Patterns and Factors Associated With Dyslipidemia among Type 2 Diabetes Patients Attending Chronic Disease Management Clinics in Turbo Sub-County, Uasin Gishu County, Kenya

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DECLARATION

This thesis is my original work and has never been submitted for the award of a degree in any University.

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DEDICATION

This thesis is dedicated to my dear parents; Mr Richard Sang and Mrs Basiliza Maindi, my wonderful siblings Miriam, Faith, Dennis and Abby for their immense support and encouragement throughout the process. Thank you for standing by my side.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

ADA	American Diabetes Association
AMPATH	Academic Model Providing Access To Healthcare
ARV	Antiretroviral
BMI	Body mass index
BP	Blood pressure
CDM	Chronic diseases management
CVDs	Cardiovascular diseases
DASH	Dietary approaches to stop hypertension
HbA1^{c}	Glycated haemoglobin
HDL-C	High density lipoprotein cholesterol
JKUAT	Jomo Kenyatta University of Agriculture and Technology
LDL-C	Low density lipoprotein cholesterol
MET	Metabolic Equivalent
MI	Myocardial infarction
MOH-K	Ministry of Health-Kenya
MTRH	Moi Teaching and Referral Hospital
MU	Moi University
NCDs	Non-Communicable Diseases
T2DM	Type 2 diabetes mellitus
TC	Total Cholesterol
TG	Triglycerides
WHO	World Health Organization

DEFINITION OF OPERATIONAL TERMS

Cardiovascular diseases- This refers to a group of disorders of the heart and blood vessels. Diabetes patients have a high chance of developing it.

Cardiovascular risk factor- This is a condition that is associated with an increased chance/risk of developing cardiovascular disease.

Chronic Disease Management clinics- These refer to AMPATH clinics that plan and coordinate the healthcare of patients with chronic or terminal medical conditions, likely; (or is likely to be) present for six months or longer for example diabetes and cardiovascular disease.

Dyslipidemia- This refers to abnormal amount of lipids in the blood. These include high low density lipoproteins, low high density lipoproteins and elevated triglycerides.

Hypertension- High blood pressure, sometimes called arterial hypertension, is a chronicmedical condition in which the blood pressure in the arteries is elevated.

Hyperglycaemia- is a disorder of having high level of blood sugar (than $HbA1^c$ of 6.5%). This is as a result of poor control of blood sugar.

Metabolic equivalent (MET) -ratio of a person's working metabolic rate relative to the resting metabolic rate. One metabolic equivalent is defined as the energy cost of sitting quietly and is equivalent to a caloric consumption of 1 kcal/kg per hour accumulating at least 600 metabolic equivalent minutes per week (minutes of physical activity can be accumulated over the course of a week but must be of duration of at least 10 minutes).

Non-communicable diseases-also known as chronic diseases are those that are not passed from person to person. They are of long duration and generally of slow progression. Examples are diabetes, heart attack, stroke and asthma.

Type 2 Diabetesmellitus- Condition that occurs when the pancreas does not produce enough insulin to maintain a normal blood glucose level, or when the body is unable to use the insulin that is produced resulting in insulin resistance and ultimately abnormal blood glucose level.

ABSTRACT

A large number of deaths worldwide are attributed to non-communicable diseases (NCDs). These NCDs are leading causes of deaths to more people yearly compared to other causes put together. Statistics show that about 80% of NCDs deaths happen in middle and low-income countries. Diabetes, an important NCD, contributes to this large mortality mainly through cardiovascular complications. Dyslipidemia is one of the major risk factors for cardiovascular disease in diabetes mellitus.The aim of this study was to determine dyslipidemia prevalence, patterns and the associated factors among type 2 diabetes mellitus patients attending Chronic Disease Management clinics (CDM) in Turbo sub-county, Uasin Gishu County, Kenya. This was a cross sectional study conducted between 2015 and 2016 atHuruma County hospital and Turbo health centre CDM clinics. Data was collected from 208 randomly selected participants using: structured questionnaires; health records and Focus Group Discussions (FGDs). Two FGDs were conducted each with 10 patients on knowledge, attitude and practice towards dyslipidemia and other cardiovascular risk factors. Laboratory investigations were also done to determine the lipid profile and fasting blood sugar. Quantitative data were analyzed using SAS 9.2.Wilcoxon test was used to compare lipid parameter means of males and females. Chi square was used to compare proportion between dysipidemia cases and normal. All variables at $p \leq 0.2$ in the univariate/bivariate analysis were included in the multivariable model. Using backward elimination criteria, variables that had a p value of <0.05 were considered significant. Qualitative data collected from FGDs were analyzed thematically. A total of 179 out of 208 (86.1%) patients had dyslipidemia. Up to 49% had elevated LDL-C, 71% low HDL-C, 47% high TC and 51% high TGs. Employment status [OR 3.1; (95% CI 1.3-7.5); p=0.01], BMI [OR 2.7; (95% CI 1.3-5.9); p=0.0007], FBS [OR 3.4; (95% CI 1.6-7.1); p=0.001] and physical activity [OR 4.8; (95% CI 1.1-21.2); p=0.04] were significantly associated with dyslipidemia. The study revealed a high prevalence of dyslipidemia among T2DM patients with a greater proportion reported in females. Low HDL-C was the most common pattern while elevated TC was least. High prevalence of dyslipidemia among T2DM patients attending CDM clinics in Turbo Sub-County require therapeutic and lifestyle modification coupled with enhanced patient education. Improved awareness of dyslipidemia and advanced training of care providers are important in reducing preventable cardiovascular episodes.

CHAPTER ONE

INTRODUCTION

1.1 Background

Non-communicable diseases (NCDs) result to more deaths worldwide; they kill more people yearly compared to other causes put together. Statistics indicate that about 80% of NCDs deaths happen in middle and low-income countries. Even with their steady growth and inequitable distribution, more of the social and human impact resulting yearly from NCD-related deaths can be reduced by less expensive, elaborate and feasible interventions (WHO, 2011).Cardiovascular diseases have become a leading cause of deaths and illnesses in developing countries with the rates expected to rise over the next few decades (Yusuf, Reddy, Ôunpuu, & Anand, 2001).

Diabetes is one of the NCDs that cause a high number of deaths (Mathers & Loncar, 2006). Type 2 diabetes mellitus (T2DM) is the most common form of diabetes and makes up about 90% of global diabetes cases, with the other 10% due primarily to type 1 diabetes mellitus and gestational diabetes. The burden of diabetes in the world is estimated to be 9% among adults aged 18 years and above (WHO, 2012). Diabetes caused about 1.5 million deaths with more than 80% of them occurring in low and middle-income countries. There is a projection that diabetes will be the 7th leading cause of death by 2030. A healthy diet, regular physical activity, maintaining normal body weight and avoiding tobacco use can prevent or delay the onset of type 2 diabetes (WHO, 2014). Cardiovascular diseases that include coronary heart diseases, stroke, and peripheral vascular diseases account for the majority of deaths in diabetic patients(Fauci, 1998).

Dyslipidemia being abnormal amounts of lipids in the blood are characterized byhigh total cholesterol (TC), high low-density lipoprotein cholesterol (LDL-C), low high-density lipoprotein cholesterol (HDL-C) and high triglycerides (TG). For diabetic patients their lipids should bewithin the following stated levels: LDL-

C<100mg/dl (2.6mmol/l), HDL-C> 40mg/dl (1.02mmol/l) and TG <150mg/dl (1.7mmol/l) (NCEP, 2001).

Research indicates that T2DM is increasing worldwide and is a significant risk factor for developing cardiovascular disease. A cluster of plasma lipid and lipoprotein abnormalities (low HDL-C, small dense LDL-C particles and elevated TG) contributes to the risk of atherosclerosis and coronary heart disease in the majority of T2DM patients(Krauss, 2004).

Evidence suggests that an isolated, non-fasting total cholesterol determination does not sufficiently select and identify patients at risk for vascular disease. Therefore, although a non-fasting assessment helped in previous tests, a fasting lipoprotein profile(total cholesterol, LDL-C, triglycerides, and HDL-C) is recommended to all patients in order to attain the most accurate lipid profiling (Jellinger et al., 2012).

1.2 Problem statement

Globally, NCDs lead in causing of deaths. Cardiovascular disease is the major cause of mortality in persons with diabetes. In patients with diabetes seventy-five percent of cardiovascular diseases are due to hypertension and related factors (Sowers, Epstein, & Frohlich, 2001). The CVDs account for up to 80% of the deaths in persons with type 2 diabetes (Haffner et al., 1998) which makes it a great public health concern.

According to Kenya STEPWise Survey for NCDs Risk Factors 2015 report, mortality attributed to CVD in Kenya is reported to be 6.1% to 8%. Additionally, 98% of participants have never checked their blood cholesterol levels with a majority of these at risk of dyslipidemia. It is also estimated that the prevalence of diabetes in adults in Kenya is 4.56% but there exists a variation of 2.7% (rural population) and 10.7% (urban population). Additionally, about 20,000 annual deaths in Kenya are attributable to diabetes (KNBS, n.d.2015). However, it is noted that most people with diabetes do not die of causes uniquely related to diabetes, but to cardiovascular complications that are caused by risk factors including dyslipidemia. To date, diabetes management in primary settings has focused on glycemic control at the expense of holistic management of all CVD risk factors in

these patients. Additionally, there is a gap in data on prevalence of dyslipidemia among T2DM patients in primary care settings in the country. It is important to address this burden in order to inform local management guidelines. Furthermore, a better understanding of the socio-demographic, economic, clinical and behavioral factors associated with dyslipidemia among people in the Kenyan set up will be useful in designing lipid screening protocols in future.

1.3 Justification

The global estimate of diabetes prevalence among adults was 422 million and was attributed 1.5 million deaths in the year 2012.This prevalence has steadily increased but is most rapid in low-and middle-income countries(WHO, 2016).A causal relationship in T2DM patients has been established between elevated lipid levels (especially TGs-rich particles and low HDL-C) and cardiovascular risk as shown in various findings from case-control, genetic, and large observational studies (Martín-timón et al., 2014). However, there is scanty information on dyslipidemia among T2DM patients in Kenya and awareness on the same despite the high mortality risk it poses. Additionally, the Kenyan guidelines do not clearly point out dyslipidemia's detriments. Intervention studies have shown that there is a reduction of cardiovascular deaths in diabetes patients when blood pressure and lipids are corrected (Adler, 2000).

There are cases of cardiovascular problems in T2DM patients attending hospitals in Uasin Gishu County inclusive of Turbo sub-county and there is little understanding of dyslipidemia among those patients. Turbo health centre serves rural population while Huruma sub-county hospital serves the urban population in Turbo sub-county. The burden of abnormal lipid profiles among the patients is not well described at Turbo sub-county despite the risk of heart related complications.There is need to scientifically document the existing levels of dyslipidemia among T2DM patients under primary care, to inform patient management, health planning and interventions.

1.4 Research questions

i) What is the prevalence and patterns of dyslipidemia among type 2 diabetes patients attending Chronic Diseases Management (CDM) Outpatient clinics in Turbo sub-county, Uasin Gishu County?

ii) What are the socio-demographic, economic, clinical and behavioural factors associated with dyslipidemia among type 2 diabetes patients attending CDM Outpatient clinics in Turbo sub-county, Uasin Gishu County?

iii) What is the knowledge, attitude and practices of type 2 diabetes patients on dyslipidemia attending CDM Outpatient clinics in Turbo sub-county, Uasin Gishu County?

1.5 Objectives

1.5.1 Broad Objective

The broad objective of this study was to determine the prevalence of dyslipidemia and the associated factors among type 2 diabetes patients attending Chronic Diseases Management (CDM) Outpatient clinics in Turbo sub-county, Uasin Gishu County, Kenya.

1.5.2 Specific Objectives

The overall objective of this study was further broken down to form the following specific objectives.

i. To determine the prevalence and patterns of dyslipidemia among type 2 diabetes patients attending CDM Outpatient clinics in Turbo sub-county, Uasin Gishu County.

ii. To determine the socio-demographic, economic, clinical and behavioural factors associated with dyslipidemia among type 2 diabetes patientsattending CDM Outpatient clinics in Turbo sub-county, Uasin Gishu County.

iii. To explore the knowledge, attitude and practices of type 2 diabetes patients towards dyslipidemia at CDM Outpatient clinics in Turbo sub-county, Uasin Gishu County.

1.6 Significance of the study

The information generated in this research will be shared with AMPATH Center Research unit, Ministry of Health and the health facilities to inform mitigation measures against dyslipidemia amongst T2DM patients. It is expected that the results will help the county and stakeholders in laying future improvement strategies for management of dyslipidemia among type 2 diabetes patients because of their increased cardiovascular risk. In addition, the findings will inform education and awareness campaigns on prevention of cardiovascular complications through modification of lifestyle. The recommendations will assist in increasing the individual responsibilities on self-care which in turn could help improve the response of the body to pharmacological therapy. The outcomes will inform future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Diabetes Mellitus

2.1.1 Type 2 diabetes mellitus

Type 2 diabetes mellitus (T2DM) is an NCD that is characterized by hyperglycemia which arises from defective insulin secretion, insulin action or both. Uncontrolled and prolonged hyperglycemia can result to irreversible long term damages and or multiple organ failure. These organs can include nerves, blood vessels, heart and eyes (ADA, 2013). T2DM is a global public health concern in the 21st century because its scale of challenge affects all people regardless of age or social class and accounts for about 90% all diabetes cases. The global T2DM prevalence among adults aged 27 -79years by 2015 was estimated to be 415 million and the number is projected to rise upto642 million in the year 2040 if no interventions are put in place to curb the disease(International Diabetes Federation, 2015).

2.1.2 Type 1 Diabetes Mellitus

Type 1 Diabetes Mellitus (T1DM) refers to an autoimmune disease characterized by T-lymphocytes(White blood cells) attacking insulin-producing pancreatic beta cells and accounts for 5-10% of all diabetes cases(Herold et al., 2002). The exact cause of T1DM has not yet been clearly described but risk factors may be genetic or environmental.

2.1.3 Diagnosis of Diabetes

Diabetes may be diagnosed based onplasma glucose criteria, either the fastingplasma glucose (FPG) or the 2-h plasmaglucose (2-h PG) value during a 75-g oralglucose tolerance test (OGTT), or A1C criteria(Kilpatrick, Bloomgarden, & Zimmet, 2009).

For diabetes mellitus to be diagnosed confirmatory tests which are either fasting plasma glucose of 7.0mmol/l, a 2-hPG 11.1mmol/l, plasma glucose above 11.1mmol/l 2 hours after 75 glucose load or a HbA1c above 6.5%; with polydipsia, polyuria, polyphagia and unexplained weight loss (ADA, 2013). Most of T2DM patients are diagnosed at age of 40 years with many being diagnosed as early as 35 years (Guidelines, Of, & Mellitus, N.D.,2010).

The A1C has several advantages compared with the FPG and OGTT, includinggreater convenience fasting not required)greater preanalytical stability, and less day-to-day perturbations during stressand illness However, these advantages may be offset by the lower sensitivity ofA1C at the designated cut point, greatercost, limited availability of A1C testing incertain regions of the developing world,and the imperfect correlation betweenA1C and average glucose in certain individuals(ADA, 2018).

When using A1C to diagnose diabetes,it is important to recognize that A1C isan indirect measure of average bloodglucose levels and to take other factorsinto consideration that may impact heamoglobin glycation independently ofglycemia including age, race/ethnicity, and anemia/hemoglobinopathies.Unless there is a clear clinical diagnosis(e.g., patient in a hyperglycemic crisisor with classic symptoms of hyperglycemia and a random plasma glucose>200mg/dL [11.1 mmol/L]), a second test isrequired for confirmation. It is recommended that the same test be repeatedor a different test be performed withoutdelay using a new blood sample for confirmation. For example, if the A1C is 7.0%(53 mmol/mol) and a repeat result is 6.8%(51 mmol/mol), the diagnosis of diabetesis confirmed. If two different tests (suchas A1C and FPG) are both above the diagnostic threshold, this also confirmsthe diagnosis(ADA, 2018).

2.1.4 Socioeconomic impact of diabetes

The estimated global expenditure on diabetes is about USD 465 billion out of which 80% is attributed to developed countries and only 20% is available for the developing countries. In United States ofAmerica, there has been an increased diabetes estimated cost between the years 2007–2012 from $174 billion to $245

billion which is a 41% increase(ADA, 2013). A study inTanzania found out that health budget allocation per person was $2 per year and yet thediabetes of care was estimated to be $138 per person per year (Chale, Swai, Mujinja, & McLarty, 1992). A similar study five years estimated the cost of managing complicationresulting from diabetes as the second consuming outpatient medical care with thecountry using $ 839,392 which was 30% of medical budget in the country(Chale et al., 1992).

2.2 Global burden of Dyslipidemia in T2DM

Dyslipidemia (abnormal lipoproteins) is common among T2DM patients across the world and increases the risk of cardiovascular diseases among these patients (Rani, Madhavi, Rao, Sahay, & Jyothy, 2005)**.** Approximately 124 million people have dyslipidemia within seven major countries worldwide. Less than 50% of people with high LDL-C are receiving treatment, and in treated patients, the disease is still under-controlled. Use of statins to lower LDL-C levels has been found to lower the risk of heart disease by about 30-45% in a period of 10 years (WHO, 2014).The World Health Organization estimated that dyslipidemia is associated with more than half of the global cases of ischaemic heart disease and more than 4 million deaths per year (WHO, 2002).

2.3 Burden of Dyslipidemia among T2DM patients in sub-Sahara Africa

Dyslipidemia has emerged as an important cardiovascular risk factor in sub-Saharan Africa. Research shows that high cholesterol level (≥3.8 mmol/l) accounted for 59% of ischemic heart disease and 29% of ischemic stroke burden in adults age 30 and over. Dyslipidemia, especially elevated cholesterol has been shown to vary across regions in sub-Saharan Africa (BeLue et al., 2009).

Dyslipidemia was initially perceived to be rare in Africans. Early reports suggested that people with African heritage have a lower prevalence of this CVD risk factor due to genetic, nutritional and environmental factors. It was also believed that protective HDL-C was significantly higher in tropical Africa, similar to reports showing that populations with increased intake of fish and marine have high levels

of HDL-C(Oguejiofor, Onwukwe, & Odenigbo, 2012). However, later findings showed that the current state of dyslipidemia in Nigeria clearly contradicted previous perceptions when (Jisieike-Onuigbo, Unuigbe, & Oguejiofor, 2011), reported a high prevalence of dyslipidemia.

2.4 Burden of dyslipidemia among T2DM patients in Kenya

Kenya being a developing country, the extent of most CVDs and the associated factors in the population is not clearly described. Non-communicable diseases are not given much attention because more focus is on communicable diseases and misclassification of diseases. According to the Annual Status Health Report 2007, the leading causes of deaths in Kenya are malaria, pneumonia, HIV/AIDS, diarrhoea, anaemia, tuberculosis, meningitis and heart failure. However, NCDs contribute to over 50% of the top 20 causes of morbidity and mortality (MOH-K, 2007).

The Kenya STEPWise Survey for NCDs Risk Factors Report estimated that the prevalence of elevated TC to be 1.5% of Kenya's population while low HDL-C levels were 50% and 60% for males and females respectively(KNBS, n.d.,2015).Dyslipidemia levels among T2DM patients in Kenya are still unclear although a previous hospital study found that elevated levels of total cholesterol and triglycerides requiring therapeutic intervention were noted in type 2 diabetic patients with no obvious chronic complications (Otieno, Mwendwa, Vaghela, Ogola, & Amayo, 2005). The current study sought to establish the prevalence and describe the types/patterns of dyslipidemia with regard to the above previous and relevant findings.

2.5 Factors associated with Dyslipidemia

2.5.1 Socio-demographic and economic factors

2.5.1.1 Age

Research shows that patients aged 50 years and above are likely to have dyslipidemia, hypertension and other cardiovascular risk factors (Al-Kaabba et al., 2012). There has been much debate on whether the age-related cholesterol increase could be as a result of a natural process of intrinsic ageing or whether it is due to age-associated anthropometrics or lifestyle changes (Grundy, 1997).

2.5.1.2 Gender

Low HDL-C, rather than high LDL-C cholesterol, is more predictive of coronary risk in women. Low HDL-C was found to occur in less magnitude in female diabetic patients as compared to males. In western India, it was found that low HDL-C prevalence was 90.2% in females and 54.9% in males (Gupta et al., 2003). Females have far lessHDL-Cwhich is an important coronary heart disease risk factor especially in patients with diabetes. Recommendations for diabetic patients include checking the fasting lipid profile especially among females to reduce the risk.

2.5.1.3 Level of Education

An inverse relationship has been found between level of education and prevalence of dyslipidemia, mainly for high TC. The prevalence was highest among illiterate individuals and lowest among middle school educated persons and then rose in the group of high school educated persons(Sun et al., 2014).

2.5.1.4 Level of Income and Occupation

The level of income is determined by the occupation and the level of education of individuals. Previously concluded study in China found that level of income was associated with dyslipidemia (Wang et al., 2011). Occupation has also been

previously described to be associated with dyslipidemia (Erem, Hacihasanoglu, Kocak, Deger, & Topbas, 2008).

2.5.1.5 Place of residence

A significant regional variation in lipid profiles has been observed. This was then related to the level of urbanisation and genetic variation. Migration from rural to urban centres and adoption of sedentary lifestyle was likely related to rising lipid levels and prevalence of dyslipidemia (Al-Kaabba et al., 2012).

