Determinants of Ischemic heart disease in Jimma University Medical Center, South West Ethiopia

By: Meron Hadis (BSc.)

A research thesis submitted to Jimma University, Institute of Health science, Faculty of Medical Sciences, Department of Biomedical Sciences in partial fulfillment of the requirements for Master of Science in Medical physiology (MSc)

October, 2017

Jimma, Ethiopia

JIMMA UNIVERSITY

INSTITUTE OF HEALTH SCIENCE

DEPARTMENT OF BIOMEDICAL SCIENCE

Determinants of Ischemic heart disease in Jimma University Medical Center, South West Ethiopia, 2017

BY: Meron Hadis (BSc.)

Advisors

1. **Mr. Samuel Tadesse (Assistant professor in Medical physiology)**
2. **Dr. Elsah Tegene (MD, Assistant professor of Internal medicine)**
3. **Mrs. Almaz Ayalew (MSc. in Medical physiology)**

October, 2017

Jimma, Ethiopia

Abstract

Background: *Ischemic heart disease (IHD) is a condition in which there is inadequate supply of blood and oxygen to a portion of the myocardium. IHD causes more deaths and disability and incurs greater economic costs than any other illnesses in the developed world. In the worldwide INTERHEART study, nine potentially modifiable factors accounted for over 90% of the population-attributable risk of a first MI. At least two-thirds of CVDs now occur in low and middle income countries, bringing a double burden of disease to poor and developing world economies.*

Objective: *To assess determinants of ischemic heart disease in JUMC, South West Ethiopia, 2017*

Method: *Hospital based age matched case control study was applied and data were collected by interview based structured questionnaire, anthropometric measurements and laboratory analysis of blood which were undertaken from May 13 to July 21, 2017. All cases of IHD within the study period were included until the sample sizes were achieved in both cases and controls. Descriptive, bivariate and multivariate backward conditional logistic regression was performed & variables with p-value <0.05 were taken as statistically significant determinants for IHD using case to control ratio of 1:2 and OR with its 95% CI.*

Result*: A total of 64 (33.33%) cases and 128(66.67%) controls were included in the study. Educational status (can't read and write), history of hypertension and family history of cardiac disease were a significant determinants of IHD with adjusted odds ratio of (AOR=2.59, 95%CI; 1.20-5.61), (AOR=3.02, 95%CI; 1.47-6.19) & (AOR=2.39, 95%CI; 1.06-5.40), respectively. Use of alcohol increases the chance of IHD by 2.79 (AOR = 2.79, 95% CI; 1.47-5.27) and use of khat by 2.58 (AOR= 2.58, 95% CI; 1.36-4.89). And similarly those who consume fruit <4 days/week were two times (AOR=2.11 95% CI; 1.07-4.17) more likely to develop IHD. Use of solidified oil was four times (AOR=4.08, 95% CI; 1.49-11.20) more likely to develop IHD than use of liquid vegetable oil. Dyslipidemia was also the most significant risk factor with adjusted odds ratio of hypercholesterolemia (AOR=2.67, 95% CI; 1.32-5.42) and hypertriglyceridemia (AOR=2.83, 95% CI; 1.42-5.65).*

Conclusion and recommendation: *this study showed that modifiable and preventable various behavioral, dietary and metabolic risk factors were important etiology behind the occurrence of IHD. Though, hypertriglyceridemia was in debate as a cause of IHD, this study found a significant association. So, lipid profile measurement should be part of a treatment plan for IHD. Besides, further prospective studies are suggested including recently emerging novel risk factors.*
Key words: *Ischemic heart disease, determinant, Case-Control Study, Conditional logistic regression, Ethiopia, Jimma*

Table of Contents

List of Figure

List of Table

Acknowledgment

First and foremost I would like to extend my deepest gratitude to Almighty GOD for keeping me safe and hard. Next to omnipotent God I would like to show my heartfelt thanks to Jimma University for giving me a chance and funding this study. My utmost gratitude also goes to my advisors Mr. Samuel Tadesse, Dr. Elsah Tegene and Mrs. Almaz Ayalew for their unreserved tremendous support. Finally my deepest appreciation goes to all participants who took part in this study, my families and friends who encouraged me all the time.

Acronyms and abbreviations

ACS; Acute coronary syndrome

AHA; American Heart Association

AMI; Acute myocardial infarction

AOR; Adjusted odds ratio

BMI; Body mass index

CAD; Coronary artery disease

CHD; Coronary heart disease

CHF; Congestive Heart Failure

CI; Confidence Interval

CLD; Conditional Logistic Regression

CKD; Chronic kidney disease

COPD; Chronic Obstructive Pulmonary disease

CVD; Cardiovascular disease

ENT; Ear, nose, throat

ETB; Ethiopian Birr

FHS; Framingham's heart scoring

HDL; High density lipoprotein

HIC; High income countries

ICU; Intensive care unit

IDF; International Diabetic Federation

IHD; Ischemic heart disease

JUMC; Jimma University Medical Center

LDL; Low density lipoprotein

LMIC; Low- and middle-income countries

MI; Myocardial infarction

MICU; Medical intensive care unit

NCD; Non-communicable disease

NCEP-ATP III; National Cholesterol Education Program Adult Treatment Pannel-III

NHANES; National Health and Nutrition Examination Survey

NYHA; New York Heart Association

PAR; Population attributable risk

PCI; Percutaneous coronary intervention

RR; Relative risk

SNNPR; South Nation & Nationality Peoples Republic

SSA; Sub-Saharan Africa

STEMI; ST elevated myocardial infarction

UA; Unstable angina

US; United states

WC; Waist circumference

WHO; World Health Organization

WHR; Waist to hip ratio

Chapter one: Introduction

1.1. Background

Ischemic heart disease is a condition in which there is inadequate supply of blood and oxygen to a portion of the myocardium; it typically occurs as a result of coronary artery disease (CAD). CAD is caused by atherosclerosis of the coronary arteries that leads to a restriction of blood flow to the heart leading to ischemia of part of myocardium(1). Atherosclerosis is a process that develops slowly over time starting at early age and worsening quietly for decades. As people age, their atherosclerosis becomes more likely to involve the arteries of the heart and to become CAD. Atherosclerosis is a chronic condition that narrows arteries by building fat filled bulges in the arterial walls forming plaques. If these plaques break will cause blood clots that are swept into the bloodstream, they can lodge in the smaller arteries downstream and completely block blood flow. If the blood supply remains blocked for a half hour or more, the heart's muscle cells will begin to die(2).

Depending on the rate of severity of coronary artery narrowing and the myocardial response, one of four syndromes may develop: angina pectoris, acute myocardial infarction, sudden cardiac death and chronic IHD with congestive heart failure (3). Patients with IHD also can present with cardiomegaly and heart failure secondary to ischemic damage of the left ventricular myocardium that may have caused no symptoms before the development of heart failure(61). It is manifested by chest pain or discomfort, radiating pain in arms, neck, jaw, shoulder, or back accompanying chest pain, nausea, and fatigue, shortness of breath, sweating and dizziness. The diagnoses includes cardiac biomarkers, electrocardiogram (ECG), echocardiography, coronary arteriography and imaging's(2,5).

IHD is the number one cause of death in adults from both low and middle income countries as well as from high-income countries though CAD mortality rates are declining in most developed countries(6,8). In developing countries due to different stages of epidemiological transition rising prosperity and urbanization leads to life style changes resulting in consumption of unhealthy diet & physical inactivity. The transition occurs usually in the urban and affluent group with greater disposable incomes and easier access to new life style(8,9). This transition affected the

developed world, including countries of Europe and North America, in the early 20th century and spread to developing countries 50 years later(8). Though neglected for years at the turn of the 21st century, IHD ranked 8th among the leading killers in Africa(9).

Most NCDs especially IHD are strongly associated with four particular behaviors: tobacco use, physical inactivity, unhealthy diet and harmful use of alcohol. These behaviors lead to four key metabolic changes: raised blood pressure, overweight/obesity, hyperglycemia and hyperlipidemia(10). Many risk factors for CVDs including IHD are modifiable by specific preventive measures. In the worldwide INTERHEART study of patients from 52 countries, nine potentially modifiable factors accounted for over 90% of the PAR of MI: smoking, dyslipidemia, hypertension, diabetes, abdominal obesity, psychosocial factors, daily consumption of fruits and vegetables, high fat intake, regular alcohol consumption, and physical inactivity. Family history is a significant independent risk factor for CHD, particularly among younger individuals with a family history of premature disease(11,12). Also these risk factors for IHD were directly examined in the INTERHEART Africa case control study having 578 cases of first-time myocardial infarction and 785 controls from nine sub-Saharan African countries(7).

1.2 Statement of the problem

The prevalence of IHD worldwide from 1990-2013 was 2.9 - 4.3 million for male and from 2.8 - 3.8 million for females(13). IHD causes more deaths and disability and incurs greater economic costs than any other illness in the developed world, where 13 million people have IHD, >6 million have angina pectoris, and >7 million have sustained MI(4). In the United States, the leading cause of death in black persons and the greatest contributor to their excess mortality in relation to white person's, is CVD of which CHD is the leading component(14).

The 2016 Heart Disease and Stroke Statistics update of the American Heart Association (AHA) has recently reported that 15.5 million people above 20 years of age in the USA have CHD, whilst the reported prevalence increases with age for both sex and it has been estimated that approximately every 42 seconds, an American will suffer from MI(15).

Also, IHD is the number one cause of death in adults from both low and middle income countries as well as from high income countries. For persons aged 40 years, the life time risk of developing CHD is 49% in men and 32% in women (16). CHD mortality was expected to

increase approximately 29% in women and 48% in men in developed countries between 1990 and 2020. The corresponding estimated increases in developing countries were 120% in women and 137% in men (2).

World Health Organization estimated that in 2005, IHD caused approximately 361, 000 deaths in the African region and current projections suggest that this number will nearly double by 2030(7). According to an estimate from the Global Burden of Disease project, between 1996 and 2020, IHD deaths in sub Saharan Africa will increase by 125% to 263 000 in men and by 141% to 222 000 in women. The revised projection in 2030 is 320 000 in men and 301 000 in women, respectively. In SSA, in 2001, cardiovascular disease accounted for 46% of all deaths due to non-communicable diseases is (1,048,000) and CHD accounted for 33% of all cardiovascular diseases (343,000)(17).

Importantly, in people aged greater than 60 years, IHD is already the leading cause of death in men and the second leading cause of death in women in the African region(9). This shows the emerging burden of chronic NCD which is superimposed on the huge burden of HIV/AIDS, other infectious and parasitic diseases, and the ravages of famine and malnutrition that constitute Africa's health challenges today. At least two-thirds of deaths now occur in this countries, bringing a double burden of disease to poor and developing world economies(18).

Though IHD is preventable, using relatively simple and inexpensive lifestyle changes it's projected to increase causing preventable loss of lives. The inexorable rise in the prevalence of obesity, diabetes, dyslipidemia, and hypertension, drives the ever increasing incidence of heart disease. Overall population-wide dietary changes that include a plant-based, calorie controlled intake of fresh foods, low in sodium and sugar, avoidance of high fats, combined with adequate physical activity, could substantially eliminate the disease (18,19).

