CVD risk compared to non-Hispanic Whites, even among those with high socioeconomic status. CT scans of thoracic fat revealed differences between symptomatic Black and White patients, suggesting a race-related variation in the relationship between thoracic adipose tissue and the pathophysiology of coronary artery disease (Apfaltrer, Schindler et al. 2014).

Hypertension was found to be one of the important risk factors of morbidity and mortality for CAD in Blacks than Whites (Hasdai, Behar et al. (2002), Malays (Hughes, Yeo et al. 1990), Fijian Indian men and Melanesian than Fijian Indian women (Collins, Dowse et al. 1996), British South Asian (Ramaraj and Chellappa 2008), Caribbean, and West Africans (Cappuccio, Cook et al. 1997, Sheth, Nair et al. 1999), Indo-Asian (Jones, Mawani et al. 2011). These individuals are at a higher risk of clinical complications from risk factors, including hypertension, which contributes to stroke (Federation, 2016). While there have been advancements in diagnosing, managing, and controlling hypertension, ethnic disparities still exist (Cappuccio, Cook et al. 1997, Sheth, Nair et al. 1999).

Tobacco is responsible for 7.2 million deaths annually (including those from second-hand smoke exposure) and is expected to rise significantly in the coming years. Smoking had been found as another major risk factor among Fijian Indians (Collins, Dowse et al. 1996), University students from Srbija (Stojanović, Višnjić et al. 2009) and Ekiti State of Southwest Nigeria (Ogunmola, Olaifa et al. 2013) for CAD.

High blood glucose level, Insulin resistance and Hyperinsulinemia were also the important risk factor for CVD morbidity and mortality in Indians (Beckles, Kirkwood et al. 1986, Hughes, Yeo et al. 1990) and Melanesian in Fiji (Collins, Dowse et al. 1996), South Asians (Ramaraj and Chellappa 2008, Nijjar, Wang et al. 2010, Jones, Mawani et al. 2011), Caribbean, and West Africans in Britain (Cappuccio, Cook et al. 1997, Sheth, Nair et al. 1999). Men from South Asia had a higher mortality rate from coronary artery disease (CAD) compared to European

men, with diabetes identified as a leading risk factor (Forouhi, Sattar et al. 2006). South Indians were found to have higher rates of diabetes, glucose intolerance, and other risk factors compared to North Indians, which contributed to the higher prevalence of CAD among them (Begom and Singh 1995). Associations were also found between total cholesterol, lower high-density lipoprotein cholesterol, and the mortality rates from cardiovascular disease (CVD) and coronary heart disease (CHD) in Indians (Hughes, Yeo et al. 1990) and Indo-Asians (Jones, Mawani et al. 2011), South-Asians (Nijjar, Wang et al. 2010), Melanesians (Collins, Dowse et al. 1996).

Various studies have reported a high prevalence of these risk factors. In Dharan municipality, the prevalence of hypertension was found to be 22.7% (Vaidya 2011). Research has indicated that approximately 20% of the adult urban population has hypertension (Maskey, Sayami et al. 2003). According to the 'Sunsari Health Survey' of 1993, the prevalence of diabetes and hypertension in adults in Sunsari District, eastern Nepal, was about 6% and 5.1%, respectively (Singh and Bhattarai 2003). More recent data from an urban area revealed that the prevalence of diabetes and impaired fasting glucose was 14.2% and 9.1%, respectively (Carruthers, Dabbous et al. 2005). A ten-year study at a teaching hospital among CAD patients showed that 74% were male and 26% were female. Among them, 82% were smokers, 40% had hypertension, 22% were diabetic, 20% had raised LDL levels, and 10% had raised triglyceride levels. A previous study at Shahid Gangalal National Heart Center found that dyslipidemia was the most common risk factor, affecting 83.3% of patients, followed by hypertension (70%), smoking (70%), and diabetes mellitus (22.2%) (Adhikari, Rajbhandari et al. 2013). Another study at the same hospital revealed that 64.3% of the patients were smokers, 27.8% were hypertensive, 15.65% were diabetic, and 9.6% had a history of dyslipidemia (Gautam, Sogunuru et al. 2013, Adhikari, Prajapati et al. 2014).