2.5.1.6 Marital status

In a study done on the prevalence of dyslipidemia and associated risk factors among in Turkish adults, it was noted that there was an association between marital statuses of the subjects with dyslipidemia(Erem et al., 2008).

2.5.2 Clinical factors

2.5.2.1 Blood pressure

Available evidence strongly suggests that insulin resistance predisposes patients to hypertension (Grundy et al., 2004), and epidemiologic studies show a strong correlation between hypertension and dyslipidemia(Kannel, 2000). Even mild elevations in blood pressure can increase risk. In persons aged 40 to 70 years with a blood pressure starting at 115/75 mmHg, CVD risk doubles with each increase of 20 mmHg in systolic blood pressure or 10 mmHg in diastolic blood pressure. Blood pressure-lowering therapy has been associated with significant decreases in the incidence of MI (20% to 25%), stroke (35% to 40%), and heart failure (>50%). However hypertension remains a CVD risk factor even when normalized with treatment (Antonakoudis, Poulimenos, Kifnidis, Zouras, & Antonakoudis, 2007).

2.5.2.2 Body Mass Index

About 13% of the world population lives with obesity and it can be reduced by a change in lifestyle and physical exercises(WHO, 2016).Dyslipidemia have been associated with obesity except for HDL-C(Al-Kaabba et al., 2012). Abdominal

obesity is also associated with CVD, dyslipidemia, and metabolic syndrome. Metabolic syndrome presence increases the risk accompanying raised LDL-C. This increase in risk appears to be mediated through multiple major and emerging risk factors. Evidence-based research shows that reducing modifiable coronary heart disease risk factors such as dyslipidemia, hypertension and diabetes decrease the chances of experiencing other related events (Kostis, 2007).

2.5.2.3 Duration since diabetes diagnosis

A study on Canadian T2DM patients showed that dyslipidemia was present in 66% for those who had diabetes for more than 15 years. This was higher compared to those who had been diagnosed with diabetes within 2 years with only 55% (Harris, Ekoé, Zdanowicz, & Webster-Bogaert, 2005).

2.5.2.4 Family history of CVDs and diabetes

Parental history of heart disease or MI has been established as an independent risk factor for CVD. It has been estimated that 77% of patients with CVD and 54% of their first- and second-degree relatives express genetically linked dyslipidemia. In addition, recent studies of asymptomatic individuals indicate that a positive family history of CVD increases the risk of subclinical atherosclerosis compared with the risk of patients without a positive family history. Although it is an important risk factor, familial history is often overlooked during evaluations of individual cardiovascular risk. A family history of CVD, however, is both highly predictive and typically easy to access by direct inquiry (Jellinger et al., 2012).

In those patients without a CVD history but have high predicted risk (men above age 50 and women above 60 years old with several other risk factors), that is comparable to those with a clinical cardiovascular heart disease history, it is necessary to treat those patients aggressively just like those with cardiovascular heart disease (target<100 mg/dL) (NCP, 2001).

2.5.2.5 Fasting Blood sugar

FBS showed significant positive correlation with cholesterol and TGs in a study done on diabetes patients in India (Dixit et al., 2014). These results were in line with other findings that showed significant positive correlation between dyslipidemia and FBS (Rosediani, Azidah, & Mafauzy, 2006).

2.5.2.6 Type of drugs administered

Initial concerns of increased rates of MI arising as a result of dyslipidemia in HIV-infected patients on ARVs have been confirmed by studies, a large, prospective, multi-cohort study that showed associations between exposure to ARV therapy and an increased risk of myocardial infarction. Studies on combination of bedtime insulin plus daytime sulphonylurea showed similar lipid effects to those with insulin therapy alone: a decrease in TG, an increase in HDL-C (20%) and no change in LDL-C levels(Karlander, Gutniak, & Efendic, 1991). Metformin plus bedtime insulin combined therapy also decreased LDL-C (15%) (Robinson, Burke, Robinson, Johnston, & Elkeles, 1998) and increased HDL-C. In a study on lipid profile and antihypertensive drugs, it was found that Beta-blockers do not significantly affect TC and LDL-C but significantly increase TG and decrease HDL-C. Diuretics cause significant elevation of TG with generally no significant changes in TC, LDL-C and HDL-C. Angiotensin-converting-enzyme inhibitor and calcium channel blockers had no significant effect on plasma lipids (Abdul-Khader, 2009).It was important therefore to explore the above factors among T2DM patients at Turbo Sub County.

2.5.3 Behavioral factors

2.5.3.1 Tobacco smoking

Many physiologic benefits have been associated with quitting smoking such as improving the lipid profile. Studies indicate that quitting smoking increased levels of HDL-C but other parameters remained the same (Maeda, Noguchi, & Fukui, 2003). Normalisation of HDL-C was noted below 20 days and would go on reducing (non-smoking) with the condition that it stopped. These findings are vital

since they would change the ratios of HDL-C, TC, HDL-C and LDL-C and aid reduction of cholesterol in the blood (Maeda et al., 2003). The relationship between dyslipidemia and smoking, smoking dosage or smoking cessation had been confirmed by a previous study(Lee et al., 2011).

2.5.3.2 Alcohol use

Alcohol has been found to dysregulate several lipid indices in addition to elevating TG(Capurso & Petrakis, 2016). Findings have also shown that daily alcohol intake and duration of drinking are all closely associated with high TG and elevated TC. By contrast, drinking duration was a protective factor against elevated TC(Shen et al., 2014).

2.5.3.3 Dietary management

Either lowering the dietary carbohydrate content or losing weight appears to attenuate atherogenic dyslipidemia (although there does not appear to be an additive effect of the two), whereas altering the total fat or saturated fat content has little influence (Musunuru, 2010). Some dietshave been shown to improve the lipid levels in adults hence lowering the chances of developing dyslipidemia (Song, Lee, Paik, Park, & Song, 2012).

2.5.3.4 Physical Activity

Despite the debate about the amount, intensity, frequency and duration of activity for optimal health, researchers concur that physical activity is necessary for the metabolic and other health benefits. Physical activity can lessen triglycerides and have an effect on both LDL-C and HDL-C particle sizes (Szapary, Bloedon, & Foster, 2003).

Performing more physical activity through exercise decreases stroke plus ischemic heart disease incidences in diabetes mellitus patients and reduces all-cause mortality rates and mortality rates from ischemic heart disease (Hu et al., 2001).

In observational studies, moderate dose-response relationships between blood cholesterol and exercise intensity have been reported(Rankinen & Bouchard,

2002). In studies of 51 individual studies with exercise training programs of 3 months, the common lipid change was an increase of HDL-C in both women and men. A decrease in LDL-Cand TG levels were also noted, although less frequently than changes in HDL-C levels (Leon & Sanchez, 2001).

2.5.3.5 Adherence to medication

It is estimated that about half of the patients suffering from chronic diseases do not take their medications as indicated by medical practitioners. Poor adherence causes high death rates and morbidity (Osterberg & Blaschke, 2005). Prolonged adherence to chronic disease medications is still very low even in those patients who already have had at least a cardiovascular event before (Glader, Sjölander, Eriksson, & Lundberg, 2010).

2.5.4 Knowledge, Attitude and Practices onDyslipidemia

Both pharmacological and non-pharmacological therapies are capable of helping T2DM patients keep their lipid levels within fairly good levels. Diet and lifestyle have lowered burden of CVDs and other chronic diseases (Yusuf et al., 2001). Studies related to Knowledge, Attitude and Practices (KAP) in dyslipidemia and risk factors among metabolic syndrome patients remain relatively scarce. KAP of T2DM patients plays a major role in their health status especially in their awareness, willingness towards the management of their conditions and behaviours. It is important for them to have some level of understanding of these CVD risk factors.

In a previous Indian study, it was found that 74% of T2DM were aware that dietary modifications should be done to control diabetes. Only 7% identified that stopping smoking/alcohol improve their health. Attitude showed 84% of T2DM patients reporting that exercises should only be done by obese persons. On the other hand, only 32% of T2DM reported taking green leafy vegetables in their diet (Shah, Kamdar, & Shah, 2009).In a study by (Saleh et al., 2011), 42% had poor knowledge and 68% had a good attitude but for practices, only 20% reported to have good practices. This created the need to understand more on the possible reasons for the wide gap between knowledge, attitude and practice.Findings also

indicate that patients with metabolic syndrome had knowledge and practices mean level that was moderate. Also attitude toward CVD risk reduction, but knowledge and practice in some specific areas were low (Amarasekara, de Silva, Swarnamali, Senarath, & Katulanda, 2016).

Some of the factors reported as causes of heart problems included stress and improper diet, particularly high fat intake. Alcohol and smoking were also stated as causes of heart problems. Because the heart also serves as a symbol of love, feelings, care, and forgiveness, it is apparent that mental/emotional health plays a significant role in heart health(National Heart, Lung, and Blood Institute, 2003).A survey in Washington about the lack of awareness among diabetic patients of the associated cardiovascular risk factors, 68% of people with diabetes do not perceive cardiovascular disease as a serious condition in diabetes, 60% of them did not feel to be at risk for either high blood pressure or cholesterol problems (Tuncer, Clough, & Pierce, 2002).

2.6 Clinical presentation of dyslipidemia

Despite hypercholesteremia being asymptomatic, longstanding high levels of serum cholesterol can cause atherosclerosis (Bhatnagar, Soran, & Durrington, 2008). Chronically elevated serum cholesterol can lead to the formation of atheromatous plaques in arteries. This cause progressive stenosis (narrowing) or complete blocking of the affected arteries. Blood supply to the organs and tissues served by the stenotic or occluded arteries gradually reduces until the organ stops functioning normally. At this stage tissue ischemia (restriction in blood supply) can occur as specific symptoms. For example, temporary brain ischemia (transient ischemic attack) may manifest as temporary loss of vision, dizziness and impairment of balance, aphasia (difficulty speaking), paresis and paresthesia (tingling or numbness), usually one side of the body. Insufficient blood flow to the heart can present as chest pain, and eye ischemia as the transient visual loss in one eye. Low blood flow to the legs may manifest as calf pain when walking, while in the intestines it may occur as abdominal pain after eating a meal (Durrington, 2003).

2.7 Pathophysiology

In T2DM patients, the typical mechanism is that of dyslipidemia in metabolic syndrome with elevated TG and reductions of HDL-C. The other alterations in lipoproteins include increase in LDL-C particle number, small dense LDL-C, and apolipoprotein. Insulin resistance/deficiency in T2DM patients in association with other various factors like adipocytokines, hyperglycemia cause qualitative, quantitative and kinetic changes in normal lipid metbolism including increased VLDL-C, elevated LDL-C and decreased HDL-C(Mazzone, Chait, & Plutzky, 2008).Insulin plays a role in most of the steps of VLDL-C production and secretion. Overproduction of largeVLDL-C is key determining factor of the concentration of TG in T2DM patients (Adiels et al., 2005).

In T2DM patients, increased VLDL-C results in formation of small dense LDL-C by the following mechanism; Cholesteryl Ester Transfer Protein mediated triglyceride movement from VLDL-C to LDL-C and Lipoprotein mediated lipolysis of the TG rich LDL-C into small dense LDL-C(Packard, 2003).T2DM patients have increased catabolism of the small dense HDL-C particles that cause decreased HDL-C concentration (Frenais et al., 1997). Postprandial hyperlipidemia occurs frequently in T2DM patients. This is mediated through the following mechanisms: decreased clearence of TG eich lipoprotein remnants andlowered lipoprotein lipase activity (Chaudhury & Aggarwal, 2018).

2.8 Diagnosis of dyslipidemia in T2DM patients

Diagnosis of dyslipidemia includes performing a fasting lipid profile in diabetes patients using venous blood sample collected in vacutainer tubes, supported by the cardiac history of family members. This involves determining TC, LDL-C (using Friedewald formula), HDL-C and TG using automated machines, for example, COBAS integra 400 plus. Cutoffs for dyslipidemiaare:TC>5.2mmol/l (200mg/dl), and or increased LDL-C >2.6mmol/l (130mg/dl), and or decreased HDL-C<1.03mmol/l for males or <1.3mmol/l for females and or TG>1.7mmol/L (150mg/dl).

Table 2.1: Recommendations to T2DM patients on dyslipidemia management

Age and condition	Recommendations
Patients of all ages with overt CVD:	High intensity statin therapy plus lifestyle therapy
<40 yrs with CVD risk factors:	Moderate/high intensity statin and lifestyle therapy
40-75 yrs without CVD risk factors:	Moderate intensity statin and lifestyle therapy
40-75 yrs and with CVD risk factors:	High intensity statin and lifestyle therapy
>75 yrs without CVD risk factors:	Moderate/high intensity statin and lifestyle therapy
>75 yrs with CVD risk factors:	Moderate intensity statin and lifestyle therapy

(Inzucchi et al., 2015)

2.9 Treatment and management of dyslipidemia

Diet is also an important part of therapeutic and lifestyle modification for the management of cholesterol levels. A cross-sectional study in Saudi Arabia on patients under recommended diets found a high percentage of patients having borderline to high-risk levels of lipids.The high proportion of dyslipidemia puts the patients at risk of cardiovascular diseases. The findings showed need to control not only glycemic levels in diabetes patients but also TC, TG, LDL-C and HDL-C(Habib, 2006).

2.10 Summary of literature review

Diabetes has been found to be a public health concern that is among the leading causes of mortality and morbidity globally. The above literature review sections have described how dyslipidemia is known to affect T2DM patients through various mechanisms. The prevalence of dyslipidemia in diabetes is still not well documented in parts of Kenya while the associated factors and patients' KAP on the same are fairly described in literature but need more research because there are existing gaps. This research therefore aims to determine the prevalence of dyslipidemia and the associated factors among T2DM patients in Turbo sub-county, Uasin Gishu County, Kenya.

CHAPTER THREE

METHODOLOGY

3.1 Study Area

The study was carried out in Turbo sub-county, Uasin Gishu County. Turbo sub-county which has an approximate population of 208,583 is one of the six sub-counties that make up Uasin Gishu county. Located in the North-West of Eldoret town, the study area covered a total area of about 364.60M^2. The headquarters of Turbo sub-county is Turbo town, 34 km along the Eldoret-Webuye road.

Turbo Health centre: This is an operational health centre in Kaptebee location, Turbo sub-county, Uasin Gishu County (north-west of Eldoret town). It is located 34 km west of Eldoret town along the Eldoret-Webuye road. It serves the rural population of Uasin Gishu County. This facility was one of the first in the country to be supported by Academic Model Providing Access to Healthcare (AMPATH) on MOH-K partnership organisation for HIV care and later diabetes and hypertension care in level 3.The other services include antenatal, ART, basic emergency obstetric care, curative in-patient and out-patient services, family planning, Prevention of Mother-To-Child Transmission (PMTCT), tuberculosis (TB) diagnosis and treatments. It is a public facility managed by Ministry of Health. It currently serves 300 diabetes patients in its Comprehensive Care Centre (CCC).

Huruma County hospital: This is a hospital in Kapyemit location, Turbo sub-county, Uasin Gishu County (north-north-west of Eldoret town). It is about 6 km from Eldoret town along Eldoret-Kitale road. It is a public facility managed by Ministry of Health with same AMPATH support for its CCC to offer both HIV and diabetes care. This facility serves the urban population of Eldoret and has about 160 type 2 diabetes patients registered under AMPATH program

3.2 Study design

This was a cross-sectional study aimed at determining the prevalence and patterns of dyslipidemia. Mixed methods research approach was used in data collection. Questionnaires were used to collect quantitative data while FGDs collected qualitative data.

3.3 Study population

The study population was type 2 diabetes mellitus patients that attended Turbo and Huruma CDM clinics aged 35 years and above of both sexes (female and male). This age cut-off was most likely to catch the desired T2DM patients. In previous studies; including one on Kenyan adults by Kaduka L. U, a notable prevalence of diabetes; 22% and 8.2% were found in the age groups of 35-44 years and 25-34 years respectively. This therefore could mean that the T2DM have dropped to about 35 years.

3.4 Inclusion/Exclusion criteria

Inclusion criteria

The study recruited patients who met the following minimum requirements

- Patients with confirmed T2DM (using $HbA1^c$ or plasma)
- Patients aged 35 years and above
- Those patients that provided informed consent

Exclusion criteria

The study excluded patients in the following cases.

- Those who were unable to give consent.
- Known T1DM patients (confirmed using MTRH diagnnostic tools)
- Patients aged below 35 years.
-

3.5 Study variables

Dependent variable

Dyslipidemia-Dyslipidemia was defined according to the third report of the National Cholesterol Education Program Expert Panel on detection evaluation and treatment of high blood Cholesterol in Adults (NCEP Adult treatment Panel III) as presence of any of the following: TC>5.2mmol/l (200mg/dl), and or increased LDL-C >2.6mmol/l (130mg/dl), and or decreased HDL-C <1.03mmol/l for males or <1.3mmol/l for females and or TG>1.7mmol/L (150mg/dl).

Independent variables

The following were tested for associations with occurrence of dyslipidemia

Age-This was categorized as follows; 35-49, 50-64 and 65 and above years.

Sex-This was categorized as follows; male and female.

Occupation-This was categorized into two; employed and not employed.

Education-This was categorized as follows; primary, secondary, university/tertiary level of education.

Income-This was categorized to as follows;≤Kshs 15000 and >Kshs 15000

Marital status-This was categorized as follows; single, married, widowed, divorced

Physical activity-This was categorised as follows ≥600 and<600 Metabolic Equivalent (MET) mins per week. This is according to the WHO STEPWise physical activity questionnaire, 2010.

Duration of diabetes- This was categorized as follows; ≤4years, 5-9 years and 10 years and above.

Blood pressure-Participants were considered to have elevated blood pressure if the BP is equal to or more than 140/90 mmHg or were on antihypertensives (NCEP, 2001).

Smoking- Smoking of cigarettes was categorized as follows; yes, yes but stopped and no.

Alcohol use-Drinking of alcohol was categorized as follows; yes, yes but stopped and no.

Fasting blood sugar-This was categorised into two: <7 mmol/L and ≥7mmol/L (ADA)

Type of medication- These included different drugs that are taken by the patients including anti-hypertensives, ARVs and diabetes medication

Family cardiac history-This was categorized as follows; present and absent.

Patients' cardiac history-This was categorised into two; present and absent.

Body Mass Index-Analysed as categorical variable with four categories; underweight, normal, overweight and obese.

Clinical attendance- Categorized patients' attendance at the clinic into two;always and not always.

Level of adherence to medication-Categorized into two;always and not always

Adherence index-This was categorized using likert scale that range from 1.0 to 5.0.An adherence index of 5 refers to a patient who; always strictly takes his medication, takes the right amount of medicine, takes medication as prescribed by the doctor, visits his doctor as scheduled and follows his doctor's or nurse's advice. A lower adherence index refers to one or more of the five practice combinations mentioned above.

3.6 Sample size determination

Cochran's formula (1977) was used to determine the study's sample size.

$$n = [Z^2 * P (1 - P)]/d^2$$

n = required sample size

Z = confidence level at 95 % (1.96)

P = estimated prevalence; 83.9%, (Alavudeen, Dhanapal, Khan, Al Akhali, & Paulliah, 2013). This was used because of its similarity with the current study in regards to definition dyslipidemia using NCEP (2002) criteria.

d = margin of error at 5%

$$n = \frac{1.96^2 * 0.839 (1 - 0.839)}{0.05^2}$$

= 208 patients from both facilities

3.7 Sampling procedure

Systematic random sample

This statistical method involving the selection elements from an ordered sampling frame from both study sites, starting with a population size of N and then selecting the k^{th} patient was used.

$$k = N/n$$

N is the population=456 patients

n is the sample size (208 patients)

456/208=2.2

For both facilities, a random number between 1 and 2 was chosen by drawing from a box with two secret folded papers containing numbers 1 and 2 then every 2^{nd} person was chosen. The random started with 2 so the patients chosen were 2, 4, 6,8,10, 12.....until the required sample was acquired from both facilities.

Purposive sampling was used to select 20 participants of the two FGDs. Each FGD had 10 participants and the criteria used to select them were; fair representation of gender (8 males and 12 females), between ages of 40-70 years and were willing to take part voluntarily. This was done using a general verbal consent from the two

groups because all were aware and had taken part in the quantitative data collection.

3.8 Data collection

Datacollection was planned through preparation of a questionnaire, FGD guides and training of research assistants followed by pretest of tools. Quantitative data collection was done through filling of questionnaires and health assessment forms. Data entry was done for quantitative datawhile audio recordings and taking of notes were utilized on qualitative data.

3.8.1 Procedures

3.8.1.1 Questionnaire clinical/anthropometric forms preparation

A questionnaire was developed by the researcher and composed of two parts: Socio-demographic, economicand behavioral data (Appendix 3).

Part A: Socio-economic and demographic data

The first part of the questionnaire was used to capture the demographic data about the participants which include age, gender, marital status, education level, occupation, economic status/ monthly income, and location of residence.

Part B: Behavioural data

This was used to collect information about:Physical activity levels of the patients in the past seven days (1 week) were assessed in accordance with the WHO physical activity tool (2010) (Appendix 8).This was developed by WHO for surveillance of physical activity in countries accross the world. It collects information on participation in three settings; activity at work, travel to and from places and recreational activities as well as sedentary behavior. Other behavioral data included smoking, drinking habits, advice on dietary management, and adherence to medication.

3.8.1.2 Training of data collection assistants

Two research assistants were recruited by the researcher to help during the data collection. They were both trained for two hours on the procedures of administering questionnaires while maintaining highest level of profesionalism.