Among IHD risk factors hypertension is a leading cause of CVD worldwide plus elevated blood pressure is strongly correlated with CHD mortality and globally, 31.1% of the adult population (1.39 billion people) had hypertension in 2010. From this 75% of people live in LMICs and in Africa more than 40 % of adults have hypertension. From 2000 to 2010, hypertension prevalence in HICs decreased by 2.6% but during the same 10-year period, it is increased in LMICs by 7.7%(20,21). Also analysis of FHS showed elevated cholesterol and TG is a well-established risk

factor, and demonstrated a strong positive relationship between this. One-third of IHD in the world is secondary to hypercholesterolemia, and it is estimated that hypercholesterolemia is responsible for 2.6 million (4.5%) deaths in the world(22,23).

Likewise Type 2 diabetes is an equivalent risk for CHD with 2 and 3 fold increase in risk for vascular disease in men and women, respectively (23). Globally, an estimated 422 million adults were living with diabetes in 2014, compared to 108 million in 1980. This reflects an increase in associated risk factors such as being overweight or obese (24). Worldwide 2.8 million people die each year as a result of being overweight (including obesity). Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. Risks of IHD increase steadily with increasing BMI (10). FHS also found smoking as a strong risk factor for CHD, conferring a two fold increase in the rates of MI. WHO has estimated that tobacco use is currently responsible for the death of about 6 million people across the world each year with many of these deaths occurring prematurely (23,25).

Another risk factor which is not well addressed but highly prevalent in our country is khat. Khat chewing is associated with STEMI. After adjustment for baseline variability, khat chewing was found to be an independent risk factor of death and for recurrent ischemia and heart failure. Worldwide around 20 million people are believed to be using khat and in our country according to EDHS 2011 the prevalence of khat use in the general population was 27.3% among men and 11% among women of 15–49 years(26,27).

Among patients with CHD, at least 1 of the 4 conventional risk factors was present in 84.6% of women and 80.6% of men. Premature CHD was related to cigarette smoking in men and cigarette smoking and diabetes in women. Smoking decreased the age at the time of CHD event by nearly 1 decade in all risk factor combinations(28).

In 2011, WHO estimated that 34% of Ethiopian population is dying from NCDs, with a national CVD prevalence of 15%(29). According to the latest WHO data published in May 2014 total death from CHD in Ethiopia was 14,728 or 2.45% with 166th rank in the world(30). The resulting double burden of NCDs with higher prevalence of pre-existing communicable, maternal, perinatal and nutritional conditions, constrains the already meager health resources and hinders economic development in Ethiopia(31,32).

In Ethiopia the disease burden is not clearly studied but a study done in Tikur Anbessa Hospital showed AMI is the 3rd cause of admission to ICU and also shows the increase in incidence of MI in Ethiopian setup(23,24). A study among all age groups for admissions in MICU in Addis Ababa reported an 8.8% prevalence of hospitalization for AMI and another study from Oromia region reported 9.8%. The prevalence of cardiovascular diseases increased from 4.4% in 1970s to 12.6% in 2000s (23,24). The prevalence of cardiovascular emergency in JUMC was 11% and from this 15% of patients had IHD(33).

Though there was no study done at a national level on IHD risk factors, small scale studies show four behavioral risk factors (physical inactivity, inadequate intake of fruits and vegetables, alcohol consumption and cigarette smoking) to be widely prevalent in Ethiopia. Similarly, high prevalence is reported for overweight, obesity and associated raised blood pressure in urban areas(34). In 2010, WHO estimates that about 4% of Ethiopia's population smokes cigarette(25). According to a study conducted in JUMC in 2015 out of study participants 61.25% were diagnosed with chronic ischemic heart disease (4) and the overall prevalence of Metabolic syndrome in Jimma Town was estimated to be 16.7% and 10.5 % by IDF and NCEP ATP III criteria respectively(35).

Generally, the uncontrolled CVD epidemic especially IHD is associated with increasing socio-economic costs with high levels of disability and loss of productivity, exacerbating poverty & increasing health inequalities. Nevertheless, data on risk factors for IHD are largely derived from developed countries, and risk factors vary between populations and differ due to racial diversity. These documented risk factors remain questionable in terms of applications to rest of the world. Moreover, in Ethiopia, especially in Jimma, definitive data on the magnitude of the burden of risk factor, the strength of the associations between the various risk factors, and the incidence of IHD have generally been lacking. So, identifying determinants of IHD helps us in order to decide which priorities to make in the battle against a disease both directly as an acute MI and angina pectoris and indirectly via its sequel like CHF.

1.3 Significance of the study

To the knowledge of the researcher, this was the first study to be done on determinants of ischemic heart disease in JUMC and all over the country. Overtime, cardiovascular risk factors can have an ill effect on the functioning of body systems. As IHD is one of the leading contributors to mortality and morbidity in the world, identifying and effectively decreasing IHD risk factors would provide a strategy to decrease this mortality rate. In Ethiopia particularly in Jimma though there is increased prevalence of CVDs as well as risk factors there is limited study in this regard. Therefore, the result of this study provides information on main determinants of IHD that will be useful in the implementation of preventive strategies and also serve as a motivation for further investigations in this area. Moreover, it will also provide valuable information for individuals who are interested to study in similar area.

Chapter two: Literature review

IHD is a condition in which there is inadequate supply of blood and oxygen to a portion of the myocardium. The most common cause of myocardial ischemia is atherosclerotic disease of an epicardial coronary artery (or arteries) sufficient to cause a regional reduction in myocardial blood flow and inadequate perfusion of the myocardium supplied by the involved coronary artery(3). It can be reduced by following heart-healthy practices, such as eating a low-fat, low-sodium diet, being physically active, not smoking and maintaining a healthy body weight(36).

2.1 Magnitude of IHD

CAD is the leading cause (45.1%) of deaths attributable to cardiovascular disease in the US(37). A report by British Heart Association in 2017 estimates that 435 people will lose their lives to CVD plus 515 people will go to hospital due to a heart attack and 190 people will die from a heart attack and 7 million people fight their daily battles with CVD(38). Eight of traditional risk factors account for 61% of CVD deaths globally. About 84 % of the total global burden of disease they cause occurs in LMICs, with studies showing that alleviating exposure to these risk factors would improve global life expectancy by almost 5 years(12).

2.2 Determinants of Ischemic heart disease

2.2.1 Socio-demographic

According to INTERHEART study, non-modifiable CVD risk factors are age, sex, family history and ethnicity. Among this age was the most common one. The incidence of CAD in male patients (20%) was higher as compared to females (8.6%) in the age group 35-45years. In the 45+age group, the male/female ratio for the occurrence of CAD was the same(39,40). WHO report shows that male population was found to have approximately 40% increased CAD mortality as compared to the female population(16). IHD affects ≈15.5 million Americans ≥20 years of age, with a lower prevalence rate for women (5.0%) compared with men (7.6%). Advanced age is a major risk factor in men's above 45 years and women's above 55 years of age with similar risk(5,41). The odds of suffering from the disease for an individual with the presence of family history of CHD is found to be very high as compared to an individual who did not have a family history(42). But in Ethiopia the majority of CVD emergencies were dominated by females and 39% are in the age group above 50 years(32).

2.2.2 Metabolic risk factors

- **Hypertension VS IHD**

The commonest risk factor for IHD is hypertension(18). According to a case control study done on IHD patients in India showed hypertension was found in 62% of cases and 20% in the controls (OR= 6.5)(43). Also a study in Bangladesh supports this finding in which 66.9% of male cases and 73.1% of female cases had hypertension compared to 37.5 % in male controls and 25.4% in female controls. A study in Oman also revealed that hypertension was present in 61% of the cases against 23% in the control(42). A study in South Africa indicated that 88.8% IHD patients are hypertensive as compared with controls 20.2% with OR of 8.38. Significantly more cases than controls had a history of hypertension (11,43,44). Also a study by Jerling & Raal 2011 found hypertension in 95% of case and 75% of controls(46).

- **DM VS IHD**

DM is an equivalent risk factor for CVD. A study in Kerala India found DM as a major risk factor in both sex of IHD patients (40). A study in Malaysia found that people with diabetes had a two to eight-fold more risk of developing heart disease (5). Also another study in India showed that 50% of cases had type 2 DM whereas in the control group only 18% had diabetes with OR of 4.5(43) and also a study in South Africa up keeping this presented 27 % of case and 4.8% of controls with OR of 2.99. Similarly a study in Bangladesh & South Africa support this (44,45). But a study in Pakistani women showed no significant results(47). In Ethiopia, Oromia region, estimated the prevalence of type 2 DM to be 5.3% among adults aged 40 years & above (32).

- **Dyslipidemia VS IHD**

A study in south Africa showed 33% of the cases and 7.6% of the controls had elevated cholesterol levels with OR of 2.82 but all cases and controls had triglyceride levels <4.5 mmol/L(45). Also a study in India, showed that mean total cholesterol levels were not significantly different in cases and controls but mean HDL cholesterol was significantly lower and non-HDL cholesterol, LDL cholesterol and triglycerides significantly greater in cases than in controls(48). There is also difference in lipid profile based on residence(49). Dyslipidemia was also a major risk factor in IHD patients likewise a study in Japan, Bahrain, Iran & India supports this(50–53). From admitted IHD patients in JUMC 26.87% were with HDL of less than 40mg/dl

(4). Also a study in south Africa in 2011small dense LDL (73 vs 15%) in the CAD compared to the control group(46).

- **Obesity Vs IHD**

Obesity is a cardiovascular risk factor and also is a risk factor in development of hypertension and DM. Studies in Nigeria revealed that obesity is common in women than in men with a rate of 8.3% in men and 35.7% in women(54). Among 100 cases of IHD patients 90% have sedentary activity from which 65% are obese and from controls 70% had sedentary activity while only 16% are obese(43). Results from Bangladesh indicated that both general or total obesity (measured in BMI) and abdominal adiposity (measured in WC, WHR or WHR) were associated with development of CHD. For men BMI, WC, and WHR were independently associated with CHD, but WHR was not. On the other hand, for women all four measures were associated(44). The study to estimate CVD risk in different government workplaces in Bahrain showed overweight and obesity was 78.4% and half of them do not engage in any type of physical activity(52). Study in Addis indicated an obesity prevalence of 5.3% and 7.2%, respectively among adult workers in particular and the adult population in general in Addis Ababa (32).

2.2.3 Behavioral factors

- **Physical inactivity**

In the INTERHEART study, the PAR of CHD due to sedentary behavior in Latin America and the Caribbean was 7.1%, ranging from 2.7% in Guatemala to 11.3% in Argentina, which is high when compared with 3.9% in Africa, 5.5% in Europe, and 3.2% in Southeast Asia(55). An individual with a sedentary occupation had 3 times the risk of developing CHD as compared to a person with an occupation involving physical activity (42). Assessment of lifestyle in cases and controls showed that 90% of cases and 70% of controls had sedentary lifestyle (43). It has been estimated that inadequate physical activity is responsible for about one-third of deaths due to CHD (12).

- **Smoking VS IHD**

Cigarette smokers were two times more likely to develop IHD as compared to non-smokers (56). A study in south Africa showed that 35% of cases were smokers compared to 10% controls (46). Despite the decline in modeled prevalence, the number of daily smokers increased from 721

million in 1980 to 967 million in 2012(57). A study on behavioral factors showed that smokers, smokeless tobacco consumers, and alcoholic were more among the cases (45.18%, 48.14%, and 17.03%) as compared to controls (28.88%, 31.11%, and 8.14%)(58). The number of cigarettes consumed worldwide increased by 26% in 2012(57). Also a study conducted in Addis showed 33% were active smokers while 56.3% were passive smokers, 8.6% were neither active nor passive smokers, and 2% were purely shisha smokers. According to a study done in Jimma in 2015 prevalence of smoking in IHD patients was 18.8% (4).