Similarly, a study conducted on 57 patients admitted to the intensive care unit of the College of Medical Sciences Teaching Hospital in Bharatpur, Nepal, found that the major risk factors for coronary heart disease were smoking (50.88%), diabetes (43.85%), hypertension (36.87%), and a previous history of coronary heart disease (31.58%) (Gautam, Sogunuru et al. 2013). In developing countries like Nepal, there is a lack of studies that estimate the disproportionate burden of cardiovascular diseases across different ethnic and racial groups. Additionally, challenges such as language barriers for some ethnic groups who cannot speak the national language, cultural differences, limited health literacy, a lack of awareness or mistrust of available healthcare services, and practical obstacles like transportation issues or financial constraints could contribute to these disparities (Lai and Surood 2010, Patel, Phillips-Caesar et al. 2012, Jones, Nanji et al. 2013).

### **Objective of the study**

#### **General**

This study was conducted to evaluate the risk factors based on ethnicity among coronary artery disease patients admitted to the coronary care unit (CCU) of the Shahid Gangalal National Heart Center (SGNHC).

#### **Specific**

The specific objectives of the study were:

1. To assess the risk factors of disease among the patients admitted with CAD.
2. To find out the association between risk factors and ethnicity among coronary artery disease patients.

## **Methods**

### **Study area**

The Coronary Care Unit (CCU) at Shahid Gangalal National Heart Center (SGNHC) in Kathmandu, Nepal, serves as a national referral center for cardiovascular diseases. Kathmandu, the capital and largest city of Nepal, is home to SGNHC, where patients from across the country seek healthcare and treatment, either by direct visit or through referrals from other medical facilities.

### **Research design:**

This study conducted was a hospital-based, single-center, descriptive, and retrospective study.

### **Sources of data:**

A hospital database was utilized to collect information about the patients and their diseases. The data included demographic details, major and contributing risk factors for coronary artery disease, and the outcomes of the disease.

### **Criteria for sample selection**

Patients diagnosed with myocardial infarction and/or angiographically confirmed coronary artery disease (CAD) will be selected as the sample population.

**Inclusion Criteria:** Patients with an acute onset of coronary artery disease or those with a known history of coronary artery disease were included in the study.

**Exclusion Criteria:** Patient records with missing essential information were excluded from the study.

### **Data collection:**

Secondary data was collected from April 14th, 2014 to April 13th, 2015, for this retrospective, observational study. A total of 837 in-patients with coronary artery disease, as recorded in the hospital registry, were included. Ethnic groups were categorized according to the National Legal Code (Muluki Ain), 1854 (Gurung 2003, Bennett, Dahal et al. 2008) and the Health Management Information System of the Department of Health Services, Ministry of Health and Population

(Bhandari, Angdembe et al. 2014).The castes are divided as follows:

1. Brahmin/ Chhetri- known as upper castes including upper castes in Tarai.
2. Newar- Unenslavable Advantaged indigenous group.
3. Janajati- Enslavable indigenous group.
4. Tarai/ Madhesi other castes (Madhesi)- Enslavable Other indigenous castes residing in Specific region of the country.
5. Dalits- lower castes, untouchable and water unacceptable.
6. Muslim- lower castes, water unacceptable.

### **Data collection tools**



A predefined questionnaire was developed to collect data, which included socio-demographic details, behavioral factors, and other relevant information about the sample population. The questionnaire was based on The American College of Cardiology Foundation (ACCF) and the American Heart Association (AHA) key data elements and definitions for measuring the clinical management and outcomes of patients with acute coronary syndromes and coronary artery disease, 2013. Ethnicity was classified into six groups according to the Health Management Information System of the Department of Health Services, Ministry of Health and Population (Bhandari, Angdembe et al. 2014). Additional questions were formulated based on the study's objectives, informed by an initial desktop review and expert opinion. The research instrument was reviewed and approved by the Institutional Review Board of SGNHC and the Review Committee of the National Health Research Council, Nepal. The required information was retrieved from patient files using the data collection tool.

#### **Validity and reliability of tool**

The data collection tool was developed based on the key data elements and definitions for assessing the clinical management and outcomes of patients with acute coronary syndromes and coronary artery disease.