3.8.1.3 Pretest of questionnaires and consequent corrections

The questionnaire were pre-tested to check for omissions, typing errors, confusing questions, biases or poor wording among other problems prior to the main study. This was done at Huruma CDM clinic by the researcher and the recruited research assistants. Necessary adjustments were done after the pretest of the tool hence ensuring that meaningful data would be collected.

3.8.1.4 Preparation of the FGD guide

An FGD guide was derived by the researcher and had the following sections; awareness of dyslipidemia, cardiovascular risk factors, their prevention and management, health seeking behaviours, the source of medical information and advice received from the clinic. These collected qualitative data with the use of guided questions about knowledge, attitudes and practices towards dyslipidemia and other cardiovascular risk factors (Appendix 5).

3.8.1.5 Preparation of data recording forms

A health assessment form was used to collect anthropometric measures (weight, height), fasting lipid profile, fasting blood sugar, systolic blood pressure and diastolic blood pressure, duration since diagnosis of diabetes, type of treatments, and family history of heart disease.

3.8.1.6 Identification of the FGD participants

A total of 20 patients (sub-set of those that participated in quantitative) were identified for the FGDs. They were aged between 40 years and 71 years with the median age of all participants being 54.45 years.

3.8.1.7 Preparation of information sheet and consent

An information sheet and consent were developed by the research in accordance to IREC/Moi university guidelines (Appendix 1). This was also transalted to swahili for better understanding by the participants (Appendix 2)

3.8.1.8 Request for ethical approval

This research was reviewed and received ethical approval from Institutional Research and Ethics Committee (IREC) at MTRH/Moi University. All requirements were met before an approval letter was issued to the researcher (Appendix 9).

3.8.1.9 Request for permission to conduct the research at AMPATH

Permission was sought from the facility in-charges of the Turbo and Huruma Chronic Disease Management Clinics in order to access the study population (Appendix 10)

3.8.1.10 Obtaining consent

A detailed infromation sheet and consent was given to all the participants. A signature and name were appended on each form to indicate good understanding and willingness to participate inthe study. The participants were assured that their participation was voluntary and they could withdraw from the study at any time.

3.8.2 Anthropometric measures

The patients' weight was measured using a manual seca weighing machine which they all stood on and recorded in kilogrammes to the nearest kg. The height was measured using StatureMeter 2M and recorded in meters. This was recorded on a health assessment form (Appedix 7).

BMI was calculated in accordance with WHO 2015 guidelines as follows:

$$BMI = Wt\ (kg)/Height\ (m)^2$$

3.8.3 Clinic assessments

Patients' blood pressure was measured using Omron M2 intellisense automatic blood pressure monitor with the patient assuming a seated position and maintaining the arm-cuff position at the heart level during rest in a seated position. The measurement was performed two or more times at intervals of 1–2 minutes, and the mean value of two measurements that provide stable values (difference in the values <5 mmHg) was used. Elevated blood pressure was based on clinical blood pressures measured on at least two different occasions recorded in accordance with American Diabetes Association, Diabetes Care; above 140/90mmHg as elevated BP (SBP, DBP). This was recorded on the health assessment form (Appedix 7).

3.8.4 Biochemical assessments

3.8.4.1 Blood sample collection

Upper arm of patients was wrapped using an elastic band, the needle site cleaned with alcohol, a venous puncture made so as to draw blood. 4-5mls of blood was collected into plain Vacutainertubes then the band removed from the arm when enough blood had been collected. A gauze pad or cotton ball was put over the needle site as the needle was removed. Each blood sample was labeled using a unique code for each patient. Universal precautions were taken into account during sample collection.

3.8.4.2 Fasting Blood Sugar

The patients' fasting blood sugar was determined using accu-chek perfoma glucometer. A drop of blood from each patient was placed on a strip connected to a glucometer then the readings made. Results were recorded on a health assessment form (Appendix 7) in accordance with ADA 2015in mmol/l.

3.8.4.3 Fasting Lipid profile

A blood sample from each fasting patient was centrifuged within 30 minutes after the blood sample was drawn, at 2200-2500 rpm for 5 minutes at the two clinics then transported in a cool box at below 10^0C. Tests were done at MTRH

laboratories using Roche kits for lipid profiling. Blood serum was analysed on COBAS Integra 400plus to determine serumtotal cholesterol, and triglyceride using an enzymatic colorimetric assay. Dyslipidemia was defined according to the third report of the National Cholesterol Education Program Expert Panel on detection evaluation and treatment of high blood Cholesterol in Adults (NCEP Adult Treatment Panel III) as the presence of any of the following:TC>5.2mmol/l (200mg/dl), and or increased LDL-C >2.6mmol/l (130mg/dl), and or decreased HDL-C <1.03mmol/l for males or <1.3mmol/l for females and or TG>1.7mmol/L (150mg/dl). This was recorded in mmol/l (units) on the health assessment form (Appedix 7).

3.8.5 Questionnaire administration

The researcher was officially introduced to the facility in-charge by the AMPATH program manager and to the clinics by the facility in charge. During the clinic days, the researcher introduced himself and explained in detail everything concerning the study. The subjects that met the inclusion criteria were given an information sheet and detailed consent form. These contained purpose, procedures, benefits and risks. The researcher explained the details needed on the questionnaires ensuring that they all understood the questions. The researcher gave enough time for the patients to answer all the questions and clarification was provided by the researcher and the assistants. The questionnaires had unique codes/identifiers to assure anonymity of the subjects hence keeping every detail confidential.

3.8.6 Focus Group Discussions

The FGDs were conducted at Huruma and Turbo CDM clinics in the month of April 2016. They were moderated and recorded in swahili by the researcher and a assistant as the note taker. Audio recordings were transcribed manually and translated manually. Each FGD took approximately 30 minutes.The FGDs were conducted to explore the knowledge, attitude and practices of type 2 diabetes patients on dyslipidemia and other cardiovascular risk factors

3.9 Data safety, validation, analysis and presentation

3.9.1 Data safety

Filled questionnaireswere kept under the custody of the researcher so as to prevent any possible alterations by other people. Each variable on the questionnaire had codes for easy data entry and analysis. A Microsoft Office-Excel 2007 database was created to capture all the information from the coded and filled questionnaires. This information was carefully entered into the database by the researcher and was write-protected.

3.9.2 Data validation checks

This was a process that ensured the data was clean and correct. It also provided certain well-defined guarantees for fitness, accuracy and consistency for the inputs from the questionnaire through manual checks on the questionnaires.

3.9.3 Data analysis and presentation

Quantitative data were analysed using SAS/STAT software, Version 9 of the SAS System for Windows. Descriptive statistics (percentages, proportions) were used for prevalence and patterns of dyslipidemia together with other patients' characteristic. Wilcoxon test was used to compare lipid parameter means of males and females. Chi square was used to describe distribution of dyslipidemia then univariate analysisand multivariable logistic regression analysis were performed to determine the associated factors. All variables at the 0.2 level of significance in the univariatewere included in the multivariable model. Using backward elimination criteria, variables that had a p-value of <0.05using 95% confidence interval were considered significant. Qualitative data were analysed thematically to determine KAP on dyslipidemia. KAP data were manually transcribed from voice recorder then followed by coding speech into meaningful categories, enabling the researcher to organise large amounts of texts and discover patterns that were difficult to detect by just listening to an audio. The next was initial coding by generating numerous category codes as the researcher read responses, labelled data that were related and a piece of text were assigned several codes. Focused coding was done to eliminate,

combine and subdivide coding categories and look for repeating ideas and larger themes that connect the codes. The analysed data were presented in form of tables, pie charts and bar graphs.

3.10 Ethical considerations

The participants were assured that their participation was voluntary and they could withdraw from the study at any time. Informed consent (Appendix 1) was obtained before administration of a questionnaire and to ensure confidentiality, both FGDs were done in designated private rooms. Questionnaires and voice recordings were stored under lockable cabinets while the data was saved under password restricted computers. Only study related personnel had access to study materials. After completion of the study, all audio recordings were destroyed. Participants were not be identified by their names but assigned unique codes to ensure privacy confidentiality.There were limited direct benefits to the participants. However, their participation contributed to increased knowledge and understanding of the cardiovascular risk factors and the associated factors in T2DM patients, and how to encourage them to reduce the risk.

CHAPTER FOUR

RESULTS

4.1 Overview

Results presented in this section are from two parts of the study. One part is from quantitative data on prevalence, patterns, factors and the other from FGDs on knowledge, attitude and practices in the period between 2015 and 2016.

4.2 Quantitative Results

A total of 208 participants were selected to participate in this study from Turbo Health Center and Huruma County hospital CDM clinics.

4.2.1 Participants characteristics

4.2.1.1 Socio-demographic and economic characteristics of participants

The mean age of the participants was 58.7years (Sd 11.4).The majority (64%) were female, aged 50-64 years (51%), had attained primary level education or below (62%) , were of low social economic status as 66% earned a monthly income of Kshs<15,000 (66%) and lived in rural areas (71%) as presented in table 4.1.

Table 4.1: Socio-demographic and economic characteristics of T2DM pateints in Turbo Sub-County, Uasin Gishu County, Kenya, 2015/2016

Participant Characteristics	Unit (s)	No. (%) N=208
Age group	35-49	40 (19)
	50-64	106 (51)
	65+	62 (30)
Gender	Male	75 (36)
	Female	133 (64)
Level of Education	Non e	34 (16)
	Primary	95 (46)
	Secondary	62 (30)
	College & University	17 (8)
Occupation	Unemployed	37 (18)
	Business person	56 (27)
	Farmer	79 (38)
	Employed	23 (11)
	Retired	13 (6)
Monthly Income (Kshs)	≤15,000	138 (66)
	>15,001	70 (34)
Marital status	Single	17 (8)
	Married	157 (75)
	Previously married	34 (17)
Residence	Urban	60 (29)
	Rural	148 (71)
Type of house	Permanent	84 (40)
	Semi-permanent & Temporary	124(60)
Religion	Muslim	1 (1)
	Christian	207 (99)

4.2.1.2 Clinical characteristics of participants

Among all participants, majority (61%) had been diagnosed with diabetes mellitus within the past 5 years, had hypertension (67%); 140 patients had Systolic ≥140mmHG or Diastolic ≥90mmHg or on anti-hypertensives. Overweight and obesity was noted in 65% of them; while fasting blood sugar was suboptimal (FBS above the recommended 7.0mmol/L) in 75% of them. Despite the significant history of cardiac disease in 51% of the participants, and high rates of multiple CVD risk factors in the study, 63% reported only fair or poor adherence to medication.Although there was higher proportion of female patients among those

with dyslipidemia, clinical characteristics did not differ by gender of participants (Table 4.2).

Table 4.2: Clinical characteristics of T2DM pateints in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

Participant Characteristics	Unit (s)	No. (%) N=208	Male N=75 (36%)	Female N=133 (64%)
Dyslipidemia*	Present	179 (86)	60 (33)	119 (67)
	Absent	29 (14)	15 (52)	34 (48)
Blood pressure**	Normal	73 (35)	25 (34)	48 (66)
	Elevated	135 (65)	50 (37)	85 (63)
BMI category	Underweight	3 (1)	1 (33)	2 (67)
	Normal weight	75 (36)	31 (42)	44 (58)
	Overweight	81 (39)	29 (36)	52 (64)
	Obese	49 (24)	14 (28)	35 (72)
Fasting Blood Sugar	<7mmol/L	51 (25)	22 (43)	29 (57)
	≥7mmo/L	157 (75)	53 (34)	104 (66)
Family history of cardiac disease	Present	81 (39)	35 (43)	46 (57)
	Absent	127 (61)	40 (32)	87 (68)
Personal history of cardiac disease	Present	106 (51)	37 (35)	69 (65)
	Absent	102 (49)	38 (37)	64 (63)
Duration since DM diagnosis	1-4 years	127 (61)	47 (37)	80 (63)
	5-9 years	42 (20)	15 (36)	27 (64)
	10+ years	39 (19)	13 (33)	26 (67)

¥ Dyslipidemia was defined as a TC>5.2mmol/l (200mg/dl), and or increased LDL-C>2.6mmol/l (130mg/dl), and or decreased HDL-C<1.03mmol/l for males or <1.3mmol/l for females and or TG>1.7mmol/L (150mg/dl).
**Blood pressure: Normal (Systolic <140mmHG & Diastolic <90 mmHg) &not on anti-hypertensive medication
Elevated (Systolic ≥140mmHG or Diastolic ≥90mmHg or on anti-hypertensives)

4.2.1.3 Behaviour and practices of study participants

Majority (99%) of the participants reported having received dietary advice about the management of their illness. However, a minority (38%) did not always adhere to the dietary advice they received. Fortunately, only a minority consumed alcohol (10%) or smoked tobacco (9%). Additionally, 77% achieved physical activity levels per week albeit, over half of the participants also spent more than 3 hours on sedentary behavior (Table 4.3).

Almost half (46%) had an adherence index of 5, which implies that patients only reported one or more but not all of the following conditions: always strictly takes

medication, takes the right amount of medicine, takes medication as prescribed by the doctor, visits his doctor as scheduled and follows his doctor's or nurse's advice (Table 4.3).

Table 4.3: Behaviour and practices of T2DM pateints in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

Participant Characteristics	Unit (s)/status	No. (%) N=208
Received dietary management advice	Yes	207 (99)
	No	1 (1)
Adhere to dietary advice	Not always	78 (38)
	Always	130 (62)
Alcohol consumption	None	188 (90)
	Yes	3 (2)
	Yes but stopped	17 (8)
Smoke(d) tobacco	No	190 (91)
	Yes but stopped	14 (7)
	Yes	4 (2)
Received physical activity advice	Yes	208 (100)
	No	0 (0)
MET mins/week	≥ 600 met mins/week	160 (77)
	<600 met mins/week	48 (23)
Sedentary behavior	≥3 hours/day sitting/reclining per day	112 (54)
	<3 hours/day sitting/reclining per day	96 (46)
Level of adherence to medication	Not always	131 (63)
	Always	77 (37)
Adherence index‖	4.0-5.0	95 (46)
	1.0-3.0	113 (54)
Clinic Attendance	Not always	62 (30)
	Always	146 (70)

**Recreational activities excluded due to no participant taking part in physical recreational activities

‖an adherence index of 5 refers to a patient who always strictly takes his medication, takes the right amount of medicine, takes medication as prescribed by the doctor, visits his doctor as scheduled and follows his doctor's or nurse's advice. A lower adherence index refers to one or more (but not all) of the above 5 combinations

4.2.2 Prevalence and patternsof dyslipidemia

4.2.2.1 Overall prevalence and patterns

A total of 179 (86.1%) out of 208 T2DM patients had dyslipidemia while 13.9% had a normal lipid profile (Figure 4.1).

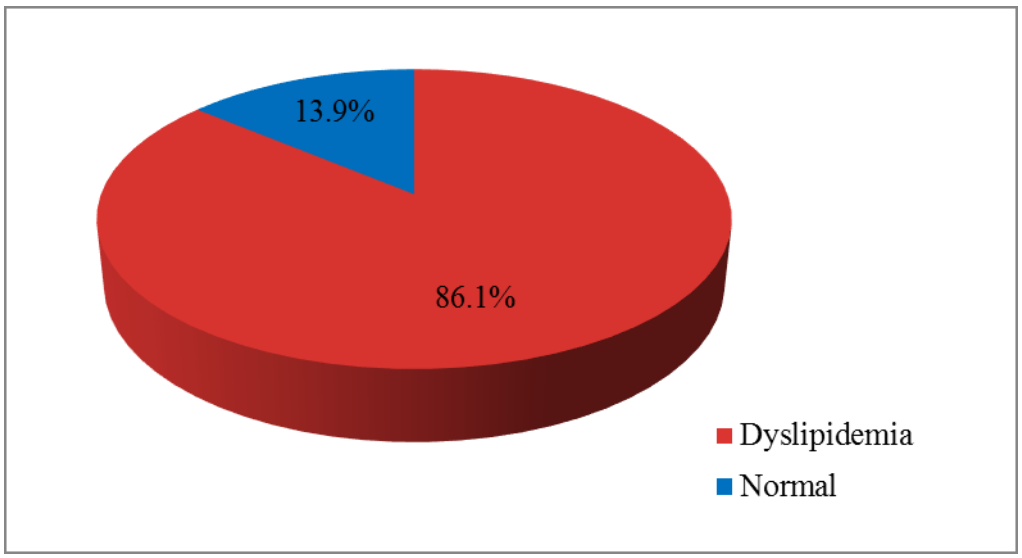


Figure 4.1: Overall prevalence of dyslipidemia amongst T2DM patients in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

The patterns/types comprised of 103 (49%) patients with high LDL-C, 147 (71%) patients hadlow HDL-C, 98 (47%) patients had high total cholesteroland 105 (51%) of patients with high triglycerides (figure 4.2).

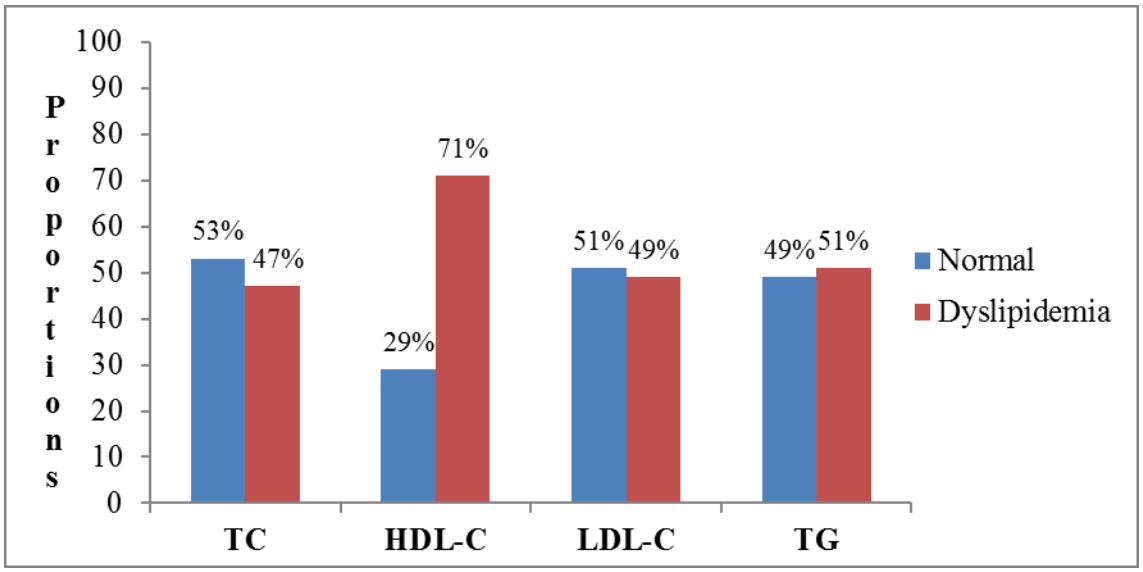


Figure 4.2: Overall patternsof dyslipidemia amongst T2DM pateints in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

4.2.2.2 Dyslipidemia prevalence and patterns by sex

There was a significantly higher proportion of females with low LDL-C compared to male (85% vs. 77%, p=0.03). Although there was also a higher proportion of females with dyslipidemia (90% vs. 80%), with high TG (61% vs. 55%), on Chi Square test, this did not achieve statistical significance (p=0.06 and p=0.16 respectively) (Table 4.4).

Table 4.4: Dyslipidemia prevalence and patterns by sex in pateints in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

	Overall N=208 N (%)	**Male N=75 n (%)**	**Female N=133 N (%)**	**Chi statistic**	**P value**
High TC	98 (47)	29 (48)	69 (58)	3.36	0.07
Low HDL-C	147 (71)	46 (77)	101 (85)	4.94	**0.03***
Elevated LDL-C	103 (49)	35 (58)	68 (57)	0.38	0.54
High TG	105 (51)	33 (55)	72 (61)	1.97	0.16

4.2.2.3 Distribution of dyslipidemia parameters by age

In all dyslipidemic patients, the age group of 75 years and above had all the four lipid abnormalities occuring in more than half of them while the age group of 35-

44 year had the least (only two) lipid abnormalities occuring in more than half (Figure 4.3).

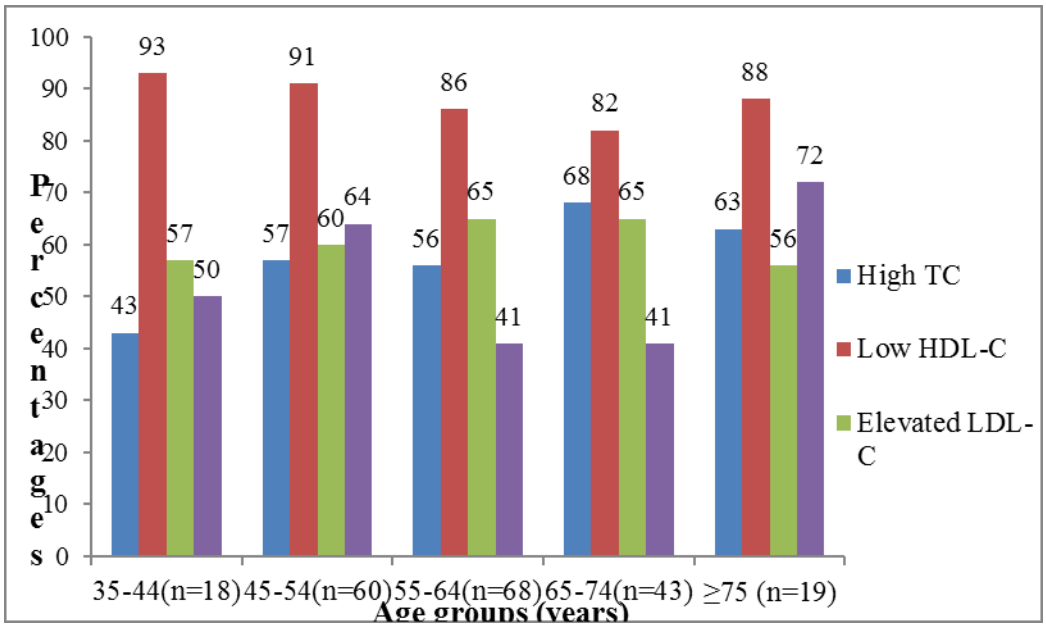


Figure 4.3: Dyslipidemia patterns by pateints'age-groups in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

4.2.2.4 Isolated and combined dyslipidemia

Most dyslipidemic patients had combined dyslipidemia (86%) with a higher proportion of female patients having combined dyslipidemia compared to male patients but did not achieve significance on Chi Square test (Table 4.5).