- **Alcohol VS IHD**

A 12 years of follow-up study of 1418 cases of MI showed men who consumed alcohol less than once per week had decreased risks of myocardial infarction than men who consumed alcohol three to four or five to seven days per week(59). Also a study in India showed there is a strong association between alcohol consumption and IHD with OR of 2.31(58). Other studies also support this (12,53,60) but moderate amount of alcohol is protective (2,49,55,61,62). Regarding excessive alcohol use a literature review in Addis showed the prevalence ranged from 23% to 62% in the year 1960 and 2011(32). Also a study in Jimma showed high percent of alcohol in the study population around 52.1% (63).

- **Khat VS IHD**

Khat has cathionone which increases blood pressure by positive inotropic and chronotropic actions in isolated atria. Khat chewing by human volunteers increases blood pressure which coincides with elevated plasma levels of cathinone(64). Twenty million people worldwide are believed to be using khat (26). A higher khat chewing prevalence of 9.2% was reported from SNNPR and, in Addis Ababa, it ranged from 7.3% to 8.5% (32). A study in Jimma showed prevalence of khat chewing was 21.9% (63). Khat chewers were more likely to present with ST-segment–elevation myocardial infarction. Overall, khat chewers had higher risk of death, recurrent myocardial ischemia, cardiogenic shock, ventricular arrhythmia, and stroke compared with non–khat chewers. After adjustment for baseline variability, khat chewing was found to be an independent risk factor of death and for recurrent ischemia, heart failure, and stroke(26).

2.2.4 Dietary factor

Higher intake of polyunsaturated fat was associated with a decreased risk of CHD whereas a higher intake of trans-fat was associated with an increased risk of CHD, independent of other dietary factors and cardiovascular risk factors. In addition, the relations of polyunsaturated fat and trans-fat intake with CHD risk were stronger among women above age 65 years (65). A study in India found that IHD cases had significantly lower intakes of green leafy vegetables and mustard oil than controls. Also increased total vegetable intake was significantly associated with a lower risk of IHD(66). Persons consuming a median of 3.5servings/week had an RR of 0.33 compared with those consuming 0.5 servings/week. Use of mustard oil, which is rich in α - linolenicacid, was associated with a lower risk than use of sunflower oil(60). The most prominent dietary risks were diets low in fruits and vegetable and those high in sodium (salt)(18). Daily consumption of fruits and/or vegetables had a protective effect, with an OR of 0.6(55).

2.3 Conceptual framework

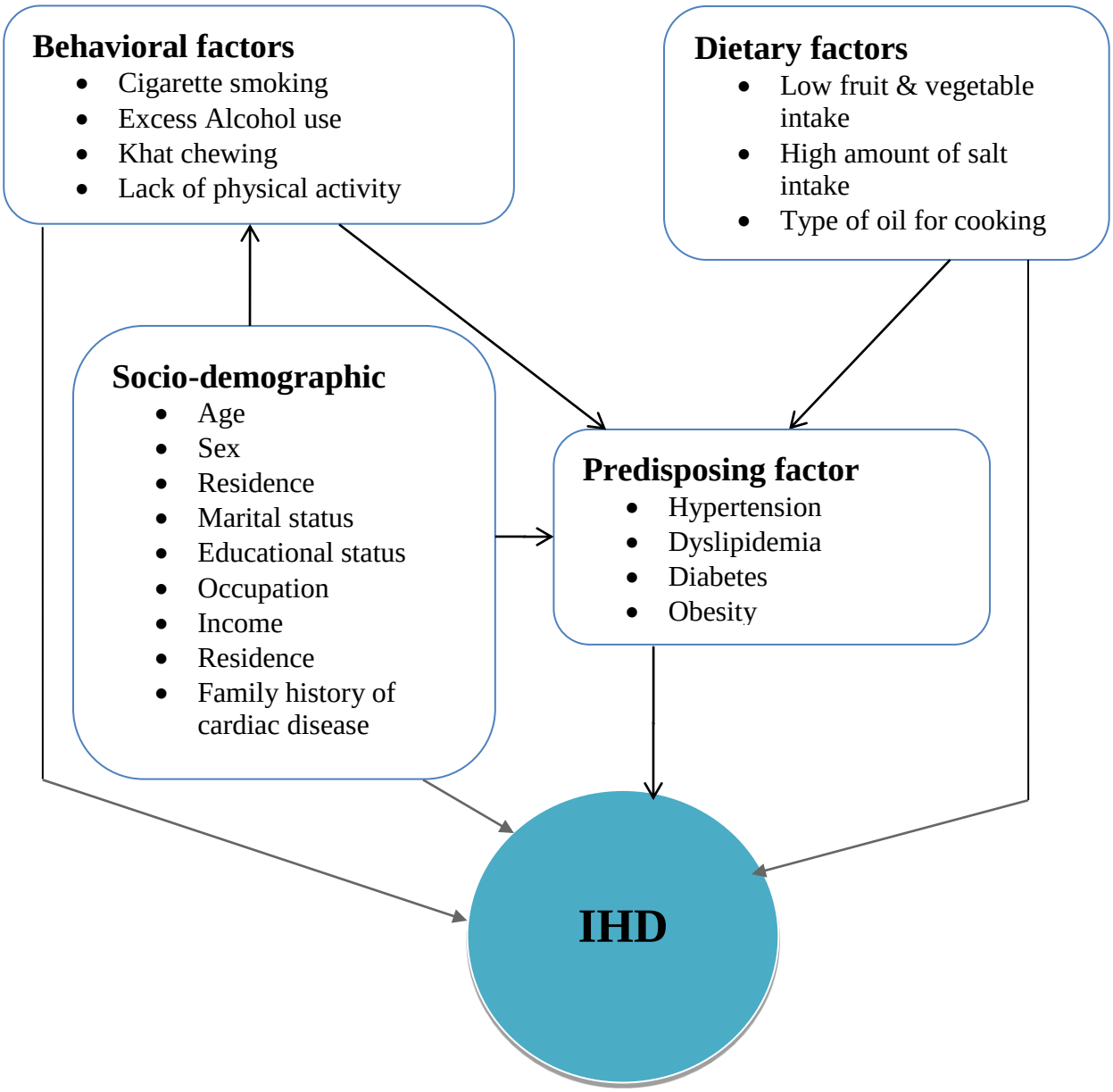

Figure 1: Conceptual framework for determinants of IHD developed by reviewing different literature.

Chapter Three: Objective

3.1 General objective

- To assess determinants of ischemic heart disease in Jimma University Medical Center, 2017

3.2 Specific objective

- To identify modifiable IHD risk factors among study participants.
- To measure the association of behavioral risk factors and Ischemic heart disease.
- To determine the association of dietary risk factors and Ischemic heart disease.
- To measure the association of metabolic risk factors and Ischemic heart disease.
- To calculate 10-year risk of heart disease among control groups using Standard Framingham Heart score.

Chapter Four: Methods

4.1 Study area

The study was conducted at Jimma University Medical Center (JUMC), located in Jimma town in southwest of Ethiopia, in Oromia region, 350km southwest of capital city, Addis Ababa. Jimma zone comprises Jimma town and its nearby woredas with estimated population of 2,486,155. JUMC is the only referral teaching hospital in this largest region of the country. The hospital gives health service at inpatient and outpatient level as a referral hospital with catchment area of 15 million population in the South West of the country. The department of internal medicine has a total of 100 beds with about 2781 annual admission of which 15% of patients were with IHD (33).

4.2 Study period

- The study was conducted from May 13 to July 21, 2017

4.3 Study design

- Hospital based age-group matched case control study

4.4 Population

4.4.1 Source Population

- All adult patients (18 and above years of age) admitted and on follow up at the medical wards of JUMC.

4.4.2 Study population

- All adult patients (18 and above years of age) admitted and on follow up for <6 month to the medical wards of JUMC with a diagnosis of IHD and those who came for minor complain other than cardiovascular were included in the study according to the inclusion criteria during the period of the study.

4.5 Inclusion and Exclusion Criteria

Inclusion Criteria for cases

- All adult patients who meet the diagnosis of IHD with ECG or cardiac biomarkers or echocardiography during the study period.

Inclusion criteria for controls

- Patients who were attending at the outpatients for minor complaints from non-cardiac clinics (ophthalmology; ENT; dermatology; family planning clinic).

Exclusion Criteria for cases

- Patients who were readmitted after once included in the study with stable IHD were excluded unless they develop ACS of new onset.
- Those who were deformed and mentally unstable
- Pregnant mothers

Exclusion criteria for controls

- Patients with the outcome which could be related with the same exposure e.g. lung cancer, COPD, CKD, Psoriasis
- Those who were deformed and mentally unstable
- Pregnant mothers

4.6 Sample size and sampling technique

4.6.1 Sample size

Sample size was calculated based on double proportion formula for case control study using Epi Info Stat Calc version 7.1, with assumption of 95% confidence level, 90% power, and ratio of case to controls 1:2. So far there was no study in our country to calculate the sample size; different determinants of IHD from different literatures had been used to obtain the largest sample size and finally study from South Africa was used (46). As estimated from study done in South Africa, proportion of CAD patients to smoking was taken (main exposure variable) among the cases and controls (35% & 10%), respectively(46). At 5% level of significance, power of 90% and non-response rate of 10%, the number of cases and controls required were 192 (64 cases and 128 controls).

$$\mathrm{n} = \frac{(z\alpha/2+z\beta)2+p2(1-p2)(r+1)2}{(p1-p2)2\,r}$$

WHERE

n = sample size

$Z\alpha/2$ = standard normal distribution for level of significance

r = ratio of control subject per case subject

Zβ = standard normal distribution for power or type two error

P1 = probability of events in case group

P2 = probability of events in control group

4.6.2 Sampling procedure

All cases of IHD within the study period were included until the sample size was achieved and for each case two hospital based controls were selected from patients with minor complains from non-cardiac outpatient clinics (ophthalmology, ENT, dermatology and family planning clinic) with equal allocation of 32 samples for each.

4.7 Study variables

Dependent Variable

- IHD

Independent variables

Socio-demographic

- ❖ Age
- ❖ Sex
- ❖ Marital status
- ❖ Educational status
- ❖ Income
- ❖ Residence
- ❖ Family history of cardiac disease

Dietary factor

- Low fruit and vegetable intake
- High salt intake
- Oil type

Behavioral factors

- ❖ Cigarette smoking
- ❖ Excess Alcohol use
- ❖ Khat chewing
- ❖ Lack of physical activity

Predisposing factor

- Hypertension
- Dyslipidemia
- Diabetics
- Obesity

4.8 Data collection procedure

Data were collected using pre-tested interviewer-administered structured questionnaires which were developed by reviewing different literatures and from WHO standard questionnaire on socio-demographic, dietary & behavioral factors.

