JIMMA UNIVERSTY,

FACULTY OF PUBLIC HEALTH,

DEPARTMENT OF EPIDEMIOLOGY

Determinants of Hypertensive Heart Diseases among adult hypertensive patients in Adama Hospital Medical College and Bishoftu General Hospital: A Matched Case-control study

By Dinka Kebede (PH, EFELTP Resident)

A thesis to be submitted to Jimma University, Faculty of public health, department of Epidemiology in partial fulfillments for the requirements of Masters of Public Health in Field Epidemiology.

September, 2022

Jimma, Ethiopia

Determinants of Hypertensive Heart Diseases among adult hypertensive patients in Adama Hospital Medical College and Bishoftu General Hospital: A Matched Case-Control study

Investigator:

Dinka Kebede (PH, EFELTP Resident)

Advisors:

Chaltu Fikru (BSc, MPH, Assistant Professor)

Habtamu Abebe (BSc, MPH in Biostatistics)

September, 2022

Jimma, Ethiopia

Abstract

Background: Hypertensive heart disease is the target organ (heart) response of chronically raised blood pressure and it continued to be the major public health challenge globally. During the last two decades, morbidities and mortalities associated with hypertensive heart diseases are significantly increasing in Ethiopia. But there are inadequate evidences on specific concomitant risk factors predisposing hypertensive patients to develop this complication. Therefore, this study provides evidences to guide risk driven prevention approaches in hypertensive patients.

Objective: To identify determinants of hypertensive heart diseases among adult hypertensive patients in Adama Hospital Medical College and Bishoftu General Hospital.

Methods: The hospital-based age matched case-control study was conducted in Adama Hospital Medical College and Bishoftu General Hospital from August-October, 2021 among adult hypertensive patients. Cases are hypertensive patients with hypertensive heart diseases and controls are hypertensive patients without hypertensive heart diseases. 71 cases and 142 matched controls were included in the study using consecutive sampling method. Data were collected using a secondary data review checklist and an interviewer administered questionnaire. Data was entered in to Epidata V-3.2 and exported to Stata SE V-14 for analysis. Variables with P value of < 0.05 in multivariate conditional logistic regression analysis were considered determinants for hypertensive heart diseases.

Results: The mean age of the respondents 52.22 ± 14.52 years (52.28 for cases vs 52.19 for controls). Determinanats of hypertensive heart diseases were found to be famiy history of cardiovascular diseases (mAOR= 3.47, 95% CI; 1.08-11.19), urban residence (mAOR = 3.51, 95% CI; 1.17-10.52), having ≥ stage II baseline blood pressure (mAOR= 4.83, 95% CI; 1.28-18.20), non-adherence to antihypertensive drugs (mAOR= 3.76 95% CI;1.01-14.09), consumption of excessive salt (mAOR= 3.57, 95% CI; 1.34-9.48) and being male (mAOR =3.12, 95% CI; 1.05-9.21).

Conclusions and recommendations: Both modifiable and non-modifiable risk factors were found to be determinant factors of hypertensive heart diseases. Therefore, health care providers at different level of the health care should give due emphasis to lifestyle modification counseling

including salt reduction and medication adherence. Early screening for identification and management of hypertensive heart diseases should be emphasized.

Key words: Hypertensive heart diseases, matched case-control, Adama, Bishoftu, Determinants

Acknowledgements

First and foremost, I would like to thank Almighty GOD for keeping me safe during this COViD-19 pandemic time. I would also like to express my gratitude to my respected advisors Chaltu Fikru and Habtamu Abebe for their constructive comment and unreserved support from the beginning to the end of this study. I would also like to extend my appreciation to Adama Hospital Medical College and Bishoftu General Hospital staffs for their kind support during data collection period. I extend my appreciation to data collectors, supervisor and respondents of this study.

Contents

List of tables

List of figures

Abbreviations and acronyms

AHMC	Adama Hospital Medical College
AOR	Adjusted Odds Ratio
BMI	Body Mass Index
BP	Blood Pressure
BGH	Bishoftu General Hospital
BSc	Batchelor of Science
CDC	Centre of Disease Control
CI	Confidence Interval
CVD	Cardiovascular Diseases
DBP	Diastolic Blood Pressure
ECG	Electrocardiography
EFELTP	Ethiopian Field Epidemiology Training Program
ETB	Ethiopian Birr
HTN	Hypertension
HHD	Hypertensive Heart Diseases
HDL	High Density Lipoprotein
ID	Identification
JU	Jimma University
LDL	Low Density Lipoprotein
LMIC	Low- and Middle-Income Countries
LVH	Left ventricular Hypertrophy
MMHG	Millimetric Mercury
MMAS-8	Morisky Medication Adherence Scale 8 item
MPH	Master’s in Public health
NCD	Non communicable Diseases
OPD	Outpatient Department
PH	Public Health
SBP	Systolic Blood Pressure

1. Introduction

1.1 Background

Hypertension (HTN) is defined as a systolic blood pressure ≥140 mmHg and/or a diastolic blood pressure ≥ 90 mmHg in adults ≥18 years old (1). Hypertension is the most common chronic medical problem and a major global economic burden because of an increased risk for cardiovascular events following hypertension (2, 3). Cardiovascular diseases (CVD) are the most common non-communicable diseases globally and responsible for 17.9 million deaths in 2019 and estimated to reach 22.2 million deaths by 2030 (4). The United Nation_(UN) Sustainable Development Goals (SDG), Goal 3 verse 4 aim to reduce premature mortality from non-communicable diseases by a third by the year 2030 (5).

Hypertensive heart disease (HHD) refers to a pattern of changes in the left ventricle, left atrium and coronary arteries as a result of chronically raised blood pressure and it is the target organ (heart and arteries) response of systemic arterial hypertension (6). Hypertensive heart disease includes left ventricular hypertrophy (LVH), heart failure (diastolic and/or systolic heart failure), coronary heart diseases, left atrial enlargement and arrhythmias (7, 8).

Hypertension co-exists with many cardiovascular risk factors than normotension and those co-existing cardiovascular risk factors multiply the risks associated with hypertension complication including hypertensive heart diseases (9, 10). As evidenced by different studies, these factors include; sex, age, educational status, lifestyle related factors, medical and genetic factors determining the damage of the left ventricle in the hypertensive patients, other factors related to comorbidities like diabetes and obesity also influence the evolution of HHD (11, 12). Hypertension combined with unhealthy diets and other behavioral factors has an increased negative effect on CVD mortality and Disability Adjusted life years (DALYs) (13).

Different investigative modalities are used to diagnose HHD, but the two most common tools used to confirm the diagnosis are the electrocardiogram (ECG) and the echocardiography (14). Most HHD patients are asymptomatic in early stage but dyspnea, angina, syncope, and sudden death can occur in hypertensive heart diseases and Hypertensive HF patients have clinical characteristics similar to those of other patients with Heart Failure (6, 14).

1.2 Statement of the problem

Cardiovascular diseases occur in both higher income, low and middle-income countries (LMICs), but in many countries the economic and social burden is highest among poor and disadvantaged groups (15). Despite several initiatives, the prevalence of hypertension and its adverse impact on cardiovascular morbidity and mortality are increasing globally (1). The risk of cardiovascular death is higher in hypertensive patients than non-hypertensive patients and this mortality in hypertensive patients are attributed to cardiovascular diseases complications of hypertension (16, 17). Hypertension is the leading causes of death and responsible for at least 45% of deaths due to heart diseases (18).

The prevalence of HHD is alarmingly increasing globally that report from analysis of global HHD burden in 2019 indicated that HHD cases increased by 137.91%, mortality increased by 78.46% and DALYs associated with HHD increased by 54.23% from 1990 to 2019 globally (19). This increment is worse for low and middle income countries; for example in Iran, HHD prevalence and death rate was reported to be more than 2 times higher than the global HHD burden (20). A report from Poland also indicated that hypertensive heart disease was the fourth most common cause of CVD death in the country (21).

The CVD are increasing in Africa and HHDs are the most common cardiovascular diseases and leading causes of heart failure. According to study on hypertensive heart diseases Epidemiology in Africa, 72% of hypertensive patients had abnormal left ventricular mass and excessive salt intake is a major risk factor for hypertension and its complications (22). According to study conducted in Cameroon among cardiac patients, HHD accounted 42.3% of cardiovascular diseases (23). Another study in Abuja Nigeria indicated that, Hypertensive heart disease was the most common cause and hypertension accounted for heart failure in 60.6% (24). While, study conducted in Kenya indicated hypertensive heart diseases occurred in 22.8% of hypertensive patients (25).

HHD is an increasingly costly and results in frequent hospital admission and prolonged hospital stays (13). Among the conditions resulting from hypertension which are capable of compromising target organs, hypertensive heart disease is the one with the highest morbidity and

mortality globally (26). In Ethiopia late hypertensive heart diseases are responsible for the majority of cardiovascular diseases related events (27).

Hypertensive heart diseases prevalence and mortality are also increasing in Ethiopia, a study on the pattern of cardiac diseases at Jimma university specialized hospital indicated, hypertension contributed for a total of 24% hypertensive heart diseases (28). A study conducted in Debre Birhan, northern Ethiopia indicated that prevalence of HHD was 44.1% (29). Another study conducted on left ventricular hypertrophy among hypertensive patients indicated that 52% of hypertensive patients had left ventricular hypertrophy which is the commonest form of hypertensive heart diseases (30).

According to report by World Heart Federation (WHF) and Pan-African Society of Cardiology (PASCAR) in 2017, HHD accounted for 11% of CVD related deaths in Ethiopia, standing third following ischemic heart diseases of other causes and stroke (31). Another trend report of cardiovascular diseases in Ethiopia from 1990 to 2017 indicated that while all cause deaths and other cardiovascular diseases related death decreased significantly, deaths from HHD increased by 3.1% from 1990 to 2017 (32).

Eventhough uncontrolled hypertension has the leading role in occurance of HHDs and other target organ damages; presence of uncontrolled hypertension alone is not solely responsible for these complications. Different literetures evidenced other concomitant cardiovascular factors multiply the risk of develoloping hypertensive heart diseases in hypertensive patients independently of hypertension control (33, 34). Different studies in Ethiopia also depicted that, concomitant cardiovascular risk factors associated with target organ damage are highly prevalent among hypertensive patients including physical inactivity (89.1%), uncontrolled hypertension (43.3%), excessive salt intake (30.4%), dyslipidemia (27.3%), medication non-adherence (34.6%), using single antihypertensive drug over combinations (34.1%) (35–38).

Despite the existence of few analytic studies about the determinants of hypertensive heart diseases and importance of their contribution to the knowledge on these diseases in Ethiopia, only some descriptive studies paid attention to anti-hypertensive drug adherence and choices of anti-hypertension drug combination to treat patients with hypertension but, these factors are also determined to be significant factors in development of HHDs (13, 38, 39).

Since recent times there are plenty of researches conducted to search for epidemiologic risk factors of cardiovascular diseases in the general population. But little is known about the unique and specific determinants of hypertensive heart diseases among hypertensive patients in Ethiopia. In order to implement preventive public health approach to reduce the damage of HHD in patients with hypertension, it necessitates understanding of determinants of HHD in at risk populations. Because early recognition and attention to preventing and treating these risk factors will lead to significant reductions in HHD incidence and severity.

Even though burden of HHD is increasing in the country and it is associated with increased socioeconomic costs with high levels of disability and loss of productivity, exacerbating poverty & increasing health inequalities, still evidences are scarce to support preventive approaches specific to the country as data on risk factors for HHD are largely derived from developed countries. Therefore, it is important to identify determinants of hypertensive heart diseases among hypertensive patients in Ethiopia particularly in Adama Hospital Medical College and Bishoftu General Hospital where there is no similar study conducted so far.

1.3 Significance of the study

Hypertensive heart diseases are exceedingly costly, debilitating and deadly; however, information supporting preventive public health approach among patients with hypertension is scarce in Ethiopia. Therefore, this study provides evidences on determinanats of hypertensive heart diseases among patients with hypertension in study areas.

This evidence helps hypertension program managers at different level of care to develop interventions used to prevent and early detect HHD among patients with hypertension. This study also supports service providers to appropriately manage those risk factors among patients with hypertension.

Moreover, it provides valuable information for researchers who are interested to continue study in similar area and will provide evidences for policymakers to design risk driven prevention methods of hypertensive heart diseases among patients with hypertension in synergy with other cardiovascular related studies.

2. Literature review

2.1 Overview of Hypertensive heart diseases

The risk of cardiovascular complications increases progressively with increase in arterial pressure (40). Effective long-term antihypertensive treatment usually is associated with a decreased LV mass , which can contribute to diminished risk of hypertensive heart diseases but this is not sufficient on its own, as other concomitant risk factors are important (41). Hypertensive heart diseases encompasses wide range of cardiac related changes including, left ventricular hypertrophy, coronary heart diseases sometimes called coronary artery diseases or ischemic heart diseases, arrythymias, and heart failure (6).

Left ventricular hypertrophy is a maladaptive response to chronic pressure overload and an important risk factor for atrial fibrillation, diastolic heart failure, systolic heart failure, and sudden death in patients with hypertension and it is a condition in which there is an increase in left ventricular mass, either due to an increase in wall thickness or due to left ventricular cavity enlargement or both (42, 43).

Left ventricular hypertrophy secondary to pressure overload (hypertension) is concentric left ventriculat hypertrophy while, LVH caused by volume overload (obesity, anemia) is eccentric LVH and confirmed by one of imaging modalities preferably echocardiography as it has higher sensitivity (44). Factors associated with left ventricular hypertrophy in patients with hypertension includes age, sex, race, severity of hypertension, duration of hypertension, DM comorbidity, obesity and genetics (12, 44).

A coronary heart disease or coronary artery disease is one of the major complications of hypertension and it enhances atherosclerotic plaques within the coronary arteries and resulting in the stenosis of the artery following reduced blood supply to heart muscles and arteries (11). In patients with hypertension factors like hypercholesterolemia, physical inactivity, diabetes, overweight, obesity and tobacco smoking, carotid plaque thickness are documented to be associated with coronary heart diseases, from this factors smoking and hypercholesterolemia are documented to have multiplicative effect to cause CHD when coexisted with hypertension (45).

Cardiac arrhythmias are disturbances in the rhythm of the heart, manifested by irregularity or by abnormally fast rates or abnormally slow rates. The most common form is atrial fibrillation (46). Hypertension and atrial fibrillation often coexist. But beyond the direct relations between atrial fibrillation and hypertension, HTN is also associated with other cardiovascular comorbidities that increase risk for atrial fibrillation, including metabolic syndrome, chronic kidney disease. A study conducted in china reported that, around 90% of patients with atrial fibrillation are reported to have previous history of hypertension (47).

2.2 Determinants of hypertensive heart diseases

2.2.1 Socio-demographic determinants

According to Framingham heart cohort study report, previous history of hypertension was noticed in 91% of heart failure cases diagnosed. Compared with the normotensive individuals, hypertensive heart failure reported to occur in hypertensive female than male and also hypertensive patients with older age were more affected with hypertensive heart failure (48).

Study conducted in China indicated that, being female, older age, poorly educated made hypertensive patients more prone to hypertension complications including hypertensive heart diseases (49). Another study done in china revealed that the incidence of CAD in hypertensive patients was 2.33% and risk factors associated with coronary heart diseases development were age and male sex each independently predicted coronary artery disease (50).