Table 4.5: Isolated and combined dyslipidemia **of patients in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016**

	Overall N=179 n(%)	**Males N=60 n (%)**	**Females N=119 n(%)**	**Chi statistic**	**P value**
Combined dyslipidemia	154 (86)	50 (83)	104 (87)	0.55	0.46
Isolated dyslipidemia	25 (14)	10 (17)	15 (13)		

4.2.2.5 Lipid profile means

The means of lipid profile measurements were done and found to be comparable in both genders except LDL-C which was significantly less in males M± SD=2.65±0.91 mg/dl and M± SD=2.82±0.94 mg/dl in females, ($p<0.01$) (Table 4.6).

Table 4.6: Means and standard Deviations of lipid profile measurements of T2DM pateints in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

	Total Mean±SD (n=208)	**Male Mean±SD**	**Female Mean±SD**	**P value**
TC	5.24 (±1.14)	5.02 (±1.08)	5.36 (±1.16)	0.07
HDL-C	0.99 (±0.30)	0.93 (±0.30)	0.98 (±0.29)	0.16
LDL-C	2.76 (±0.93)	2.65 (±0.91)	2.82 (±0.94)	**<0.01***
TG	1.99 (±1.17)	2.01 (±1.21)	1.97 (±1.15)	0.54

4.2.3 Distribution of dyslipidemia

In this section, chi square statistics was done to describe dyslipidemia distribution in regards tosocio-demographic, economic, clinical, and behavioural characteristics (practices). The results are presented below.

4.2.3.1 Dyslipidemia by socio-demographic and economic characteristics

Among all patients, there was a significantly higher proportion of patients with dyslipidemia among female participants compared to male patients ($p=0.05$) (Table 4.7).

Table 4.7: Distribution of dyslipidemia by socio-demographic and economic characteristics of pateints in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

Variables	Variable status level	No. (%) N=208	Dyslipidemia N=179 (86) N(%)	Normal N=29 (14%)	Chi square statistic	P value
Age group (yrs)	35-49	40 (19)	33 (83)	7 (17)	0.53	0.8
	50-64	106 (51)	92 (86)	14 (14)		
	65 and above	62 (30)	54 (87)	8 (13)		
Sex	Male	75 (36)	60 (80)	15 (20)	3.84	**0.05 ***
	Female	133 (64)	119 (89)	14 (11)		
Level of Education	Non e	34 (16)	32 (94)	2 (6)	4.60	0.3
	Primary	95 (46)	83 (87)	12 (13)		
	Secondary	62 (30)	49 (79)	13 (21)		
	College & University	17 (8)	15 (88)	2 (12)		
Employment status	Employed	158 (76)	139 (89)	19 (11)	2.23	0.1
	Not employed	50 (24)	40 (78)	10 (22)		
Monthly Income (Kshs)	≤15,000	138 (66)	118 (86)	20 (14)	0.10	0.7
	>15,000	70 (34)	61 (87)	9 (13)		
Marital status	Single	17 (8)	14 (82)	3 (18)	4.14	0.1
	Married	157 (75)	132 (84)	25 (16)		
	Previously married	34 (17)	33 (97)	1 (3)		
Type of house	Permanent	84 (40)	71 (85)	13 (15)	0.28	0.6
	Semi-permanent & Temporary	124 (60)	108 (87)	16 (13)		
Residence	Urban	60 (29)	53 (88)	7 (12)	0.37	0.5
	Rural	148 (71)	126 (85)	22 (15)		

Religion was not included in this table since 99% of the patients were Christian hence little variability in the sample

4.2.3.2 Dyslipidemia by clinical characteristics

There was a significantly higher proportion of participants with dyslipidemia among persons who were overweight and obese compared to those who were normaland underweight (p=0.003) (Table 4.8).

Table 4.8: Distribution of dyslipidemia by clinical characteristics of pateints in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

Variables	Variable status level	No. (%) N=208	Dyslipidemia N=179 (86) N(%)	Normal N=29 (14%)	Chi square statistic	P values
DM Duration (yrs)	≤4	127 (61)	111 (87)	16 (13)	1.14	0.6
	5-9	42 (20)	34 (81)	8 (19)		
	10 and above	39 (19)	34 (87)	5 (13)		
Blood pressure (BP)	Normal BP	73 (33)	59 (86)	14 (14)	2.61	0.1
	Elevated BP	136 (67)	120 (86)	16 (14)		
BMI* **	Underweight & Normal weight	78 (38)	60 (77)	18 (33)	8.68	**0.003***
	Overweight & Obese	130 (62)	119 (92)	11 (8)		
Fasting blood sugar (FBS)	<7 mmol/L	51 (25)	41 (80)	10 (20)	1.90	0.2
	≥7mmol/L	157 (75)	138 (88)	19 (12)		
Family cardiachistory	Present	81 (39)	71 (88)	10 (12)	0.29	0.6
	Absent	127 (61)	108 (85)	19 (15)		
Personal cardiac history	Present	106 (51)	91 (86)	15 (14)	0.01	0.9
	Absent	102 (49)	88 (86)	14 (14)		

***Normal and underweight category includes 3 patients who were underweight and none of them had dyslipidemia

4.2.3.3 Dyslipidemia by behaviour and practices

There was a significantly high proportion of participants with dyslipidemia whose physical activity was <600 met minutes per week compared to those whose physical activity was ≥600 met minutes per week (96% vs. 83%), p=0.03 (Table 4.9).

Table 4.9: Distribution of dyslipidemia by behaviour/practices of pateints in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

Variables	Variable status level	No. (%) N=208	Dyslipidemia N=179 (86) N(%)	Normal N=29 (14%)	Chi square statistic	P value
Received dietary advice	Yes	207 (99)	178 (86)	29 (14)	-	0.7
	No	1 (1)	1 (100)	0 (0)		
Adhered to dietary advice	Not always	78 (38)	66 (85)	12 (15)	0.22	0.6
	Always	130 (62)	113 (87)	17 (13)		
Alcohol consumption	No	188 (90)	160 (85)	28 (15)	-	0.5
	Yes but stopped	17 (8)	16 (94)	1 (6)		
	Yes	3 (2)	3 (100)	0 (0)		
Smoke tobacco	No	190 (91)	162 (85)	28 (15)	-	0.5
	Yes but stopped	14 (7)	13 (93)	1 (7)		
	Yes	4 (2)	4 (100)	0 (0)		
Received physical activity advice	Yes	208 (100)	179 (100)	29 (100)	-	
	No	0 (0)	0 (0)	0 (0)		
Sedentary behavior	≥3 hours/day	112 (54)	101 (90)	11 (10)	3.44	0.06
	<3 hours/day	96 (46)	78 (81)	18 (19)		
Physical activity	≥ 600 met mins/week	150 (77)	133 (83)	27 (17)	4.97	**0.03***
	<600 met mins/week	48 (23)	46 (96)	2 (4)		
Clinic Attendance	Not Always	62 (30)	56 (90)	6 (10)	1.42	0.2
	Always	146 (70)	123 (84)	23 (16)		
Medication adherence level	Not always	131 (63)	116 (88)	15 (12)	1.83	0.2
	Always	77 (37)	63 (82)	14 (18)		
Adherence index‖	4.0-5.0	95 (46)	80 (84)	14 (16)	0.13	0.7
	1.0-3.0	113 (54)	99 (88)	15 (12)		

*significance as p<0.05

**Recreational activities excluded due to no participant taking part in physical recreational activities

‖an adherence index of 5 refers to a patient who always strictly takes his medication, takes the right amount of medicine, takes medication as prescribed by the doctor, visits his doctor as scheduled and follows his doctor's or nurse's advice. A lower adherence index refers to one or more (but not all) of the above 5 combinations

4.2.4 Factors associated with dyslipidemia

In this section, univariate and multivariable logistic regression were done to determine the factors associated with dyslipidemia. Factors that achieved significance on univariate analysis at p≤0.2 were included in a multivariable logistic regression. The results of the univariable and multivariable analyses are presented in the next section.

4.2.4.1 Socio-demographic and economic factors associated with dyslipidemia

In univariate analyses, it was found that sex, employment status and marital status were associated with dyslipidemia (p=0.05, p=0.06 and p=0.1 respectively). All the other socio-demographic and economic characteristics did not achieve any significance (Table 4.10).

Multivariable logistic regression analysis showed that formally employed persons were more likelyto have dyslipidemia compared to those not formally employed (OR 3.1 95% CI 1.3-7.5, p=0.01) (Table 4.10). All other socio-demographic factors did not show any significant relationship with dyslipidemia.

Table 4.10: Socio-demographic and economic factors associated with dyslipidemia amongst pateints in Turbo Sub-County, Uasin Gishu County, Kenya, 2015/2016

	Participant Characteristics	Dyslipidemia/Total 179/208 (86%) n/N (%)	COR (95 % CI)	P value	AOR (95% CI)	β coefficient	P value
Age group (yrs)	35-49	33/40 (83)	Ref	0.8			
	50-64	92/106 (86)	1.3 (0.5-3.7)				
	65 and above	54/62 (13)	1.4 (0.5-4.3)				
Sex	Male	60/75 (80)	Ref	**0.05**	Ref	0.64	0.11
	Female	119/133 (89)	2.1 (1.0-4.7)		1.9 (0.9-4.6)		
Level of Education	Primary and below	115/129 (89)	Ref	0.21			
	Secondary and above	64/79 (81)	0.5 (0.2-1.1)				
Employment status	Employed	139/158 (89)	2.2 (0.9-5.0)	**0.1**	3.1 (1.3-7.5)	1.13	**0.01 ***
	Not employed	40/50 (78)	Ref		Ref		
Monthly Income (Kshs)	≤15,000	118/138 (86)	0.8 (0.4-2.0)	0.7			
	>15,001	61/70(87)	Ref				
Marital status	Single	14/17 (82)	Ref	**0.1**	Ref	2.22	0.2
	Married	132/157 (84)	1.1 (0.3-4.2)		1.4 (0.3-5.3)		
	Previously married	33/34 (97)	7.1 (0.7-73.9)		9.2 (0.8-102.0)		
Residence	Urban	53/60 (88)	1.3 (0.5-3.3)	0.5			
	Rural	126/148 (85)	Ref				

COR: Crude Odds Ratio

AOR: Adjudted Odds Ratio

4.2.4.2 Clinical factors associated with dyslipidemia

In univariate analyses, it was found that blood pressure, BMI and FBS were associated with dyslipidemia (p=0.06, p=0.003 and p=0.2 respectively). All the other clinical characteristics did not achieve any significance (Table 4.11).

Multivariable analysis showed that patients who were; overweight and obese were more likely to have dyslipidemia compared to those who were normal weight and underweight and; patients who had ≥7mmol/l compared to those with <7mmol/l (OR 2.7 95% CI 1.3-5.9, p=0.007 and OR 3.4 95% 1.6-7.0, p=0.001respectively) (Table 4.11).

Table 4.11: Clinical factors associated with dyslipidemia amongst pateints in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

Variable	Variable level/status	Dyslipidemia/Total 179/208 (86%) n/N (%)	COR (95% CI)	P value	AOR (95% CI)	β coefficient	P value
DM Duration (yrs)	≤4	111/127 (87)	Ref	0.6			
	5-9	34/42 (81)	0.6 (0.2-1.7)				
	10 and above	34/39 (87)	1.6 (0.5-5.3)				
Blood pressure	Normal BP	59/73 (86)	ref	0.06			
	Elevated BP	120/136 (86)	0.9 (0.4-2.0)				
BMI* **	Normal weight &Underweight	60/78 (77)	Ref	**0.003**	Ref	0.99	**0.0007***
	Overweight & Obese	119/130 (92)	1.4 (2.5-5.0)		2.7 (1.3-5.9)		
Fasting blood sugar	<7 mmol/L	41/51 (80)	Ref	**0.0003**	Ref	1.23	**0.001***
	≥7mmol/L	138/157 (88)	3.3 (0.7-10.0)		3.4 (1.6-7.1)		
Family cardiac history	Present	71/81 (88)	1.2 (0.5-2.8)	0.6			
	Absent	108/127 (85)	Ref				
Personal cardiac history	Present	91/106 (86)	0.9 (0.4-2.1)	0.9			
	Absent	88/102 (86)	Ref				

COR: Crude Odds Ratio

AOR: Adjudted Odds Ratio

***Normal and underweight category includes 3 patients who were underweight and none of them had dyslipidemia

4.2.4.3 Behavioral factors and practices associated with dyslipidemia

In univariate analyses, it was found that physical activity, sedentary behavior, clinic attendance and level of adherence to medication were associated with dyslipidemia (p=0.03, p=0.06, p=0.2 and p=0.2 respectively). All the other behavioral/practices did not achieve any significance (Table 4.12).

Multivariate analysis showed that patients whose physical activity was <600 met mins/week (insufficient physical activity) were more likely to have dyslipidemia compared to thosewhose exercise activity was ≥600 met mins/week (OR 4.8; 95% CI 1.1-21.1; p<0.05). All the other behaviours and practices did not show any significant relationship with dyslipidemia (Table4.12).

Table 4.12: Behavior/practiceassociated with dyslipidemi amongst pateints in Turbo sub-county, Uasin Gishu County, Kenya, 2015/2016

Variable	Variable level	Dyslipidemia/Total 179/208 (86%) n/N (%)	COR (95% CI)	P value	AOR (95% CI)	β coefficient	P value
Physical activity	≥ 600 met mins/week	133/160 (83)	Ref	0.03	Ref	1.57	**0.04 ***
	<600 met mins/week	46/48 (96)	4.7 (1.1-20.4)		4.8 (1.1-21.2)		
Clinic attendance	Not always	56/62 (90)	1.7 (0.7-4.5)	0.21			
	Always	123/146 (84)	Ref				
Adhere to dietary advice	Not always	66/78 (85)	1.2 (0.5-2.7)	0.6			
	Always	113/130 (87)	Ref				
Level of adherence to medication	Not always	116/131 (89)	1.7 (0.8-3.8)	0.2	1.8 (0.8-4.0	0.59	0.1
	Always	63/77 (82)	Ref		Ref		
Adherence index	4.0-5.0	80/95 (84)	Ref	0.5			
	1.0-3.0	99/113 (88)	0.8 (0.3-1.7)				

COR: Crude Odds Ratio

AOR: Adjudted Odds Ratio

4.3 Qualitative Results

A total of 20 patients participated in FGDs. These were part of the general objective to explore the knowledge, attitude and practices of T2DM on dyslipidemia, diabetes and other cardiovascular risk factors.

4.3.1 Emerging themes and supporting statements from FGDs

Emerging themes that were identified as related to participants' knowledge, attitude and practices on dyslipidemia and other cardiovascular risk factors are discussed in subsequent sections. The most important emergent themes included; lack of time for exercises, inability to follow diet recommendation and medication, financial problems and thoughts that obesity is a sign of affluence.

4.3.2.1 Knowledge

Understanding of (Abnormal lipid profiles) dyslipidemia

Participants expressed that dyslipidemia referred to fat levels in the body that are not within the recommended range. One of the respondents explained as follows;

> "*Abnormal cholesterol levels are when the fats in the body are either low or high*" (Female respondent, FGD 2)

Another described it as follows;

> "*Cholesterol are in different levels for different people.. Abnormal cholesterol is those that occur in the body in levels that are not recommended health wise"* (Female respondent, FGD1)

Understanding of causes of dyslipidemia

It strongly emerged from the participants that high cholesterol was caused by consuming a fatty diet, overeating, being overweight or not following the doctor's advice. One of them explained as follows;

> "*Abnormal cholesterol level is caused by being weighty where there are fats everywhere in the body. It's also caused by eating a lot of fats in food like pig meat, grilled meat, foods like chips, milk cream, sheep meat"* (Male respondent, FGD2)

Another respondent said the following:

> "*High levels of cholesterol is caused by eating non-recommended foods and also not adhering to medication which includes not checking blood sugar often, not coming for drugs and not taking them, not visiting the clinic as required, living a life of not being careful about oneself when it comes to sugars, white ugali and bread, a lot of salt"*(Female respondent, FGD1)

Another explained as follows;

> "*Things that cause all these include being fat and eating food without knowing what is in it"* (Male respondent, FGD1)

Understanding of effects of dyslipidemia

Participants reported that high cholesterol would lead to bodily changes and abnormalities that include body swelling, breathing problems, an inability to walk, excessive fatigue, damaged kidneys, heart problems, visual problems, paralysis**.** One respondent explained as follows;

> "*Effects of high cholesterol in the body include hiccups, legs swellings, breathing problems, blockage of veins, kidney problems"*(Male respondent, FGD2)

Another reported as follows;

> "*The effects include breathing problems, being tired or at times the heart can be problematic"* (Female respondent, FGD1)

Understanding of preventative management of dyslipidemia

Participants reported that high cholesterol can be prevented by using liquid fats (as opposed to solid fats), drinking plenty of water, following the doctor's advice regarding diet and medication, and exercise, attending doctors' appointments as scheduled, being knowledgeable on cholesterol management. One respondent described his understanding as follows;

> "*Cholesterol increase can be prevented by using liquid cooking fats and also drinking water in plenty and besides these, it is good to follow doctors' advice because without, we will suffer. Examples are drinking the medication as required, eating brown ugali, checking blood sugar and pressure often"* (Male respondent, FGD2)

Another respondent explained as follows;

> "*Problems of cholesterol are preventable by taking care which means coming to the clinic often, not eating large amounts of meat and doing a few exercises"* (Male respondent, FGD1)

Source of medical information

Medical information was reported to be mainly obtained information from print and electronic media from the health care providers during seminars and from books provided in the clinics and medical camps and also from friends. A respondent explained as follows:

> "*The radio sometimes has programs that are so educative about diabetes, cancer, HIV, hypertension etc"* (Female respondent, FGD2)

Another stated the following:

> "*I get more information from the newspapers, doctor; gave me some book so as to improve my health, on the radio. There are doctors that advertise to be at certain places where they give more information* (Male respondent, FGD1)

Health advice received from the health care providers

According to the health advice received, it ranged from dietary, medical and lifestyle modification.

Dietary advice: Participants stated they had been asked to take plenty of clean water, control their food portions, eat plenty of traditional vegetables, eat millet (as opposed to corn) meal, reduce meat intake, avoiding sugary tea/ drinks and snacks, to eat brown bread, to take frequent small meals,eating high fibre foods (Weetabix a wheat cereal), use liquid fats as opposed to solid fats. A respondent explained as follows:

> "*The advice I received from the hospital include drinking a lot of water often, taking a little food with a lot of traditional vegetables, white ugali from maize flour is not advisable but brown ugali is advisable. If meat is to be taken it is just 2-3 pieces"* (Male respondent, FGD2)

Another respondent stated the following:

> "*Taking sugarless tea, drinks, eating a lot of vegetables and like others have said, I think white ugali is not so bad if it is not taken daily, taking clean water, cooking fats like elianto and golden fry because those that are*

not liquids are not good for us, eating weetabix and brown bread" (Female respondent, FGD1)

Medical advice: Maintaining a healthy weight, take prescribed medication, observing clinic appointments, ophthalmological check up, to monitor their blood sugar in between appointments strongly emerged from the discussion. One respondent explained as follows:

"*We are not supposed to miss medication but it is difficult but am not supposed to miss clinic days"* (Male respondent, FGD1)

Another respondent explained as follows:

"*Reducing weight,.. the diabetes drugs exactly as indicated, checking blood sugar levels even before it reaches the day am supposed to go back to the clinic"* (Female respondent, FGD2)

Another respondent stated the following:

"*It includes using medication without skipping; I use the oral drugs, not insulin injection. I tell my sons to bring them because I never want to get worse. The other is reducing weight and checking eyes"* (Female respondent, FGD1)

Lifestyle modification: Participants stated that they are advised to live a stress-free life, avoiding alcohol and exercise regularly. One respondent said the following:

"*The advice I received from the hospital includeavoiding alcohol,2-3 days in a week we need to do jogging so that the body sweats and it will feel better"* (Male respondent, FGD2)

Another respondent explained this:

"*I was told to do physical exercises to straighten and keep the body well and fit, then about lots of thoughts, they make someone more sick through headaches, high blood pressure so we are told to try avoid that"* (Female respondent, FGD1)

4.3.2.2 Attitudes

Attitudes towards advice received from the health care provider

In subsequent sections, we report what the participants felt/thought about different aspects of their treatment. Also the challenges in adhering to clinic appointments, diet difficulties and trusting medication they receive.