First, for anthropometric measurements instrument calibration and random auditing was done and measurements were conducted using standard beam balance that is applicable for weight measurement in medical setups. The scale pointer was checked at zero before taking every measurement. The person was required to dress in light clothes. He/she stood straight and unassisted on the center of a balance platform so that height was measured using standard scale attached to the weight scale. The study participants were asked to remove their shoes, stood erect, position at the plane with feet together and knee straight. The heels, buttock, shoulder blades and the back of the head were in touch against the vertical stand of the stadio meter so that it was taken two times to minimize measurement error and finally height to the nearest 0.1cm and weight to the nearest 0.1kg was taken.

Body mass index (BMI) was calculated using weight and height (Kg/m2).Waist circumference (WC) was measured at the midpoint level of mid-axillary line between the 12^{th} rib head and the superior anterior iliac spine, with measuring time at the end of normal expiration (>102 cm in males and >88 cm in females). Hip circumference was measured at the widest point on buttocks below the iliac crest (92-98.7cm for men and 78.7-98.2 for women).

- **BMI:** underweight (<18.5), normal weight (18.5-24.9), overweight (BMI 25-29.9), or obese (BMI >30).
- **WHR:**>0.9 for males and >0.85 for females

❖ Lipid profile and blood sugar level were measured by collecting five milliliters of venous blood in a plain tube and allowed to clot, centrifuged for five minutes at 3,000 revolutions per minute and serum was separated for serum lipid measurement. Lipid profiles were assessed through enzymatic methods using hem analyzer machine (Human, USA) and appropriate reagents. Clinical chemistry Analyzer (BS 200) which includes total cholesterol (TC), HDL-cholesterol (HDL), triglycerides (TG), Low-density lipoprotein (LDL) cholesterol and blood glucose.

- ✓ **Cholesterol:** ≥ 200mg/dl was considered as hypercholesterolemia
- ✓ **Triglyceride:** ≥150mg/dl was considered as hypertriglyceridemia
- ✓ **HDL:** 30-60 mg/dl, normal value: <40mg/dl was a risk
- ✓ **LDL:** no normal value but borderline is 10-100mg/dl (67)

❖ Blood glucose:

- ✓ **FBS:** normal if below 108mg/dl and diabetes if above 126mg/dl.
- ✓ **RBS:** normal below 200mg/dl diabetes if above 200mg/dl

❖ Blood pressure was measured using digital sphygmomanometer at comfortable sitting position three times & classified as:

- ✓ Normal <120/80
- ✓ Pre hypertension; 120-139/80-89
- ✓ Stage 1: 140-159/90-99
- ✓ Stage 2: >160/>100
- ✓ Hypertensive crisis: ≥180/110

Recruitment and training of data collectors

❖ Four BSc nurses and two laboratory technician were recruited from staffs for interview administered questionnaire and laboratory analysis of blood, respectively based on their previous experience and interest to collect data. The data collectors were trained for two day on objective of the study, data collection tools, approach to the interviewees, details of interviewing techniques, respect and maintaining privacy and confidentiality of the respondents plus practicing on how to measure and draw blood.

Pretesting and data collection

❖ The questionnaire was pre-tested in 5% of sample in one of the selected hospital Shenen Gibe hospital other than study area and further revised accordingly.

4.9 Data processing and analysis

The data on each coded questionnaire was entered into Epi-data version 3.1 and double entry verification was made and exported to SPSS version 21 statistical packages for analysis. The data was explored to check outliers, missing data and assumptions. During analysis frequencies of the different variables were determined as supposed necessary; cross-tabulations and bivariate backward conditional logistic regression were performed to select variables for multivariate analysis. Hence variables with p-value <0.25 in the bivariate analysis was taken as candidates for multivariable analysis. Finally, multivariable backward conditional logistic regression analysis was performed to control for possible confounding effect of the selected variables and variables with p-value of less than 0.05 was taken as statistically significant for risk factor identification in

IHD patients and OR with its 95% CI was used to show the degree of association between the dependent and independent variables.

4.10 Data quality control

The questionnaire was developed using a tool that had been applied in different studies related to determinants of IHD and anthropometric measurements and blood sample analysis was interpreted according to international guidelines. It was translated from English to Amharic and back to English to assure consistency. The principal investigator supervised the performance of the data collectors on daily basis. The collected data were checked for completeness, accuracy, clarity and consistency by the principal investigator.

4.11 Operational definition

- **Unstable angina**; was considered to be present in patients with ischemic symptoms suggestive of an ACS without elevation in biomarkers with or without ECG changes indicative of ischemia.

- **Current Alcohol user:** a respondent was considered alcohol user if she/he used alcohol for the last one month.

- **Past Alcohol user:** a respondent was considered previous user if he/she was using alcohol for long time but stopped now.

- **Smoker:** Subjects who smoked at least one cigarette per day were considered current smokers. Subjects who didn't smoke considered as non-smokers. A previous smoker was a person who had previously smoked but stopped now.

- **Physical activity** was defined as any bodily movement produced by skeletal muscles that result in energy expenditure. It was classified as moderate activity, such as jogging, walking, or swimming; vigorous activity that causes sweating or hard breathing, such as heavy lifting, aerobics, or fast bicycling; and sedentary, such as staying at home most of the time or doing a little walking outside or generally less than 150min/week or 30min/day(68).

- **Unhealthy diet:** low in fruit & vegetable intake & high in salt and saturated type of oil used.

- **Low fruit and vegetable intake:** less than four servings of fruits or vegetables per one typical week.

4.12 Ethical consideration

Ethical clearance was obtained from ethical review committee of Jimma University Institute of Health Science and support letter was obtained from Department of Bio medical Sciences and Internal Medicine. All the study participants were informed about the purpose of the study, their right to refuse and assured confidentiality and informed verbal consent was obtained prior to the interview. At the end of each interview and measurement procedures awareness creation was made to study participants in control groups about the risk factors of IHD and importance of regular checkup and aggravating factors for the cases.

4.13 Dissemination plan

The study will be presented to the Jimma University, advisors and examiners, submitted to Department of Biomedical Sciences and copies will be given to the JUMC so that it will be used as a source of information for possible planning and implementation of health intervention and effort will be made for possible publication.

Chapter Five: Result

A total of 64 (33.33%) cases and 128(66.67%) controls were included in the study. Among the cases 42(65.6%) and among controls 74(57.8%) were males. As it was shown in Table 1; 39.1% of the respondents in both groups were in the age group 55-64 years. The mean age of the cases and controls were 53.70±12.538 and 52.63±13.49, respectively. With regards to the participant's residence, majority of cases 57.8% and 48.4% controls were from rural. The ethnic composition of the study indicated that 75% of cases and 72.7% of controls were Oromo in ethnicity. Concerning to the education level, 42.2% of cases and 18.8% of control can't read and write while 10.9% of cases and 21.8% of controls were college & above. From the total respondents, 78.1% of cases and 80.5% controls were married followed by 14.1% of cases being widowed and 9.4% of controls were being single. According to the findings of this study 48.4% of cases were farmers while 32.8% of controls were government employees. Among the cases and controls 68.8% and 47.7% were Muslim's, respectively. Among cases and controls 28.1% and only 14.8% had family history of cardiac illness, respectively and 42.2% of cases and 22.7% of controls had past history of hypertension but history of DM was high in controls. Most of the respondents had total monthly income above 1000 ETB.

Table 1: Socio-demographic characteristics of respondents in JUMC, 2017

Variable	Categories	Cases No (%)	Controls No (%)	Total No (%)
Sex	Male	42(65.6)	74(57.8)	116(60.4)
	Female	22(34.4)	54(42.2)	76(39.6)
Age	<44	11(17.18)	26(20.3)	37(19.3)
	45-54	12(18.8)	24(18.8)	36(18.7)
	55-64	25(39.1)	50(39.1)	75(39.1)
	>65	16(25)	28(21.9)	44(22.9)
Residence	Urban	27(42.2)	66(51.6)	93(48.4)
	Rural	37(57.8)	62(48.4)	99(51.6)
Ethnicity	Oromo	48(75)	93(72.6)	141(73.4)
	Other*	16(25)	35(27.3)	51(26.6)

Marital Status	Married	50(78.1)	103(80.5)	153(79.7)
	Widowed	9(14.1)	6(4.7)	15(7.8)
	Single/Divorced/Separated	5(7.8)	19(14.8)	24(12.5)
Religion	Orthodox	18(28.1)	26(20.3)	44(22.9)
	Muslim	44(68.8)	61(47.6)	105(54.7)
	Protestant/Catholic/Joba	2(3.1)	41(32.0)	43(22.4)
Educational status	Can't read & write	27(42.2)	24(18.8)	51(26.6)
	College & above	7(10.9)	28(21.8)	37(19.3)
	Other**	24(37.5)	76(59.4)	100(52.1)
Occupation	Farmer	31(48.4)	34(26.6)	65(33.8)
	Government Employee	5(7.8)	42(32.8)	47(24.5)
	Other***	28(43.8)	52(40.6)	80(41.7)
Monthly Income	<1000	9(14.1)	6(4.7)	15(7.8)
	≥1000	55(85.9)	122(95.3)	177(92.2)
Family history of IHD	Yes	18(28.1)	19(14.8)	37(19.3)
	No	46(71.9)	109(85.2)	155(80.7)
History of HYP	Yes	27(42.2)	29(22.7)	56(29.2)
	No	37(57.8)	99(77.3)	136(70.8)
History of DM	Yes	12(18.8)	29(22.6)	41(21.4)
	No	52(81.3)	99(77.3)	151(78.6)

*Note: Other*Amhara, Dawuro, Kafa, Yem, Gurage** Read & write only, primary & Secondary ***Student, House wife, merchant, Self-Employ.*

Behavioral risk factor

It was found that 20.3% and 60.9% of cases had history of smoking and alcohol consumption while only 19.5% and 33.9% of the controls had history of smoking and alcohol intake, respectively. Most of the cases (53.8%) and (36%) of controls were daily smokers. Among those who had history of smoking more than two third of cases and controls (86.7% and 72%) were past smokers while 17.2% of case and 7.8% of controls had family history of smoking. As shown

in Table 2; among alcohol drinkers 43.6% of cases drink ‘tejj’ and 44.2% of controls drink beer followed by other drink types like “Tela, borde, areke” in both groups. And also 48.8% of controls were drinking alcohol three times a week but among cases 41% were drinking alcohol daily. Among those who had history of alcohol drinking 72.7% and 19.5% of cases and controls were past alcohol drinkers (ceased drinking alcohol currently), respectively. Regarding history of khat chewing 64.1% of cases and 38.3% of controls had history of chewing khat and 56% of cases chew daily followed by 29.3% chew once a week and among controls 38.7% chew once a week. From those chewing khat 34.2% of cases and 12.2% of controls were chewing >2 zurba/week. Almost all of cases and controls (82.8% and 72.6%) were physically active having moderate physical activity (150min/week or 30min/day).

Dietary risk factors

Fruit and vegetable consumed by cases for ≥5 days was 26.6% and 32.8% but among controls 43.8% and 46.9%, respectively. Concerning oil usage 7.8% of cases and 28.1% controls used liquid oil for cooking food but the rest 92.2% of cases and 71.9% controls used solidified oil (Table 2). Also as shown in *figure 3* educational status and the type of oil were assessed and showed those who can’t read and write were more prone to use solidified oil (1.56% of cases and 4.69% of controls use liquid oil). In relation to salt consumption 32.8 % of cases use too much salt or very too much amount of salt on food but 77.3% of controls use just the right amount of salt on food or less. Knowledge about importance of lowering salt in their diet was 51.6% of cases and 60.9%.