Another study among hypertensive patients in Indonesia indicated, socio-demographic risk factors associated with cardiovascular diseases including hypertensive heart diseases in hypertensive patients were age > 60 years, female sex, being widowed, self-employed workers and urban residence (51).

According to study conducted in Australia to identify factors associated with heart failure in hypertensive patients one of cardiac complication of hypertension indicated that, older age, male sex, obesity, and history of cardiovascular disease in family member were independently determined heart failure in hypertension (52).

Study conducted in Cameroon on determinants of ischemic heart disease among hypertensive patients indicated that socio-demographic factors like family history of cardiovascular diseases

are present in 14% of HHD patients and being male and having higher educational level were associated with hypertensive heart diseases. Another study in cameroon also showed that hypertensive heart disease is the most common cardiac disease occurring in semi-urban region (23, 53). According to study conducted in Kenya among hypertensive patients, low educational level and low-income level of the participants were associated with Hypertensive heart diseases (25).

Study in south west Ethiopia on factors associated with left ventricular hypertrophy in hypertensive patients indicated that, age being greater than 50 and being female were socio-demographic factors associated with left ventricular hypertrophy which is precursor for all hypertensive heart diseases (28).

2.2.2 Life style related determinants

A study conducted in Cuba revealed that; smoking, excessive salt intake, obesity and sedentariness were risk factors identified to be associated with HHD (54). According to atlas report on cardiovascular risk factors among hypertensive patients; factors identified to be associated with coronary heart disease were high blood cholesterol, tobacco use, unhealthy diet and physical inactivity (55).

A study conducted in India indicated alcohol consumption, smoking, sedentary life and obesity wee risk factors associated HHD (33). A study among hypertensive patients in Nigeria indicated that, fruits and vegetables consumption had significant association with prevention of hypertensive heart diseases because they have a role to moderate lipid profile (56).

Study done in northern Ethiopia showed that behavioral factors determining development of cardiovascular diseases including hypertensive heart diseases in hypertensive patients were smoking and physical inactivity (57). Another study in north Ethiopia on cardiovascular risk factors among hypertensive individuals indicated that physical inactivity, excessive alcohol consumption and smoking were associated with cardiovascular complications of hypertension. Another study conducted in Gondar also revealed that stresses and physical inactivity had determined hypertensive heart diseases development among hypertensive patients (38, 58).

2.2.3 Medical related determinants of hypertensive heart diseases

A study conducted in Cuba on factors associated with hypertensive heart diseases among hypertensive patients revealed that; uncontrolled arterial blood pressure, stage II base line hypertension, dyslipidemia and time of evaluation of hypertension(> 10 years) were reported to determine hypertensive heart diseases in hypertensive patients (59).

The study conducted in Italy indicated that different biological and hemodynamic mechanisms can influence development of hypertensive heart diseases in hypertensive patients, but adipose mass strongly influences left ventricular hypertrophy, particularly in women which may develop as a result of either physical inactivity or un healthy diet (60).

A study done in south Korea on the occurrence of complications in patients with newly diagnosed hypertension revealed that hypertensive patients having low adherence to antihypertensive medications had shown two times higher risk of developing cardiovascular complications in hypertensive patients (61).

According to study in rural china among hypertensive patients indicated that, 78% of hypertensive patients were treated with single drug. This single drug treatment increased risk of hypertension complication including hypertensive heart diseases than treating with combination therapy with ≥2 anti-hypertensive drugs (49). Presence of co-existent risk factors among hypertensive patients including history of myocardial infarction, diabetes mellitus and obesity reported to increase risk of hypertensive heart failure in both male and female (40).

Another study conducted in China on coronary artery disease development indicated that hypertensive patients with elevated baseline BP (> = stage 2 HTN) were most likely to have coronary heart diseases than slightly increased baseline blood Pressure (11).

Another study conducted in China among hypertensive patients indicated that hypertensive individuals who developed coronary artery diseases had a greater baseline waist circumference, greater waist to hip ratio, dyslipidemia and diabetic when compared to hypertensive patients who did not developed CAD (62).

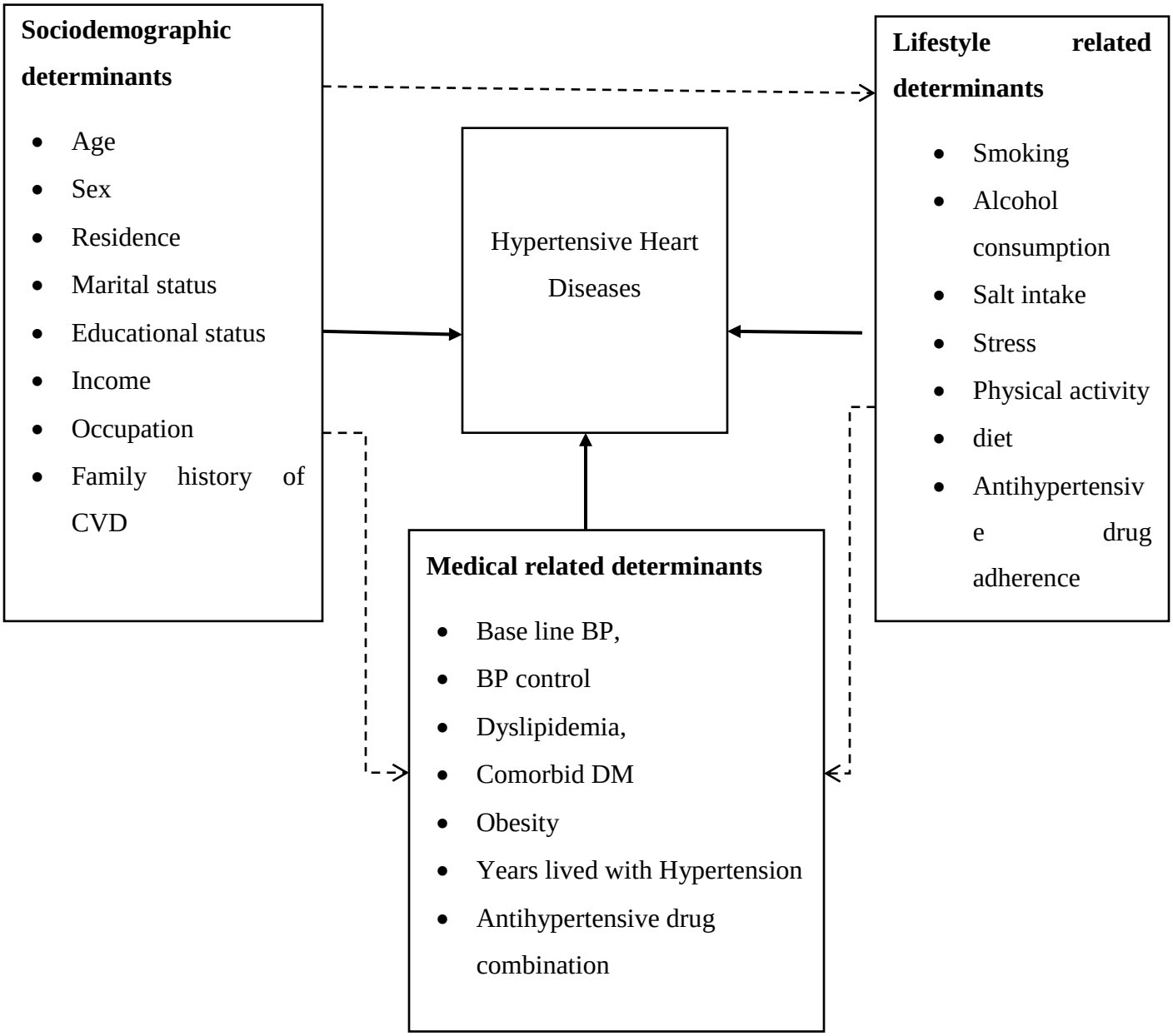
Another study on correlation between heart diseases and other cardiovascular risk factors indicated that, having stage II hypertension and hypertension emergency had increases risk of

hypertensive heart diseases in hypertensive patients than those with stage I hypertension patients (63). A study conducted in India indicated that factors which heightens risk of developing coronary artery diseases and other cardiovascular diseases in hypertensive patients are early age of onset of hypertension, inter-arm difference in blood pressure readings, stages of hypertension (9).

A study conducted in Nigeria on determinants of hypertensive heart failure among hypertensive patients indicated non-adherence to antihypertensive medications were the single most important risk factor for hypertensive heart failure and the other important factor are proteinuria and decreased glomeruli filteration rate (34)

A study in Ethiopia on assessment of risk factors of cardiovascular diseases including HHD in hypertensive patients indicated that diabetic mellitus, protinurea and having isolated systolic hypertension were associated with cardiovascular complications among hypertensive patients (36). Another study in Ethiopia regarding factors associated with determinants of left ventricular hypertrophy reported that, hypertensive cases with non-adherence to anti-hypertensive medications, abdominal obesity, physical inactivity, adding excessive salt to diet and uncontrolled hypertension are reported to be associated with left ventricular hypertrophy development (39).

2.3 Conceptual frame Work



Dotted line was used to represent relationship between individual determinants and in this study their associations was not analysed and bold arrow represents relationship of independent determinants with outcome variable (HHD) and in this study their association were analysed.

Figure 1: Conceptual framework of hypertensive heart diseases determinants among hypertensive patients in Adama Hospital Medical College and Bishoftu General Hospital, 2021(13,34,38,54,64)**.**

3. Objective

To identify determinants of hypertensive heart diseases among adult hypertensive patients in Adama Hospital Medical College and Bishoftu General Hospital: East Showa, Oromia, Ethiopia -August to October, 2021

4. Methods and Materials

4.1 Study Area and Period

The study was conducted at Adama Hospital Medical College (AHMC) and Bishoftu General Hospital (BGH). AHMC is located in Adama town which is 99 km from Addis Ababa, the capital of Ethiopia on Ethio-Djibouti main road. While, Bishoftu General Hospital (BGH) is found in Bishoftu town which is 47.9 km south east from the capital of the country and 50 km to the west of Adama town. Both hospitals have separate hypertension and diabetic mellitus outpatient department, and they have separate chronic medical OPD for follow up of cardiovascular diseases and other non-communicable diseases. Currently AHMC has catchment population of about 5 million serving as referral hospital for all nearby hospitals and BGH has 1.2 million catchment populations. A total of 1231 patients with hypertension were on follow-up in AHMC and 419 patients with hypertension were on follow-up care in BGH while, a total of 234 HHD cases in AHMC and 110 HHD cases in BGH were diagnosed. The study was undertaken from August to October, 2021.

4.2 Study design

Hospital based age matched case-control study design was used with 1:2 case to control ratio

4.3 Population

4.3.1 Source Population

All adult hypertensive patients attending Adama Hospital Medical College and Bishoftu General Hospital were source population.

4.3.2 Study Population

All cases and matched controls fulfilling inclusion criteria at outpatient department of Adama Hospital Medical College and Bishoftu General Hospital were study population.

Cases: are hypertensive patients with hypertensive heart diseases on follow-up at out patient department of Adama Hospital Medical College and Bishoftu General Hospital

Controls: are hypertensive patients without hypertensive heart diseases on follow-up at out patient department of Adama Hospital Medical College and Bishoftu General Hospital

4.4 Eligibility criteria

4.4.1 Inclusion criteria

For cases:

A hypertensive patient with either one or a combination of the common cardiac complications, such as left ventricular hypertrophy, coronary heart diseases, arrythmias and heart failure diagnosed by prior imaging studies and confirmed by physician, ≥ 18 years of age, being on follow-up and care in AHMC and BGH during the study period and diagnosed and enrolled in to care within last 1 year before this study.

For Controls:

Hypertensive patients with out any of the cardiac complications such as LVH, heart failure, arrythmias and coronary artery diseases as confirmed by a physician, individually matched with case by age ±3 years for cases, being on follow-up and care in AHMC and BGH during the study period and having prior investigation report of one or more of imaging modalities like ECG and/or echocardiography.

4.4.2 Exclusion Criteria:

Hypertensive patients with incomplete documentation

4.5 Sample size determination

To calculate the sample size we used a matched case-control study design sample size determination formula (65).

$$d_p = [Z\alpha\ (\lambda+1) + 2Z\beta\sqrt{\lambda}]^2 / (\lambda-1)^2, \qquad n = 2d_p/\pi_{d,}$$

Since we carried out one case to two controls pairing, we have to use correction formula

$N_C = (c+1)^2*n/4c$ and to calculate number of cases (Sc), Sc = [C+1/2C]*S1, S1=n/2

- d_p: the number of discordant pair required if pair matching,
- λ: the odds ratio from the previous study,

- $\pi_{d:}$ estimated probability of getting discordant pair,
- S1: number of sample cases required if pair matching
- n: number of sample required (concordant and discordant) if pair matching (1:1),
- N_c: total number of sample required for one to many control selection,
- C: numer of controls to be paired with one case,
- Sc: number of sample cases required for one to many control,

To get maximum sample size based on the following assumptions; 95% level of confidence, 80% Power, 1:2 cases to control ratio, to detect matched odds ratio of 3.5 from previous study on exposure variable medication non-adherence (34), assumed probability of getting discordant pairs $\pi_d = 0.25$ (66). First, calculated sample size for pair matching was as follows,

$d_p = [1.96*(3.5+1) + 2*0.84*\sqrt{3.5}]^2/(3.5-1)^2$, = 23,

n= 2*23/0.25, = 184,

S_1 = 184/2, = 92.

The total number of sample required for this study was then, $Nc= (2+1)^2 *184/4*2$, = 207. From this, total cases required was Sc= [(2+1)/2*2]*92, = 69 cases and number of controls was Nc-Sc, = 207-69, = 138 controls. Therefore, a total of 69 cases and 138 controls were required and adding 10% for non-response rate, a total of 76 cases and 152 controls were calculated.

4.6 Sampling Techniques and Procedures

Cases were identified from registers and medical records of hypertensive patients on follow up by medical doctors using checklists from both hospitals. Cases were selected from both hospitals while on follow up visit. Controls were paired off with age ±3 years with cases. Representative cases from respective hospitals were recruited proportionally according to HHD cases they enrolled in to care with in last one year using the formula; $ni= Ni*n_o/N$. Where: ni = number of sample size required from specific Hospital. Ni = total number of HHD cases who were diagnosed and enrolled in to care with in one year. n_o= calculated sample size and N = total number of HHD cases in one year at both hospitals. The hypertensive heart diseases patients diagnosed in last one year were 94 in AHMC and 39 in BGH. Finally in the study 52 cases from AHMC and 19 cases from BGH with their matched controls were included.

4.7 Variables

4.7.1 Dependent variable

Hypertensive heart diseases

4.7.2 Independent variables

Sociodemographic variables: Age, sex, marital status, educational level, income, place of residence, occupation, family history of cardiovascular diseases

Life style related variables: salt intake, alcohol consumption, smoking, physical activity, stress, diet, treatment adherance

Medical related variables: duration of hypertension, blood pressure control, baseline blood pressure, diabetic mellitus, obesity, lipid profile, combinations of antihypertensive drugs

4.8 Operational definitions and Case definitions

L**eft ventricular Hypertrophy**: A history of hypertension exists with echocardiographic documentation of left ventricular mass index >95g/m2 for female and left ventricular mass index > 115g/m2 for male(67).