#### **Data Analysis:**

Descriptive statistics were used to present frequencies and percentages for categorical variables (such as age, gender, residence, diagnosis, CAG findings, etc.) and mean and standard deviation (SD) for continuous variables (such as systolic blood pressure (SBP), diastolic blood pressure (DBP), left ventricle ejection fraction (LVEF%), total cholesterol, triglycerides, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and random blood sugar (RBS)). SPSS V20.0 for Windows (IBM SPSS Inc., Chicago, Illinois, USA) was used for all statistical analyses. To estimate frequencies and percentages for descriptive variables, cross-tabulation, the Chi-square test, and the Kruskal-Wallis (KW) test were applied to determine the level of significance and assess the relationship between variables in the study area. A p-value of  $\leq 0.05$  was considered statistically significant.

**Dependent Variables:** Risk factors for coronary artery disease (CAD) include a previous history of Angina Pectoris, Myocardial Infarction, or Heart Failure, as well as hypertension, diabetes mellitus, dyslipidemia, smoking, and a family history of the disease.

**Independent Variables:** Ethnicity categories include Brahmin/Chhetri, Newar, Janajati, Madhesi and other castes, Dalit, and Muslim.

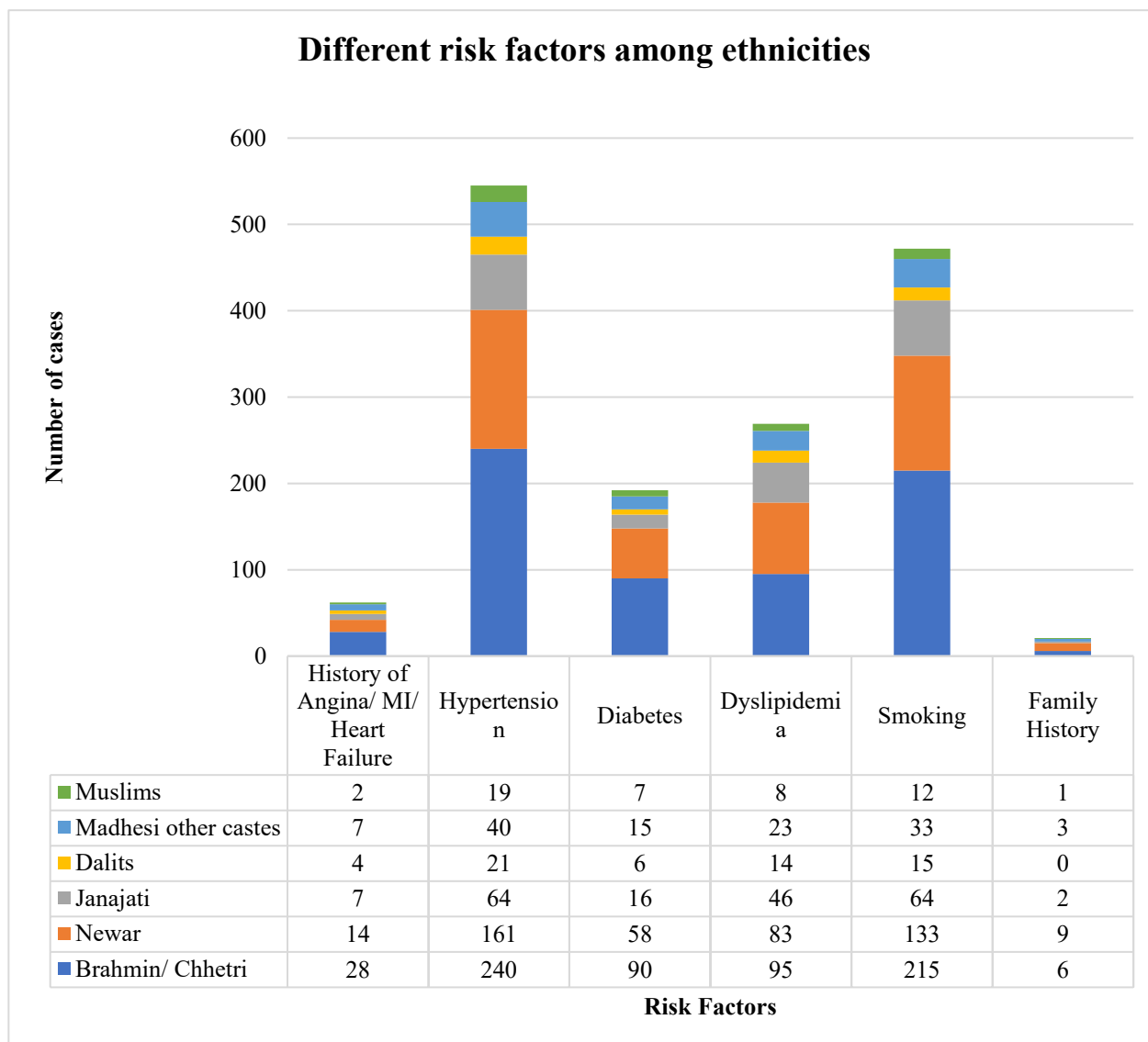
#### **Results**

In this study, we examine the relationship between the risk factors of coronary artery disease (CAD) and the ethnicity of the sample population. Data on major CAD risk factors, including a previous history of Angina Pectoris, Myocardial Infarction, or Heart Failure, hypertension, diabetes mellitus, dyslipidemia, smoking, and family history, were collected from the sample population.

**Figure 1 Distribution of different risk factors among ethnicities** explains about the major risk factors by ethnicity. Among 6 major risk factors, Hypertension 545 (65.1%) was most

prevalent risk factor followed by Smoking 472 (56.4%), Dyslipidemia 269 (32.1%), Diabetes Mellitus 192 (22.9%), Previous history of Angina Pectoris/ Myocardial Infarction/ Heart Failure 62 (7.4%) and Family History 21 (2.5%).