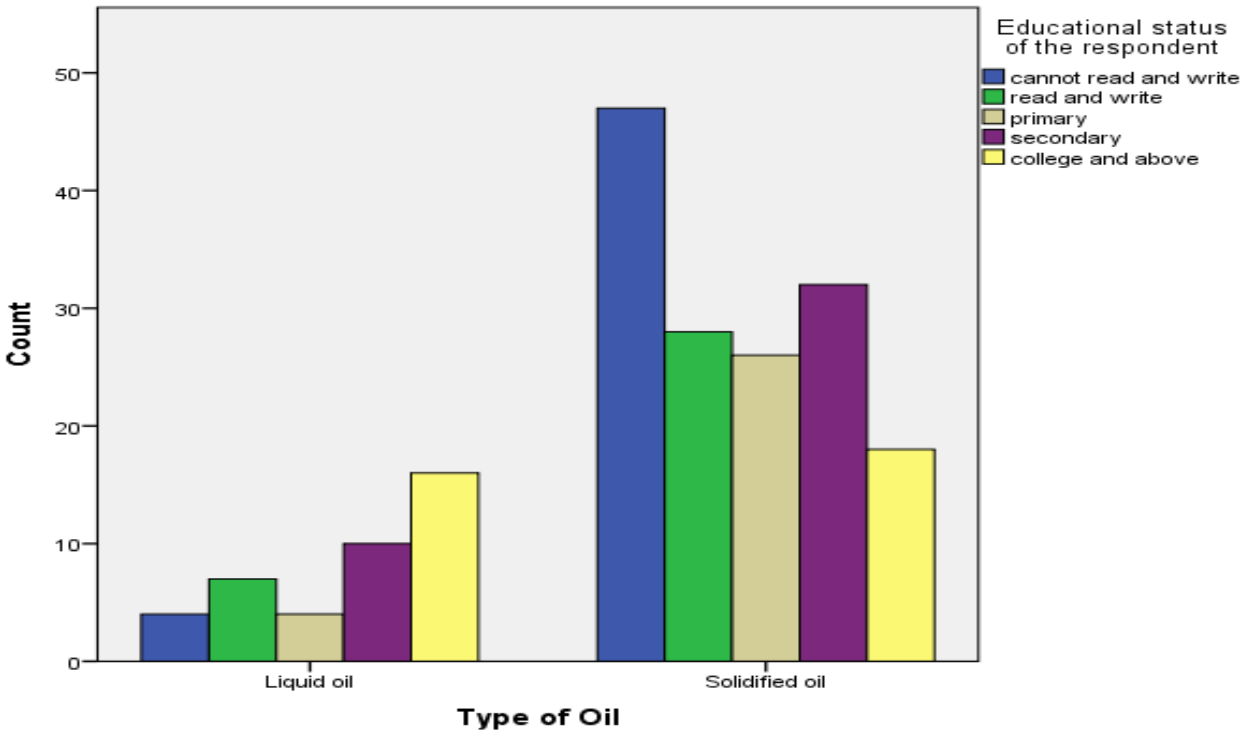

Figure 2: Figure showing educational status verses type of oil for food preparation, JUMC 2017

Metabolic risk factors

One of the main metabolic risk factors was hypertension and 23.4% of cases had hypertension among which 12.5% were stage 4 so that linked to chronic illness clinic for follow up. The rest 32.8% were in pre-hypertensive category and thus informed to the respective OPD physicians for further checkup. From controls 71.1% had normal blood pressure and only 7.8% of them had stage 3 hypertension. Almost equal number of cases and controls were in the normal body weight category (57.8% and 59.1%), respectively which was followed by 25% of cases and 23.4% of controls were underweight (BMI<18.5) and 72% of cases an 81% of controls were in the normal WHR category. Total cholesterol among cases and controls ≥200mg/dl was 56.3% and 24.2% respectively and HDL <40 mg/dl was found in 29.7% in cases and 25% among controls. LDL >100 mg/dl among cases was 65.6% and 51.6% of controls. Triglyceride ≥150 mg/dl among cases was 56.3% and in controls 23.4%. Among cases 35.9% and among controls 20.3% were diabetic.

Table 2: Behavioral, dietary and metabolic determinants of Ischemic heart disease, JUMC 2017

Variable	Cases No (%)	Controls No (%)	Total No (%)
History of smoking			
Yes	13(20.3)	25(19.5)	38(19.8)
No	51(79.7)	103(80.5)	154(80.2)
Frequency of smoking			
Daily	7(53.8)	9(36)	16(42.1)
3x/week	4(30.7)	5(20)	9(23.6)
Once per week	2(15.4)	11(44)	13(34.2)
Excess Alcohol consumption			
Yes	39(60.9)	43(33.9)	82(42.7)
No	25(39.1)	85(66.4)	110(57.3)
Type of alcohol			
Beer	9(23)	19(44.2)	28(34.1)
Tejj	17(43.6))	11(25.6)	28(34.1)
Other	13(33.3)	13(30.2)	26(31.7)
Frequency of alcohol drinking			
Daily	16(41)	6(14)	22(26.8)
3x/week	9(23.1)	21(48.8)	30(36.6)
Once per week	8(20.5)	9(20.9)	17(20.7)
Once per month	6(15.4)	7(16.3)	13(15.8)
Khat chewing			
Yes	41(64.1)	49(38.3)	90(46.8)
No	23(35.9)	79(61.7)	102(53.2)
Frequency of Khat chewing			
Daily	23(56)	10(20.4)	33(36.67)
Once a week	12(29.3)	19(38.7)	31(35.44)
Other	6(14.6)	20(40.8)	26(28.89)
Amount of zurba			
< 2 zurba/week	27(65.8)	43(87.8)	70(77.7)

≥ 2 zurba/week	14(34.2)	6(12.2)	20(22.23)
Physical activity			
<30min/day	11(17.2)	35(27.4)	46(23.9)
≥30min/day	53(82.8)	93(72.6)	146(76.04)
Fruit consumption			
<4days/week	47(73.4)	72(56.2)	119(61.9)
≥5days/week	17(26.6)	56(43.8)	73(38.1)
Vegetable consumption			
<4days/week	43(67.2)	68(53.1)	111(57.8)
≥ 5days/week	21(32.8)	60(46.9)	81(42.2)
Type of Oil			
Liquid	5(7.8)	36(28.1)	41(21.4)
Solidified	59(92.2)	92(71.9)	151(78.6)
Salt consumption			
≤ the right amount	43(67.2)	99(77.3)	142(73.9)
>the right amount	21(32.8)	29(22.7)	50(26.04)
Hypertension			
Yes	15(23.4)	10(7.8)	25(13.1)
No	49(76.6)	118(92.2)	167(86.9)
BMI			
<18.5	16(25)	30(23.4)	46(24)
18.5-24.9	37(57.8)	76(59.4)	113(58.9)
25-29.9	9(14.1)	19(14.8)	28(14.6)
≥30	2(3.1)	3(2.3)	5(2.6)
Total Cholesterol			
<200 mg/dl	28(43.8)	97(75.8)	125(65.1)
≥200 mg/dl	36(56.3)	31(24.2)	67(34.9)
LDL			
<100 mg/dl	22(34.4)	62(48.4)	84(43.8)
≥100 mg/dl	42(65.6)	66(51.6)	108(56.2)
HDL			
<40mg/dl	19(29.7)	32(25)	51(26.5)
≥40mg/dl	45(70.3)	96(75)	141(73.4)
Triglyceride			
<150 mg/dl	28(43.8)	98(76.6)	126(65.6)
≥150 mg/dl	36(56.3)	30(23.4)	66(34.4)
RBS			
Diabetic	23(35.9)	26(20.3)	49(25.5)
Non-diabetic	41(64.1)	102(79.7)	143(74.5)

Note: **p-value <0.25**** Single, Divorced, Separated ***read and write, primary, secondary*

Multivariate associations of determinants of IHD

Determinants of IHD on bivariate analysis using backward CLR at the level of P value <0.25 were fit in to multivariate backward CLR model. Accordingly, as shown in Table 3 below variables such as educational status, place of residence, marital status, family history of cardiac disease, personal history of hypertension, history of smoking, excess alcohol consumption, khat chewing, fruit and vegetable intake, type of oil used, amount of salt consumed, total cholesterol level, HDL, LDL, triglyceride and blood sugar level were entered in to the multivariate logistic regression model.

Table 3: Bivarate association of determinants of ischemic heart disease in JUMC, 2017

Variable	Category	COR (95% CI)	p-value
Residence	Urban	1.46(0.79-2.67)	**0.22**
	Rural	1	
Marital status	Married	1	
	Widowed	3.09(1.04-9.16)	**0.04**
	Other**	0.54(0.19-1.54)	**0.26**
Educational status	Can't read & write	2.85(1.43-5.70)	**0.003**
	College & above	0.63(0.25-1.61)	**0.63**
	Other***	1	
Family history of cardiac disease	Yes	2.25(1.08-4.66)	**0.03**
	No	1	
History of hypertension	Yes	2.46(1.31-4.75)	**0.006**
	No	1	
Alcohol consumption	Yes	3.08(1.65-5.74)	**<0.001**
	No	1	
Khat chewing	Yes	2.87(1.54-5.36)	**<0.001**
	No	1	

Amount of zurba	< 2 zurba/week	2.13(1.07-4.23)	**0.24**
	> 2 zurba/week	1	
Fruit consumption	<4days/week	2.15(1.11-4.14)	**0.022**
	≥5 days/week	1	
Vegetable consumption	<4days/week	1.81(0.97-3.38)	**0.06**
	≥5 days/week	1	
Type of oil	Liquid oil	1	
	Solidified oil	4.62(1.71-12.44)	**0.002**
Salt consumption	≤ the right amount	1	
	> the right amount	1.67(0.86-3.23)	**0.13**
Total cholesterol	<200	1	
	≥200	4.02(2.12-7.62)	**<0.001**
LDL	<100	1	
	≥100	1.79(0.96-3.34)	**0.07**
Triglyceride	<150	1	
	≥150	4.2(2.21-7.97)	**<0.001**
RBS	Diabetic	2.2(1.13-4.29)	**0.021**
	Non- diabetic	1	

Note: Other read and write, primary, secondary, **p-value<0.05*

After controlling for socio-demographic factors and unhealthy behaviors; unhealthy diet and metabolic risk factors were still more likely to be associated with IHD. Thus, those who consume fruit <4 days/week were two times (AOR=2.11 95% CI; 1.07-4.17) more likely to develop IHD. Use of solidified oil was four times (AOR=4.08, 95% CI; 1.49-11.20) more likely to develop IHD than those who use liquid oil for food preparation. Hypercholesterolemia and hypertriglyceridemia were also the most significant risk factors with adjusted odds ratio of (AOR=2.67, 95% CI; 1.32-5.42) and (AOR=2.83, 95% CI; 1.42-5.65), respectively.