Arrythmias: history of hypertension and persistent atrial fibrillation of long evolution and permanent fibrillation not caused by valve diseases confirmed using echocardiogram by physicians(47).

Physically inactive: An individual who performs physical exercise for less than 30 minutes/day and/or for less than 05 days/week or a person who does not walk from/to places(68).

Heavy alcohol consumers: An equivalent of > 6 standard drinks of alcohol on average/occasion among men, or an equivalent of > 4 standard drinks of alcohol on average/occasion among women(68).

Excessive salt intake: a person reported to add more than a level teaspoonful/day (68).

BMI Classification: Overweight: BMI between 25 and 29.9 kg/m^2, Obesity BMI $\geq$ $30kg/m^2$, Normal weight: 18.5–24.9kg/m^2, Underweight, BMI < = $18.5kg/m^2$(69).

Abnormal lipid profile: Cholesterol level, of at least one of the components turned an abnormal value (HDL<40mg/dl, LDL >160 mg/dl and total cholesterol > 200mg/dl)(68).

Fruit and vegetable servings: One serving size equals to 80 grams. For raw green leafy vegetables, 1 serving = one cup; for cooked or chopped vegetables, 1 serving = half cup; for fruit (apple, banana, orange etc…), 1 serving = 1 medium sized piece; for chopped and canned fruit, 1 serving = half cup; and for juice from fruit, 1 serving = half cup(70).

Adequate fruit and Vegetable consumption: consumption of fruit and vegetable ≥ 5 servings/day for ≥ 5 days/week are considered adequate(71).

Stress: Using Kessler Psychological Distress Scale questionnaire, score under 20 were considered to be well, score 20-24 were considered to have a mild mental distress, score 25-29 were considered to have moderate mental distress and score 30 and over were considered to have a severe mental distress(72).

Drug adherence: Is the extent of deviation of drug taking behavior of a patient from the agreed recommendations by health care provider which was measured with Morisky's 8 item scale. In this study, score of 8 were considered high adherence, 6-8 medium adherence while <6 were considered non-adherent(34,68).

Controlled Blood pressure: <140/90 mmHg for all hypertensive patients aged <65 years and <130/80mmhg in hypertensive patients with DM and CKD(73).

4.9 Data collection instruments and procedures

The data was collected using structured interviewer administered questionnaire on socio-demographic characteristics and lifestyle related factors adapted from WHO STEPS guide and CDC non-communicable investigation guide (68, 71). Other secondary data were extracted using checklists adapted from similar literatures (38, 54). Modified Morisky's Adherence Scale (MMAS-8) was used to measure patients' adherence to their medication. To assess the mental distress status of the hypertensive patients we made use of Kessler Psychological Distress Scale (K10), consisting of 10 item measures (72). Two medical doctors and two BSc nurses were involved in data collection and 1 resident of internal medicine from AHMC supervised the data collection procedure.

4.10 Data quality control

Before data collection, two days training was given for personnels involved in data collection (two general practitioners, two BSc nurses and 2 medical record keepers 1 from each hospital). The training focused on the objectives of the study, brief explanation about the tool and how they fill the tool as well as the issue of consent and privacy of participants for interview questionnaires. All tools were translated to Afaan Oromoo and Amharic and later re translated to English for consistency checking. The questionnaire and checklist were tested on 5% of the sample size at Mojo Primary hospital and modified accordingly. The completeness and quality of checklists and questionnaire was checked on weekly bases by taking 5% of the data extracted.

4.11 Data processing and analysis

The collected data was coded, entered and cleaned using Epi data software (version 3.2) and was exported for analysis in to Stata SE version 14. Descriptive statistics were computed using proportions for categorical variables and mean and standard deviations (SD) for continuous variables (age, income, body mass index, total cholesterol, low density lipoprotein, high density lipoprotein, systolic blood pressure, diastolic blood pressure, duration of smoking, standard unit of alcohol, time duration for different physical activities). Generally, results were presented using frequency tables, bar graphs, percentages and texts.

Monthly income was categorized by calculating quartiles and categorized in to lowest 25 percentile (below 2400 ETB), between 25 and 75 percentile (2401-8999 ETB), and above 75 percentile (greater than 9000 ETB). Morisky Medication Adherence Scale (MMAS-8) an eight-item self-reported adherence measure was used to measure patient adherence to their medications. It consists of eight questions with closed dichotomous (yes / no) answers. The last question has a five point Likert scale: “never”, “once in a while”, “sometimes”, “usually”, and “always.” The degree of adherence was determined according to the score resulting from the sum of all the correct answers: good adherence (8 points), medium adherence (6-7 points) and low-adherence (< 6 point) (68). To assess the mental distress status of the patients we made use of Kessler Psychological Distress Scale (K10), consisting of 10 item measures. The scale has five levels including: 1 = “None of the time”, 2 = “A little of the time”, 3 =”Some of the time”, 4 =”Most of the time”, 5 =”All of the time”. The mental distress scale status was determined from

the sum of the answers: Well (Score < 20), mild stress (score 20-24), moderate stress (score 25-29) and severe stress (score ≥30) (72). Again for analysis purpose we categorized to two categories for stress as yes and no; Yes (mild, moderate and severe distress) and no (Well). We analyzed the data using conditional logistic regression. Variables with p-values of <0.25 in bivariate conditional Logistic regression analysis were exported into multivariable conditional logistic regression analysis. Finally, adjusted odds ratio with 95% confidence intervals and p-value ≤ 0.05 was considered to determine the associated factors. The multicollinearity of independent variables was tested using variance inflation factor (VIF) and the calculated VIF for all exposure variables were < 10% which indicated there was no multicollinearity among independent variables. Model fitness was assessed using Hosmer–Lemeshow goodness-of-fit tests. The model was fit with hosmer and lameshow test result p value > 0.05.

4.13 Ethical considerations

Ethical clearance was obtained from Institutional Review Board of Jimma University and letter of support was obtained from Jimma University department of Epidemiology and Oromia regional health bureau. The ethical clearance and support was submitted to AHMC and BGH Ethical committee. Oral informed consent was obtained from each patient and the information from individual patient was kept confidential.

4.14 Dissemination of results

The finding of this study will be disseminated to all relevant stakeholders through presentation and publication. Copies of the research thesis will be submitted to Epidemiology department, Jimma University, AHMC and BGH for applications of the study findings and the manuscript will be prepared and will be sent to reputable medical Journals for publication.

5. Result

5.1 Socio-demographic variables

A total of 213 hypertensive patients, 71 cases and 142 controls were included in the study making a response rate of 93.42%. The mean age of the respondents was 52.22 ± 14.52 years (52.28 for cases vs 52.19 for controls). Of total respondents, 27 (38.03%) of cases and 83 (58.45%) of controls were females. 28 (39.44) of cases and 25 (17.61) controls were in the first wealth quantile. Nineteen (26.76%) of cases and 93 (65.49%) of controls were rural residents. Around two-third 46 (65%) of cases and three-fourth 108 (76.06%) of controls were married. With regarding to educational status, 27 (38.02%) of cases and 53 (37.33%) of control patients reported to attend tertiary level.

From bivariable analysis of socio-demographic variables; family history of cardiovascular diseases (P<0.001), income (P=0.04), male sex (P=0.017) and urban residence (P<0.001) were exported to multivariable conditional logistic regression **(Table 1).**

Table 1*: Socio-demographic determinanats of HHD among adult hypertensive patients on follow-up at AHMC and BGH, 2021*

Variables	Categories	Cases N=71(%)	Controls N=142 (%)	COR (95% CI)	P –Value
Sex	Male	44(61.97)	59(41.55)	2.00(1.33-3.52)	0.017*
	Female	27(38.03)	83(58.45)	1	
Residence	Rural	19(26.76)	93(65.49)	1	
	Urban	52(73.24)	49(34.51)	4.48(2.38-8.44)	0.00*
Educational status	No formal edu.	9(12.68)	34(23.94)	0.53(0.22-1.29)	0.16
	Primary (1-8)	21(29.58)	31(21.83)	1.22(0.61-2.47)	0.57
	2^{ndary} (9-12)	14(19.72)	24(16.90)	1.09(0.44-2.69)	0.86
	Tertiary	27(38.02)	53(37.33)	1	
Occupation	Gov’t worker	24(33.80)	39(27.46)	1	
	Farmer	15(21.13)	28(19.72)	0.95(0.4-2.27)	0.91

	Merchant	12(16.90)	22(15.49)	0.79(0.32-1.96)	0.61
	Housewife	11(15.49)	30(21.13)	0.47(0.18-1.19)	0.11
	Unemployed	6 (8.45)	12(8.45)	0.77(0.22-2.54)	0.67
	Other	3(4.23)	11(7.75)	0.71(0.20-2.48)	0.59
Marital status	Married	46(64.79)	108(76.06)	1	
	Single	5(7.04)	9(6.34)	1.20(0.28-5.20)	0.80
	Divorced	9(12.68)	14(9.86)	1.63(0.62-4.30)	0.33
	Widowed	11(15.49)	11(7.75)	2.49(0.96-6.40)	0.06
Monthly income	≤ 2400 ETB	28(39.44)	25(17.61)	2.32(1.02-5.27)	0.04*
	2401-8999 ETB	24(33.80)	78(54.93)	0.63(0.30-1.33)	0.23*
	≥ 9000 ETB	19(26.76)	39(27.46)	1	
Family hx of CVD	Yes	37(52.11)	32(22.54)	4.05(2.06-7.96)	0.00*
	No	34(47.89)	110(77.46)	1	

CI: Confidence interval, *: Significant and candidate for multivariate analysis, COR: Matched Crude odds ratio

Thirty one (43.66%) of cases and 54(38.03%) of controls were in the age category of 50-64 years and around one-fifth of cases and controls are ≥ 65 years.

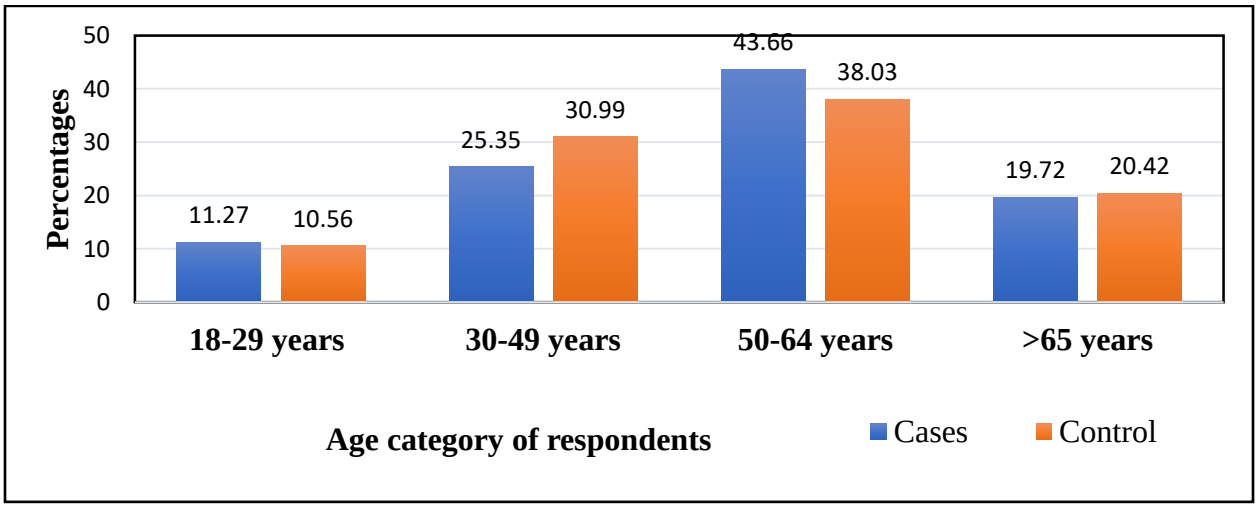


Figure 2: Age category of adult hypertensive patients and hypertensive heart disease cases in Adama Hospital Medical College and Bishoftu General Hospital, Ethiopia, 2021.

5.2. Lifestyle related variables

From the total respondents, 27 (38.03%) of cases and 42 (29.58%) of controls were smokers. While the mean years of smoking in respondents were 14.37±6.27 (13.89 years in cases and 14.69% years in controls) the minimum duration of years of smoking were five, while the maximum duration of smoking were 30 years. Among smokers, 19 (70.37%) of cases and 37 (88.10%) of controls were daily smokers.

The proportion of respondents reported to consume excessive salt was 47 (66.20%) among cases and 52 (36.62%) among controls. Proportion of patients reported to ever consume alcohol were 48 (67.61%) among cases and 77 (54.23%) among controls. All ever alcohol consumer cases 48(100%) had consumed an alcohol during last 12 months before their diagnosis with HHD and all ever alcohol consumer controls 77 (100%) had consumed an alcohol during the last 12 months prior to this study. The mean standard alcohol unit consumption at one occasion among alcohol consumers were 3.88 units in cases and 3.14 units in controls. Among alcohol consuming cases, 18 (37.5%) consume an alcohol 1-4 days/week and among alcohol consuming controls, 31 (40.26%) consumed alcohol 1-4 days/week.

The proportion of respondents who reported to consume fruit adequately in a week were 3 (6%) in a cases and 7 (5.18%) in a controls. The proportion of respondents who reported to consume vegetable adequately/week were 12 (16.90%) in a case and 41 (27.88%) in a control.

With regarding to physical activity, from total respondents 13 (18.31%) of cases and 64 (45.07%) of controls were exercising vigorous activity with mean minutes of 24.92 in case and 44.17 in controls in a single day. And respondents who exercise moderate activity were 30 (42.25%) from cases and 93 (65.49%) from controls with mean minutes of 21.5 in cases and 52.17 in controls. The percentages of respondents who walk or use bicycle from/to places for at least 10minutes/day were 56 (78.88%) in cases and 137 (96.48%) in controls. The mean minutes of walk/bicycle use were 19.63 in cases and 40.73 in controls. Respondents who exercise vigorous sport activities or recreational activities that causes large increase in breathing rate and heart rate for at least 10 minutes in a single day were 4 (5.63%) in cases and 82 (57.75%) in controls.

With regarding to antihypertensive drug adherence, 38 (53.52%) of cases and 53 (37.32%) of controls had low adherence, while 16 (22.53%) of the cases and 22 (15.49%) of controls had medium adherence and 17 (23.94%) of cases and 67 (47.18%) of controls had good adherence to antihypertensive medications. For the purpose of data analysis, the three categories of adherence were transformed in to two categories. Adherence with score eight were taken as adherent and medium and low adherence was taken as non-adherent with score of less than eight. Based on this, 54 (76%) of the cases and 75 (52.81%) of the controls were non- adherent to anti-hypertensive medications.

From bivariate analysis of behavioral determinants of hypertensive heart diseases, respondents with excessive salt consumption (P< 0.001), heavy alcohol consumption (P=0.014), physically inactivity (P<0.001) and anti-hypertensive drug non-adherence (p <0.001), ever alcohol consumer (P=0.173), in adequate fruit and vegetable intake (P= 0.174) were significantly determining hypertensive heart diseases development in hypertensive patients on follow-up. However Tobacco smoking, frequency of alcohol consumption and stress had not shown significant difference in determining HHD in cases and controls (**Table 2**).