Adherence to clinic appointments

Majority of the participants said they were unable to observe the schedule due to work commitments**.** A respondent explained as follows:

> "*I skip clinic days once in a while because of the nature of my work (petrol station attendant). It is hard to get off days as indicated on my clinic card"* (Female respondent, FGD1)

Another mentioned the following:

> "*We are not supposed to miss medication but it is difficult but am not supposed to miss clinic days"* (Male respondent, FGD2)

Medical treatment

Participants felt that their current medication and clinic was useful and without, they would suffer; although a minority preferred tablets to injections. They also needed to adhere to the prescribed dietary advice even when they were at home for their medication to be effective. They felt that they had received the appropriate treatment at the clinic. They felt that the medication should be free (cost) since their illness was a lifelong illness.One of the respondents explained as follows:

> "*A person with diabetes can better his/her health if they decide to; by following advice. The doctor gives the medicine but if the patient continues taking sugar in their tea, not coming to the clinic as required, not doing exercises then the whole treatment is not helpful*" (Male respondent, FGD2)

Another respondent stated as follows:

> "*I think our medication needs to be made free because it seems we will treat this diabetes for the rest of our lives. Without medication I normally feel weak, tired, thirsty, numbness on my feet and sweating a lot"* (Male respondent, FGD1)

Physical exercises

Although most participants felt the exercise was useful, they found it difficult to allocate time to exercise or found it embarrassing to participate in exercise at an advanced age around their homesteads. This particular attitude was likely to shape their practice despite knowledge. One respondent explained as follows:

> "*I travel using my car most of the time so walking as required of me is rare. Exercises are important but I hardly get time to do them"* (Male respondent, FGD1).

Another respondent stated as follows:

> "*Exercises are so important. Mothers of my age at home cannot take part in exercises like jogging in the morning or take part in any sport because it could be a source of embarrassment"* (Female respondent, FGD2)

Dietary recommendation

Participants felt that it was difficult to adhere to the diet because sometimes they were not at home, they did not have control over the cooking since someone else did the cooking, and they would have to eat what was available. The diet was also boring and they craved for the foods they were told to restrict, and they sometimes indulged in a little alcohol. Majority of the participants stated that they found the advice useful but were unsure whether their diet had an effect on the cholesterol levels. One respondent stated as follows:

> "*It is also hard to be careful with the food types because you can get hungry when in town and the hotels are the first place to get food which is made for 'normal people'-without diabetes. It is hard to control the urge for sugar and meat sometimes. I take a little alcohol too which are all not good for my health. I even do not know if what i eat reduces cholesterol in the body*" (Male respondent, FGD1)

Another respondent explained as follows:

> "*It is difficult to be strict on the kind of food especially if you are not cooking for yourself. For example at work, we eat the food that is available"* (Female respondent, FGD2)

Obesity

Although some participants viewed being overweight as a sign of affluence and a sign of having achieved self-actualization, they also stated that it was difficult to manage their weight and that being overweight reduces person's lifespan and increases cholesterol levels. One explained this:

> "*In life, there comes a time when someone relaxes; meaning he/she has been employed or satisfied therefore not stressed. At this point, he/she adds weight which still not good for their health. Diabetes patients often feel hungry and so since*
>
> *reducing amount of food intake helps to reduce weight, it becomes a problem since hunger and tiredness will follow"* (Male respondent, FGD2)

Another respondent explained as follows:

> "*Being fat can be a sign of being rich or sick depending on different people's opinions and views. I feel being fat is not good, reduces lifespan but I don't know if it has an effect on cholesterol levels"* (Female respondent, FGD2).

Alcohol consumption and cigarettes smoking

Participants reported that cigarette smoking and alcohol consumption were dangerous, and some indulged in a little alcohol. Some of them thought that cigarette smoking and alcohol consumption increase cholesterol levels, they make someone forget to take their medication, they damage teeth and lead to respiratory illnesses. One respondent explained as follows:

> "*I take a little alcohol but I know alcohol and smoking are not good for the health of any person. I tend to think they increase cholesterol in the body"* (Male respondent, FGD1).

Another stated the following:

> "*Alcohol makes a patient forget to take the medication as needed and deteriorates their health. Smoking spoils teeth and brings coughing problem"* (Female respondent, FGD1).

4.3.2.3 Practices

What the participants were doing to improve their health

The participants discussed along issues of dietary modification, adherence to clinic appoinments and general lifestyle modification.

Dietary modification: The participants attempted to follow the recommended diet however difficult it was. One respondent explained as follows:

> "By *doing my best in accordance to what our doctor tells me; eating a lot of vegetables, fruits"* (Female respondent, FGD2).

Adherence to clinic appointments: Half of those interviewed said they come to the clinic as recommended; the others said they try to come as recommended but ensure they make unscheduled visits if they feel unwell prior to their appointment dates, or they are unable to come as scheduled due to work commitments. A respondent explained as follows:

> "*I try to visit the clinic as required by my doctor although I do so when am weakly or sickly"* (Male respondent, FGD1)

Another expressed herself as follows:

> "*Attending the clinic is sometimes beyond my decision because I have to work from Monday to Saturday. This therefore makes it difficult to attend the clinic as required "* (Female respondent, FGD1)

Lifestyle modification: The participants stated that they tried to incorporate exercise into their daily lifestyle despite odds. One respondent explained the following:

> "*Ensuring that I at least walk over long distances; to the market place, church, meetings, and around my home. I also do the normal chores at home"* (Male respondent, FGD1)

Another respondent stated as follows:

> "*I spend most of my time doing farming practices because I don't have any other work.Digging around the farm, planting, weeding and harvesting. I*

carry the vegetables to a neighbouring shopping centre where someone sells them for me"(Female respondent, FGD2)

Other practices: Participants expressed that: to live a stress-free life, relaxing after a long days work, practicing wound prevention are other important practices to live healthy. A respondent explained as follows:

"*I try to, stay stress-free, avoiding family wrangles and quarrels or with other people"* (Female respondent, FGD1)

A respondent stated this:

"*By doing my best in accordance with what our doctor tells me; …., taking care of myself, to prevent wounds, being clean"* (Female respondent, FGD2)

Another respondent also mentioned the following:

"*Itake time to relax after my duties in the house because I feel tired and have a problem of experiencing pain on my left leg* (Male respondent, FGD1)

Challenges faced by participants when trying to follow the advice from healthcare providers.

Challenges with adhering to dietary advice: The prescribed diet was boring, they craved for what they had been asked to avoid and got hungry often. Participants stated that total adherence to the recommended diet and medication was expensive. Additionally, the recommended diet was not always available and they did not have control over who was doing the cooking. One respondent explained the following:

"*The kind of cooking fats we are told to use are expensive compared to the ordinary solid fats that come as little as for 10 shillings so that is the other problem, craving meat is very true and I find myself eating like a quarter of it but not often, I drink tea with sugar sometimes just to end that feeling"* (Female respondent, FGD1)

A respondent mentioned this:

> "*It is also hard to be careful with the food types because you can get hungry when in town or places of work and the hotels are the first place to get food which is made for 'normal people'-without diabetes. It is hard to control the urge for sugar and meat sometimes. I take a little alcohol too which are all not good for my health. I even don't know if it reduces cholesterol in the body*" (Male respondent, FGD1)

Challenges with lifestyle modification: The participants also had day to day problems and financial problems that predisposed them to stress. Others felt that it was difficult to exercise due to joint pains, their busy schedules and the fact they were too old to exercise. A respondent explained as follows:

> "*My challenge is a problem with my knees so doing exercises or other heavy practices is hard"* (Female respondent, FGD2)

A respondent also explained as follows:

> "*First when it comes to exercises, the time to do those is not easy to get because of my nature of work (driver), food that we are supposed to eat are not so easy to follow strictly and other things in life*" (Male respondent, FGD1)

Another respondent had this to say:

> "*Injections make someone feel like wounds are developing and we are told it is hard for them to heal… I don't do the exercises because I don't get time plus this old age*. (Female respondent, FGD2)

Other challenges: They felt that their bodies were damaged from daily insulin injections; additionally, they felt incapacitated since they could not survive without their medication which sometimes made them feel tired. A respondent explained as follows:

> "*When you see us here we have a lot of problems and challenges as diabetes patients. …there is the problem of getting worn out with insulin injections in the body til I ask myself if actually this body will be damaged with daily injections, another is money problems and life stresses that do not get along with our disease*" (Female respondent, FGD1)

Another respondent stated the following:

> "*My challenge is that my body has been damaged already and cannot get well, am saying so because since I started using these drugs I feel better only when in use but I feel sick if I don't use them so this means the body has become dependent on the drugs….. Back home life is not easy because am not employed in a stable job so I still need to take care of my children's' needs together with mine hence I strain and have stress on money issues*" (Female respondent, FGD2)

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 DISCUSSION

The study aimed at determining dyslipidemia prevalence, patterns, and associated factors and explored the knowledge, attitude and practices of type 2 diabetes patients that attended CDM clinics in Turbo sub-county, Uasin Gishu County, Kenya.

5.1.1 Prevalence and patterns of dyslipidemia

This study found out 86% of the patients had dyslipidemia. This was similar to findings in India where 86% and 89% dyslipidemia prevalence were reported (Borle, Chhari, Gupta, & Bathma, 2017; Udawat, Goyal, & Maheshwari, 2001).The current study prevalence was lower than findings inTanzania 95% (Chattanda & Mgonda, 2008) and Pakistan 94% (Jan et al., 2011) but higher compared to those done in Nigeria 74% (Isezuo & Ezunu, 2005). This difference may be due to the variation in cut-offs for dyslipidemia in these different studies and urbanization that has been associated with life-style modernisation. This involves changes in the society and nutritional transition that accelerate global rise in obesity (WHO, 2003). The main implication of high levels of dyslipidemia in T2DM patients is the increased chances for coronary artery disease (Kabakci, Koylan, Ilerigelen, Kozan, & Buyukozturk, 2008). A third of participants had insufficient amount of physical activity which is similar to previous findings (Nelson, Reiber, & Boyko, 2002). Dyslipidemia was more prevalent in females than in males which were consistent with study in the Middle East that found females to be more dyslipidemic (Siddiqui, Bano, Shabbir, Bashir, & Hussain, 2011).The reasons for this gender disparity are not very clear. However, it is suggested that women are less concerned about their health and may not raise their symptoms with physicians, or physicians have been reported to perceive women at lower risk than men despite having similar CVD risk equivalents (Al-Zakwani et al., 2018).Despite short period since diagnosis of diabetes, majority had dyslipidemia and multiple CVD risk. This finding was similar to previous study

that found that T2DM patients compared with non-diabetic people have increased cardiovascular risk (Gu, Cowie, & Harris, 1999).

The study found that LDLwas significantly higher in females than in males. This gender difference is similar to findings in Ethiopia (Ambachew, Shimelis, & Lemma, 2015) and in Botswana (Mengesha, 2006). Furthermore, a study done in Jordan indicated that sex was a major predictor of the LDL levels (Abdel-Aal et al., 2008). The implication of the above finding is that high LDL in females puts them at higher CVD risk since LDL has been documentedto be a strong risk factor in subjects with T2DM (Russo et al., 2015).

The study found that the most common type of dyslipidemia was low HDL-C (71%) followed by elevated TGs (51%) and elevated LDL-C (49%). The least common was elevated TCs (47%). This was in line with findings in India where low HDL-C of 71% was most prevalent and TCs 41% was the least prevalent pattern (Kandula & Shegokarz, 2013). There are other studies also consistent with the current study that found elevated TGs and low HDL-C to be the most frequent types of dyslipidemia (Faseeh, Pasha, Maryam, & Thunga, 2015; S. Haffner & Taegtmeyer, 2003; Kaithala et al., 2016). Low HDL-C levels being the most common type contrasted with a Tanzanian studythat found the most common being elevated TGs (94.7%) followed by low HDL-C levels (35.3%)(Chattanda & Mgonda, 2008). Another study conducted in the year 2015 in a Tertiary Hospital in Kenya revealed a relative dyslipedimia with 60.4% having elevated HDL-C, 37.6% with elevated TC andalmost 40% had high TG among T2DM patients. Only 5.9% of this patients were on statins (Nduati, Simon, Eva, & Lawrence, 2016).Combined dyslipidemia (at least two lipid abnormalities) was found to be present in 87% of the T2DM patients with dyslipidemia in the current study. This is slightly higher than 74% that was documented in Nigeria (Jisieike-Onuigbo et al., 2011). Isolated single dyslipidemia was found to be present in 13% of dyslipidemic type 2 diabetes patients. The difference might be as a result ofvariationsin dietary habits, genetic diversities and treatment schemes (Ambachew et al., 2015).There are a few documented comparison reports on dyslipidemia across the world. Generally, global variations in the prevalence of abnormal lipids among patients with history

of hyperlipidemia are associated with country-level economic development and health system indices (Venkitachalam et al., 2012).

The main implication of this study's levels of LDL-C, HDL-C, TC and TG are an increased risk of developing a coronary heart disease. This is because much of the pathophysiology linking diabetes and dyslipidemia has been elucidated. Although undoubtedly of importance, diabetic dyslipidemia is likely to be but one of many reasons for the accelerated macrovascular disease in diabetic patients (Goldberg, 2001).

5.1.2 Factors associated with dyslipidemia

Employment status, BMI, FBS and insufficient physical activity (MET mins/week<600) were important factors associated with occurrence of dyslipidemia. Being formally employed was found to be significantly associated with dyslipidemia. This is similar toa previous studythat found dyslipidemia to beassociated with occupation (Abalkhail, Shawky, Ghabrah, & Milaat, 2000) which may have been from lack of enough physical activity. Previous studies reported that dyslipidemia occurrence is more prevalent in subjects whose occupation management/administrative compared to those that doing physical/labour (Mahley et al., 1995) although other studies found no significant association between occupation and dyslipidemia (Yarnell et al., 2004).

Insufficient physical activity (MET mins/week < 600) was significantly associated with dyslipidemia. This concurs with previous findingsthat showed a strong dose-response association between exercise intensity and lipids (Leon & Sanchez, 2001). Physical activity of >600METmins/week is associated with cardiovascular health benefits (Di Loreto et al., 2005). In a previous study, intense physical activity was found to be associated with improved lipids (Al-Kaabba et al., 2012). Also intervention study findings showed that increase in physical exercises has the same effect (Zhao et al., 2007); (Erem et al., 2008). Physical exercises mainly results in a reduction in TG levels and increased HDL-C(Polychronopoulos, Panagiotakos, & Polystipioti, 2005). Sedentariness has been found to be associated with most cardiovascular problems(Estruch et al., 2013).

Body Mass Index was significantly associated with dyslipidemia. This corroborated with previous study that showed excess weight to be associated with increased prevalence of dyslipidemia and metabolic syndrome (Bays, Chapman, Grandy, & Group, 2007; Hill & Kris-Etherton, 2008). Fasting blood sugar (FBS) was also found to be significantly associated with dyslipidemia. This was in agreement with previous studies in Kuwait(Al-Adsani, Memon, & Suresh, 2004), in India (Kaur, Sudhera, Singh, Singh, & Bassi, 2017) and in China (Chan et al., 2005) which found the same association.

Two thirds and three quarters of the participants had BMI >24 and FBS>7mmol/l respectively. These have been associated with increased risk for a wide range of vascular diseases, hypertension and strokes (Emerging risk , 2010).

Although the association between sex and dyslipidemia showed no significance, females were more likely to have dyslipidemia compared to males. This was similar to findings by (Chattanda & Mgonda, 2008; Siddiqui et al., 2011) study in Tanzania that did not find any significant association. However, this contrasted an Ethiopian study by (Tamiru & Alemseged, 2010) that found a significant association.Blood pressure was also associated with dyslipidemia but showed no significance but a higher proportion of dyslipidemic patients had elevated BP compared to non-dyslipidemic patients. This was in agreement with other studies that have indicated probable existing link between hypertension and abnormal lipids(S. M. Haffner, Miettinen, Gaskill, & Stern, 1996; Oparil, Zaman, & Calhoun, 2003).

5.1.3 Knowledge, attitude and practices

Knowledge

Qualitative findings further noted nowledge of participants as high cholesterol being caused by consuming a fatty diet, overeating, being overweight or not following the doctor's advice. It emerged from the participants explanations that they understood that cholesterol would lead to bodily changes and abnormalities that include body swelling, breathing problems, an inability to walk, excessive fatigue, damaged kidneys, heart problems, visual problems, paralysis. Additionally,

CVD risk factors were deemed as those that can cause damage to the body including eating too much, heart problems, blood vessel problems; blockage of blood vessels, high blood pressure or a high level of fats in the body. The above discussion showed unsatisfactory understanding by the participants and was in line with previous studies done inUnited Arab Emirates(Al-Maskari et al., 2013) and in Sri Lanka (Amarasekara et al., 2016).

Attitude

Findings from the qualitative section generated important themes of positive attitude towards medication, exercises and other advices. Smoking cigarettes and alcohol drinking was deemed dangerous as they could increase cholesterol levels and tend to cause forgetting to take medications when under the influence. Attitude towards recommended food and exercising embarrassments among females were important to note. Being overweight emerged to be a sign of affluence and a sign of having achieved self-actualization. Participants also expressed difficulty in managing their weight despite knowing that being overweight could reducelifespan and increase cholesterol levels. The above indicate that despite having known most of the things required of them, the patients' attitude shape their eventual behavior of not doing as recommended. Their attitudes were fair and in line with a previous study which concluded that individual or close attention is required to make changes in diet and lifestyle (Vanstone et al., 2013). Support for the patients to adhere to recommendations is also needed.

Practices

Qualitative results further derived themes like strict adherence tomedications but they failed to eat the recommended diet terming them as boring. They craved for what they had been asked to avoid.Generally, the practices did not match knowledge and attitude. Several studies conducted on NCDs/CVDs have shown that there are many interrelated issues connected to individual behavior, so that even when knowledge and attitudes are high, practice remains low (Aubert et al., 1998; Islam et al., 2014).

5.1.4 Limitations of the study

The current study did not determine the association between level of education and KAPon dyslipidemia and CVD factors but most of the participants had inadequate education levels which could have had an impact lipid profiles.A previous study found out that education level is a major determinant of KAP-level regarding dyslipidemia in diabetes(Saleh et al., 2011). Other studies can be done to fully describe and possibly determine levels of associations between level of education and KAP on dyslipidemia and CVD factors.Adequate awareness of various factors controlling diabetes is vital and its complications are fatal. Improper diet, medication and lifestyle probably is the main reason for dyslipidemia and related complications (Sarfraz, Sajid, & Ashraf, 2016).

There was limited literature on patterns and factors associated with dyslipidemia in T2DM patients of above 35 years of age in Kenya. Other countries' findings had to be used instead for purposes of this research.

There was no available data on lipid lowering drugs administered.

Hypertension might have been underestimated as a result of self-reporting hence affecting the proportion of patients with personal cardiac history. This was addressed through counter-checking medical records.

Riding of a bicycle might have been misinterpreted to be being carried on a bicycle. This was likely to affect the physical activity section (MET mins/week).

5.2 Conclusions

From discussions on prevalence, patterns and the factors associated with dyslipidemia, the following conclusions were derived:

1. A majority of T2DM patients in Turbo sub-county are middle aged, females, only attain primary education level and below, farmers, have low monthly income, married and live in rural areas. Although many attain recommended physical activity level and do not use tobacco and alcohol,

majority have poor/fair adherence to medication with irregular clinic attendance.

2. Dyslipidemia is high among T2DM patients with the most common pattern being lowered HDL-C while least is elevated TC.
3. Employment status, BMI, insufficient physical activity and FBS were significantly associated with occurence of dyslipidemia.
4. The T2DM patients have fair but unsatisfactory understanding on lipid abnormalities, fair attitudes and poor/low practices even with better attitude and knowledge towards dyslipidemia.

5.3 Recommendations

The study gave rise to the following recommendations:

- The high dyslipidemia prevalence found in the study warrants attention. Priority groups are; females, overweight and obese, hypertensive and those with fasting blood sugar >7mmol/l. Low HDL-C being most common followed by elevated TGs and almost half having elevated LDL-C, a mitigation layout needs to be developed for improved health outcomes.
- Frequent improved blood sugar monitoring/management practices and physical exercises have to be incorporated into patient's therapy hence reduce the weight of those who are overweight and obese. This is inclusive of employed persons who tend to spend most of their time seated at their workplace.
- Strategies to adequately encourage people to enroll in formal education especially to at least secondary and tertiary education levels and adult education for older people need to be put in place by the government. A better diabetes patient education plan should be developed and implemented.
- There is need to prioritise research driven control and management of dyslipidemia. This should be done at both the national level and county level with government and society playing the role. Turbo being one of the sub-counties in Uasin Gishu can be a starting point to lare campaigns

against dyslipidemia and the risks they pose to those with diabetes with health research being on the forefront.

REFERENCES

Abalkhail, B. A., Shawky, S., Ghabrah, T. M., & Milaat, W. A. (2000). Hypercholesterolemia and 5-year risk of development of coronary heart disease among university and school workers in Jeddah, Saudi Arabia. *Preventive Medicine*, *31*(4), 390–395.

Abdel-Aal, N. M., Ahmad, A. T., Froelicher, E. S., Batieha, M., Hamza, M. M., & Ajlouni, K. M. (2008). Prevalence of dyslipidemia in patients with type 2 diabetes in Jordan. *Saudi Medical Journal*, *29*(10), 1423–1428.

Abdul-Khader, A.-K. A. (2009). Lipid profile and antihypertensive drugs. *Al-Kindy College Medical Journal*, *5*(1), 1–4.

Adiels, M., Borén, J., Caslake, M. J., Stewart, P., Soro, A., Westerbacka, J., … Taskinen, M.-R. (2005). Overproduction of VLDL1 driven by hyperglycemia is a dominant feature of diabetic dyslipidemia. *Arteriosclerosis, Thrombosis, and Vascular Biology*, *25*(8), 1697–1703.