Table 4: Multivariate backward conditional LR association of IHD with socio-demographic, behavioral, dietary and metabolic factors in JUMC, 2017

Variable	AOR(95%; CI)	p-value
Educational status		
Can't read & write	**2.59(1.20-5.61)**	**0.015****
College & above	0.55(0.20-1.47)	0.23
Other*	1	
Family history of cardiac disease		
Yes	**2.39(1.06-5.40)**	**0.04****
No	1	
History of Hypertension		
Yes	**3.02(1.47-6.19)**	**0.003****
No	1	
Alcohol consumption		
Yes	**2.79(1.47-5.27)**	**0.002****
No	1	
Khat chewing		
Yes	**2.58(1.36-4.89)**	**0.004****
No	1	
Fruit Consumed		
<4 days/week	**2.11(1.07-4.17)**	**0.03****
≥5 days/week	1	
Oil type		
Liquid	1	
Solidified	**4.08(1.49-11.20)**	**0.006****
Total Cholesterol		
<200 mg/dl	1	
≥200 mg/dl	**2.67(1.32-5.42)**	**0.006****
Triglyceride		
≥150 mg/dl	**2.83(1.42-5.65)**	**0.003****
<150 mg/dl	1	

Note: Other read and write, primary, secondary, ** p-value <0.05*

Risk Score Calculation (Assessment) Based on Framingham Risk Scoring System

Risk assessment for determining 10-year risk for developing CHD events, was carried out by using the Framingham risk score updated for NCEP guidelines. The risk factors included in the Framingham calculation of 10-year risk were: age, total cholesterol, HDL cholesterol, smoking status, and systolic blood pressure. The risk score classified the estimated risk of CHD into three categories; low risk with total score less than 10%, moderate risk with a total risk score range from ≥10% - 20% and the high risk category of ≥20% risk score. In this study as shown in Table 5; almost all of the control groups were placed in low risk score category (less than 10%) but only 7.81% were in moderate risk which needs repeated follow up and checkup.

Table 5: Risk Score Calculation (assessment) based on Framingham risk scoring system, JUMC, 2017

Score %	Male		Female		Total	
	No	%	No	%	No	%
<1	59	79.7	39	72.2	98	76.6
1	2	2.7	0	0	2	1.56
3	1	1.35	5	9.26	6	4.68
4	5	6.76	3	5.56	8	6.25
5	3	4.05	1	1.85	4	3.13
10	1	1.35	1	1.85	1	1.56
12	3	4.05	5	9.26	8	6.25

Chapter Six: Discussion

The present study was designed as hospital-based matched case-control study to assess determinants of ischemic heart disease. On univariate as well as age adjusted analyses significant associations were observed with educational status, family histories of cardiac disease, past history of hypertension, alcohol consumption, khat chewing, fruit consumption, type of oil for cooking, dyslipidemia were significantly associated with IHD. A total of 192 subjects (64 cases & 128 controls) were studied. Demographic data of the study population revealed that mean age of the cases and controls was 53.70±12.538 and 52.63±13.49 years, respectively. Approximately 80% of the cases included in this study were younger than 65 years and fell within the working-age group with largest number of respondents in the age group of 55-64 years (39.1%), followed by >65 years.

Family histories of cardiac disease and personal history of hypertension were strong determinants of IHD. Therefore, genetic factors may play a role in the predisposition of this community to develop IHD. In this study family history of cardiac disease can increase an individual's risk for IHD two fold (AOR= 2.39; 95% CI (1.06-5.40)) and personal history of hypertension increase by three times (AOR= 3.02(1.47-6.19). Furthermore, the findings were similar to those reported by the INTER- HEART study that was conducted in nine African countries(69). The family history was considered to be significant when a male relative's first CHD event occurred before the age of 55, or a female relative's first CHD event occurred before 65(70). Also a study in India support this with (AOR; 5.3, 95% CI; 2.8-9.9)(10) and positive family history was a strong predictor in different studies(5,69). But this is in contrary to a study in Pakistan which found no association(72).

Information on blood pressure in this study was based on self-reported history of diagnosed and treated hypertension. Although data on the patients' blood pressure after admission was taken, this information wasn't used because blood pressure may have been modified by treatment or by the cardiovascular event. A history of hypertension was a significant risk factor for IHD in this study with OR of 3.02 (p-value =0.003) which was in line with a finding in Malaysia and Pakistan (5,72). The prevalence of hypertension in Ethiopia and in the study area Jimma was 19.6 % (73) & 13.2% (74), respectively. It contributes to more than one third of premature

mortality due to CHD. Ganguly & Al-maniri in there study found that hypertension was present in 61% of the cases against 23% in the control ($p<0.001$)(75).

This study found out that almost half of the cases (42.2%) were unable to read and write which is slightly lower than a study conducted in India by Deb & Dasgupta in which 45% were illiterate. Also a study from South Africa and Saudi Arabia supports this (76,77). In contrary to this a study by Kapoor et al. found that more than half of the cases were educated up to secondary level and above and approximately one-quarter of the cases were illiterate(10). This might be due to study population difference in socio-demographic and socio-economic characteristics.

In this study significant association was observed between alcohol drinking and IHD (AOR=2.79), which was similar with other findings(58,66,74) but in contrary to (69,78,79). Also khat chewing was strongly related to IHD (AOR=2.58). In present study, unhealthy behavior like alcohol consumption and Khat chewing were more among the males as compared to females in cases and controls, similarly EDHS 2011 report shows that 27.3% of men and 11.0% of women chew khat. Possible reason may be that these types of unhealthy behaviors are more socially acceptable for males than for females. Ram & Trivedi in their study reported that smoking increases by twofold the chances of developing CHD as compared to nonsmokers ($p<0.001$)(58). Also a study in India showed significant association between smoking, current smoking and coronary artery disease (AOR=2.03 and 2.72 respectively)(58). But this study found no significant association between smoking history and development of IHD ($p>0.05$). This may be due to reluctance to provide a correct history of smoking habits because of religious and cultural taboos or economic source.

On univariate analysis fruit and vegetable consumption was significantly associated with IHD but in age adjusted multivariate analyses significant associations are observed with educational status, family histories of cardiac disease, past history of hypertension, alcohol consumption, khat chewing, less fruit consumption, type of oil for cooking and dyslipidemia. In this study consumption of fruit <4 days/week was associated with IHD (AOR=2.11). Similarly the risk of CHD was decreased by 7% for each additional portion per day of fruit consumption (80) and also a study on IHD in Africa (69) supports this. Similarly another study in India showed fruit consumption has increased chance of lowering IHD (AOR 8.95, CI 1.66-43.23)(79). Besides

CAD patients had a significantly lower intake of vitamin C than the controls, most probably reflecting a lower intake of fresh fruit and vegetables(46).

Concerning oil usage, 7.8% of cases and 28.1% controls use liquid oil for cooking food (AOR= 4.08; CI(1.49-11.20) which were saturated like "Avena, Hayat, Viking " commonly used by participants. Also a study in India showed 100% use of saturated oil for cooking increase IHD by 0.49 (95% CI: 0.24, 0.99)(66,71). A study by Islam & Majumder in Bangladesh showed use of mustard oil, which is rich in α-linolenic acid, was associated with a twofold lower risk than was use of other oils(81). Also a study by Rastogi et al. showed the addition of vanaspati, which is rich in trans fatty acids, to food was associated with a moderate increase in IHD risk, although there was no significant association vanaspati used for cooking or frying(66).

In this study results indicated that both general and total obesity (measured in BMI) and abdominal adiposity (measured in WC, WHR) wasn't associated with IHD development. (44)In addition to this gender, religion, marital status, residence, type of occupation and diabetes weren't not statistically associated to IHD. So that these risk factors had no public health importance to the study area. Similarly, behavioral factors physical inactivity and smoking was not associated with IHD which might be due to socio-economic related issue or reluctance to provide the correct information.

Dyslipidemia is the major risk factor in the development of ischemic heart disease which is mostly due to unhealthy diet. Hypercholesterolemia and hypertriglyceridemia were the most common modifiable risk factors of IHD with adjusted odds ratio of AOR= 2.67 (CI, 1.32-5.42) and AOR=2.83 (CI, 1.42-5.65), respectively. The current study found that 56.3% of the samples had high total cholesterol level which was in agreement with a study done in Malaysia in which 50% of cases had total cholesterol level ≥200mg/dl (5). A study from South Africa also showed that hypercholesterolemia was marginally associated with IHD (OR 2.53, 95% CI .92-6.89). But this is in contrary to a study done in India which showed no significant association rather got significant association with hypertriglyceridemia with AOR of (3.62, 2.35-5.59)(79) and a prospective study from Copenhagen Male Study supports this(82). Furthermore, James et al. in their study found that 71% of IHD patients had dyslipidemia(71). Doing sex wise analysis for hypercholesterolemia & hypertriglyceridemia after adjustment for socio-demographic, behavioral and dietary factors men were more commonly affected than women. Similarly a study

in Malaysia found men are more commonly affected than women until the fifth decade, after which time the frequency of CHD is similar in both sexes (5).

Strength

The current study has strengths like

1. Application of case control study design and statistical criteria for analyses.
2. Use of laboratory test which makes the finding realistic.
3. Different factors from socio-demographic to life style where assessed to know the real association between dependent and independent variables.
4. Results were communicated with the physician for future prevention and treatment.
5. This study may direct physician attention to lipid profiles and associated factors to patients as routine test.

Limitation

- Case control studies have selection and recall bias. To minimize these, controls were included from the hospital as these would be from the same locations as cases.
- Although the number of subjects were not large, it is the largest study of determinants of IHD in the study area and the country at large.
- This was not a prospective study which could have definitely evaluated the potential impact of various risk factors.
- Many emerging risk factors lipoprotein(A), fibrinogen levels and dietary recalls triglyceride remnants, C-reactive protein, inflammatory factors or genetic markers that have been implicated in IHD, were not studied because there was no instrument in the hospital as well as other laboratories in the study area.

Chapter Seven: Conclusion and Recommendations

Our country Ethiopia still faces many daunting challenges in infectious diseases, nutritional deficiencies, and perinatal morbidity and mortality that are often seen as more pressing and deserving of limited health resources than are chronic non-communicable diseases such as IHD. In conclusion this study has found out statistically significant association between behavioral, metabolic and dietary factor and IHD in the study. Likewise modifiable and preventable various behavioral and dietary risk factors were important etiology behind the occurrence of IHD. Improving lifestyles with alcohol and khat cessation or minimization, diet modulation with more fruits and low cholesterol diet and increasing health education program are critical. Target oriented control of hypertension and lipid levels are also required. Public health remedial measures at multi-level prevention strategies therefore, are urgently needed to minimize the significant proportion of premature morbidity and mortality due to IHD because these risk factors are highly prevalent in the community and but also preventable. Therefore, efforts to bring about changes in these major determinants and emphasis should be given to reduce the disease as well as the risk factors to decrease morbidity & mortality. Next, behavioral change communications (BCC) are recommended at individual and community level (community education about attaining healthy behaviors and diet modulation). In addition, further studies are suggested by using follow up (prospective designs) on determinants of IHD and inclusion of novel risk factors in the study area as well as a country should be assessed. Also health information dissemination and health education should be part of the plan to combat the growing IHD burden in the area. However, as Goethe so aptly put it, ‘‘Knowing is not enough; we must apply. Willing is not enough; we must do.’’ For our country especially to the study area, there can be no better time than now to act to prevent IHD from becoming epidemic. Likewise, JUMC is one of the largest hospital in south west Ethiopia as well as in the country pertinent instruments and laboratory equipment’s should be fulfilled. Similarly, biomedical department also should have full and advanced instrument for students learning and researching purpose.