Table 2: Life style related determinants of HHD in Adult hypertensive patients attending Adama Medical College and Bishoftu General Hospital, 2021

Variables	**Category**	**Cases N (%)**	**Controls N (%)**	**P value**	**COR (95%CI)**
Tobacco smoking	Yes	27(38.03)	42(29.58)	0.25	1.40 (0.79-2.46)
	No	44(61.97)	100(70.42)	1	
Excessive Salt consumption	Yes	47(66.20)	52(36.62)	0.00*	2.87(1.62-5.08)
	No	24(33.80)	90(63.38)	1	
Ever alcohol drink	Yes	34(47.89)	53(37.32)	0.173*	1.46 (0.85-2.50))
	No	37(52.11))	89(62.68)		
Heavy alcohol consumption	Yes	22(64.71)	14(26.42)	0.014*	6.50(1.47-28.8)
	No	12(35.29)	39(73.58)	1	
Fruit and vegetable intake	Adequate	57(80.28)	101(71.13)	1	
	Inadequate	14(19.72)	41(28.87)	0.174*	1.59(0.82-3.10)

Physical activity	Active	16(22.54)	105(73.94)	1	
	Sedentary	55(77.46)	37(26.06)	0.00*	8.81(4.13-18.80)
Fat or oil consumption	Vegetable oil	46(64.79)	104(73.24)		
	Butter	19(26.76)	29(20.42)	0.253	1.49(0.76-2.89)
	None used	6(8.45)	9(6.34)	0.676	1.36(0.32-5.86)
Stress	Yes	28(39.44)	38(26.76)	0.80	1.65(0.94-2.90)
	No	43(60.56)	104(73.24)	1	
Drug adherence	Low adheren	54(76.06)	75(52.82)	0.00*	5.32(2.15-13.19)
	Adherent	17(23.94)	67(47.18)	1	

CI: Confidence interval, P.V: P-value, *: Significant and candidate for multivariable analysis, COR is the matched crude odds ratio

5.3 Medical related variables

The proportion of participants with normal BMI were 44 (61.97%) and 90 (63.38%), proportion of participants with overweight were 20 (28.17%) and 36 (25.35%), while proportion of obese patients were 7 (9.86%) and 16 (11.27%) in cases and controls respectively. For analysis purpose we categorized BMI in to normal and above normal (overwight and obese) since there was no underweight in both cases and controls. So, 27 (38.03%) of cases and 52 (36.62%) of controls had higher body mass index (overweight and obese) respectively.

The mean total cholesterol was 197.49 in cases and 167.56 in controls. The mean low-density lipoprotein was 158.46 in cases and 138.99 in controls and the mean high-density lipoprotein in respondents of the study was 41.28 in cases and 45.97 in controls. For analysis purpose we categorized the lipid profiles in to two categories as hyperlipidemia (at least one measurent of lipid profile deviated from normal range) and normal. The proportion of participants with hyperlipidemia was 49 (69%) and 31 (22%) among cases and controls respectively.

The proportion of study participants with DM comorbidity was 30 (42.25%) and 31 (21.83%) in cases and controls respectively. The mean baseline systolic blood pressure of the study participants was 173.08mmhg in cases and 154.83mmhg in controls. While the mean baseline diastolic blood pressure of the study participants was 93.73mmhg in cases and 89.19mmhg in

controls. For analysis purpose we categorized baseline blood pressure in to stage 1 and ≥ stage 2 categories, study participants with baseline BP of ≥ stage 2 were 53 (74.65%) in cases and 61 (42.96%) in controls. With regarding to blood pressure control status before developing hypertensive heart diseases in cases and at the last visit for controls, 40 (56.34%) of cases and 47 (33.10%) of controls had uncontrolled blood pressure.

The mean years of duration after enrollment in to hypertension care before developing hypertensive heart diseases in cases and at the last visit for controls were 13.62 years and 9.58 years respectively. For analysis purpose we categorized years of duration of hypertension in to two and the proportion of participants with years of duration of > 10 years was 40 (56.34%) in cases and 69 (49.29%) in controls.

With regarding to proportion of hypertensive patients on follow-up and put on anti-hypertensive medications, 38 (53.52) were taking single drug, 27 (38.03) were taking two drugs, 6 (8.45%) were taking three or more drugs in cases and 59 (41.55%) were taking single drug, 48 (33.80) were taking two drugs, 35 (24.65%) were taking three or more drugs in controls respectively. For analysis purpose, we categorized number of drug combination given to hypertensive patients on follow-up in to single drug and multidrug (two or more anti-hypertensive drugs). The proportion of participants on multidrug was 33 (46.48%) and 83 (58.45%) in cases and controls respectively.

From the bivariable analysis of medical determinants; having DM comorbidity ($P<0.005$), uncontrolled Hypertension ($P<0.005$), hypertensive patients with abnormal lipid profile ($P<0.001$) and having ≥ stage 2 baselines BP ($p<0.001$), having longer duration of hypertension ($p<0.25$) and single antihypertensive drug choice ($P<0.25$) had higher odds of developing hypertensive heart diseases.

Table 3: Medical related factors determinants of HHD among adult hypertensive patients attending AHMC and BGH, 2021

Variables	Category	Cases N=71 (%)	Controls N=142 (%)	P-Value	COR (95%CI)
BMI	Normal	44(61.97)	90(63.38)	1	
	>normal	27(38.03)	52(36.62)	0.85	1.06(0.60-1.86)
Diabetic Mellitus Comorbidity	Yes	30(42.25)	31(21.83)	0.002*	2.85(1.47-5.56)
	No	41(28.87)	111(78.17)	1	
Lipid profile	Hyperlipidemia	49(69)	31(22)	0.00*	6.10(3.20-11.63)
	Normal	22(31)	111(78)	1	
Baseline blood pressure category	≤ stage I	18(25.35)	81(57.04)	1	
	≥ stage II	53(74.65()	61(42.96)	0.016*	2.17(2.17-4.08)
Duration of hypertension	< 10 years	31(43.66)	73(51.41)	1	
	≥ 10 years	40(56.34)	69(48.59)	0.231*	1.49(0.77-2.89)
BP Control	Controlled	31(43.66)	95(66.90)	1	
	Uncontrolled	40(56.34)	47(33.10)	0.002*	2.55(1.42-4.57)
Anti-hypertensive medications	Single drug	38(53.52)	59(41.55)	0.088*	1.69(0.92-3.11)
	Multidrug	33(46.48)	83(58.45)	1	

CI: Confidence interval, P.V: P-value, *: Significant and candidate for multivariate analysis, COR = matched crude odds ratio

5.4 Multivariable determinants of hypertensive heart diseases

Variables turned significant in bivariable conditional logistic regression analysis includes: gender, residency, family history of CVD, monthly income, salt and alcohol consumption, adherence to antihypertensive drug, physical activity, number of antihypertensive drugs, comorbid DM, blood pressure control, duration of hypertension, hyperlipidemia and baseline blood pressure were exported to multivariable conditional logistic regression analysis.

Hypertensive patients who live in urban areas were 3.51 times more likely to develop hypertensive heart diseases as compared with hypertensive patients who reside in rural areas (mAOR = 3.51, 95% CI; 1.17-10.52). Similarly, hypertensive patients who had family history of cardiovascular diseases had 3.47 times more likely to develop hypertensive patients than those who has no family history of CVD (mAOR =3.47, 95% CI; 1.08-11.19).

Male hypertensive patients were also more likely to develop hypertensive heart diseases as compared to female hypertensive patients (mAOR =3.11, 95% CI; 1.05-9.21). Hypertensive patients with stage II and above baseline blood pressure had 4.83 times more likely to develop hypertensive heart diseases than those who had baseline BP of ≤ stage I (mAOR = 4.83, 95% CI; 1.28- 18.20).

Hypertensive patients with poor adherence to anti-hypertensive medications were more likely to to develop HHD than those with a good adherence (mAOR = 3.76, 95% CI: 1.01-14.09) and those tend to add excessive salt to their diet had 3.57 times higher odds of developing HHD (mAOR = 3.57, 95% CI; 1.34-9.49). On the other hand, the effect of monthly income, hyperlipidemia, antihypertensive drug combination choice, duration of hypertension and blood pressure control disappeared in the multivariable analysis when adjusted for other possible confounders.

Table 4: Multivariate determinants of HHD among adult Hypertensive patients attending AHMC and BGH, 2021

Variables	Category	Cases N (%)	Controls N (%)	P-value	mAOR(95.0% CI)
Family history of CVD	Yes	37(52.11)	32(22.54)	0.037	3.47 (1.08-11.19)*
	No	34(47.89)	110(77.46)	1	
Residence of the respondent	Urban	19(26.76)	93(65.49)	0.025	3.51 (1.17-10.52)*
	Rural	52(73.24)	49(34.51)	1	
Years lived with hypertension	<10 years	31(43.66)	73(51.41)	1	
	>10 years	40(56.34)	69(48.59)	0.43	1.67 (0.46-6.07)
BP control status	Controlled	31(43.66)	95(66.90)	1	
	uncontrolled	40(56.34)	47(33.10)	0.053	3.20 (0.99-10.32)
Baseline BP category	≤ stage I	18(25.35)	81(57.04)	1	
	≥ stage II	53(74.65()	61(42.96)	0.02	4.83 (1.28-18.20)*
selection of Anti-HTN drug	Single drug	38(53.52)	59(41.55)	0.28	1.97 (0.58-6.72)
	Multidrug	33(46.48)	83(58.45)	1	
Antihypertensive drug adherence	Nonadherent	54(76.06)	75(52.82)	0.049	3.76 (1.01-14.09)*
	Adherent	17(23.94)	67(47.18)	1	
Income category	≤ 2400 ETB	28(39.44)	25(17.61)	0.11	4.51 (0.72-28.42
	2401-8999 ETB	24(33.80)	78(54.93)	0.44	1.23 (0.45-2.77)
	≥ 9000 ETB	19(26.76)	39(27.46)	1	
DM comorbidity	Yes	30(42.25)	31(21.83)	0.078	3.03 (0.88-10.39)
	No	41(28.87)	111(78.17)	1	
Lipid profile	Hyperlipidemia	49(69)	31(22)	0.20	2.10 (0.68-6.52)
	Normal	22(31)	111(78)	**1**	
Excessive salt consumption	Yes	47(66.20)	52(36.62)	0.011	3.57 (1.34-9.49)*
	No	24(33.80)	90(63.38)	1	
Sex	Male	44(61.97)	59(41.55)	0.04	3.12 (1.05-9.21)*
	Female	27(38.03)	83(58.45)	1	

AOR= matched Adjusted Odd Ratio, CI= Confidence Interval, CVD = cardiovascular diseases, DM= diabetic mellitus, BP= blood pressure, N= number, *= variables significant in multivariable conditional logistic regression

6. Discussion

In this study, hypertensive patients with positive family history of CVD were 3.47 times more likely to develop hypertensive heart diseases than hypertensive patient's with-out family history of cardiovascular diseases. This finding agrees with the studies conducted in northern part of Ethiopia (38), Cameroon (53) and Australia (52). This can be justified by existence of numeruos genes that contribute to the development of hypertensive heart disease, targeting the renin-angiotensin-aldosterone system and by affecting human type A natriureticeptide receptor gene and the G-protein β 3-subunit gene affecting sodium and hydrogen ion exchanger activity and also other genes like the myosin-binding protein C (MyBP-C) gene and the β-adrenergic receptor kinase (βARK) gene have been identified that affect myocardial contractility in hypertensive patients which later predisposes to development of hypertensive heart diseases (10, 74). Therefore this study finding agrees with theoretical concept of the science.

Male hypertensive patients were more likely to develop HHD than female counterparts in this study. This finding is consistent with studies conducted in China (50), Ghana (75) and Greece (62). The possible explanation for HHD to develop in male than female which is evident in this study might be, the risk of cardiovascular disease increases linearly in men with time and the atherosclerotic process is constantly evolving from even the younger age (76). On the other hand, because estrogen has a beneficial effect on the cardiovascular system, women during the fertile age can be protected from atherosclerosis which plays a role in reducing risk of developing Coronary heart diseases in hypertensive patients (77, 78).

The other determinant factor of HHD in hypertensive patients is urban residence. The urban resident hypertensive patients were more likely to develop HHD than rural residents. When compared with study conducted in Indonesia (51) , Cameroon (53) and India (79), this study finding is similar that HHD cases had lived in urban than their control counterparts. The increased odds of having HHD in hypertensive patients living in urban area than those hypertensive patients living in rural area could be attributed to the reason that patients living in

urban area have lesser healthy lifestyle choice like healthy diet and tend to be physically inactive (80).

The behavioral determinants of hypertensive heart diseases shown significance in multivariable analysis to determine HHD was excessive salt consumption and anitihypertensive drug non-adherence. So, excessive salt consumption was determinant factor of hypertensive heart diseases, that hypertensive patients adding excessive salt to their daily food were more likely of developing hypertensive heart diseases which is in line with previous finding in studies conducted in Cuba (13) and another study conducted in Ethiopia (39) and in Kenya (25). This could be due to excessive consumption of salt impairs renal sodium excretion which in turn leads to persistently increased blood pressure and later on lead to left ventricular hypertrophy which is the most common HHD (81, 82).

Antihypertensive drug non-adherence was found to be determinant factor for hypertensive heart diseases. In this study, having hypertensive heart diseases increased by 3.76 times in non-adherent hypertensive patients than adherent hypertensive patients to anti-hypertensive drugs. This finding is consistent with studies conducted in Brazil (83) and study conducted in south Korea (61) and another study in Ethiopia (84) and also study done in Nigeria (34). This study implies that antihypertensive medicine adherence in these study areas are poor which might be due to absence of adherence tracing mechanisms and it might also due to COViD-19 disease pandemic which disturbed the health care delivery system of health facilities and follow-up visits of hypertensive patients.

Baseline blood pressure reading ≥ stage II was also associated with hypertensive heart disease occurrence in hypertensive patients than hypertensive patients with ≤ stage I baseline BP readings in this study. This finding agrees with other studies conducted in Cuba, China and USA (11, 59, 63). This increased risk of developing hypertensive heart diseases in hypertensive patients with baseline BP of ≥ stage II can be because the left ventricular hypertrophy develops following longer duration and more severe form of hypertension (7). In order to prevent hypertension complication in patients with severe form of hypertension, they need to be treated with proper antihypertensive combinations to control the hypertension (87). Majority of hypertensive heart diseases had higher baseline blood pressure when enrolled to care which predispose them to higher odds of developing HHD. This might indicate adult population

screenings for hypertension detection in general public by lower health care level are weak. The other reason might be the health seeking behavior of the communities is not strong unless they become sympthomatic for a disease which occurs late in hypertension.

On the other hand, even if it was found significant in bi-variable analysis, alcohol consumption was avoided after multivariate analysis. This finding is in contrary to other similar studies in Cuba (13) but consistent with study conducted in Kenya (25)**.** This disparity might be due to differences in study settings and design differences. The other important factor dropped after multivariable conditional logistic regression was physical inactivity but found to be significant determinant factor in binary condictional logistic regression was physical inactivity. This finding contradicts with some study finding and agrees with some other studies as well. The study conducted in northern part of the Ethiopia indicated that hysical inactivity was associated with HHD and also with study done in India (33, 38). But study conducted in Cuba on predictors of hypertensive heart diseases agrees with this study finding (13). The difference seen in those different studies might be due to study design and study area difference as well.