Adler, A. I. (2000). Association of systolic blood pressure with macrovascular and microvascular complications of type 2 diabetes (UKPDS 36): prospective observational study. *Bmj*, *321*(7258), 412–419. https://doi.org/10.1136/bmj.321.7258.412

Al-Adsani, A., Memon, A., & Suresh, A. (2004). Pattern and determinants of dyslipidaemia in type 2 diabetes mellitus patients in Kuwait. *Acta Diabetologica*, *41*(3), 129–135.

Al-Kaabba, A. F., Al-Hamdan, N. A., El Tahir, A., Abdalla, A. M., Saeed, A. A., & Hamza, M. A. (2012). Prevalence and correlates of dyslipidemia among adults in Saudi Arabia: results from a national survey. *Open Journal of Endocrine and Metabolic Diseases*, *2*(4), 89.

Al-Maskari, F., El-Sadig, M., Al-Kaabi, J. M., Afandi, B., Nagelkerke, N., & Yeatts, K. B. (2013). Knowledge, attitude and practices of diabetic patients in the United Arab Emirates. *PloS One*, *8*(1), e52857.

Al-Zakwani, I., Al-Mahruqi, F., Al-Rasadi, K., Shehab, A., Al Mahmeed, W., Arafah, M., … Santos, R. D. (2018). Sex disparity in the management and outcomes of dyslipidemia of diabetic patients in the Arabian Gulf: findings from the CEPHEUS study. *Lipids in Health and Disease*, *17*(1), 25.

Alavudeen, S. S., Dhanapal, C. K., Khan, N. A., Al Akhali, K. M., & Paulliah, S. D. (2013). Prevalence and control of cardiovascular risk factors among type 2 diabetes mellitus patients in southern region of Saudi Arabia. *Journal of Young Pharmacists*, *5*(4), 144–147.

Amarasekara, P., de Silva, A., Swarnamali, H., Senarath, U., & Katulanda, P. (2016). Knowledge, attitudes, and practices on lifestyle and cardiovascular risk factors among metabolic syndrome patients in an Urban Tertiary Care Institute in Sri Lanka. *Asia Pacific Journal of Public Health*, *28*(1_suppl), 32S–40S.

Ambachew, H., Shimelis, T., & Lemma, K. (2015). Dyslipidemia among diabetic patients in Southern Ethiopia: Cross-sectional study. *Journal of Diabetes and Endocrinology*, *6*(4), 19–24.

Antonakoudis, G., Poulimenos, I., Kifnidis, K., Zouras, C., & Antonakoudis, H. (2007). Blood pressure control and cardiovascular risk reduction. *Hippokratia*, *11*(3), 114.

Association, A. D. (2013). Standards of medical care in diabetes—2013. *Diabetes Care*, *36*(Suppl 1), S11.

Association, A. D. (2018). 2. Classification and diagnosis of diabetes: standards of medical care in diabetes—2018. *Diabetes Care*, *41*(Supplement 1), S13–S27.

Aubert, L., Bovet, P., Gervasoni, J.-P., Rwebogora, A., Waeber, B., & Paccaud, F. (1998). Knowledge, attitudes, and practices on hypertension in a country in epidemiological transition. *Hypertension*, *31*(5), 1136–1145.

Bays, H. E., Chapman, R. H., Grandy, S., & Group, S. I. (2007). The relationship of body mass index to diabetes mellitus, hypertension and dyslipidaemia:

comparison of data from two national surveys. *International Journal of Clinical Practice*, *61*(5), 737–747.

BeLue, R., Okoror, T. A., Iwelunmor, J., Taylor, K. D., Degboe, A. N., Agyemang, C., & Ogedegbe, G. (2009). An overview of cardiovascular risk factor burden in sub-Saharan African countries: a socio-cultural perspective. *Globalization and Health*, *5*(1), 10.

Bhatnagar, D., Soran, H., & Durrington, P. N. (2008). Hypercholesterolaemia and its management. *Bmj*, *337*, a993.

Borle, A. L., Chhari, N., Gupta, G., & Bathma, V. (2017). Study of prevalence and pattern of dyslipidaemia in type 2 diabetes mellitus patients attending rural health training centre of medical college in Bhopal, Madhya Pradesh, India. *International Journal Of Community Medicine And Public Health*, *3*(1), 140–144.

Capurso, N. A., & Petrakis, I. (2016). Dyslipidemia associated with heavy alcohol use. *The American Journal on Addictions*, *25*(3), 188–190.

Chale, S. S., Swai, A. B., Mujinja, P. G., & McLarty, D. G. (1992). Must diabetes be a fatal disease in Africa? Study of costs of treatment. *BMJ*, *304*(6836), 1215–1218.

Chan, W. B., Tong, P. C. Y., Chow, C. C., So, W. Y., Ng, M. C. Y., Ma, R. C. W., … Chan, J. C. N. (2005). Triglyceride predicts cardiovascular mortality and its relationship with glycaemia and obesity in Chinese type 2 diabetic patients. *Diabetes/metabolism Research and Reviews*, *21*(2), 183–188.

Chattanda, S. P., & Mgonda, Y. M. (2008). Diabetic Dyslipidemia Among Diabetic Patients Attending Specialized Clinics in Dar es Salaam. *Tanzania Medical Journal*, *23*(1), 8–11.

Chaudhury, D., & Aggarwal, A. (2018). Diabetic Dyslipidemia: Current Concepts in Pathophysiology and Management. *Journal of Clinical & Diagnostic Research*, *12*(1).

Collaboration, E. R. F. (2010). Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. *The Lancet*, *375*(9733), 2215–2222.

Di Loreto, C., Fanelli, C., Lucidi, P., Murdolo, G., De Cicco, A., Parlanti, N., … Santeusanio, F. (2005). Make your diabetic patients walk: long-term impact of different amounts of physical activity on type 2 diabetes. *Diabetes Care*, *28*(6), 1295–1302.

Dixit, A. K., Dey, R., Suresh, A., Chaudhuri, S., Panda, A. K., Mitra, A., & Hazra, J. (2014). The prevalence of dyslipidemia in patients with diabetes mellitus of ayurveda Hospital. *Journal of Diabetes & Metabolic Disorders*, *13*(1), 58.

Durrington, P. (2003). Dyslipidaemia. *The Lancet*, *362*(9385), 717–731.

Erem, C., Hacihasanoglu, A., Kocak, M., Deger, O., & Topbas, M. (2008). Prevalence of prehypertension and hypertension and associated risk factors among Turkish adults: Trabzon Hypertension Study. *Journal of Public Health*, *31*(1), 47–58.

Estruch, R., Ros, E., Salas-Salvadó, J., Covas, M.-I., Corella, D., Arós, F., … Lapetra, J. (2013). Primary prevention of cardiovascular disease with a Mediterranean diet. *New England Journal of Medicine*, *368*(14), 1279–1290.

Expert, N. (2001). Panel on detection, evaluation and treatment of high blood cholesterol in adults. Executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert Panel on detection, evaluation and treatment of high blood cholesterol in adults (Adult Treatment Panel III). *JAMA*, (285), 2486.

Faseeh, K. M., Pasha, S. W., Maryam, Z., & Thunga, M. V. (2015). The Pattern of dyslipidemia among type 2 Diabetes Mellitus patients of Mangalore.

Fauci, A. S. (1998). *Harrison's principles of internal medicine* (Vol. 2). Mcgraw-hill New York.

Frenais, R., Ouguerram, K., Maugeais, C., Mahot, P., Maugere, P., Krempf, M., &

Magot, T. (1997). High density lipoprotein apolipoprotein AI kinetics in NIDDM: a stable isotope study. *Diabetologia*, *40*(5), 578–583.

Glader, E.-L., Sjölander, M., Eriksson, M., & Lundberg, M. (2010). Persistent use of secondary preventive drugs declines rapidly during the first 2 years after stroke. *Stroke*, *41*(2), 397–401.

Goldberg, I. J. (2001). Diabetic dyslipidemia: causes and consequences. *The Journal of Clinical Endocrinology & Metabolism*, *86*(3), 965–971.

Grundy, S. M. (1997). Cholesterol and coronary heart disease: the 21st century. *Archives of Internal Medicine*, *157*(11), 1177–1184.

Grundy, S. M., Hansen, B., Smith Jr, S. C., Cleeman, J. I., Kahn, R. A., & Participants, C. (2004). Clinical management of metabolic syndrome: report of the American Heart Association/National Heart, Lung, and Blood Institute/American Diabetes Association conference on scientific issues related to management. *Circulation*, *109*(4), 551–556.

Gu, K., Cowie, C. C., & Harris, M. I. (1999). Diabetes and decline in heart disease mortality in US adults. *Jama*, *281*(14), 1291–1297.

Guidelines, N. C., Of, M., & Mellitus, D. (n.d.). Republic of kenya.

Gupta, A., Gupta, R., Sarna, M., Rastogi, S., Gupta, V. P., & Kothari, K. (2003). Prevalence of diabetes, impaired fasting glucose and insulin resistance syndrome in an urban Indian population. *Diabetes Research and Clinical Practice*, *61*(1), 69–76.

Habib, S. H. (2006). Frequency distribution of atherogenic dyslipidemia in Saudi type 2 diabetic patients. *Pak J Physiol*, *2*(2), 20–23.

Haffner, S. M., Lehto, S., Rönnemaa, T., Pyörälä, K., & Laakso, M. (1998). Mortality from coronary heart disease in subjects with type 2 diabetes and in nondiabetic subjects with and without prior myocardial infarction. *New England Journal of Medicine*, *339*(4), 229–234.

Haffner, S. M., Miettinen, H., Gaskill, S. P., & Stern, M. P. (1996). Metabolic precursors of hypertension: the San Antonio heart study. *Archives of Internal Medicine*, *156*(17), 1994–2001.

Haffner, S., & Taegtmeyer, H. (2003). Epidemic obesity and the metabolic syndrome. *Circulation*, *108*(13), 1541–1545.

Harris, S. B., Ekoé, J.-M., Zdanowicz, Y., & Webster-Bogaert, S. (2005). Glycemic control and morbidity in the Canadian primary care setting (results of the diabetes in Canada evaluation study). *Diabetes Research and Clinical Practice*, *70*(1), 90–97.

Herold, K. C., Hagopian, W., Auger, J. A., Poumian-Ruiz, E., Taylor, L., Donaldson, D., … Zivin, R. A. (2002). Anti-CD3 monoclonal antibody in new-onset type 1 diabetes mellitus. *New England Journal of Medicine*, *346*(22), 1692–1698.

Hill, A. M., & Kris-Etherton, P. M. (2008). Contemporary strategies for weight loss and cardiovascular disease risk factor modification. *Current Atherosclerosis Reports*, *10*(6), 486–496.

Hu, F. B., Stampfer, M. J., Solomon, C., Liu, S., Colditz, G. A., Speizer, F. E., … Manson, J. E. (2001). Physical activity and risk for cardiovascular events in diabetic women. *Annals of Internal Medicine*, *134*(2), 96–105.

International Diabetes Federation. (2015). *Idf Diabetes Atlas*. *Idf Diabetes Atlas*. https://doi.org/2-930229-80-2

Inzucchi, S. E., Bergenstal, R. M., Buse, J. B., Diamant, M., Ferrannini, E., Nauck, M., … Matthews, D. R. (2015). Management of hyperglycemia in type 2 diabetes, 2015: a patient-centered approach: update to a position statement of the American Diabetes Association and the European Association for the Study of Diabetes. *Diabetes Care*, *38*(1), 140–149.

Isezuo, S. A., & Ezunu, E. (2005). Demographic and clinical correlates of metabolic syndrome in Native African type-2 diabetic patients. *Journal of the*

National Medical Association, *97*(4), 557.

Islam, F. M. A., Chakrabarti, R., Dirani, M., Islam, M. T., Ormsby, G., Wahab, M., … Finger, R. P. (2014). Knowledge, attitudes and practice of diabetes in rural Bangladesh: the Bangladesh population based diabetes and eye study (BPDES). *PLoS One*, *9*(10), e110368.

Jan, S. S., Rehman, A., Ahmad, R., Khan, T. M., Ahmad, A., & Abrar, A. (2011). Evaluation of pattern of dyslipidemia in type 2 diabetics in Swat. *Gomal Journal of Medical Sciences*, *9*(2).

Jellinger, P., Smith, D., Mehta, A., Ganda, O., Handelsman, Y., Rodbard, H., … Seibel, J. (2012). American Association of Clinical Endocrinologists' guidelines for management of dyslipidemia and prevention of atherosclerosis. *Endocrine Practice*, *18*(Supplement 1), 1–78.

Jisieike-Onuigbo, N. N., Unuigbe, E. I., & Oguejiofor, C. O. (2011). Dyslipidemias in type 2 diabetes mellitus patients in Nnewi South-East Nigeria. *Annals of African Medicine*, *10*(4).

Kabakci, G., Koylan, N., Ilerigelen, B., Kozan, O., & Buyukozturk, K. (2008). Impact of dyslipidemia on cardiovascular risk stratification of hypertensive patients and association of lipid profile with other cardiovascular risk factors: results from the ICEBERG study. *Integrated Blood Pressure Control*, *1*, 5.

Kaithala, C., Namburi, H. K., Bandaru, S. S., Bandaru, S. B. S., Adla, N., & Puchchakayala, G. (2016). Prevalence of dyslipidemia and its association with glycemic control in Indian type 2 diabetes population. *Romanian Journal of Diabetes Nutrition and Metabolic Diseases*, *23*(3), 277–283.

Kandula, R., & Shegokarz, V. E. (2013). A study of lipid profile in patients with type-2 diabetes mellitus. *Age*, *1635743319*(0.02).

Kannel, W. B. (2000). Fifty years of Framingham Study contributions to understanding hypertension. *Journal of Human Hypertension*, *14*(2), 83.

Karlander, S. G., Gutniak, M. K. M., & Efendic, S. (1991). Effects of combination

therapy with glyburide and insulin on serum lipid levels in NIDDM patients with secondary sulfonylurea failure. *Diabetes Care*, *14*(11), 963–967.

Kaur, G., Sudhera, N., Singh, K., Singh, G., & Bassi, D. K. (2017). Effect of Fasting Blood Glucose (FBG) on Lipid Metabolism and Gender Differences in the Pattern of Dyslipidemia in Adults with Type 2 Diabetes in Northern India. *Studies on Ethno-Medicine*, *11*(3), 209–215.

Kenya Ministry of Health (2007).*Annual Health Sector Status Report 2005-2007*. Nairobi, Kenya

Kilpatrick, E. S., Bloomgarden, Z. T., & Zimmet, P. Z. (2009). International Expert Committee report on the role of the A1C assay in the diagnosis of diabetes: response to the International Expert Committee. *Diabetes Care*, *32*(12), e159–e159.

KNBS, M. O. H. (n.d.). WHO. Kenya STEPwise Survey for Non-communicable diseases risk factors 2015 report. Nairobi; 2015.

Kostis, J. B. (2007). The importance of managing hypertension and dyslipidemia to decrease cardiovascular disease. *Cardiovascular Drugs and Therapy*, *21*(4), 297–309.

Krauss, R. M. (2004). Lipids and lipoproteins in patients with type 2 diabetes. *Diabetes Care*, *27*(6), 1496–1504.

Lee, M. H., Ahn, S. V., Hur, N. W., Choi, D. P., Kim, H. C., & Suh, I. (2011). Gender differences in the association between smoking and dyslipidemia: 2005 Korean National Health and Nutrition Examination Survey. *Clinica Chimica Acta*, *412*(17–18), 1600–1605.

Leon, A. S., & Sanchez, O. A. (2001). Response of blood lipids to exercise training alone or combined with dietary intervention. *Medicine & Science in Sports & Exercise*, *33*(6), S502–S515.

Maeda, K., Noguchi, Y., & Fukui, T. (2003). The effects of cessation from cigarette smoking on the lipid and lipoprotein profiles: a meta-analysis.

Preventive Medicine, *37*(4), 283–290.

Mahley, R. W., Palaoğlu, K. E., Atak, Z., Dawson-Pepin, J., Langlois, A. M., Cheung, V., … Vakar, F. (1995). Turkish Heart Study: lipids, lipoproteins, and apolipoproteins. *Journal of Lipid Research*, *36*(4), 839–859.

Martín-timón, I., Sevillano-collantes, C., Segura-galindo, A., Cañizo-gómez, F. J., Martín-timón, I., & Sevillano-collantes, C. (2014). Type 2 diabetes and cardiovascular disease : Have all risk factors the same strength ?, *5*(4), 444–470. https://doi.org/10.4239/wjd.v5.i4.444

Mathers, C. D., & Loncar, D. (2006). Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Medicine*, *3*(11), e442.

Mazzone, T., Chait, A., & Plutzky, J. (2008). Cardiovascular disease risk in type 2 diabetes mellitus: insights from mechanistic studies. *The Lancet*, *371*(9626), 1800–1809.

Mengesha, A. Y. (2006). Lipid profile among diabetes patients in Gaborone, Botswana. *South African Medical Journal*, *96*(2), 147–148.

Musunuru, K. (2010). Atherogenic dyslipidemia: cardiovascular risk and dietary intervention. *Lipids*, *45*(10), 907–914.

National Heart, Lung, and Blood Institute. (2003). Cardiovascular risk in the Vietnamese community: Formative research from Houston, Texas. *Bethesda, MD: US Department of Health and Human Services*

Nduati, N. J., Simon, K., Eva, N., & Lawrence, M. (2016). Factors Associated With Glycemic Control among Type 2 Diabetes Patients Attending Mathari National Teaching Hospital , Nairobi Kenya.

Nelson, K. M., Reiber, G., & Boyko, E. J. (2002). Diet and exercise among adults with type 2 diabetes: findings from the third national health and nutrition examination survey (NHANES III). *Diabetes Care*, *25*(10), 1722–1728.

Oguejiofor, O. C., Onwukwe, C. H., & Odenigbo, C. U. (2012). Dyslipidemia in

Nigeria: prevalence and pattern. *Annals of African Medicine*, *11*(4), 197.

Oparil, S., Zaman, M. A., & Calhoun, D. A. (2003). Pathogenesis of hypertension. *Annals of Internal Medicine*, *139*(9), 761–776.

Organization, W. H. (2002). . Quantifying Selected Major Risks to Health. *The World Health Report 2002; Reducing Risks, Promoting Healthy Life*.

Organization, W. H. (2003). *Diet, nutrition, and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation* (Vol. 916). World Health Organization.

Organization, W. H. (2012). Global physical activity questionnaire (GPAQ) analysis guide. Geneva.

Organization, W. H. (2014). Global health estimates: deaths by cause, age, sex and country, 2000-2012. *Geneva, WHO*, *9*.

Organization, W. H. (2016). *World health statistics 2016: monitoring health for the SDGs sustainable development goals*. World Health Organization.

Osterberg, L., & Blaschke, T. (2005). Adherence to medication. *New England Journal of Medicine*, *353*(5), 487–497.

Otieno, C. F., Mwendwa, F. W., Vaghela, V., Ogola, E. N., & Amayo, E. O. (2005). Lipid profile of ambulatory patients with type 2 diabetes mellitus at Kenyatta National Hospital, Nairobi. *East African Medical Journal*, *82*(12).

Packard, C. J. (2003). Triacylglycerol-rich lipoproteins and the generation of small, dense low-density lipoprotein. Portland Press Limited.

Polychronopoulos, E., Panagiotakos, D. B., & Polystipioti, A. (2005). Diet, lifestyle factors and hypercholesterolemia in elderly men and women from Cyprus. *Lipids in Health and Disease*, *4*(1), 17.

Rani, H. S., Madhavi, G., Rao, V. R., Sahay, B. K., & Jyothy, A. (2005). Risk factors for coronary heart disease in type II diabetes mellitus. *Indian Journal of Clinical Biochemistry*, *20*(2), 75–80.

Rankinen, T., & Bouchard, C. (2002). Dose-Response Issues Concerning the Relations between Regular Physical Activity and Health. *President's Council on Physical Fitness and Sports Research Digest*.

Robinson, A. C., Burke, J., Robinson, S., Johnston, D. G., & Elkeles, R. S. (1998). The effects of metformin on glycemic control and serum lipids in insulin-treated NIDDM patients with suboptimal metabolic control. *Diabetes Care*, *21*(5), 701–705.

Rosediani, M., Azidah, A. K., & Mafauzy, M. (2006). Correlation between fasting plasma glucose, post prandial glucose and glycated haemoglobin and fructosamine. *The Medical Journal of Malaysia*, *61*(1), 67–71.

Russo, G., Pintaudi, B., Giorda, C., Lucisano, G., Nicolucci, A., Cristofaro, M. R., … Rossi, M. C. (2015). Age-and gender-related differences in LDL-cholesterol management in outpatients with type 2 diabetes mellitus. *International Journal of Endocrinology*, *2015*.

Saleh, F., Mumu, S. J., Afnan, F., Ali, L., Chaudhury, H. S., Akhter, A., … Akter, S. (2011). Knowledge, Attitude And Practice Of Hypercholesterolemic Type 2 Diabetic Subjects On Dyslipidemia. *IMC Journal of Medical Science*, *5*(2), 37–41.

Sarfraz, M., Sajid, S., & Ashraf, M. A. (2016). Prevalence and pattern of dyslipidemia in hyperglycemic patients and its associated factors among Pakistani population. *Saudi Journal of Biological Sciences*, *23*(6), 761–766.