Ethnic distribution of risk factors varied by ethnicity, the percentages given below are the percentages calculated by total number of patients from the respective ethnic groups and risk factors. Hypertension was highly prevalent among Brahmin/Chhetri people 240(64.2%) followed by Newar 161 (70.3%), Janajati 64 (55.2%), Madhesi 40 (64.5%), Dalits 21 (70%), Muslims 19 (73.1%) respectively. After Hypertension, smoking was the most prevalent risk factor. The trend of smoking was similar with HTN; Most of the patients who were smoker or past smoker were from Brahmin/Chhetri people 215 (57.5%) followed by Newars 133 (58.1%), Janajati 64 (55.2%), Madhesi 33 (53.2%), Dalits 15 (50%), Muslims 12 (46.2%) respectively. Dyslipidemia was highly prevalent among Brahmin/Chhetri people 95(25.4%) followed by Newar 83 (36.2%), Janajati 46 (39.7%), Madhesi 23 (37.1%), Dalits 14 (46.7%), Muslims 8 (30.8%) respectively. The relation between Dyslipidemia and Ethnicity was statistically significant (Chi-sq.= 16.165, P value=0.000). Diabetes Mellitus was forth most prevalent risk factor; it was highly prevalent among Brahmin/Chhetri people 90 (24.1%) followed by Newar 58(25.3%), Janajati 16 (13.8%), Madhesi 15 (24.2%), Dalits 6 (20%), Muslims 7 (26.9%) respectively. Most Brahmin/Chhetri people had the Previous history of Angina Pectoris/Myocardial Infarction/Heart Failure 28 (7.5%), followed by Newar 14 (6.1%), Janajati 7 (6%), Madhesi 7 (11.3%), Dalits 6 (20%), Muslims 4 (13.3%) respectively. Most Newar people had the Family history of CAD 9(3.9%), followed by Brahmin/Chhetri people 6 (1.6%), Madhesi 3 (4.8%), Janajati 2 (1.7%), Muslims 1 (3.8%) respectively and Dalits people had no Family history of CAD.



**Figure 1 Distribution of different risk factors among ethnicities**

Pearson's Chi- Square test P- Value for History of Angina / MI / Heart failure is 0.873, Hypertension- 0.931, type 2 Diabetes Mellitus- 0.219, Dyslipidemia- 0.000, smoking- 0.418 and Family history- 0.453

**Table 1** describes the distribution of the number of modifiable cardiovascular risk factors are categorized into five groups (0,1, 2, 3,  $\geq 4$ ), people who had no any risk factor among five risk factors such as Previous history of Angina Pectoris/Myocardial Infarction/Heart Failure, Hypertension, Diabetes Mellitus, Dyslipidemia and Smoking were kept into group 0, those who had any one risk factor were kept in group 1, who had any two risk factors were kept in group 2, those who had any three risk factors were kept in group 3 and those who had any four or more risk factors were kept in group  $\geq 4$ . The number of risk factors did not show a clinically significant difference across the various ethnic groups.