These study findings in general imply that if effective public health interventions are in place in this study areas, a number of hypertensive heart disease cases can be prevented as more than half of determinants identified are modifiable. Focusing on those determinants for risk stratification among hypertensive patients are not only important for mere prevention of HHD cases but also in preventing economic loses following long hospital stay and losing productive work forces which could have occurred in hypertensive heart diseases. The findings of non-modiable determinant factors in this study imply early screening effort escalation in this study area is important to counter the hypertensive heart diseases related burden.

6.2. Strenghth and limitation of the study

6.2.1 Strengths of the study

We included some under-studied but very important determinant factor for hypertensive heart diseases in hypertensive patients in contexts of Ethiopia like antihypertensive drug adherence and choice of single drug over multidrug in treating hypertension.

6.2.2 Limitations of the study

Since some of the data was secondary record review, it had its limitation as there was large incomplete data which led to drop of some cases and controls. Since it was not feasible to screen all hypertensive patients currentily we made use of priorly investigated hypertensive patients by ECG or Echocardiography to look for evidence of hypertensive heart diseases by experts. We also used matched study and it might introduce some deliberate selection bias to match for the age which is difficult to avoid. We also sought previous history of risk factor which is self report and common in case-control study which might lead to recall bias. To avoid this recall bias we tried to restrict patients with hypertensive heart diseases diagnosed before 1 year.

7. Conclusion

Having family history of cardiovascular diseases and being male was found to be non-modifiable determinant factors of hypertensive heart diseases in hypertensive patients on follow-up. Urban residence, adding excessive salt to food, non-adherence to antihypertensive medications and stage II and above baseline blood pressure was modifiable determinant factor of hypertensive heart diseases in hypertensive patients attending follow-up care.

8. Recommendations

To Adama Hospital Medical College and Bishoftu General Hospital service providers

- Should have to strengthen life style modification counseling like salt reduction and adherence to antihypertensive medications for patients with hypertension.
- Attention should be given to screening and management of hypertensive heart diseases among hypertensive patients
- Hypertensive patients with higher baseline blood pressure (≥ stage II) should be aggressively managed to get favorable blood pressure level as severe and longstanding form of hypertension is associated with early hypertensive heart disease occurrence

To ministry of health and other stakeholders

- Strengthening policies enabling lower health care facilities to screen clients for hypertension to early identify the high risk group for hypertensive heart diseases
- Develop comprehensive risk driven public health prevention approaches in hypertensive patients to prevent hypertensive heart diseases

To researchers

- To conduct further studies using primary data and incident hypertensive heart disease cases

9. References

1. Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, Prabhakaran D, et al. Clinical Practice Guidelines 2020 International Society of Hypertension Global Hypertension Practice Guidelines International Society of Hypertension. 2020;1334–57.

2. Mahmood S, Jalal Z, Hadi MA, Shah KU. Association between attendance at outpatient follow - up appointments and blood pressure control among patients with hypertension. BMC Cardiovasc Disord [Internet]. 2020;1–11. Available from: https://doi.org/10.1186/s12872-020-01741-5

3. Gheorghe A, Griffiths U, Murphy A, Legido-quigley H, Lamptey P, Perel P. The economic burden of cardiovascular disease and hypertension in low- and middle-income countries : a systematic review. BMC Public Health. 2018;18:1–11.

4. World Health Organization. World health statistics : monitoring health for the SDGs, Geneva. 2021.

5. United Nations. Transforming our world: the 2030 agenda for sustainable development. 2016.

6. Prisant LM. Hypertensive Heart Disease. Clin Hypertens. 2010;7(4):231–8.

7. Izzo JL, Gradman AH. Mechanisms and management of hypertensive heart disease : from left ventricular hypertrophy to heart failure. Med Clin North Am. 2018;(November):1257–1271.

8. Nwabuo CC, Vasan RS. Pathophysiology of Hypertensive Heart Disease : Beyond Left Ventricular Pathophysiology of Hypertensive Heart Disease : Beyond Left Ventricular Hypertrophy. Curr Hypertens Rep [Internet]. 2020;(February). Available from: https://doi.org/10.1007/s11906-020-1017-9

9. Mehta AK. Managing Hypertension in Coronary Artery Disease. Indian Heart J. 2020;6.

10. Diamond JA, Health N. Hypertensive Heart Disease. Hypertens Res. 2014;(April).

11. Guo Q, Lu X, Gao Y, Zhang J, Yan B, Su D, et al. Cluster analysis : a new approach for

identification of underlying risk factors for coronary artery disease in essential hypertensive patients. Nat Publ Gr. 2017;(March):1–7.

12. Díez J, Frohlich ED. A Translational Approach to Hypertensive Heart Disease. 2010;1–8.

13. Sánchez GP, Aliaga AÁ-, Céspedes CM De, González-aguilera JC. Hypertensive Heart Disease Predicitive Index. 2017;25:217–28.

14. Diez J. Hypertensive heart disease. 2013. 152–166 p.

15. World Health Organization. A global brief on Hypertension on World Health Day. 2013.

16. Justin J, Fayol A, Bruno R, Khettab H, Boutouyrie P. International Guidelines for Hypertension : Resemblance , Divergence and Inconsistencies. Clin Med (Northfield Il). 2022;11.

17. WHO - World Health Organization. Assessing national capacity for the prevention and control of noncommunicable diseases. Global Survey. Geneva: World Health Organization; 2016 (http://www.who.int/chp/ncd_ capacity/en/, accessed. 2016.

18. Luiz T, Klein CH, Nogueira R, Helena L, Salis A. Cardiovascular mortality among a cohort of hypertensive and normotensives in Rio de Janeiro - Brazil - 1991 – 2009. BMC Public Health [Internet]. 2015;1–11. Available from: http://dx.doi.org/10.1186/s12889-015-1999-4

19. Lu Y, Lan T. Global , regional , and national burden of hypertensive heart disease during 1990 – 2019 : an analysis of the global burden of disease study. BMC Public Health [Internet]. 2022;1–10. Available from: https://doi.org/10.1186/s12889-022-13271-0

20. Omidi N, Arabloo J, Rezapour A, Id FA, Bragazzi L, Pourasghari H, et al. Burden of Hypertensive Heart Disease in Iran during 1990 – 2017 : Findings from the Global Burden of Disease study. 2021;1–10. Available from: http://dx.doi.org/10.1371/journal.pone.0257617

21. Miazgowski T, Kopec J, Widecka K, Miazgowski B, Kaczmarkiewicz A. Clinical research Epidemiology of hypertensive heart disease in Poland : findings from the Global

Burden of Disease Study. 2021;

22. Akinyemi Aje AAA and AOF. Hypertensive heart disease in Africa. 2013;(13):42–51.

23. Nkoke C, Makoge C, Dzudie A, Mfeukeu LK, Luchuo EB, Menanga A, et al. A predominance of hypertensive heart disease among patients with cardiac disease in Buea , a semi - urban setting , South West Region of Cameroon. BMC Res Notes [Internet]. 2017;10:1–6. Available from: https://doi.org/10.1186/s13104-017-3034-6

24. Ojji D, Stewart S, Ajayi S, Manmak M, Sliwa K. A predominance of hypertensive heart failure in the Abuja Heart Study cohort of urban Nigerians : a prospective clinical registry of 1515 de novo cases. 2013;835–42.

25. Amugitsi IL, Ayieko AO, Omuga BO. Determinants of Hypertension Complications Among Adult Hypertensive Patients in Medical Wards at Kenyatta National Hospital , Nairobi. 2016;5(5):213–21.

26. Ogah OS, Rayner BL. Recent advances in hypertension in sub-Saharan Africa. 2013;1–8.

27. Paolo F, Michelle C, Miller A. Cardiovascular disease and hypertension in sub-Saharan Africa : burden , risk and interventions. Intern Emerg Med. 2016;11(3):299–305.

28. Habte B, Alemseged F, Tesfaye D. the pattern of cardiac diseses at the cardiac clinic of Jimma University, Ethiopia. Ethiop J Heal Sci. 2010;20(2):99–103.

29. Aragaw S, Tesfahun E, Derseh BT. Research Article Determinants of Selected Cardiovascular Diseases among Adult Patients at Cardiac Clinic of Debre Berhan Referral Hospital , Ethiopia : Unmatched Case-Control Study. Cardiovasc Ther. 2020;(May).

30. Gudina EK. Left ventricular hypertrophy among black hypertensive patients : f. BMC Res Notes. 2016;(January).

31. Yadeta D, Walelgne W, Fourie JM, Scholtz W, Scarlatescu O, Nel G. Cardiovascular Topics Ethiopia Country Report PASCAR and WHF Cardiovascular Diseases Scorecard project. Cardiovasc J Afr. 2021;32(1).

32. Ali S, Misganaw A, Worku A, Destaw Z, Negash L, Bekele A. The burden of cardiovascular diseases in Ethiopia from 1990 to 2017 : evidence from the Global Burden of Disease Study. Cardiovasc J Afr. 2021;(September 2020):318–26.

33. 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.

34. OguntadeID AS, 1, 2* IOA. Risk factors of heart failure among patients with hypertension attending a tertiary hospital in Ibadan , Nigeria : The RISK-HHF case-control study. PLoS One [Internet]. 2021;1–16. Available from: http://dx.doi.org/10.1371/journal.pone.0245734

35. Bahrey D, Mariye T, Gebremedh G, Kassa A, Teklay G, Tasew H, et al. Magnitude of Cardiovascular Risk Factors among Adult Hypertensive Patients Attending in Ayder Comprehensive Specialized Hospital , Ethiopia , 2018. Int Arch Cardiovasc Dis Bahrey. 2019;1–7.

36. Habtamu Ayele , Akalu Banbeta AN. Cardiovascular Disease Risk Factors in Hypertensive Patients : A Case Study of Jimma University Medical Center. Heal Serv Res Manag Epidemiol. 2022;9:1–7.

37. Gemeda AT, Regassa LD, Legesse N, Tusa BS. Adherence to antihypertensive medications and associated factors among hypertensive patients in Ethiopia : Systematic review and meta-analysis. SAGE Open Med. 2020;8:1–22.

38. Atkilt G, Shaweno T. Determinants of hypertensive heart disease among adult hypertensive patients in the University of Gondar Referral Hospital, Gondar, Ethiopia: A case-control study. cardio-thoracic Med. 2019;(3):530–40.

39. Kinfe DG, Berhe G, Gidey K, Demoz GT. Blood Pressure Control , Left Ventricular Hypertrophy and Treatment Practice Among Hypertensive Patients in Ethiopia. 2020;903–16.

40. Franz H. Messerli, MD,a,b,c Stefano F. Rimoldi, MD,a Sripal Bangalore M. The

Transition From Hypertension to Heart Failure. JACC. 2017;5(8):544–51.

41. Howell SJ, Sear JW, Foe P. Hypertension , hypertensive heart disease and perioperative cardiac risk [2]. 2009;92(4):570–83.

42. Katholi RE, Couri DM. Left Ventricular Hypertrophy : Major Risk Factor in Patients with Hypertension : Update and Practical Clinical Applications. 2014;(January 2011).

43. Cuspidi C, Sala C, Negri F, Mancia G MA. Prevalence of left-ventricular hypertrophy in hypertension: an updated review of echocardiographic studies. J Hum Hypertens. 2017;26(6):343–9.

44. Aronow WS. Hypertension and left ventricular hypertrophy. 2017;5(1):5–8.

45. Themistocleous I, Stefanakis M, Douda HT. Coronary Heart Disease Part I : Pathophysiology and Risk Factors Coronary Heart Disease Part I : Pathophysiology and Risk Factors. 2017;(May).

46. Ogunsua AA, Shaikh AY, Ahmed M, Mcmanus D. Atrial Fibrillation and Hypertension : Mechanistic , Epidemiologic, treatment parallels. 2015;(October).

47. Liao L, Wen X, Zhang S, Li W. Hypertension and Atrial Fibrillation : A Study on Epidemiology and Mendelian Randomization Causality. 2021;8(March).

48. Gyu chul oh HC. Blood pressure and heart failure. BMC Cardiovasc Disord. 2020;26(1):1–8.

49. Zhang M, Meng Y, Yang Y, Liu Y, Dong C, Xiao J, et al. Major inducing factors of hypertensive complications and the interventions required to reduce their prevalence : an epidemiological study of hypertension in a rural population in China. 2011;1–8.

50. Xu D, Chen W, Li X, Zhang Y, Li X, Lei H, et al. Factors Associated with Blood Pressure Control in Hypertensive Patients with Coronary Heart Disease : Evidence from the Chinese Cholesterol Education Program. 2013;8(5).

51. Maharani A, Id S, Praveen D, Id DO. Cardiovascular disease risk factor prevalence and

estimated 10-year cardiovascular risk scores in Indonesia : The SMARThealth Extend study. 2019;1–13.

52. Sahle BW, Owen AJ, Krum H, Reid CM. Incidence of heart failure in 6083 elderly hypertensive patients : the Second Australian National Blood Pressure Study (ANBP2). 2016;38–45.

53. Aminde LN, Dzudie A, Mapoure YN, Tantchou JC, Veerman JL. Estimation and determinants of direct medical costs of ischaemic heart disease , stroke and hypertensive heart disease : evidence from two major hospitals in Cameroon. 2021;4:1–13.

54. alexis alvarez, julio cezar gonzalez liliana del R. factors associated to hypertensive heart diseases development. medwave. 2016;16(6).

55. World Health Organization. Types of cardiovascular disease and risk factors. 2012;1774.

56. Adebawo O, Salau B, Ezima E, Oyefuga O, Ajani E, Idowu G, et al. Fruits and vegetables moderate lipid cardiovascular risk factor in hypertensive patients. 2010;4(Ldl):1–4.

57. Mohammed OY, Tesfahun E, Mohammed A. Magnitude of sedentary behavior and associated factors among secondary school adolescents in Debre Berhan town , Ethiopia. 2020;1–7.

58. Bahrey D, Gebremedhn G, Mariye T, Girmay A, Aberhe W, Hika A, et al. Prevalence and associated factors of chronic kidney disease among adult hypertensive patients in Tigray teaching hospitals : a cross - sectional study. BMC Res Notes [Internet]. 2019;3–7. Available from: https://doi.org/10.1186/s13104-019-4610-8

59. Agudelo EL, Salvá AR, Piñera AD, Roche RG, Vos P De. Assessment of hypertension management and control : a registry-based observational study in two municipalities in Cuba. 2019;6:1–10.

60. Simone G De, Mancusi C, Izzo R, Losi MA, Ferrara LA. Obesity and hypertensive heart disease : focus on body composition and sex differences. Diabetol Metab Syndr. 2016;1–9.

61. Kim H, Yoon S, Oh I, Lim JH, Kim YA. Medication Adherence and the Occurrence of Complications in Patients with Newly Diagnosed Hypertension. Korean Circ J. 2016;46(3):384–93.

62. Dimitriadis K, Tsiou C, Mazaraki A, Liatakis I, Koutra E, Kordalis A, et al. Waist circumference compared with other obesity parameters as determinants of coronary artery disease in essential hypertension : a 6-year follow-up study. 2016;(December 2015):475–9.