Shah, V. N., Kamdar, P. K., & Shah, N. (2009). Assessing the knowledge, attitudes and practice of type 2 diabetes among patients of Saurashtra region, Gujarat. *International Journal of Diabetes in Developing Countries*, *29*(3), 118.

Shen, Z., Munker, S., Wang, C., Xu, L., Ye, H., Chen, H., … Yu, C. (2014). Association between alcohol intake, overweight, and serum lipid levels and the risk analysis associated with the development of dyslipidemia. *Journal of Clinical Lipidology*, *8*(3), 273–278.

Siddiqui, S. A., Bano, K. A., Shabbir, I., Bashir, S., & Hussain, R. (2011). Prevalence of dyslipidemia in Patients with type-2 diabetes mellitus. *Pakistan Journal of Medical Research*, *50*(1), 29.

Song, S. J., Lee, J. E., Paik, H.-Y., Park, M. S., & Song, Y. J. (2012). Dietary patterns based on carbohydrate nutrition are associated with the risk for diabetes and dyslipidemia. *Nutrition Research and Practice*, *6*(4), 349–356.

Sowers, J. R., Epstein, M., & Frohlich, E. D. (2001). Diabetes, hypertension, and cardiovascular disease: an update. *Hypertension*, *37*(4), 1053–1059.

Sun, G.-Z., Li, Z., Guo, L., Zhou, Y., Yang, H.-M., & Sun, Y.-X. (2014). High prevalence of dyslipidemia and associated risk factors among rural Chinese adults. *Lipids in Health and Disease*, *13*(1), 189.

Szapary, P. O., Bloedon, L. T., & Foster, G. D. (2003). Physical activity and its effects on lipids. *Current Cardiology Reports*, *5*(6), 488–493.

Tamiru, S., & Alemseged, F. (2010). Risk factors for cardiovascular diseases among diabetic patients in southwest Ethiopia. *Ethiopian Journal of Health Sciences*, *20*(2).

Tuncer, D., Clough, L., & Pierce, B. (2002). Awareness of Link Between Diabetes. *Heart Disease and Stroke Critically Lacking. The American Diabetes Association. Available on: Http://www. Diabetes. Org/uedocuments/marketresearch. Pdf (Accessed on 10 March 2008)*.

Udawat, H., Goyal, R. K., & Maheshwari, S. (2001). Coronary risk and dyslipidemia in type 2 diabetic patients. *The Journal of the Association of Physicians of India*, *49*, 970–973.

Vanstone, M., Giacomini, M., Smith, A., Brundisini, F., DeJean, D., & Winsor, S. (2013). How diet modification challenges are magnified in vulnerable or marginalized people with diabetes and heart disease: a systematic review and qualitative meta-synthesis. *Ontario Health Technology Assessment Series*, *13*(14), 1.

Venkitachalam, L., Wang, K., Porath, A., Corbalan, R., Hirsch, A. T., Cohen, D. J., … Bhatt, D. L. (2012). Global variation in the prevalence of elevated cholesterol in outpatients with established vascular disease or 3 cardiovascular risk factors according to national indices of economic development and health system performance. *Circulation*, *125*(15), 1858–1869.

Wang, S., Xu, L., Jonas, J. B., You, Q. S., Wang, Y. X., & Yang, H. (2011). Prevalence and associated factors of dyslipidemia in the adult Chinese population. *PloS One*, *6*(3), e17326.

WHO. (2014). Global status report on noncommunicable diseases 2014. *World Health*, 176. https://doi.org/ISBN 9789241564854

Yarnell, J., Yu, S., McCrum, E., Arveiler, D., Hass, B., Dallongeville, J., … Ruidavets, J. B. (2004). Education, socioeconomic and lifestyle factors, and risk of coronary heart disease: the PRIME Study. *International Journal of Epidemiology*, *34*(2), 268–275.

Yusuf, S., Reddy, S., Ôunpuu, S., & Anand, S. (2001). Global burden of cardiovascular diseases: part I: general considerations, the epidemiologic transition, risk factors, and impact of urbanization. *Circulation*, *104*(22), 2746–2753.

Zhao, W.-H., Zhang, J., Zhai, Y., You, Y., Man, Q.-Q., Wang, C.-R., … Yang, X.-G. (2007). Blood lipid profile and prevalence of dyslipidemia in Chinese adults. *Biomedical and Environmental Sciences: BES*, *20*(4), 329–335.

APPENDICES

Appendix 1: Information Sheet and Informed Consent (English)

Study Title: *Patterns and Factors Associated With Dyslipidemia among Type 2 Diabetes Patients Attending Chronic Disease Management Clinics in Turbo Sub-County, Uasin Gishu County*

Principal Investigator: Victor Kiplagat Sang

Organization: Jomo Kenyatta University of Agriculture and Technology

Sponsor: Self sponsored-Victor Kiplagat Sang

Informed consent for: For Type 2 Diabetes Patients

This informed consent has two parts

- Information sheet (To share information about the study with you)
- Certificate of consent (For signatures if you choose to participate)

You will be given a copy of the signed Informed Consent Form

PART I: Information sheet

Introduction

You are being asked to take part in a research study. This information is provided to tell you about the study. Please read this form carefully. You will be given a chance to ask questions. If you decide to be in the study, you will be given a copy of this consent form for your records.

Taking part in this research study is voluntary. You may choose not to take part in the study. You could still receive other treatments. Saying no will not affect your rights to health care or services. You are also free to withdraw from this study at any time. If after data collection you choose to quit, you can request that the information provided by you be destroyed under supervision- and thus not used in the research study. You will be notified if new information becomes available

about the risks or benefits of this research. Then you can decide if you want to stay in the study

Purpose

This is to find out about dyslipidemia and their determinants among type 2 diabetes mellitus patients. Also so as to fulfill the requirement of Master of Science in Public Health Program at JKUAT.

Type of Research

The project involves filling a questionnaire, being interviewed in a groupd and a draw of blood from your arm for some laboratory tests.

Why have I been identified for the study?

I chose you to take part because you are among the patients who need help. Secondly the results will aid in improving your health.

How long will the study take?

The research will take part in the early mornings of clinic days. Your participation will take about 30 minutes.

What will happen to me in the study?

A. This research will involve you filling a questionnaire about yourself and practices. We are asking you to help us learn more about dyslipidemia and other cardiovascular risk factors in diabetes.

All the procedures of this study have been approved by the appropriate authority and Institutional Research and Ethics Committee of Moi University (IREC). The study involves getting blood sample from a vein on your arm then laboratory test done to determine the lipid profile, measuring your height, weight and blood pressure. You will fill a questionnaire that will collect data on your socio-demographic, socio-economic and behavioral characteristics. Furthermore assessment of knowledge, attitude and practices will be done on selected few.

B. We will also ask questions concerning you understanding, views and opinions about diabetes and other cardiovascular risk factors. The questions are not targeted at doing any harm to you so you don't need to worry.

Risk

The study involves no forseeable risk of harm, you are likely to feel a slight pain during getting blood sample from a vein on your arm. Injuries are less likely to occur

Benefits

The possible benefits to you from this study are that you gauge your understanding on cardiovascular risk factors and diabetes.

You may not benefit personally from the study but the general public will have the understanding on dyslipidemia in diabetes.

Results will help in better management of the effects of dyslipidemia including in the participants.

The possible benefits to the society may include that by participating and answering questions you will help us and the findings of this report will be useful to people around you. The other beneficiaries include the general public and AMPATH.

Reimbursements

A small amount for breakfast will be reimbursed by the researcher.

Questions on the study

If you have any questions related to the questionnaires now or any time during the study, please feel free to ask or discuss with me. Please contact me on the following address

Victor Kiplagat Sang

P.O BOX 6470

ELDORET,KENYA

Tel: +254728217607

Email: viksang19@gmail.com

Confidentiality

Ethical clearance was attained from IREC which is a recognized body. A unique code number on each questionnaire will be used so that your personal identity will not be disclosed. All the information in connection with this study will remain confidential and the questionnaire will be destroyed after completion of the study.

All reasonable efforts will be made to keep your protected information (private and confidential. Protected Informationis information that is, or has been, collected or maintained and can be linked back to you. Using or sharing ("disclosure") of such information must follow National privacy guidelines. By signing the consent document for this study, you are giving permission ("authorization") for the uses and disclosures of your personal information. A decision to take part in this research means that you agree to let the research team use and share your Protected Information as described below.

As part of the study, Victor Kiplagat Sang and his study team may share the results of your laboratory tests. These may be study or non-study related. They may also share portions of your medical record, with the groups named below:

- The National Bioethics. Committee,
- The Institutional Review and Ethics Committee

SECTION B: Consent

I have read or have had read to me the description of the research study. The investigator or his/her representative has explained the study to me and has answered all of the questions I have at this time. I have been told of the potential risks, discomforts and side effects as well as the possible benefits (if any) of the study. I freely volunteer to take part in this study.

_____ _____ _____

Name of ParticipantSignature of subject/thumbprint Date & Time

(Witness to print the name if the subject is unable to write

_____ _____

Name of Representative/Witness Relationship to Subject

_____ _____

_____

Name of person Obtaining Consent Signature of person Date

Obtaining Consent

_____ _____

_____

Printed name of Investigator Signature of Investigator Date

Appendix 2: Information Sheet and Informed Consent (Kiswahili Version)

MADA: *kiwango kikubwa cha mafuta damuni Na sababu zake miongoni mwa watu wenye ugonjwa Wa kisukari katika kliniki za cdm turbo*

Mdadisi: Victor Kiplagat Sang

Chuo: Jomo Kenyatta University of Agriculture and Technology

Mdhamini: Binafsi

Ridhaa ya: Wagonjwa wenye kisukari

Sehemu mbili

- Maelezo kuhusu lenfo letu (Kukujulisha kuhusu utafiti/udadisi huu)
- Cheti cha ridhaa (kwa ajili ya sahihi za kuonyesha kukubali kushiriki)

Utapewa fomu moja iliyotiwa sahihi

SEHEMU I: Ridhaa

Utangulizi

Unaalikwa kushiriki katika utafiti huu na maelezo haya yanakueleza kuhusu utafiti wenyewe. Tafadhali soma kwa uangalifu na tapewa muda wa kuuliza maswali. Ukikubali kushiriki katika utafiti huuutapewa fomu kwa minaajili ya rekodi yako mwenyewe.

Kushiriki sion kwa lazima bali ni kwa hiari yako na tapokea matibabu kama kawaida. Unaeweza kuchagua kutoshiriki katika utafiti huu na hakutakua na mabadiliko katika uhuru wako wa kupokea matibabu. Unaweza pia kujiondoa katika utafiti huu wakati wowote na ukihitaji kujiondoa katikati ya utafiti basi taarifa yoyote kukuhusu itafutiliwa mbali na haitatumika katika utafiti huu. Pia utajulishwa kuhusu mambo yatakayotokea kuhusu hatari ama manufaa ya utafiti huu. Utakua na uhuru wa kubaki katika utafiti pia

Sababu

Utafiti huu ni wa kudadisi kiwango cha mafuta (cholesteroal-dyslipidemia) na sababu zake miongoni mwa wagonjwa walio na kisukari. Pia ni kuhitimisha shahada katika chuo kikuu cha Jomo Kenyatta.

Aina ya Utafiti

Utafiti huu unahitaji kuyajibu maswali kadhaa na pia kutoa damu ya kutumia kwa uchunguzi. Wachache wenu watahitajika kushiriki katika mahojiano.

Mbona nimekuchagua katika utafiti huu?

Nimekuchagua kwa sababu wewe ni mmoja wa wagonjwa walioandikishwa na AMPATH kwa ajili ya matibabu ya kisukari. Pia, matokeo ya utafiti huu yatasaidia kukuelewa wewe mwenyewe na jinsi ya kuboresha afya yako zaidi.

Muda wa Utafiti

Utahitajika kwa muda wa dakika takriban 20 siku moja tu unapokuja kliniki. Utafiti wote utamaliza muda wa miezi mbili.

Nini nitafanyiwa wakati wa utafiti?

A. Taratibu ni kama vile kujibu maswali kukuhusu wewe mwenyewe. Tunakusihi ushiriki ili tuweze kuelewa sana kuhusu mafuta ya cholesterol katika mwili wako na pia hatari za ugonjwa wa moyo na mishipa kwa wagonjwa walio na kisukari.

Tratibu zote zimethibitishwa na kameti ya Institutional Research and Ethics Committee ya Moi University (IREC). Utahitajika kutolewa damu mkononi mwako kisha itumike kwa udadisi, pia utapiwa uzani na urefu na pia shinikizo la damu. Utajaza fomu iliyo na maswali utakayohitajika kujaza kikamilifu na wachache watashiriki mahojiano kuhusu hatari na ugonjwa wa moyo na kisukari.

B. Utaulizwa maswali kuhusu maarifa, maoni kuhusu ugonjwa wa kisukari na hatari za ugonjwa moyo na mishipa pamoja. Maswali yenyewe hayatakua na ubaya wowote kwa hivyo hufai kua na wasiwasi wowote.

Hatari

Utafiti huu haina hatari kwako bali utahisi uchungu kidogo utakapo tolewa damu kiasi mkononi mwako. Mauivu ya aina yoyote hayatatokea kwako.

Manufaa

Manufaa kwako ni kuelewa zaidi kuhusu ugonjwa huu na hatari zake kwako na jinsi ya kuboresha afya yako. Unawezagundua kua haina manufaa sana kwako lakini wananchi na pia hospitali itapata manufaa.

Kutakua na manufaa kwa jamii ukishiriki na hivyo basi ni muhimu. Pia AMPATH na wananchi kwa jumla watapata kuelewa zaidi kuhusu ugonjwa huu.

Malipo

Kushiriki kwako utatupa tutagharamia usafiri na kiamsha kinywa kwa sababu utahitajika kusafiri hadi hospitalini asubuhi bila kula chochote kwa ajili ya udadisi wa damu.

Maswali kuhusu utafiti huu

Ukiwa na maswali kuhusu utafiti huu tafadhali kua na uhuru wa kunifikia

Victor Kiplagat Sang, S.L.P 6470. ELDORET,KENYA, Simu: +254728217607

Email: viksang19@gmail.com

Siri

Kila dodoso itakua na namabri tofauti ili majina yako yasitumike na iwe siri. Taarifa utakayotupa pia itakua ya siri na hakuna atakayeyatumia baada ya udadisi huu kwa sababu nitayachoma baada ya utafiti.

Katika utafiti huu, Victor Kiplagat Sang na watu wake wanawezakutumia taarifa yako lakini itakua ni kwa ajili ya utafiti tu. Tunaweza kutumia taarifa hiyo pamoja na:

- The National Bioethics. Committee,

- The Institutional Review and Ethics Committee

SEHEMU II B: Kibali

Nimesoma na kuelewa maelezo kuhusu utafiti huu. Mdadisi ameeleza vyema na kujibu maswali ninazo kwa sasa. Nimeelezwa kuhusu hatari, na manufaa ya akushiriki katika utafiti huu. Nakubali kushiriki kwa hiari yangu mwenyewe

_____ _____
_____

Jina la mshiriki Sahihi Tarehe & saa

_____
_____
_

Jina la shahidiUhusiano na mshiriki

_____ _____
_____

Jina la mwenye kupokea ridhaa Sahihi Tarehe

_____ _____
_____

Jina la mdadisi Sahihi ya mdadisi Tarehe

Appendix 3: Questionnaire (English)

Patterns and Factors Associated With Dyslipidemia Among Type 2 Diabetes Patients Attending Chronic Disease Management Clinics In Turbo Sub-County

Date.....Code.....Time.....

Venue:.....

Please answer the following questions by putting a tick on the appropriate answer.

SECTION A: SOCIO-DEMOGRAPHIC AND ECONOMIC DATA		
	Response	**Code**
1.Age (years)	_____	
2. Place of residence	_____	
3.Gender	□ Male □ Female	1 2
4. Marital status	□ Single □ Married □ Widowed □ Divorced/Separated	1 2 3 4
5.Religion	□ Muslim □Christian □Others Specify.....	1 2 3
6.Residence (Urban or Rural)	□ Urban □ Rural	1 2
7. Level of Education (choose one from the categories)	□ None □ Primary school □ Secondary school □ College	1 2 3 4

	□Tertiary/University	5
8.Occupation (choose one from the categories)	□ Unemployed □ Business person □Farmer □Employed as ..... □ Retired	1 2 3 4 5
9. Monthly Income in Kshs (choose one from the categories).	□ Below 15,000 □ 15,001 – 30,000 □ 30,001 – 45,000 □ 45,001 – 70,000 □ Above 70,000	1 2 3 4 5
10. What type of a house do you live in?	□ Permanent □ Semi Permanent □ Temporary	1 2 3
SECTION B: BEHAVIORALAND CLINICAL DATA		
11. Do you/have you ever smoked cigarettes?	□ No □ Yes but stopped □ Yes I currently smoke	1 2 3
12. Do you/have you ever taken alcohol?	□ No □ Yes but stopped □ Yes I currently drink	1 2 3
13. Received advice or talk about dietary management?	□ Yes □ No	1 2
14. How often do you observed the dietary management plan?	□ Always □ Not always	1 2

15. Have you been diagnosed with heart or blood vessles problem before? (E.g highblood pressure, stroke etc)	□ Yes □ No	1 2
16. Do you have family member with heart or blood vessels problem?	□ Yes □ No	1 2

17. Please answer the following questions correctly concerning practice on medication by putting a tick.

Level of adherence	**Rarely** (0)	**Sometime** (0.5)	**Always** (1)
a). I strictly take my medication			
b). I take the right amount of medicine			
c). I take my medications timely as prescribed by my doctor			
d). I visit my doctor as scheduled			
e). I follow my doctor's or nurse's advice			
TOTAL ADHERENCE SCORE			

18. Physical Activity part

a) Have you received advice on physical exercises/Activity?	□ Yes □ No	1 2

b) Level of physical activity

Physical Activity

Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. *[Insert other examples if needed]*. In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.

	Questions	**Response**	**Code**
Activity at work			
1	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like *[carrying or liftingheavy loads, digging or construction work*] for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 *If No, go to P 4*	P1
2	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days ⌊__⌋	P2
3	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P3 (a-b)
4	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking *[or carrying light loads*] for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 *If No, go to P 7*	P4

5	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days ⌊__⌋	P5
6	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P6 (a-b)
Travel to and from places			
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. [insert other examples if needed]			
7	Do you walk or use a bicycle (*pedal cycle*) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 *If No, go to P 10*	P7
8	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days ⌊__⌋	P8
9	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P9 (a-b)
Recreational activities			
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure), [insert relevant terms].			
10	Do you do any vigorous-intensity sports, fitness or	Yes 1	

	recreational (*leisure*) activities that cause large increases in breathing or heart rate like [*running or football,]* for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	No 2 *If No, go to P 13*	P10
11	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (*leisure*) activities?	Number of days ⌊__⌋	P11
12	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P12 (a-b)
13	Do you do any moderate-intensity sports, fitness or recreational *(leisure*) activities that causes a small increase in breathing or heart rate such as brisk walking,(*cycling, swimming, volleyball*)for at least 10 minutes continuously? *[INSERT EXAMPLES] (USE SHOWCARD)*	Yes 1 No 2 If No, go to P16	P13
14	In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (*leisure*) activities?	Number of days ⌊__⌋	P 14
15	How much time do you spend doing moderate-intensity sports, fitness or recreational (*leisure*) activities on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P15 (a-b)
Sedentary behavior			

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent [sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television], but do not include time spent sleeping. *[INSERT EXAMPLES] (USE SHOWCARD)*			
16	How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes └─┘└─┘ : └─┘└─┘ hrs min s	P 16 (a-b)

Appendix 4: Dodoso (Questionnaire-Kiswahili Version)

KIWANGO KIKUBWA CHA MAFUTA/KOLESTROLI DAMUNI MIONGONI MWA WAGONJWA WENYE KISUKARI KATIKA KLINIKI ZA CDM TURBO

Tafadhali jibu maswali haya kwa kuweka sahihi kwa jibu bora kwako

SEHEMU A: DEMOGRAFIA NA UCHUMI		
	Jibu	**Kodi**
1. Umri (miaka)		
2. Makaazi		
3.Jinsia	□ Mwanaume □ Mwanamke	1 2
4. Hali ya ndoa	□ Sijaoa/sijaolewa □ Nimeoa/olewa □ Mjane □ Tuliachana	1 2 3 4
5.Dini	□ Muislamu □Mkristo □Nyinginezo.....	1 2 3
6. Makaazi-Mjini au mashinani	□ Mjini □ Mashambani	1 2
7. Kiwango cha elimu	□ Sijaenda shule □ Shule ya msingi □ Sekondari □ Koleji □Elimu ya juu	1 2 3 4 5
8. Kazi	□Sijaajiriwa □Mwanabiashara	1 2

	□ Mkulima □ Nimeajiriwa kama..... □ Nimestaafu	3 4 5
9. Mshahara wako kwa mwezi	□ Chini ya 15,000 □ 15,001 – 30,000 □ 30,001 – 45,000 □ 45,001 – 70,000 □ Zaidi 70,000	1 2 3 4 5
10. Aina ya nyumba unayoishi	□ Ya kudumu kabisa □ Ya kudumu kidogo tu □ Isio ya kudumu	1 2 3
SEHEMU C: MAZOEA, TABIA NA AFYA		
11. Umewahitumia ama unatumia sigara kwa sasa?	□ La □Ndio,lakini niliacha □ Ndio navuta sigara kwa sasa	1 2 3
12. Umewahitumia ama unakunywa pombe?	□ La □Ndio,lakini niliacha □ Ndio nakunywa pombe kwa sasa	1 2 3
13. Umeelezwa kuhusu vakula?	□ Ndio □ La	1 2
14. Je umefuatiliaaje vyakula?	□ Kila mara □ Sio kila mara	1 2
15. Je, umepatikana na shida ya moyo ama shinikizo la damu?	□ Ndio □ La	1 2
16. Je, kuna mtu katika familia yako aliye na ugonjwa wa moyo ama shinikizo la damu?	□ Ndio □ La	1 2