The mean number of risk factors were for each ethnic groups was; Brahmin/Chhetri 1.8, Newar 1.9, Janajati 1.6, Madhesi 1.8, Dalit 2.0 and Muslims 1.8. Table 2.1 The table shows the distribution of the number of risk factors across each ethnic group. As indicated, having two risk factors simultaneously was the most common occurrence among all ethnic groups. Most of the people 317 (37.9%) had two risk factors, then 222 (26.5%) had any 1 risk factor, 194 (23.2%) had any 3 risk factors, 85 (10.2%) of the sample population had no any risk factor for CAD, and 19 (2.3%) of people had any 4 or more risk factors. The table also reveals that the Newar and Madhesi ethnic groups had the highest prevalence of  $\geq 4$  simultaneous risk factors, each at 4.8%. In contrast, the Brahmin/Chhetri and Janajati groups had the lowest prevalence rates (0.8% and 0%, respectively). Additionally, the Brahmin/Chhetri (9.6%) and Dalit (3.3%) groups were most commonly found to have no conventional risk factors at all. The relation between the 4 or more risk factors and Ethnicity was statistically significant (P value=0.009).

**Table 1**

Distribution of the number of preexisting cardiovascular risk factors among different ethnic groups

Ethnicity	Number of risk factors (P Value) a									
	None	0.6	1-Risk	0.8	2-Risk	0.40	3-Risk	0.40	$\geq 4$ -Risk	0.009
Brahmin/Chhetri (374)	36 (9.6)	58	102 (27.3)	10	150 (40.1)	7	83 (22.2)	0	3 (0.8)	
Newar (229)	24 (10.5)		54 (23.6)		79 (34.5)		61 (26.6)		11 (4.8)	
Janajati (116)	13 (11.2)		35 (30.2)		47 (40.5)		21 (18.1)		0	
Madhesi (62)	9 (14.5)		15 (24.2)		18 (29)		17 (27.4)		3 (4.8)	
Dalits (30)	1 (3.3)		9 (30)		11 (36.7)		8 (26.7)		1 (3.3)	
Muslims (26)	2 (7.7)		7 (26.9)		12 (46.2)		4 (15.4)		1 (3.8)	
Total (837)	85 (10.2)		222 (26.5)		317 (37.9)		194 (23.2)		19 (2.3)	

- a. The Number of risk factors means any risk factors among history of Angina/ MI/ Heart failure, Hypertension, Diabetes, Dyslipidemia and Smoking.
- b. Data are presented as n (%), Percentages are presented as % within ethnicity, KW Test-  $\chi^2 = 6.396$ , P = 0.270

**In Table 2** Binary Logistic Regression model had been used to see the relation and association between the risk factors for CAD and ethnicity. The sample size in each ethnic group was smaller after dividing the sample population into six groups so, due to insufficient sample size in each group we couldn't get much significant associations between the risk variables and ethnicity so we couldn't conclude on the basis of the result we got after the statistical analysis.

In table 2.2, Age was statistically significant with ethnicity among the patients who had previous history of Angina/ Myocardial infarction/ heart failure ( $p=0.017$ ). In addition, sex was associated with ethnicity among the smokers ( $P= 0.045$ ). Male patients had higher risk of CAD due to smoking compared to female patients (OR-1.4, 95% CI-1-1.9). Other variables didn't show the statistical association from logistic regression analysis.