Reference

1. Riley L, Melnie C. WHO Noncommunicable Diseases Country Profiles 2014. 2014;
2. Michael Jay K, Sheryl M. N. Coronary Artery Disease (CAD). Med Educ. 2015;
3. Anthony Fauci. Harrison's Principles of Internal Medicine, 18th Edition. 2000.
4. Bekele M. Pattern and outcome of Ischemic heart disease in patients admitted to Jimma University specialized hospital,South west ETHIOPIA. 2015;1–37.
5. Haque ATME, Binti F, Yusoff M, Haidir M, Bin S, Fadhli M, et al. Lipid Profile of the Coronary Heart Disease (CHD) Patients Admitted in a Hospital in Malaysia. J Appl Pharm Sci. 2016;6(05):137–42.
6. Mittal D, Shekhawat K. Study of cardiovascular risk factor profile among first-degree relatives of patients with premature coronary artery disease. Int J Community Med Public Heal. 2016;3(7):1894–9.
7. Mensah GA. Ischemic Heart Disease in Africa. 2017;(August 2008).
8. Gupta R, Mohan I, Narula J. Trends in Coronary Heart Disease Epidemiology in India. Ann Glob Heal [Internet]. 2016;82(2):307–15. Available from: http://dx.doi.org/10.1016/j.aogh.2016.04.002
9. George A. M. Ischemic Heart Disease in Africa. 2008;(August 2008).
10. Kapoor R, Vyas S, Patel P, Mehta H, Mehta P, Modi J, et al. Short Communication A case-control study of risk factors for ischemic heart disease in patients attending tertiary care hospitals in India. South East Asia J Public Heal. 2013;3(1):57–60.
11. Suh I, Oh KW, Lee KH, Psaty BM, Nam CM, Kim S Il, et al. Moderate dietary fat consumption as a risk factor for ischemic heart disease in a population with a low fat intake : a case-control study in Korean men 1 – 3. 2001;(4):722–7.
12. WHO. Prevention of Cardiovascular Disease. 2007;
13. GBD. Ischemic heart disease worldwide, 1990-2013 Estimates from the Global Burden of

Disease (GBD). 2013;2013.

14. Ceria-ulep C, Qureshi K. CORONARY HEART DISEASE KNOWLEDGE AND RISK FACTORS AMONG FILIPINO-AMERICANS CONNECTED TO PRIMARY CARE SERVICES. 2010;

15. Sanchis-gomar F, Perez-quilis C, Leischik R, Lucia A. Epidemiology of coronary heart disease and acute coronary syndrome. 2016;4(13):1–12.

16. Judith AF, Perviz A, Francis DP. Mortality from ischaemic heart disease by country, region, and age Statistics from World Health Organisation and United Nations. 2012.

17. Gaziano TA, Asaf B, Shuchi A, Shafika A, Murphy A. NIH Public Access. 2011;35(2):1–34.

18. Paolo F, Michelle C, Miller A. Cardiovascular disease and hypertension in sub-Saharan Africa : burden , risk and interventions. Intern Emerg Med [Internet]. 2016;11(3):299–305. Available from: "http://dx.doi.org/10.1007/s11739-016-1423-9

19. Kones R. Recent advances in the management of chronic stable angina I : Approach to the patient , diagnosis , pathophysiology , risk stratification , and gender disparities. 2010;635–56.

20. Steven van de V, Hilda A, Samuel O, Ademola O, Charles A, Isabella A, et al. The African Union Conference of Ministers of Health on NCD ' s. 2013;8688:1–17.

21. Mills KT, Bundy JD, Kelly TN, Reed JE, Kearney PM, Reynolds K. Global Disparities of Hypertension Prevalence and Control. 2016;441–50.

22. Jocelyne V, Moor A, Amougou SN, Ombotto S, Ntone F, Wouamba DE, et al. Dyslipidemia in Patients with a Cardiovascular Risk and Disease at the University Teaching Hospital of Yaoundé , Cameroon. 2017;2017.

23. WILSON PF. Assessing Coronary Heart Disease Risk with Traditional and Novel Risk Factors. Clin Cardiol. 2004;27:7–11.

24. WHO. GLOBAL REPORT ON DIABETES. 2016;

25. WHO. WHO global report on trends in prevalence of tobacco smoking. 2015;

26. Ali WM, Habib KF Al, Al-motarreb A, Singh R, Hersi A, Faleh H Al, et al. Acute Coronary Syndrome and Khat Herbal. 2011;

27. Wondemagegn AT, Cheme MC, Kibret KT. Perceived Psychological , Economic , and Social Impact of Khat Chewing among Adolescents and Adults in Nekemte Town , East Welega Zone , West Ethiopia. 2017;2017.

28. Khot MB, Bajzer CT, Sapp SK, Ohman EM, Ellis SG, Lincoff AM, et al. Prevalence of Conventional Risk Factors in Patients With Coronary Heart Disease. 2003;290(7).

29. WHO. Noncommunicable Diseases Country Profiles 2011. 2011;

30. WHO. Coronary Heart Disease in Ethiopia. 2014.

31. Tolla MT, Norheim OF, Memirie ST, Abdisa SG, Ababulgu A, Jerene D, et al. Prevention and treatment of cardiovascular disease in Ethiopia : a cost ‐ effectiveness analysis. Cost Eff Resour Alloc [Internet]. 2016;1–14. Available from: "http://dx.doi.org/10.1186/s12962-016-0059-y

32. Misganaw A, Mariam DH, Ali A, Araya T. Epidemiology of Major Non-communicable Diseases in Ethiopia : A Systematic Review Search strategy. 2014;32(1):1–13.

33. Hailemariam T. Emergency Medicine : Open Access Prevalence of Cardiovascular Emergencies in Specialized Hospital , Addis Ababa. 2014;4(4):8–12.

34. NHSD. Health Sector Transformation Plan (HSDPs) by National health sector development. 2015;

35. Rajesh PN, Mossie A, Mezgebu Y. Prevalence Of Metabolic Syndrome And Its Components In Jimma. 2016;3(3):1685–704.

36. Staff HE. Ischemic Heart Disease - Symptoms, Causes, Treatments. 2016.

37. AHA. Heart Disease and Stroke Statistics 2017. 2017;

38. BHF. CVD STATISTICS BY BRITISH HEART FOUNDATION: BHF UK

FACTSHEET. 2017.

39. Mohammadnezhad M, Mangum T, May W, Lucas JJ, Ailson S. Common Modifiable and Non-Modifiable Risk Factors of Cardiovascular Disease (CVD) among Pacific Countries. 2016;153–70.

40. James C, Attacheril T V, Balakrishnan N, Gaydarova DK, Stancheva NY, Gerchev IP, et al. RISK FACTORS FOR CORONARY ARTERY DISEASES : A STUDY AMONG PATIENTS WITH ISCHEMIC HEART DISEASE IN INDIA (KERALA). 2015;6(2).

41. Mcsweeney JC, Rosenfeld AG, Abel WM, Braun LT, Burke LE, Daugherty SL, et al. Preventing and Experiencing Ischemic Heart Disease as a Woman : State of the Science A Scientific Statement From the American Heart Association. 2016. 1302-1331 p.

42. Ganguly SS, Al-maniri AA. Some Risk Factors for Coronary Heart Disease among Omani Males. 2008;8(1):45–51.

43. Kapoor R, Vyas S, Patel P, Mehta H, Mehta P, Modi J, et al. Short Communication A case-control study of risk factors for ischemic heart disease in patients attending tertiary care hospitals in India. 2013;3(1):57–60.

44. Khan RJ, Harvey DJ, Leistikow BN, Haque KS, Stewart CP. Relationship between obesity and coronary heart disease among urban Bangladeshi men and women. 2015;1(3):49–55.

45. Fourie JM, Tudy ACASEOS. Coronary heart disease and risk factors in Black South Africans : A case-control study. 2006;(February 2006).

46. Jerling J, Raal F. CHAPTER 3 RISK FACTOR PROFILE OF CORONARY ARTERY. South African Hear J. 2011;11:4–11.

47. Amjad N. Ischemic Heart Disease in Pakistani Women : A Case Control ... Ischemic Heart Disease in Pakistani Women : A Case Control Study. Asian Heal. 2015;(January 2012).

48. Panwar RB, Gupta R, Gupta BK, Raja S, Vaishnav J. Atherothrombotic risk factors & premature coronary heart disease in India : A case-control study. BMJ. 2011;(July):26–32.

49. Lano-maduagu AT, Crb O, Eb O, Mu A, Onabanjo OO. Nutritional Disorders & Therapy Prevalence of Coronary Heart Diseases Risk Factors in Adults Population Living in Nigeria ' s Largest Urban City. 2015;5(1):1–5.

50. Uang HH, Zhaojia YE, Agahama IN, Azoe HT, Be YA, Oyagi KA. Impact of Hypertension , Diabetes and Dyslipidemia on Ischemic Heart Disease among Japanese : A Case-Control Study Based on National Health Insurance Medical Claims. 2012;13–8.

51. James C. Risk Factors for Coronary Artery Diseases : A Study Among Patients With Ischemic Heart Disease in Kerala. 2013;1(1).

52. Al-nooh AA, Abdulabbas A, Alajmi A, Wood D. The Prevalence of Cardiovascular Disease Risk Factors among Employees in the Kingdom of Bahrain between October 2010 and March 2011 : A Cross-Sectional Study from a Workplace Health Campaign. 2014;2014.

53. Ebrahimi M, Kazemi-bajestani SMR, Ferns GAA. Coronary Artery Disease and Its Risk Factors Status in Iran : A Review. 2011;13(9):610–23.

54. Nwaneli CU. Changing Trend in Coronary Heart Disease in Nigeria. 2010;1–4.

55. Lanas F, Serón P, Lanas A. Coronary Heart Disease and Risk Factors in Latin America. Glob Heart [Internet]. 2013;8(4):341–8. Available from: http://dx.doi.org/10.1016/j.gheart.2013.11.005

56. Stallones RA. Reprints and Reflections The association between tobacco smoking and coronary heart disease †. Int J Epidemiol. 2015;(July):735–43.

57. Ng M, Freeman MK, Fleming TD, Robinson M, Dwyer-lindgren L, Thomson B, et al. Smoking Prevalence and Cigarette Consumption in 187 Countries, 1980-2012. 2014;98121(2):183–92.

58. Ram R V, Trivedi A V. Behavioral risk factors of coronary artery disease : A paired matched case control study. J Cardiovasc Dis Res. 2012;3(3).

59. Mukamal KJ, Conigrave KM, Mittleman MA, Camargo CA, Stampfer MJ, Willett WC, et

al. Roles of Drinking Pattern and Type of Alcohol Consumed in Coronary Heart Disease in Men. 2003;109–18.

60. Rastogi T, Reddy KS, Vaz M, Spiegelman D, Prabhakaran D, Willett WC, et al. Diet and risk of ischemic heart disease in India 1 – 3. 2015;(6):582–92.

61. Emanuele N V, Swade TF, Emanuele MA. Consequences of Alcohol Use in Diabetics. 1998;211–9.

62. Public E, Problems H. Emerging Public Health Problems in Ethiopia : Chronic Non-Communicable Diseases. 2012;

63. Rajesh PN, Mossie A, Mezgebu Y. Influence Of Substance Use On The Development Of Metabolic Syndrome In The Semi-Urban Population Of Jimma Town , South West Ethiopia . 2016;3(3):1670–84.