63. Heather M, Joseph C PD. Correlation between Subclinical Heart Disease and Cardiovascular Risk Profiles in an Urban Emergency Department Population with Elevated Blood Pressures. HHS Public Access. 2016;48(6):756–61.

64. Cecília M, Jayme B. Conceptual framework for research and clinical practice concerning cardiovascular health-related behaviors 1. 2013;21.

65. Woodward M. EPIDEMIOLOGY STUDY DESIGN AND DATA ANALYSIS. 1999. 349–364 p.

66. Walters D. Required sample size for categorical Matching. J Am Stat Assoc. 1984;387(79):662–7.

67. Rao S. Left Ventricular Hypertrophy (LVH). 2020;(September).

68. David Sugerman UPGS, Krumm P. Non communicable Diseases(NCD) Field Investigation guide. CDC FETP. 2017;1(1):402.

69. Shiferaw F, Letebo M, Misganaw A, Feleke Y, Gelibo T, Getachew T, et al. Non-communicable Diseases in Ethiopia: Disease burden, gaps in health care delivery and strategic directions. Ethiop J Heal Dev. 2018;32(3).

70. Gelibo T, Amenu K, Tadele T, Getnet M, Getachew T, Defar A. Low fruit and vegetable intake and its associated factors in Ethiopia : A community based cross sectional NCD steps survey. 2018;(February).

71. WHO-World Health Organization. WHO STEPS Instrument (investigation guide) for

Chronic Disease Risk Factor Surveillance. 2013;2.1:1–14. Available from: www.who.int/chp/steps

72. Kessler R. Kessler Psychological Distress Scale (K10) Source : Kessler R . Professor of Health Care Policy , Harvard Medical This is a 10-item questionnaire intended to yield a global measure of distress based on questions about anxiety and depressive symptoms tha. 2001;1(1):3.

73. Unger T, Borghi C, Unger T, Borghi C, Charchar F, Khan NA, et al. International Society of Hypertension; global hypertension practice guidelines. J Hypertens. 2020;(May).

74. Louis S, Hunt SC, Arnett DK. Genetics of Hypertension and Cardiovascular Disease and Their Interconnected Pathways: Lessons from Large Studies. Curr Hypertens Rep. 2012;13(1):46–54.

75. Kofi OI, Emmanuel A. Determinants of Left Ventricular Hypertrophy in Hypertensive Patients seen in a Teaching Hospital in Ghana Journal of Hypertension : Open Access. 2018;(November).

76. Gao Z, Chen Z, Sun A, Deng X. Gender differences in cardiovascular disease. Med Nov Technol Devices [Internet]. 2019;4(October):100025. Available from: https://doi.org/10.1016/j.medntd.2019.100025

77. Antikainen R, Grodzicki T, Palmer AJ, Bulpitt C. The determinants of left ventricular hypertrophy defined by Sokolow – Lyon criteria in untreated hypertensive patients. 2015;

78. Ching sM, Chia YC WAW. Prevalence and Determinants of Left Ventricular Hypertrophy in Hypertensive Patients at a Primary Care Clinic in Malasia. 2012;7(2).

79. Mary A, Joseph V, George K, Jose VJ. Prevalence of coronary heart disease in rural and urban Vellore : A repeat cross-sectional survey. Indian Heart J [Internet]. 2016;68(4):473–9. Available from: http://dx.doi.org/10.1016/j.ihj.2015.11.015

80. World Heart Federation. Urbanization and cardiovascular disease. 2019;1–4.

81. Ando K, Kawarazaki H, Miura K, Matsuura H, Watanabe Y, Yoshita K, et al. Report of

the Salt Reduction Committee of the Japanese Society of Hypertension ; Role of salt in hypertension and cardiovascular diseases. Hypertens Res. 2013;(October):1009–19.

82. Modolo R, Faria AP De, Paganelli MO, Sabbatini AR, Barbaro NR, Nascimento BB, et al. Predictors of Silent Myocardial Ischemia in Resistant Hypertensive Patients. 2015;28(February).

83. Braz D, Maria T, Moreira M, Wicto J, Borges P, Thaís M. Association between treatment compliance and different types of cardiovascular complications in arterial hypertension patients. 2016;(January). Available from: https://www.researchgate.net/publication/306272703%0AAssociation

84. Abegaz TM, Tefera YG, Abebe TB. Target Organ Damage and the Long Term Effect of Nonadherence to Clinical Practice Guidelines in Patients with Hypertension : A Retrospective Cohort Study. 2017;2017.

85. Franjic B, Marwick TH. The diabetic , hypertensive heart : epidemiology and mechanisms. J Hum Hypertens. 2014;23(March):709–17.

86. Sheikh SA, Aljohani EM, Alrayes FH, Aldakhil AR, H SB. Hypertension and Coronary Heart Disease in Diabetic Patients : A Systematic Review. 2020;11(4):130–4.

87. Alexandre Persu , Marilucy Lopez-Sublet, Engi Abd El-Hady Algharably RK. Starting Antihypertensive Drug Treatment With Combination Therapy. Hypertension. 2021;77(March):800–5.

10. Annexes I-Questionnaire and checklists

English Version Questionnaires

Dear Sir/Madam; Good Morning/Afternoon?

My name is _____ I am research assistant and working with Mr. Dinka Kebede from Jimma University. He is doing research on determinants of hypertensive heart diseases among adult hypertensive patients on follow up at Adama Hospital Medical College and Bishoftu General Hospital as partial fulfillment for Maters in Public Health in Field Epidemiology.

I am going to give you information and invite you to be part of this research. If you agree to participate, you will be required to answer for a questionnaire which will take about 20 minutes of your time. Because of your participation on this study, you will not get any harm and immediate benefit. However, I would also like to inform you that the responses that you will provide us are very essential, not only for the successful accomplishment of the study but also for producing relevant information which will be helpful in planning and implementation of intervention activities in hypertensive patients.

The information that you will obtain using this interview will be used only for research purpose and also, I need to assure you that confidentiality is our main quality. Therefore; I politely request your cooperation to participate in this interview. You do have the right not to respond at all or to withdraw in the meantime, but your input has great value for the success of our objective.

If you have further question, you may contact Dinka Kebede through **0917439409** and/or ribkadinka84@gmail.com . Do you agree to proceed with the interview?

Yes; ----proceed with the interview No; ---- thank and end.

Name of interviewer who sought the consent: _____

Date of data collection: _____ Signature: _____

Part I: Case identification checklist

S.N	Variables	Options	Remarks
1	ECG findings indicative of HHD	1.Yes 2.No	
2	Echocardiogram indicative of HHD	1.Yes 2.No	
3.	MRI indicative of HHD	1. Yes 2. No	
4.	CT scan indicative of HHD	1.Yes 2.No	

Part II Data extraction checklist

Checklist CODE_____

S. N	Variables		Remarks
1.	BMI	Weight in kg_____ Height in m_____	
2.	Total cholesterol	In mg/dl _____	
3.	HDL Cholesterol	In mg/dl_____	
4.	LDL cholesterol	In mg/dl_____	
5.	Comorbid DM	1.Yes	
		2.No	
6.	Baseline BP	_____mmHg	
7.	BP control	1.Controlled	
		2.Uncontrolled	
8.	Duration of HTN	_____ in years	
9.	Anti-hypertensive Medications	1.Single drug	
		2.Two drug	
		3.Three or more drug combinations	

Part III Interviewer administered Questionnaires

Questionnaire Code in Match of data extraction checklist code _____

Q. No	Variables	Possible answers/choices	Skip to:	Remark
Q1	Sex of the respondent	1. Male 2. Female		
Q2	Age of the respondent	_____ in years		
Q3	Religion	1. Orthodox 2. Protestant 3. Muslim 4. Wakefata 5.Other (specify_____)		
Q4	Ethnicity	1. Oromo 2. Amhara 3. Gurage 4.Tigre 5.Other (specify_____)		
Q5	Marital status	1. Single 2. Married 3.Divorced 4. Widowed 5. other (specify___)		
Q6	Educational status	1. no formal education 2. primary (1-8) 3. Secondary (9-12) 4. Higher education		
Q7	Residency	1. Urban 2. rural		
Q7	Occupation	1.Governmental worker 2.Farmer 3. Merchant 4. House wife 5. unemployed 6.other(specify)		
Q8	Monthly income	In _____ ETB		
Q9	Do you have a family history of cardiac diseases	1. Yes 2. No		

Part IV lifestyle related variables

Q. No	Variables	Possible response	Skip to	remarks
	Smoking			
Q10	Did you smoke cigarrete?	1.yes 2.no	If no go to Q15	
Q11	If you were smoking, for how long?	In years----------		
Q12	Before you diagnosed with HHD or equivalent time for controls, did you ever smoke daily?	1.yes 2.no		
Q13	How long ago did you stop smoking before you were diagnosed with HHD or equivalent time?	1. In years_____ 2. In months____		
	Salt consumption			
Q15	Did you (any one at home) add > a level teaspoonful salt/person when cooking or distributed among dishes for meal before you diagnosed with HHD or equivalent time for controls	1.yes 2.No		
	Alcohol consumption			
Q15	Have you ever consumed an alcoholic drink before you diagnosed with HHD or equivalent time for controls?	1.yes 2.No	If no go to Q19	
Q16	Have you consumed an alcoholic drink within the past 12 months of your diagnosis or equivalent time for controls?	1.yes 2.no		
Q17	During the past 12 months of your diagnosis with HHD or equivalent time for controls, how frequently have you had at least one alcoholic drink?	1.Daily 2.5-6 days per week 3.1-4 days per week 4.1-3 days per month 5. Less than once a		

		month		
Q18	During the past 30 days, when you drank alcohol, on average, how many drinks did you have during one drinking occasion? Specify the type of alcohol	Number of measurement		
Diet				
Q19	In a typical week, on how many days do you eat fruit before you were diagnosed with HHD or equivalent time for controls?	1. Number of days__		
Q20	How many servings of fruit do you eat on one of those days?	1.Number of servings__		
Q21	In a typical week, on how many days do you eat vegetables?	1.Number days_____		
Q21	How many servings of vegetables do you eat on one of those days	Number of servings		
Q22	What type of oil or fat is most often used for meal preparation in your household before you were diagnosed with HHD or equivalent time for controls?	1.Vegetable oil 3. Butter 4. Other 5.None used		
Physical activity (All Questionnaire items are designed to collect a history before HHD diagnosis or equivalent time for controls)				
Q23	Did your work involve vigorous-intensity activity that caused large increases in breathing or heart rate like (carrying or lifting heavy loads, digging or construction work) for at least 10 minutes continuously?	1 yes 2 No	If no go to Q25	
Q24	How much time did you spent doing vigorous-intensity activities at work on a typical day?	In hrs:min___:_____		
Q25	Did your work involve moderate-intensity activity that caused small increases in	1 yes 2 No		

	breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously?					
Q26	How much time did you spend doing moderate-intensity activities at work on a typical day?	In hrs:min____:____				
Q27	Did you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	1.yes 2.No				
Q28	How much time did you spend walking or bicycling for travel on a typical day?	In hrs: min___: ____				
Q29	Did 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				
Q30	How much time did you usually spend sitting or reclining on a typical day?	Hrs.: min __: _____				
Stress (Kessler Psychological Distress Scale) All questions are designed to collect history before HHD diagnosis and equivalent time for controls.						
S.N	Questions	1.None of the time	2.Little of the time	3. Some of the time	4. Most of the time	5. All of the time
Q31	During the last 30 days, about how often did you feel tired out for no good reason?					
Q32	During the last 30 days, about how often did you feel nervous?					
Q33	During the last 30 days, about how often did					

	you feel so nervous that nothing could calm you down?					
Q34	During the last 30 days, about how often did you feel hopeless?					
Q35	During the last 30 days, about how often did you feel restless or fidgety?					
Q36	During the last 30 days, about how often did you feel so restless you could not sit still?					
Q37	During the last 30 days, about how often did you feel depressed?					
Q38	During the last 30 days, about how often did you feel that everything was an effort?					
Q39	During the last 30 days, about how often did you feel so sad that nothing could cheer you up?					
Q40	During the last 30 days, about how often did you feel worthless?					

8-Items Morisky Medication Adherence Scale- (MMAS-8)

S. N	Items	Yes	No
1	Do you sometimes forget to take your pills before you diagnosed with HHD or equivalent time for controls?	0	1
2	People sometimes miss taking their medications for reasons other than forgetting. Thinking over the last two weeks before your diagnosis with HHD or equivalent time for controls, were there any days when you did not take your medicine?	0	1
3	Have you ever cut back or stopped taking your medicine without telling your doctor because you felt worse when you took it before you diagnosed with HHD or equivalent time for controls?	0	1
4	When you travel or leave home, do you sometimes forget to bring along your medicine before you diagnosed with HHD or equivalent time for controls?	0	1

5	Did you take all your medicine the day before your diagnosis as HHD or equivalent time for controls? if they remember? If not jump this Q	1	0
6	When you feel like your symptoms are under control, do you sometimes stop taking medicine before you diagnosed with HHD or equivalent time for controls?	0	1
7	Taking medicine every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan before you diagnosed with HHD or equivalent time for controls?	0	1
8	How often do you have difficulty remembering to take all your medicine before you diagnosed with HHD or equivalent time for controls? 1= Never /rarely, 0=Once in a while, 0 = Sometimes, 0= Usually, 0= All the time		
	Total score		

Thank you for your cooperation!

Amharic Version

Annex: የአማርኛ መጠይቅ ቅፅ

ቅፅ 1: የስምምነት ቅፅ

ወድ ያቃለ መጠይቅ ተሳታፊ፤ እንደምን አደሩ/ዋሉ?

ስሜ__________________________ ይባላል። እኔ የምርምር ረዳት ነኝ ከጅማዩኒቨርስቲ **ከአቶ ዲንቃከበደ** ጋር እሰራለሁ። በአዳማ ሆስፒታል ሜዲካል ኮሌጅ እና በበሾፍቱ አጠቃላይ ሆስፒታል ክትትል በሚደርጉ የደምግፊት ታካሚዎች መካከል ከደምግፊት ጋር የተያያዘ የልብበሽታዎችን የምያስኑ ነገሮችን ለመለየት ጥናት ያደርጋል፡፡ እኔ ሚጃ ልሰጥዎ እና የዚህ ምርምር አካል እንዲሆኑ እጋብዞዎታለሁ፣ ለመሳተፍ ከተስማሙ፣ዘዎን 20 ደቂቃያህል የሚወስድ መጠይቅ እንዲመልሱ ይጠየ ቃሉ። በዚህ ጥናት ላይ በመሳተፋችሁ ምክንያት ምንምጉዳት እና ፈጣን ጥቅምአያገኙም፡፡ ሆኖምግን እርስዎ የሚሰጡ ምላሾች በጣምአስፈላጊ ስለሆኑ ጥናቱ በተሳካ ሁኔታእንዲከናወን ብቻሳይሆን የደምግፊት ታካሚዎች ዉስጥ የመከላከል እንቅስቃሴዎችን ለማቀድ እና ለማዋገበር የሚረዳ ጠቃሚሚጃን ለማፍለቅ ጭምር ነው፡፡ ይህንን ቃለ መጠይቅ በመጠቀምየሚገኙት ሚጃ ለምርምር ብቻየሚዉል ስሆን ፣ ሚስጥራዊነት ዋነኛውጥረታችን መሆኑን ላረጋግጥላችሁ እፈልጋለሁ፡፡ ስለዚህ; በዚህ ቃለ መጠይቅ ላይ እንዲሳተፉ ትብብራችሁን በትህትና እጠይቃለሁ፡፡ በጭራሽ ምላሽ ላለመስጠት ወይም እስከዚያው የመመለስ መብት አለዎት ፣ ግን የእርስዎ ተሳትፎ ለአላማችን ስኬት ትልቅ ዋጋ አለው፡፡ ተጨማሪ ጥያቄ ካለዎት፣ በ **0917439409** ወይም**ribkadinka84@gmail.com** ደንቃከበደን ማገኘት ይችላሉ፡፡

በቃለ መጠይቁ ለመቀጠል ተስማምተዋል?