**Table 2**

Binary Logistic regression model for risk factors of CAD

Risk Factors, OR (95%CI)						
Dependent variables	History of Angina / MI /n	Hypertension	Diabetes Mellitus-2	Dyslipidemia	Smoking	Family History
<b>Independent variable</b>						
Ethnicity						
Muslims (Ref.)	-	-	-	-	-	-
Brahmin/ Chhetri	0.9 (0.2-4)	0.7 (0.3-1.6)	0.8 (0.4-2.1)	0.8 (0.3-1.9)	1.6 (0.7-3.5)	0.4 (0.04-3.9)
Newar	0.8 (0.2-3.7)	0.9 (0.3-2.2)	0.9 (0.4-2.2)	1.3 (0.6- 3.2)	1.7 (0.7-3.8)	1.02 (0.1-8.5)
Janajati	0.7 (.1-3.8)	0.5 (0.2-1.2)	0.4 (0.2-1.2)	1.5 (0.6- 3.7)	1.4 (0.6-3.4)	0.5 (0.04-5.3)
Dalits	1.8 (0.3-10.9)	0.9 (0.3-2.9)	0.7(0.2- 2.3)	2 (0.7-6)	1.1 (0.4-3.2)	NA
Madhesi other Castes	1.5 (0.3-7.8)	0.7 (0.2-1.8)	0.8 (0.3-2.4)	1.4 (0.6- 3.7)	1.4 (0.5-3.4)	1.3 (0.1-13.6)
Age	*0.017					
21-40 (Ref.)	-	-	-	-	-	-
41-60	1.6 (0.4-7.2)	1.4 (0.8-2.4)	1.8 (0.9-3.6)	0.8 (0.5-1.5)	0.8 (0.4-1.3)	0.5 (0.1-2.1)
61-80	3.8 (0.8-16.1)	1.3 (0.7-2.2)	1.4 (0.7-3)	0.9 (0.5-1.6)	1.0 (0.6-1.8)	0.4 (0.1-1.5)
>81	2.4 (0.4-15)	1.6 (0.7-3.6)	1.9 (0.7-4.8)	0.7 (0.3- 1.6)	0.53 (0.2-1.2)	0.9 (0.1-5.8)
Sex	*0.045					
Female (Ref.)	-	-	-	-	-	-
Male	1.1 (0.6-2)	0.8 (0.6-1.1)	1.1 (0.8-1.61)	0.9 (0.7- 1.3)	1.4 (1 -1.9)*	0.5 (0.2-1.2)

-Reference Categories: Ethnicity: Muslims, Age: 21-40 Years, Sex: Female

-Variable with (\*) means P- value < 0.05

## Discussion

Our study identified a diverse distribution of well-known conventional risk factors among major Nepalese ethnic groups, with coronary artery disease (CAD) showing a significant association with ethnicity (Sharma, Badhu et al. 2017). The prevalence of traditional atherothrombotic risk factors varied considerably across the different ethnic/racial groups (Organization 2015). In our study, Hypertension (65%), smoking (56.4%) and dyslipidemia (32.1%) were the most common risk factors.

Previous studies done in the same hospital, where this study was carried out correspond the data related to Hypertension (Adhikari, Rajbhandari et al. 2013, Adhikari, Prajapati et al. 2014) but in other studies the results differ from our study related to hypertension. Other several studies done in the same hospital and other areas of country show that more than half of the sample population were smokers (Collaborators) and for Diabetes and Dyslipidemia, data vary according to study area and type. More than 70% of Muslims, Newars and Dalits among the recruited population had the prevalence of hypertension and more than 55% of Brahmin/Chhetris, Newars, Dalits, Madhesi other castes people were current or previous smokers. The Newar (4.8%) and Tarai/Madhesi other castes (4.8%) ethnic groups had the highest prevalence of  $\geq 4$  simultaneous risk factors. Between 2001 and 2003, Nepal contributed 244 cases and 239 controls to the global multicenter case-control INTERHEART study (Yusuf, Hawken et al. 2004). As in other participating countries, the following nine factors were found to be significant in Nepal as well: abnormal lipids, smoking, hypertension, diabetes, abdominal obesity, psychosocial factors, fruit and vegetable consumption, alcohol consumption, and physical inactivity. Many of these factors were later identified as major risk factors in the nationwide 2007 NCD Risk Factor Survey and other smaller studies (Vaidya 2011). The prevalence of hypertension was 22.7% in a suburban city of Nepal, Dharan municipality (Vaidya 2011). In another study, the prevalence of hypertension in the adult urban population was approximately 20% (Maskey, Sayami et al. 2003).