64. Tesfaye G, Derese A, Hambisa MT. Substance Use and Associated Factors among University Students in Ethiopia : A Cross-Sectional Study. 2014;2014.

65. Oh K, Hu FB, Manson JE, Stampfer MJ, Willett WC. Dietary Fat Intake and Risk of Coronary Heart Disease in Women : 20 Years of Follow-up of the Nurses ' Health Study. Am J Epidemiol. 2005;161(7):672–9.

66. Rastogi T, Reddy KS, Vaz M, Spiegelman D, Prabhakaran D, Willett WC, et al. Diet and risk of ischemic heart disease in India 1 – 3. Am J Clin Nutr. 2015;(6):582–92.

67. Jellinger PS, Handelsman Y. AACE 2017 Guidelines American association of clinical endocrinologists and American college of endocrinology guidelines for management of dyslipidemia and prevention. 2017.

68. WHO. The WHO STEPwise approach to stroke surveillance. 2010.

69. Mensah GA. Ischemic Heart Disease in Africa. Reaserch Gate. 2017;(August 2008).

70. Scheuner MT, Whitworth WC, Mcgruder H. Familial risk assessment for early-onset coronary heart disease. Am Coll Med Genet. 2006;8(8):525–31.

71. James C, Attacheril T V, Balakrishnan N, Gaydarova DK, Stancheva NY, Gerchev IP, et al. Original Article RISK FACTORS FOR CORONARY ARTERY DISEASES : A STUDY AMONG PATIENTS WITH ISCHEMIC HEART DISEASE IN INDIA (KERALA) Shreya Ohri , © Medical University Pleven. J Biomed Clin Res. 2015;6(2).

72. Amjad N. Ischemic Heart Disease in Pakistani Women : A Case Control ... Ischemic Heart Disease in Pakistani Women : A Case Control Study. Asian Heal. 2016;(January 2012).

73. Kibret KT, Mesfin YM. Prevalence of hypertension in Ethiopia : a systematic meta-analysis. Public Health Rev [Internet]. 2015; Available from: http://dx.doi.org/10.1186/s40985-015-0014-z

74. Assegid S. Prevalence of hypertension and its risk factors in southwest Ethiopia : a hospital-based cross-sectional survey. Dove Press. 2013;

75. Ganguly SS, Al-maniri AA. Some Risk Factors for Coronary Heart Disease among Omani Males. Clin Basic Reaserch. 2008;8(1):45–51.

76. Fourie JM, Tudy ACASEOS. Coronary heart disease and risk factors in Black South Africans : A case-control study. Reaserch Gate. 2013;(February 2006).

77. Aljefree NM, Lee P, Alsaqqaf JM, Ahmed F. Association between Vitamin D Status and Coronary Heart Disease among Adults in Saudi Arabia : A Case-Control Study. Health Care (Don Mills). 2016;

78. Mukamal KJ, Conigrave KM, Mittleman MA, Camargo CA, Stampfer MJ, Willett WC, et al. Roles of Drinking Pattern and Type of Alcohol Consumed in Coronary Heart Disease in Men. N Engl J Med. 2003;109–18.

79. Panwar RB, Gupta R, Gupta BK, Raja S, Vaishnav J. Atherothrombotic risk factors & premature coronary heart disease in India : A case-control study. Indian J Med Res. 2011;(July):26–32.

80. Dauchet L, Amouyel P, Hercberg S, Dallongeville J. Fruit and Vegetable Consumption and Risk of Coronary Heart Disease : A Meta-Analysis of Cohort Studies 1. Nutr Epidemiol. 2006;(July):0–5.

81. Islam AKMM, Majumder AAS. Coronary artery disease in Bangladesh : A review. IHJ [Internet]. 2013;65(4):424–35. Available from: http://dx.doi.org/10.1016/j.ihj.2013.06.004

82. Jeppesen J, Hein HO, Suadicani P, Gyntelberg F. Clinical Investigation and Reports Triglyceride Concentration and Ischemic Heart Disease An Eight-Year Follow-up in the Copenhagen Male Study. Epidemiol Res Unit. 1998;

Annex I: Consent

Hello! My name is _____and I am collecting data for a study on the *determinants of ischemic heart disease* to identify risk factors in Jimma University specialize hospital. I would like to ask you some questions about the risk factors of ischemic heart disease and if you are willing I will also take some physical measurements and blood sample. The interview would take about 25 minutes. By going through the study you will know your lipid profile, blood pressure, blood sugar level, body fat percent and other anthropometric parameters of yourself. Your participation in the study is very critical for developing an input for assessing risk factors of heart disease for hospital community as well as for Jimma Zone, too. However, your participation is entirely based on your willingness and your refusal doesn't affect the service you get from us in any way. The data you provided will be kept in highly confidential manner and none of your personal identifiers will be on the questionnaire. If you want to know your results you can check it yourself using your secret Identification number that we shall provide you. All people analyzing the laboratory results and the data itself do not have access to your personal identifiers.

Verbal consent obtained Yes ☐ No ☐

Date of data collection _____ / _____ / _____

(Ethiopian calendar: Day Month Year)

ID No:_____

Annexes II: Questionnaire

PART I: Questions on Socio-economic and Socio- demographic characteristics of the respondent

No.	Questions	Response categories	Remarks
101	Identification Number	ID NO ----------	
102	Sex	1. Male 2. Female	
103	Age of respondent	In competed years ----------	
104	Where is your residence?	1. Urban ---------- 2. Rural ----------	
105	What is your ethnicity?	1. Oromo 2. Amhara 3. Dawuro 4. Kafa 5. Yem 6. Other(specify)	
106	What is your marital Status?	1. Married 2. Single 3. Divorced 4. Widowed 5. Separated	
107	What is your religion?	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Other (specify)	
108	Educational status of the respondent	1. Can't read and write 2. Read & write only 3. Primary 4. Secondary 5. College and above	
109	What is your occupation?	1. Farmer 2. Government Employee 3. Student 4. House wife 5. Jobless(dependent) 6. Self-Employ 7. Other (specify) --------	

110	How much money do you earn on monthly basis	----------	
111	What is the monthly income of your house hold (total income)?	_____Ethiopian birr	

Part II: BEHAVIOURAL MEASUREMENTS

Tobacco use practice			
No.	**Questions**	**Response categories**	**Remarks**
201	Do you have history of cigarettes smoking?	1. Yes 2. No	
202	If yes to 301, how often were you smoking?	1. Daily 2. 3 times per week 3. Once a week 4. Once a month	
203	If Yes to 301 how long ago did you start smoking?		
204	On average, how many of the cigarettes do you smoke each day/week?		
205	Do you currently smoke tobacco products **daily**?	1. Still smoking 2. Reduced 3. Ceased	
206	Is there family member who smoke cigarette?	1. Yes 2. No	
207	How often was He/She smoking?	1. Daily 2. 3 times per week 3. Once a week 4. Once a month	
Alcohol use practice			
208	Do you have history of alcohol drinking?	**1.** Yes 2. No	
209	If yes to 305, which one?	1. Beer/Draft 2. Wine 3. Tejj 4. Local areke 5. Others (specify)	

210	**How frequently** have you had at least one standard alcoholic drink?	1. Daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week 5. 1-3 days per month 6. Less than once a month	
211	When you drank alcohol, how many standard **drinks on average** did you have during one drinking occasion?	**_____Drinks**	
212	Are you currently drinking alcohol daily?	1. Still drinking 2. Reduced 3. Ceased	
KHAT Chewing			
213	Do you chew Khat?	1. Yes 2.No	
214	If Yes, how often do you chew Khat?	1. Daily 2. 3 times per week 3. Once a week 4. Once a month	
215	How many **zurbas** do you chew on **one** of those days?	----------zurbas	
Physical Inactivity			
216	Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football] for at least 10 minutes continuously?	1. Yes 2. No	
217	If yes, in a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?	_____Days	
218	If yes, how much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	____Hours___Minutes	
219	Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such as	1. Yes 2. No	

	brisk walking, [cycling, swimming, and volleyball] for at least 10 minutes continuously?		
220	How much time do you usually spend sitting or reclining on a typical day?	_____Hours	

Part III: Dietary practice

No.	**Questions**	**Response categories**	**Remarks**
301	In a typical week, on how many days do you **eat fruit**?	_____**Days**	
302	How many **servings** of fruit do you eat on **one** of those days?	_____**Servings**(a serving in this case refers to one fruit eg.orange, banana, mango...)	
303	In a typical week, on how many days do you **eat vegetables**?	**_____Days**	
304	How many **servings** of vegetables do you eat on one of those days?	_____**Servings**(a serving in this case refers cups of vegetable stews...)	
305	In a typical week, on how many days do you **eat** fats (fats and oils)?	___ _____**Days**	
306	What type of **oil or fat is <u>most often</u>** used for meal preparation in your household? **(*Circle ONLY ONE answer)***	1. Liquid Vegetable oil(type) 2. Solidified oil (type) 3. Butter 4. Margarine / peanut butter 5. Shenolega 6. Other	
307	On average, how many meals per week do you eat that were not prepared at a home? By meal, I mean breakfast, lunch and dinner.	_____Meals	
Dietary salt consumption			
No.	**Questions**	**Response categories**	**Remarks**
316	How much salt or salty sauce do you think you consume? **(*Circle ONLY ONE answer)***	1. Far too little 2. Too little 3. Just the right amount 4. Too much 5. Far too much 6. Don't know	

317	How important to you is **lowering the salt** in your diet? **(*Circle ONLY ONE answer)***	1. Very important 2. Somewhat important 3. Not at all important 4. Don't know	
318	Do you think that too much salt or salty sauce in your diet could cause a **health problem**?	1. Yes 2. No	

Part IV: PHYSICAL MEASUREMENTS

Blood Pressure(BP)(mmHg)			
	Reading 1	**Systolic(mmHg)**_____ **Diastolic(mmHg)**_____	
	Reading 2	**Systolic(mmHg)**_____ **Diastolic(mmHg)** _____	
	Reading 3	**Systolic(mmHg)**_____ **Diastolic(mmHg)** _____	
Anthropometry and body fat Measurements			
	Height	Height in(m)_____	
	Weight	Weight (kg)_____	
	BMI	_____	
	Waist Circumference	WC(cm) _____	
	Hip Circumference	HC(cm) _____	
	WtHR	_____	
BIOCHEMICAL MEASUREMENTS			
	Total Cholesterol	Chol.(mg/dl)_____	
	High density Lipoprotein(HDL)	HDL(mg/dl)_____	
	Low density Lipoprotein (LDL)	LDL(mg/dl)_____	
	Triglycerides (TG)	TG(mg/dl) _____	
	Fasting Blood Glucose level (FBS)	FBS(mg/dl)	

Part VI: Calculation of 10 year risk of developing heart disease

Calculated 10 year risk = _____ (For controls only)

DECLARATION

I, the undersigned, declare that this thesis is my original work, which isn't been presented for a degree in this or any other university and that all sources of materials used for the thesis have been fully acknowledged.

Name: _____

Signature: _____

Name of the institution: _____

Date of submission: _____

This thesis has been submitted for examination with my approval as University advisor.

Name and Signature of the first advisor

_____

_____

Name and Signature of the second advisor

_____

_____