አዎ; ---- በቃለ መጠይቁ ይቀጥሉ;

አይ---- አመሰግንና/ኚ እና ጨርስ/ሺ

ፈቃዱን የጠየቀ የቃለ-መጠይቅ ስም____

ቀንና ፊርማ____

Part I: Case identification checklist

S.N	Variables	Options	Remarks
1	ECG findings indicative of HHD	1.Yes 2.No	
2	Echocardiogram indicative of HHD	1.Yes 2.No	
3.	MRI indicative of HHD	1.Yes 2. No	
4.	CT scan indicative of HHD	1.Yes 2.No	

Part II Data extraction checklist

Checklist CODE_____

S. N	Variables		Remarks
1	BMI	Weight in kg_____ Height in m_____	
2.	Total cholesterol	In mg/dl _____	
3.	HDL Cholesterol	In mg/dl_____	
4.	LDL cholesterol	In mg/dl_____	
5.	Comorbid DM	1.Yes	
		2.No	
6.	Baseline BP	_____mmHg	
7.	BP control	1.Controlled	
		2.Uncontrolled	
8.	Duration of HTN	_____ in years	
9.	Anti-hypertensive	1.Single drug	

	Medications	2.Two drug	
		3.Three or more drug combinations	

Part III Interviewer administered Questionnaires

Questionnaire Code in Match of data extraction checklist code _____

Q. No	Variables	Possible answers/choices	Skip to:	Remark
Q1	የተጠሪ ፆታ	1. ወንድ 2. ሴት		
Q2	ዒድሜ	የተጠሪ ዕድሜ_____ በ ዐ. ም		
Q3	ሀይማኖት	1. ኦርቶዶክስ 2. ፕሮቴስታንት 3. ሙስሊም 4. ዋቄፋታ 5. ሌለ (ይግለጹ_____)		
Q4	ብሄር	1. ኦሮሞ 2. አማራ 3. ጉራጌ 4. ትግሬ 5. ሌለ (ይጥቀሱ_____)		
Q5	የጋብቻሁኔታ	1. ያላገባ/ች 2. ያገባ/ች 3. የተፋታ/ች 4. የሞተባት/በት 5. ሌለ (ይጥቀሱ_____)		
Q6	የትምህርት ሁኔታ	1. መደበኛ ትምህርት የለመም 2. የመጀመሪያ (1-8) 3. ሀለተኛ ደረጃ (9-12) 4. ከፍተኛ ትምህርት		
Q7	የመኖሪያ ቦታ	1.ከተማ 2. ገጠር		
Q8	ሥራ	8. የመንግስት ሰራተኛ 2. ገበሬ 3. ነጋዴ 4. የቤት አያቴት 5. ዕለታዊ ሠራተኛ 6. ተማሪ 7. የግል ሰራተኛ 8. ሥራ አጥ ሌለ (ይጥቀሱ_____)		
Q9	ሚሃዊ ገቢ	**በ ብር_____**		
Q10	የልብበሽታከቤተሰብዎ ጫጥ ያለዉሰዉአለዎት	1.አዎ 2. የለኝም		

Part IV lifestyle related variables

Q. No	Variables	Possible response	Skip to	remarks
Smoking All questions are designed to collect history before HHD diagnosis and equivalent time for controls.				
Q10	በ ልብበሽታከማየዞ በፊት (cases) ሲጋራ አጨ·ነ በር?	1.አዎ 2.አይ	If no go to Q11	
Q11	በየቀኑ ወደምጠ·ዙ ጊዜ የሚያጨ·ከሆነ ለምን ያህል ጊዜ?	_____ _____		
Q12	በ ልብበሽታከማየዞ በፊት (cases) በየቀኑ ሲጋራ ያጨ·ያወቃሉ?	1.አዎ 2.አይ		
Q13	በ ልብበሽታከማየዞ በፊት (cases) በየቀኑ ሜጨን ካቆሙት ስንት ዓመት ሆኖታል?	1. በአመት_____ 2. በወር____		
የምጠጡአጠቃቀምAll questions are designed to collect history before HHD diagnosis and equivalent time for controls.)				
Q15	በ ልብበሽታከማየዞ በፊት(cases) አርሶ ወይስ ማኛውምአቤት ያለ ሰው፡ ምጠስያበስሉ ወይምስማበ፤ አንድሰዉበአንድግዜ የምበላዉ ምጠዉጥ ከአንድመካከለኛ የሻይ ማኪያ በላይ ጨዉይጠቀማሉ?	1.አዎ 2.አይ		
የአልኮል መጠጥ አወሳሰድ(All questions are designed to collect history before HHD diagnosis and equivalent time for controls).				
Q15	በ ልብበሽታከማየዞ በፊት (cases) እንደ በራ፣ ወይን ፣ አረቄ ያሉ የአልኮል መጠጦችን መቼምጠጥተውያወቃሉ?	1.አዎ 2.አይ	If no go to Q19	
Q16	በ ልብበሽታከማየዞ በፊት (cases) 12 ወራት በፊት በ ነ በረ ጊዜ ዉስጥ የአልኮል መጠጥ ተጠቅሟል?	1.አዎ 2.አይ		
Q17	መልሶ አዎ ከሆነ ፣ ቢያንስ አንድየአልኮል መጠጥ ምን ያህል ጊዜ ጠጥተዋል?	1.በየቀኑ 2.5-6 ቀናት በሳምንት 3.1-4 ቀናት በሳምንት		

		4.1-3 ቀናት በወር 5.በወር ከ 1 ገን ያነ ሰ		
Q18	በአለፉት 30 ቀናት ወቅጥ አልኮል ሲጠጠብአማኪይ በአንድየ ማጠጥ ጊዜ ወቅጥ ምን ያህል መጀበኛ የ አልኮል ማጠጦች?አይነ ቱን ይግለጹ	1.በቁጥር_____ አላወቅም77		
ምጦብአጥቃቀም (All questions are designed to collect history before HHD diagnosis and equivalent time for controls)				
Q19	በ ልብበሽታከማያዞ በፊት (cases) በሳምንት ስንት ቀናት ፍራ ፍሬ ይበላሉ?	1. የ ቀን ብዝት__ አላወቅም77		
Q20	በእነ ዚያ ቀናት ወቅጥ በአንዱ ጊዜ ስንት ያህል የ ፍራፍሬ አቅርቦቶች ብዝት ይጣ ባሉ?	1. የ ቀን ብዝት__ አላወቅም77		
Q21	በተለመጀወሳምት ወቅጥ ስንት ቀናት አትክልቶችን ይጣ ባሉ?	1. የ ቀን ብዝት__ አላወቅም77		
Q22	በ ልብበሽታከማያዞ በፊት (cases) አብዘኛወን ጊዜ በቤተሰብዎ ወቅጥ ለምጦበዝግጅት የ ሚዉለወንማ ዓይነ ት ዘይት ወጀምስብነ ወ?	1. የ አትክልት ዘይት 2. ቅቤ 3. ለለ 4. ምንም አልተጠቀመም		
Physical activity (All Questionnaire items are designed to collect a history before heart diseases or equivalent time for controls)				
Q23	ሥራዎ በትንሹ ለ 10 ደቂቃዎች ያህል ከፍተኛ ትንፋሽ ወጀምየ ልበምቱን የ መቱዉየ የ መለለ (ከባድ ሸክማችን መሸከምወጀምማ ሳት ፣ መቆፈር ወጀምየ ግንባታ ሥራ) የ ሚያስከትሉ ኃይለኛ እንቅስቃሴን ያካትታል?	1 አዎ 2 አይ	2 ከሆነ ወደ Q25 ዕለፍ	
Q24	በተለመጀወቀን በሥራ ላይ ኃይለኛ እንቅስቃሴዎችን ለ ማድረግ ምን ያህል ጊዜ ያሳልፋሉ?	በሳዕት___:_____		
Q25	ሥራዎ በትንሽ ትንፋሽ ወጀምልበ ምት ያለ ማዞረ ጥ ለ 10 ደቂቃዎች ያህል የ ሚቱዉየ እንደ (ፈጣን ጉዞ ወጀምቀላል ሸክማችን) የ ሚያደርግ እንቅስቃሴን ያካትታል?	1 አዎ 2 አይ	2 ከሆነ ወደ Q27 ዕለፍ	
Q26	በተለመጀወቀን በሥራ ላይ መጠ ኛ ኃይለኛ እንቅስቃሴዎችን ለ ማድረግ	በሳዕት_____:_____		

	ምን ያህል ጊዜ ያሳልፋሉ?			
Q27	ወደ ቦታዎች ለመሄድና ለመመለስ በተከታታይ ቢያንስ ለ 10 ደቂቃዎች አንድ ብስክሌት ወይም በእግር ይጠቀማሉ?	1 አዎ 2 አይ	2 ከሆነ ወደ Q29 ዕለፍ	
Q28	በተለመደው ቀን ለማዝ በእግር ወይም በብስክሌት ምን ያህል ጊዜ ፈጅተዋል?	በሰዐት___: _____		
Q29	እንደ [ሩጫ ወይም እግር ኳስ] ያሉ ያለማቋረጥ ለ 10 ደቂቃዎች ከፍተኛ የትንፋሽ ወይም የልብ ምት ፍጥነ ት እንዲፈጠር የሚደርጉ ኃይለኛ ስፖርቶችን ፣ የአካል ብቃት እንቅስቃሴዎችን ወይም ማዜና እንቅስቃሴዎችን ያደርጋሉ?	1 አዎ 2 አይ	2 ከሆነ ወደ Q27 ዕለፍ	
Q30	በተለመደው ቀን ለመቀመጥ ወይም በማናት ምን ያህል ጊዜ ያሳልፋሉ?	በሳዐት __: _____		

Stress (Kessler Psychological Distress Scale) All questions are designed to collect history before HHD diagnosis and equivalent time for controls.

S.N	ጥያቄዎች	1.የትኛውም ጊዜ በሆን የለም	2. ትንሽ ጊዜ	3.አንዳ ንድጊዜ	4. ብዙ ጊዜ	5. ሀል ጊዜ
Q31	ባለፉት 30 ቀናት ያለ በቂ ምክንያት ለምን ያህል ጊዜ እንደደከመዎ					
Q32	በአለፉት 30 ቀናት ወጣጥ ስንት ጊዜ ያህል ብስጭት ስሜት ተሰምቶዎታል?					
Q33	ባለፉት 30 ቀናት ወጣጥ ምን ያህል ጊዜ ተረብሸውስለነ በረ ምንምነ ገር ሊያረጋጋዎት አልቻለም?					
Q34	ባለፉት 30 ቀናት ወጣጥ ስንት ጊዜ ያህል የተስፋ መቁረጥ ስሜት ተሰማዎት?					
Q35	ባለፉት 30 ቀናት ወጣጥ ስንት ጊዜ ያህል እረፍት ማጣት ወይም የነጠሸነ ት ስሜት ይሰማዎታል?					
Q36	ባለፉት 30 ቀናት ወጣጥ ፣ ምን ያህል ጊዜ ያህል እረፍት እንደሰማዎት ሆኖ ዝምብለወመቀመጥ አልቻለም?					
Q37	ባለፉት 30 ቀናት ወጣጥ ስንት ጊዜ ያህል የማፊስ ጫንቀት ይሰማዎታል?					

Q38	ባለፉት 30 ቀናት ዉስጥ ፣ ሀለምነ ገር ሽከምእንደነ በረ ምን ያህል ጊዜ ተሰማዎት?					
Q39	ባለፉት 30 ቀናት ዉስጥ ምን ያህል ጊዜ በሀዘን እንደተሰማዎት ምንም ነ ገር ሊያበረታታዎት አልቻለም?					
Q40	ባለፉት 30 ቀናት ዉስጥ ምን ያህል ጊዜ ዋጋ በሰ እንደሆኑ ይሰማዎታል?					

ሞዚስኪ" መድኃኒትን በታዘዘውመሠረት በአግባቡስለመዉሰድመመሌከያ- 8

S. N	Items	Yes	No
1	አንዳንድጊዜ መድኃኒትዎን ረስተውሳይወስዱቀርተዉያወቃሉ?	0	1
2	ሰዎች አንዳንድጊዜ ከመሮሳት በተሬፀዬ ባሉት የተሊያዩ ምክንያቶች መድኃኒታቸዉን ሳይወስዱይቀሪሉ፡ ፡ ባለፉት ሀለት ሳምንታት፣ መድኃኒትዎን ሳይወስዱየቀሩበት ቀኖች ነበሩ?	0	1
3	መድኃኒትዎን እየ ወሰዱህማሞ ሲበባስ ሐኪምዎን ሳያማክሩ መድኃኒትዎን አቋርጠው ያወቃሉ?	0	1
4	በጉዞ ወይምበለለ ምክንያት ከቤትዎ ርቀውሲጓዙ አንዳንድጊዜ መድኃኒትዎን ረስተወት ሳይወስዱያወቃሉ?	0	1
5	በትላንትናወዕለት ሀለንምመድኃኒትዎን ወስደዋል?	1	0
6	ህማሞ ሲሻልዎት(የህማምስሜቶች ሲጠፉ) አንዳንድጊዜ መድኃኒትዎን አቋርጠውያወቃሉ?	0	1
7	መዴሀኒቶችን በየቀኑ መዉሰድ ለአንዳንድ ሰዎች ምቾት ይነሳቸዋል። እርስዎ በህክምና ክትትልዎ ወቅት በየቀኑ ወይምአንደምጊዜ ሳያዛንፉ መድዛኒት በትክክል ለመዉሰድተሰላችተዉያወቃሉ?	0	1
8	ሀለንምመድዛኒቶች መዉሰድአለመዉሰድዎን ማዘታወስ የከበደዎት ጊዜ አለ? 1=በፍፀም, 0= አልፎአልፎ, 0= አንዳንድጊዜ, 0= አብዘኛዉጊዜ,, 0= ሀልጊ		
	Total score		

ለትብበርዎ እናመሰግናለን!!

Annex-3 Afaan Oromoo Version Questionnaires

Kutaa 1ffaa: Fuula odeeffannoo fi foormii eyyamamtummaa

Nagaan isiniif hata'u!

Akkam bultan/Ooltan? Maqaan koo _____jedhama.