According to the 1993 'Sunsari Health Survey' data, the prevalence of diabetes and hypertension in adults in Sunsari District, eastern Nepal, was about 6% and 5.1%, respectively (Singh and Bhattarai 2003). More recent data from an urban area indicated that the prevalence of diabetes and impaired fasting glucose was 14.2% and 9.1%, respectively (Carruthers, Dabbous et al. 2005). A ten-year study at a teaching hospital among CAD patients found that 82% were smokers, 40% had hypertension, 22% were diabetic, 20% had raised LDL levels, and 10% had elevated triglycerides. Another study at Shahid Gangalal National Heart Center revealed that dyslipidemia was the most common CAD risk factor (83.3%), followed by hypertension (70%), smoking (70%), and diabetes mellitus (22.2%) (Adhikari, Rajbhandari et al. 2013). A further study at the same hospital showed that 64.3% of the sample population were smokers, 27.8% were hypertensive, 15.65% were diabetic, and 9.6% had a history of dyslipidemia (Adhikari, Prajapati et al. 2014). Similarly, a study conducted on 57 patients admitted to the intensive care unit of College of Medical Sciences Teaching Hospital in Bharatpur, Nepal, identified the major risk factors for coronary heart disease as smoking

(50.9%), diabetes (43.9%), hypertension (36.87%), and a previous history of coronary heart disease (31.6%) (Gautam, Sogunuru et al. 2013). Previous studies, both in Western and developing countries, have also shown a disparity in CAD severity across different ethnic groups. Another study found that white and Asian Indian populations had a higher atherosclerotic burden compared to blacks and Hispanics, independent of risk factor diversity (Amin, Nathan et al. 2009, Mukherjee, Brouillette et al. 2009).

It has also been found that Asian Indians have shorter telomeres, which may increase their susceptibility to a higher prevalence of coronary artery disease (CAD), particularly premature CAD (Daviglius, Pirzada et al. 2014). In this study most of the risk factors were more prevalent in Brahmin/ Chhetri group followed by Newar group. Hypertension was most prevalent in Brahmin/ Chhetri group which group is also known as higher caste. There was no any specific study performed in Nepal regarding distribution of risk factors and disease outcome related to ethnicity so; we have taken the studies performed in various countries and areas of the world for reference. Studies performed in USA and other developed and developing countries have shown difference in prevalence of hypertension in different ethnic groups. The increased prevalence of hypertension, particularly uncontrolled and/or undertreated hypertension as seen within the black population in a recent study (Organization 2015). A recent study investigated cardiovascular disease (CVD) risk factors using a cohort. In this study, 25.4% of participants had hypertension, with significant variations based on sex and region of origin. For example, 32.6% of men from the Dominican Republic had hypertension, compared to 15.9% of South American women. Similar variations were observed for other risk factors, such as obesity, cholesterol levels, diabetes status, and smoking habits. The study found that the most common risk factors for coronary heart disease (CHD) were, in descending order, high cholesterol, obesity, smoking, and hypertension for men, while for women, the leading risk factors were obesity, high cholesterol, and hypertension. The HCHS/SOL study underscores the significant heterogeneity within the Hispanic population (Daviglius, Pirzada et al. 2014, Jose PO 2014) . While Asian-Americans are often under-studied, national-level surveys have gathered data on cardiovascular risk factors. According to NHANES, 25.6% of Asian adults reported having hypertension, with higher rates observed among older adults and those with lower levels of education (Jose PO 2014, Leigh, Alvarez et al. 2016).

Studies conducted on the South Asian population have shown that, for any given weight, South Asians tend to have a higher proportion of body fat, particularly in the abdominal area (Snehalatha, Ramachandran et al. 2001, Nair and Prabhakaran 2012). This tendency towards central obesity is a well-established risk factor and may contribute to a higher incidence of coronary artery disease (CAD) among South Asians by affecting blood pressure, diabetes, and insulin resistance (Koenig, Schwartzbard et al. 1996, Hughes, Aw et al. 1997, Bhopal, Unwin et al. 1999, Reddy, Prabhakaran et al. 2002, Venkatramana and Reddy 2002, Prabhakaran, Shah et al. 2005). Diabetes, hyperinsulinemia, and insulin resistance are recognized risk factors for CAD, and their prevalence is notably higher in South Asians (McKeigue, Ferrie et al. 1993, Rao and White 1993, Chandalia, Abate et al. 1999). A study by (Amin, Nathan et al.) found that Asian Indians have higher insulin resistance than Europeans, with a glucose disposal rate

of 3.7 ( $\pm 1.3$ ) mg/min/kg lean body mass in Asian Indians compared to 5.3 ( $\pm 2.0$ ) in Europeans ( $p = 0.003$ ). Insulin resistance not only raises the prevalence of other physiological CAD risk factors like glucose intolerance and hyperinsulinemia, but it also independently increases CAD risk either directly or through its effects on lipid metabolism (Chandalia, Abate et al. 1999). The lipid profile of South Asians, especially Asian Indians, is marked by a high total cholesterol to HDL ratio and elevated levels of small dense LDL particles, which enhance the atherogenicity of the lipid pool (Sewdarsen, Vythilingum et al. 1991, Koenig, Schwartzbard et al. 1996, Kulkarni, Markovitz et al. 1999, Joshi, Islam et al. 2007). The INTERHEART study highlighted that apolipoprotein B100/apolipoprotein A-I, a strong indicator of dyslipidemia, is notably higher in South Asians (61.5%) across all age groups compared to other ethnic groups (48.3%) (Ridker and Antman 1999). HDL is inversely related to CAD risk, especially due to its role in facilitating cholesterol ester and triglyceride metabolism (Jafar, Jafary et al. 2005). Epidemiological studies also show an inverse relationship between HDL and endogenous tissue plasminogen activator inhibitor-1 (PAI-1), suggesting that HDL's beneficial effect may be partly mediated through its influence on fibrinolytic activity (Beckles, Kirkwood et al.).

In general, South Asians are found to have lower plasma levels of HDL (Rao and White 1993, Koenig, Schwartzbard et al. 1996, Bhopal, Unwin et al. 1999, Gama, Elfatih et al. 2002, Radhika, Ganesan et al. 2009) which has been mainly attributed to their dietary habits (Jafar, Jafary et al. 2005, Nair and Prabhakaran 2012).

The lipid profile of South Asians, especially Asian Indians is characterized by high total cholesterol to high-density lipoprotein (HDL) ratio and high levels of the small dense fraction of low-density lipoprotein (LDL), which increases the atherogenicity of the lipid pool (McKeigue, Ferrie et al. 1993, Rao and White 1993, Koenig, Schwartzbard et al. 1996, Chandalia, Abate et al. 1999). HDL is inversely associated with the risk of CAD, particularly due to its ability to facilitate cholesterol ester and triglyceride metabolism (Jafar, Jafary et al. 2005). Epidemiological studies also show an inverse relationship between HDL and endogenous tissue plasminogen activator inhibitor-1 (PAI-1), thus its beneficial effect may be partly mediated through alterations in fibrinolytic activity (Beckles, Kirkwood et al. , Snehalatha, Ramachandran et al. 2001).

## Conclusion

Among the studied population, hypertension, smoking, and dyslipidemia were the most common preexisting risk factors. Hypertension affected 65% of participants, while 56.4% reported smoking. Notably, over 70% of Muslims, Newars, and Dalits had a history of hypertension, and more than 55% of individuals from various ethnic groups were current or former smokers. Dyslipidemia was observed in more than 25% of individuals across all six ethnic groups, showing a statistically significant association with ethnicity. The Newar and Tarai/Madhesi groups had the highest rates of four or more concurrent risk factors, while Brahmin/Chhetris and Janajatis had the lowest. Interestingly, Brahmin/Chhetris (9.6%) and

Dalits (3.3%) were the most likely to lack conventional risk factors, underscoring notable ethnic differences in health risk profiles.

### **Author Contribution**

#### **By Expertise**

1. Literature Review & Background Research: Ms. Mamta Bista, Ms. Sunita Dhakal
2. Conceptualization & Research Question: Ms. Mamta Bista, Mr. Saroj Prasad Gaudel
3. Methodology & Data Collection: Ms. Mamta Bista, Mr. Saroj Prasad Gaudel
4. Data Analysis & Interpretation: Mr. Kshitij Gartoulla, Ms. Mamta Bista
5. Writing Drafts: Ms. Mamta Bista, Mr. Kshitij Gartoulla
6. Editing & Proofreading: Mr. Saroj Prasad Gaudel, Ms. Sunita Dhakal, Mr. Kshitij Gartoulla
7. Management & Communication: Ms. Mamta Bista, Ms. Sunita Dhakal

### **Conflict of interest**

1. The authors declare that they have no conflicts of interest to declare.

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