Ani gargaaraa Barataa Jimmaa yuunivarsitii kan ta'e Obbo Dinqaa Kabbadati. Innis Qorannoo "wantoota nama dhibee dhiibbaa dhiigaan qabamee yaalarra jiru tokko akka gara dhibee onneetti ce'u sababa ta'an adda baasuuf Hospitaala Kolleejjii Meedicala Adaamaafi Hospitaala Waliigalaa Bishooftuu keessatti kan gaggeessu yeroo ta'u, Qorannoon kun maastersii Fayyaa Hawaasaa damee Epidemiology dirree tiin akka argatuuf walakkaan kan gargaaruudha. Kanaaf Ani amma odeeffannoo barbaachisu isiniif kenneen akkasin qorannoo kana keessatti qooda qabaattan isin afeera. Yoo itti walii galtean gaaffiiwwan muraasaaf deebii kennitu, kunis daqiiqaa 20 yeroo keessanirraa fudhachuu danda'a.Sababa qorannoo kana keessatti qooda fudhattaniif miidhaan tokkoyyuu kan isinirra hin geenyeefi akkasumas fayidaa battalia argachuu dhiisuu dandeessu. Garuummoo deebii isin nuuf kennitan qorannoo kana karaa milkaa'aa ta'een raawwachuu qofaaf utuu hin taane namoota dhibee dhiibbaa qabaniif yaalaafi deggersa godhamu karoorsuu fi hojiirra oolchuu keessatti ga'ee olaanaa qaba.

Odeeffannoon yeroo afgaaffii kana isin kennitan qorannoo kana qofaaf kan oolu yommuu ta'u, iccitiin odeeffannoo keessan kamiyyuu ifa kan hin baane ta'uu isiniifan mirkaneessa. kanaaf afgaaffii kana keessatti qooda akka fudhattan kabajaanan isin gaafadha.

Yeroo kamittiyyuu gaaffi gaafatamtan guutummaan deebisuu dhiisuu ni dandeessu. Akkasumas addaan kutuu ni dandeessu. Garuummoo hirmaannaan keessan milkaa'ina qorannoo kanaaf baay'ee murteessaadha, Gaaffii dabalataa yoo qabaattan obbo Dinqaa Kabbadaa karaa 0917439409 ykn email: ribkadinka84@gmail.com gaafachuu ni dandeessu. Afgaaffii kana itti fufnuu? 1. Eyyee---- itti fufi, 2. Lakkii---- galateeffadhuu xumuri

Maqaa fi mallattoo Nama afgaaffii gaggeessee _____ guyyaa_____ Hirmaannaa keessaniif galatoomaa!

Part I: Case identification checklist

S.N	Variables	Options	Remarks
1	ECG findings indicative of HHD	1.Yes 2.No	
2	Echocardiogram indicative of HHD	1.Yes 2.No	
3.	MRI indicative of HHD	1. Yes 2. No	
4.	CT scan indicative of HHD	1.Yes 2.No	

Part II Data extraction checklist

Checklist CODE_____

S. N	Variables		Remarks
1.	BMI	Weight in kg_____ Height in m_____	
2.	Total cholesterol	In mg/dl _____	
3.	HDL Cholesterol	In mg/dl_____	
4.	LDL cholesterol	In mg/dl_____	
5.	Comorbid DM	1.Yes	
		2.No	
6.	Baseline BP	_____mmHg	
7.	BP control	1.Controlled	
		2.Uncontrolled	
8.	Duration of HTN	_____ in years	
9.	Anti-hypertensive Medications	1.Single drug	
		2.Two drug	

		3.Three or more drug combinations	

Kutaa 3ffaa

Gaaffiiwwan afgaaffii

Questionnaire Code in Match of checklist code

_____

Q. No	Gaaffiiwwan	Deebiifi filannoowwan	Ce'umsa:	yaadaa
Q1	Saala nama hirmaatuu	1.Dhiira 2. Dhalaa		
Q2	Umurii nama hirmaatuu	_____ wagga dhaan		
Q3	Amantaa	1. Orthodoksii 2. Pirotestaantii 3. Musliima 4. Waaqeffataa 5.kan biraa (ibsi_____)		
Q4	Saba	1. Oromoo 2. Amhaaraa 3. Guraagee 4. Tigree 5. Kan biraa (ibsi_____)		
Q5	Haala gaa'ela	1.Kan hin fuune/hin heerumne 2.Kan fuudhe/heerumte 3. Kan wal hike 4. Kan irraa du'e /duute 5. Kan biraa (ibsi_____)		
Q6	**Haala barnootaa**	1. Barnoota idilaa'aa kan hin qabne 2. Sadarkaa 1ffaa (1-8) 3. Sadarkaa 2ffaa (9-12) 4. Barnoota olaanoo		
Q7	**Bakka jireenyaa**	1. Magaalaa 2. Baadiyyaa		
Q7	**Hojii dhaabbataa**	1.Hojjetaa mootummaa 2. Qonnaan Bulaa 3. Daldalaa		

		4. Haadha manaa 5. Hojii guyyaa /guyyuu 6. Barataa 7. Hojii dhuunfaa 8. Kan hin mindeeffamne 9. Kan biraa (ibsi_____)		
Q8	**Galii ji'aa**	Qarshii dhaan _____		
Q9	**Maatii hidda dhiigaan sitti dhiyaatan keessaa namni dhibee Onneen qabame jiraa?**	1.Eyyee 2.Lakkii		

Kutaa 4ffaa Haala Amala jireenyaa ilaalchisee

Q. No	Gaaffiiwwan	Deebii ta'uu malu	Yoo hin jiraanne ce'i	remarks
	Tamboo ilaalchisee			
Q10	Utuu dhibee Onneetiin hin qabamin dura (cases) bu'aa tamboo kan ta'an kan akka cigaaraa, kamshaa ykn gaayyaa ni xuuxxa turtee?	1.Eyyee 2.Lakkii	Yoo 2 ta'e Q11 ce'i	
Q11	Yoo guyyuu ykn yeroo baayyee ni xuuxxa ta'e yeroo hagamiif?	Wagga_____ Ji'a_____		
Q12	Utuu dhibee Onneen hin qabamin dura (case), takkaa guyyuu(yeroo hunda) xuuxxee beektaa?	1.Eyyee 2.Lakkii		
Q13	Utuu dhibee Onneen hin qabamin (cases) yeroo hagamiif xuuxuu dhaabde?	1. waggaa _____ 2. ji'a_____		
Itti fayyadama soogiddaa				
Q15	Utuu dhibee Onneetiin hin qabamin (cases) ati ykn namni nyaata siif qopheessu guyyaatti nyaata ati nyaattutti fal'aana sukkaaraa ishee xiqqoo tokkoo ol itti naqaa turee?	1.Eyyee 2.Lakkii	Yoo 2 ta'e gara Q16tti ce'i	

Dhugaatii Alkoolii				
Q16	Utuu dhibee Onneetiin hin qabamin(cases) takkaa dhugaatii alkoolii of keessaa qabu kan akka Biiraa, Araqeefaa dhugdee beektaa?	1.Eyyee 2.Lakkii	Yoo 2 ta'e gara Q17tti ce'i	
Q17	Utuu dhibee Onneen hin qabamin(cases) ji'oota 12n darban keessatti dhugaatii alkoolii dhugdee beektaa?	1.Eyyee 2.Lakkii		
Q18	Utuu dhibee Onneen hin qabamin(cases) ji'oota 12n darban keessatti dhugaatii alkoolii yeroo tokkollee yoo ta'e hammamiif dhugdee beekta?	1.Guyya Guyyaan 2.torbanitti yeroo 5-6 3.torbanitti yeroo 1-4 4.ji'atti yeroo 1-3 5.ji'atti yeroo 1 gadi		
Q19	Utuu dhibee Onneetiin hin qabamin dura(cases) Guyyoota 30n jiran keessatti yeroo dhugdu, giddugaleessaan dhugaatii alkoolii hagam dhugda? Gosa isaa ibsi	1.lakk _____ 2.hin beeku 77		
Haala nyaataa				
Q20	Utuu dhibee Onneen hin qabamin (cases) torban tokko keessatti guyyaa meeqa fuduraalee nyaatta?	1. Baay'ina guyyaa 2.Hin beeku 77		
Q21	Guyyoota fuduraalee nyaattu kana yeroo meeqa dhiyeeffattee nyaatta?	1. lakk. _____ 2. Hin beeku 77		
Q22	Utuu dhibee onneen hin qabamin dura (cases) torban tokko keessatti guyyaa meeqa muduraalee nyaatta?	1.Lakk _____ 2. Hin beeku 77		

Q23	Utuu dhibee Onneen hin qabamin (cases) nyaata yeroo qopheeffattu yeroo baay'ee zayita ykn cooma isa kamiin fayyadamta?	1.kan muduraalee 2. dhadhaa 3. kan biraa (ibsi___) 4.homaayyuu 77.Hin beeku		
Sochii qaamaa (All Questionnaire items are designed to collect a history before HHD diagnosis or equivalent time for controls)				
Q24	Hojiin ati hojjettu sochii qaamaa cimaa kan afuura baafannaa fi dha'annaa Onnee kee dabalu (kan akka Ijaarsaa, qonnaa fi ba'aa baachuufaa) walitti fufiinsaan daqiiqaa 10f kan turuu danda'uudhaa?	1 Eyyee 2.Lakkii	Yoo lakkii ta'e gaaffii 25tti ce'i	
Q25	Guyyaatti sochii qaamaa cimaarratti yeroo hagamii dabarsita?	Sa'atiin___: ____		
Q26	Hojiin ati hojjettu sochii qaamaa giddugaleessa kan afuura baafannaa fi dha'annaa onneekee xiqqoo dabalu (kan akka deemsa miillaa fi ba'aa xixiqqaa baachuufaa) walitti fufiinsaan daqiiqaa 10f kan turuu danda'uudhaa??	1 yes 2 No	If No go to Q 27	
Q27	Guyyaatti sochii qaamaa giddu galeessaarratti yeroo hagamii dabarsita?	Sa'atii____: ____		
Q28	Iddoodhaa iddootti yeroo sochootu miillaan ykn motor saayikiliin yoo xinnaate daqiiqaa 10f walitti fufinsaan ni gootaa?	1 Eyyee 2 Lakkii	Lakii yoo ta'e gara gaaffii 29tti ce'i	
Q29	Guyyaatti yeroo sochii gootu miillaanis ta'e saayikiliin hagam sitti fudhata?	Sa'a___:daq____		
Q30	Sochii spoortii cimaa kan akka ga'umsa qaamaas	1 Eyyee	Yoo lakkii	

	ta’e bashannanaaf kan afuura baafannaa dabalu ykn rukuttaa onnee dabaluu danda’u (kan akka fiigichaa, kubbaa miillaa faa) daqiiqaa 10 f walitti aansitee ni hojjettaa?	2 Lakkii	ta’e ce’i	
Q31	Guyyaatti taa’umsaafis ta’e ciisichaaf saa’atii meeqa fudhatta?	Sa’a _____: _____		

Gaaffii haala dhiphina sammuu ilaalchisee

	Gaaffiiwwan	0	1	2	3	4
32	Utuu dhibee onneen qabamuun kee hin beekamin ji’a tokko dura yeroon ati sababa tokko malee miirri dadhabbii sitti dhaga’ame jiraa?					
33	Utuu dhibee onneen qabamuun kee hin beekamin ji’a tokko dura callistee jeeqamtee ni beektaa?					
34	Utuu dhibee onneen qabamuun kee hin beekamin ji’a tokko dura jeeqamtee hanga wanti si tasgabbeessu dhibutti geesseettaa?					
35	Utuu dhibee onneen qabamuun kee hin beekamin ji’a tokko dura miira abdii kutannaa keessa galteettaa?					
36	Utuu dhibee onneen qabamuun kee hin beekamin ji’a tokko dura miira tasgabbii dhabuu keessa galtee beektaa?					
37	Utuu dhibee onneen qabamuun kee hin beekamin ji’a tokko dura miira tasgabbii dhabuu hanga si teessisuu si dhorkutti si ga’ee beektaa?					
38	Utuu dhibee onneen qabamuun kee hin beekamin ji’a tokko dura miira mukaa’uu keessa galtee beektaa?					
39	Utuu dhibee onneen qabamuun kee hin beekamin ji’a tokko dura waanti hundinuu carraaqqiin malee waan hin raawwatame sitti fakkaateeraa?					
40	Utuu dhibee onneen qabamuun kee hin beekamin ji’a tokko dura miira gaddaa qofa keessa galtee, wanti si gammachiisu tokkoyyuu akka hin jirreetti yaaddee beektaa?					
41	Utuu dhibee onneen qabamuun kee hin beekamin ji’a tokko dura takkaa homaafuu waa’ee akka hin baasnetti of yaaddee beektaa?					

1= gonkumaayyuu, 2= darbee darbee, 3= yeroo tokko tokko, 4= yeroo baay’ee, 5= yeroo hundaa

Itti fayyadama qorichaa ilaalchisee

S. N	Items	Yes	No
1	Utuu dhibee onneetiin hin qabamin (cases) qorichakee yeroo tokko tokko	0	1

	liqimsuu hin irraanfatta turtee?		
2	Namoonni irraanfannaa maleeyyuu akkasumatti qoricha kan utuu hin liqimsin hafan jiru yeroo tokko tokko. Utuu dhibee onneen hin qabamin dura tarban lama kan ta'u dursitee, mee yaadi yeroon ati qorichakee itti hin fudhanne jiraa?	0	1
3	Utuu dhibee onneen hin qabamin dura(cases) takkaa qoricha addaan kuttee ykn dhaabdee beektaa fknf dhibee natti hammeessaa jira jettee yaaddee utuu ogeessa fayyaatti hin beeksisin	0	1
4	Utuu dhibee onneen hin qabamin dura(cases) yeroo imaltu ykn manaa baatu yeroo tokko tokko qoricha fudhattee ba'uu ni irraanfattaa?	0	1
5	Guyyaa dhibee Kanaan qabamuukee barte dura(cases) qoricha guutummaatti fudhatteettaa? Kaleessa qoricha kee guutummaatti fudhatteettaa(controls)? Yoo yaadatan, yoo hin yaadanne darbi	1	0
6	Utuu dhibee onneen hin qabamin dura (cases) yeroo mallattoon dhibee dhiibbaa dhiigaakee to'atameera jettee yaaddu yeroo tokko tokko qoricha fudhachuu ni dhaabdaa?	0	1
7	Namoota tokko tokko qoricha yeroo hundaa fudhachuun hin mijatuuf. Utuu dhibee onneen hin qabamin dura takkaa karoora yaala kanaaf utuu ofin qopheessin akka dhiibbaan sirraan ga'amee itti galteetti sitti dhaga'ameeraa?	0	1
8	Utuu dhibee onneen hin qabamin dura(cases) yeroo hagamiif qorichakee hunda fudhachuu yaadachuun si rakkisa? 1= gonkumaayyuu, 0= darbee darbee, 0 = yeroo tokko tokko, 0 = yeroo baay'ee, 0= yeroo hunda		
	Total score		

ASSURANCE OF PRINCIPAL INVESTIGATOR

I the undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the Faculty of Public Health in effect at the time of grant is forwarded as the result of this application.

- Name of the investigator: **Dinka Kebede**

Date. _____ Signature _____

Approval of the first advisor

This Thesis proposal has been submitted with my approval as the University advisor

- Name of the first advisor: **Mrs Chaltu Fikru (MPHE, Assistant professor)**

Date. _____ Signature _____

Approval of the second advisor

This Thesis proposal has been submitted with my approval as the University advisor

- Name of the second advisor: **Mr. Habtamu Abebe (MSc, Lecturer)**

Date. _____ Signature _____