17. Tafadhali jibu maswali haya kuhusu matibabu yako.

Kuzingatia matibabu	**Nadra** (0)	**Mara kadhaa** (0.5)	**Siku zote**(1)
a).Nimefuatilia na kutumia dawa hizo			
b). Nimetumia kipimo sahihi ya dawa			
c). Nimemeza dawa kwa wakati ufaao kulingana na maagizo ya daktari			
d). Nimemetembelea daktari mara kwa mara			
e). Nimefuatilia maagizo na mawaidha ya daktari			
TOTAL ADHERENCE SCORE			

18. Mazoezi ya kimwili

a) Umepokea mashauri kuhusu mazoezi ya kimwili?	□ Ndio □ La	1 2

b) Kiwango cha mazoezi

Mazoezi ya kimwili		
Ninaenda kukuuliza maswali kuhusu unavyotumia wakati wako ukifanya mazoezi na kazi kwa wiki moja. Tafadhali jibu maswali haya tatu hata kama huoni kama wewe hujihusisha sana na kazi pia mazoezi ya kimwili.Fikiria kwanza kuhusu muda/wakati unaotumia kufanya kazi. Fikiria kazi kama vitu unavyofanya kama vile ili upate kulipa au bila malipo, kusoma, kazi za nyumbani, kuvuna vyakula/mazao/mboga, kuvua samaki, ama kuwinda ili upate chakula, kutafuta kazi.*[Ongeza mifano mengine yakihitajika]*. Kwa kujibu maswali yafuatayo 'Kazi ya nguvu ya juu' ni kazi zinahitaji bidii na nguvu ya juu sana na inahitaji kupumua kwa nguvu/kuhema na moyo kupiga kwa kasi, 'Kazi ya kadri' ni kazi zinahitaji nguvu ya kiwango cha kadri na huongeza kasi ya moyo kwa kiasi tu		
Maswali	**Majibu**	Kodi
Shughuli kazini		

1	Je, kazi yako unatumia nguvu sana na kufanya moyo wako huende kasi poa kupumua kwa nguvu/kuhema. *[kubeba na kuinua mizigo mizito, kulima, kujenga*] kwa muda usionpungua dakika 10 mfululizo? *[INGIZA MIFANO] (ONYESHA KADI)*	Ndio 1 La 2 *Kama La, Nenda P 4*	P1
2	Kwa wiki moja,siku ngapi unafanya kazi ya nguvu ya juu kando na kazi yako?	Nambari ya siku ⌊__⌋	P2
3	Muda kiasi gani unayotumia kufanya kazi ya nguvu ya juukatika siku moja?	⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ Saa nzima : Dakika SaaDakika	P3 (a-b)
4	Je, kazi yako unatumia nguvu ya kadiri na kufanya moyo wako kudunda kuliko kawaida na kuongeza unavyopumua kwa kadiri pia kama kutembea?.*[kubeba mizigo nyepesi*] kwa muda usionpungua dakika 10 mfululizo?? *[INGIZA MIFANO] (TUMIA KADI)*	Ndio 1 La 2 *Kama La,Nenda P 7*	P4
5	Kwa wiki moja,siku ngapi unafanya kazi ya nguvu kadiri kando na kazi yako?	Nambari ya siku ⌊__⌋	P5
6	Muda kiasi gani unayotumia kufanya kazi ya nguvu kadiri katika siku moja?	⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ Masaa : Dakika SaaDakika	P6 (a-b)
Kusafiri			
Maswali yafuatayo hayahusu mazoezi ya mwili kazini ambayo umetaja tayari. Ningependa kuuliza kuhusu jinsi unavyosafiri kutoka na kuenda sehemu mbalimbali.Kwa mfano kuenda kazini, kununua bidhaa,sokoni, kanisani. [ingiza mifano mengine]			

7	Je, wewe hutembea ama kutumia baiskeli kwa muda usiopungua dakika 10 mfululizo kuenda na kurudi toka sehemu mbalimbali?	Ndio 1 La 2 *Kama La,nenda P 10*	P7
8	Kwa wiki moja, singu ngapi unatembea ama kutumia baiskeli kwa muda usiopungua dakika 10mfululizo kenda na kutoka sehemu mbalimbali?	Siku ngapi ⌊__⌋	P8
9	Unatumia muda gani kutembea ama kutumia basiskeli kusafiri kwa siku moja?	Masaa : Dakika ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ SaaDakika	P9 (a-b)
Kujiburudisha			
Maswalli yafuatayo hayahusu kazi ama kusafiri kwako ambapo ushataja. Ningependa kukuuliza kuhusu michezo, mazoezi na kujiburidisha wakati wako mwenyewe, [Ingiza matamshi yafaayo].			
10	Je, unashiriki michezo zinazohitaji nguvu na ya kasi, mazoezi ya kimwil ama kuburudika. Matukio yanayoongeza kupumua na kupiga/kudunda kwa moyo [Kukimbia ama kucheza kandanda*,]kwa muda usiopungua dakika* 10 mfululizo? *[INSERT EXAMPLES] (USE SHOWCARD)*	Ndio 1 La 2 *kama La,nenda P 13*	P10
11	Kwa wiki moja, unashiriki spoti zinazohitaji nguvu, mazoezi na kujiburudisha?	Nambari ya siku ⌊__⌋	P11
12	Je, unatumia muda gani kushiriki spoti, mazoezi ama kujiburudisha ambapo nguvu zaidi ya kawaida huitajika kwa siku moja?	Saa :Dakika ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ MasaaDakika	P12 (a-b)

13	Je, unashiriki katika spoti , mazoezi ama kujiburudisha yoyote inayohitali nguvu kadiri. Mazoezi zinazofanya uongeze kupua na pia moyo kupiga zaidi ya kawaida lakini kadiri tu. kama kutembea (kuendesha baiskeli, kuogelea, kucheza voliboli)) kwa muda usiopungua dakika 10 mfululizo? *[INGIZA MIFANO] (TUMIA KADI)*	Ndio 1 La 2, Kama La nenda P16	P13
14	Kwa wiki moja, ni siku ngapi unashiriki spoti, mazoezi ama kujiburudisha na yahitaji nguvu ya kadiri?	Masaa : Dakika └─┘└─┘ : └─┘└─┘ SaaDakika	P14
15	Je, unatumia muda gani kushiriki spoti, mazoezi ama kujiburudisha ambapo nguvu kadiri tu huitajika kwa siku moja?	Masaa : Dakika └─┘└─┘ : └─┘└─┘ SaaDakika	P15 (a-b)
Tabia sedentari			
Swali lifuatalo ni ya kuhusu kuketi na kupumzika kazini, nyumbani, kusafiri kutoka sehemu moja hadi nyingine ama na marafiki pamoja na muda (kuketi kwa dawatu, kuketi na marafiki, kusafiri kwa gari, basi, gari ya moshi, kusoma, kucheza kadi ama kutazama televisheni) lakini sio pamoja na muda wa kulala. *[INGIZA MIFANO] (TUMIA KADI)*			
16	Je unatumia muda gani ukiketi na kuoumzika katika siku moja?	Masaa : Dakika └─┘└─┘ : └─┘└─┘ MasaaDakika	P16 (a-b)

Appendix 5: Focus Group Discussion Guide (English)

Knowledge, Attitude and Practices towards Dyslipidemia And Other Cardiovascular Risk Factors

Introduction

Good morning/ afternoon. My name is Victor Kiplagat from Jomo Kenyatta University of Agriculture and Technology. I am doing a study on dyslipidemia (abnormal lipid profiles) and the associated factors. First, I want to thank you all for taking the time to be with us today. With me is my assistant who will help me with taking of notes.

Awareness

Now let's talk about abnormal cholesterol levels. Let's say I am your friend and I know nothing about it, how would you explain it to me?

- What are abnormal lipids/cholesterol? (What are the causes?)
- What are the effects of high cholesterol? (Why is it a problem?)

Prevention

- Can you prevent high levels of cholesterol? If so how?

Management of lipids/cholesterol levels

- How can you manage high cholesterol levels? (What do you do to lower cholesterol?)
- What else do you do to improve your health in general?

Advice from the CDM clinic

- What advice have you been given at the clinic about cholesterol levels?
- What are the challenges that you face while putting in practice what you where advised?
- What do you think/feel about physical exercises and diet recommended to you?
- Do they have an effect on your cholesterol levels and health?

- What do you think/feel about your current treatment?
- What do you think/feel about obesity, alcohol consumption, cigarettes smoking in relation to your health?
- What effect do they have on levels of cholesterol?

Communication

- When do you seek medical attention?
- Where do you get information on diabetes and other related problems?

Closing

• We are almost finished. Is there anything else you'd like to say before we finish up?

• Thank you all for taking the time to participate today. The information you provided is extremely helpful and will be used to help clinic provide better care in the clinic and programs for you and others like you in the future.

Appendix 6: Focus Group Discussion Guide (Kiswahili Version)

Mwongozo Wa Majadiliano

Umaarifa/Ufahamu, Mtazamo Na Tabia Kuhusu Hatari Za Kiwango Kikubwa Cha Kolesteroli Na Ugonjwa Wa Moyo Na Mishipa

Utangulizi

Good morning/ afternoon. Ninaitwa Victor Kiplagat kutoka Jomo Kenyatta University of Agriculture and Technology.Ninafanya utafiti kuhusu kiwango kikubwa cha kolestrol (abnormal lipid profiles) na sababu zake. Kwanza kabisa ningependa kuwashukuru kwa kuitikia mwito wangu. Aliye nami hapa leo ni msaidizi wangu ambaye atanisaidia kuandikisha maelezo kutoka kwa majadiliano ya siku ya leo

Ufahamu

Sasa tuzungumze kuhusu kiwango kikubwa cha kolestrol ama kiwango kisichofaa mwilini. Tuseme mimi ni rafiki yako na sijui chochote kuihusu, unawezakunieleza vipi, ni nini hasa?

- Kolestrol ni nini hasa?
- Kiwango kikubwa hutokea aje?

Kudhibiti kiwango cha kolestroli/lipids

- Kiwango kikubwa cha kolestroli hudhibitiwaje?

Kuzuia

- Kolestroli ya juu mwilini huweza kuzuiwa kwa njia zipi? Eleza zaidi
- Je, wewe hufanya nini kando na hayo kuboresha afya yako?

Maelezo na ushauri kutoka kliniki yako ya CDM

- Je, umepokea mashauri gani kutoka kwa kliniki yako kuhusu kolesteroli?
- Ni nini changamoto za kufuatilia mashauri hayo?
- Je, ni nini hisia ama fikira zako kuhusu mazoezi na chakula unayohitajika kutumia? Zinaleta tofauti kwa kolesteroli na afya?

- Je, ni nini hisia ama fikira zako kuhusu matibabu yako ya kisukari sasa hivi?
- Je, ni nini hisia ama fikra zako kuhusu kua na uzani mkubwa, kunywa pombe, kuvuta siagara na afya?
- Inasababisha tofauti gani katika kiwango ya kolesteroli?

Mazungumzo na mawasiliano

- Je, wewe hutafuta matibabu wakati gani?
- Je, wewe hupokea maelezo kuhusu kisukari na matatizo yanayofuatana nayo kutoka wapi?

Kufunga

• Tumekaribia tamati. Kuna mtu angependa kuongezea?

• Nawashukuru wote kwa kupata wakati wa kushiriki leo hii. Maelezo mlionipa itakua kwa manufaa sana na yatasaidia kliniki kutoa matibabu iliyo bora.

Appendix 7: Health Assessment Record Form

Code.....Date and time of sample collection.....

1. Blood pressure	Systolic...../Diastolic.....(mmHg)
2. Lipid Profile	TC.....(mmol/l) HDL.....(mmol/l) LDL.....(mmol/l) TGs.....(mmol/l)
3. FBS	.....(mmol/l)
4. Body weight	.....(Kg)
5. Height	.....(M)
6. Body mass Index	.....
7.Year of diabetes diagnosisabetes	.....

Appendix 8: W.H.O. physical activity recommendation tool (gpaq)

Instrument questions:

- **P1-P6a & b**: Activity at work
- **P7-P9a & b**: Travel to and from places
- **P10-P15a & b**: Recreational activities

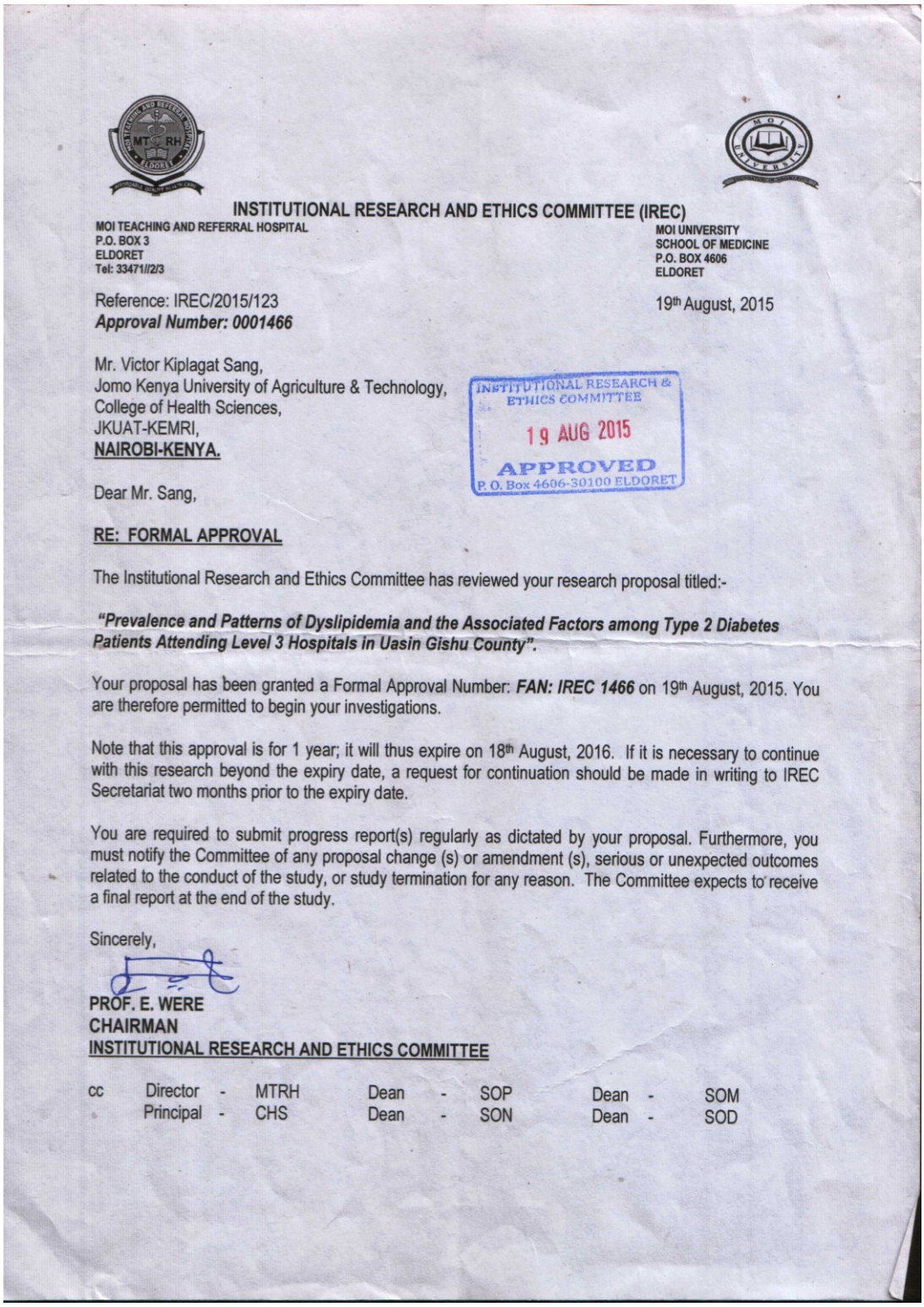
Calculations:

Domain	**MET Value**
Work	• Moderate MET value = 4.0 • Vigorous MET value = 8.0
Transport	• Cycling and walkin MET value = 4.0
Recreation	• Moderate MET value = 4.0 • Vigorous MET value = 8.0

Equations	Total physical activity MET-minutes/week (= the sum of the total MET minutes of activity computed for each setting) Equation: Total Physical Activity MET-minutes/week = [(P2 * P3 * 8) + (P5 * P6 * 4) + (P8 * P9 * 4) + (P11 * P12 * 8) + (P14 * P15* 4)]

WHO recommen-dations	**Physical activity cutoff value**
Not meeting recommen-dations	• IF: Total Physical Activity MET minutes per week is < 600

Appendix 9: IREC Ethical Approval Letter



INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

Reference: IREC/2015/123
Approval Number: 0001466

19th August, 2015

Mr. Victor Kiplagat Sang,
Jomo Kenya University of Agriculture & Technology,
College of Health Sciences,
JKUAT-KEMRI,
NAIROBI-KENYA.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
19 AUG 2015
APPROVED
P. O. Box 4606-30100 ELDORET

Dear Mr. Sang,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"Prevalence and Patterns of Dyslipidemia and the Associated Factors among Type 2 Diabetes Patients Attending Level 3 Hospitals in Uasin Gishu County".

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 1466*** on 19th August, 2015. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 18th August, 2016. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

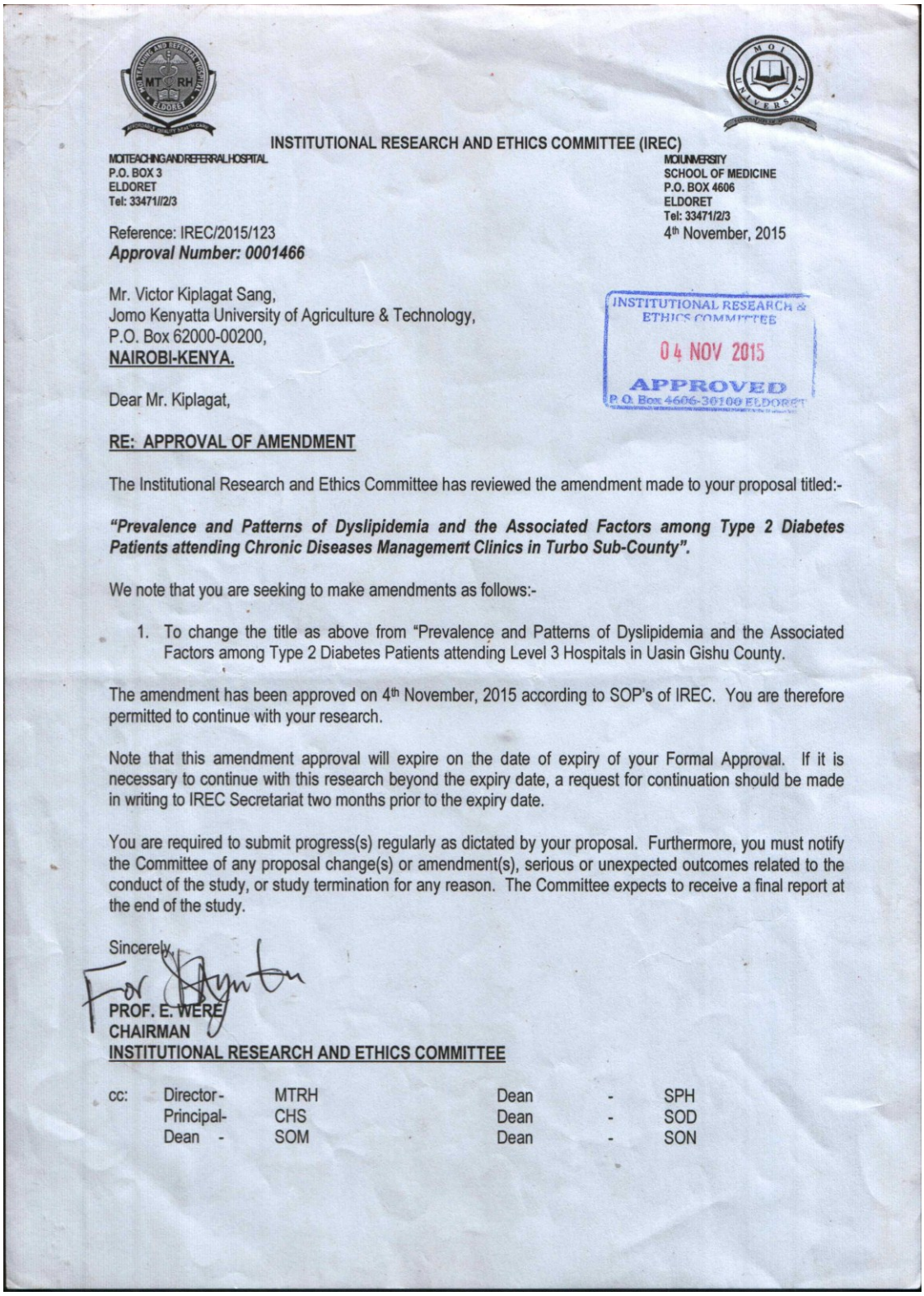
You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc Director - MTRH Dean - SOP Dean - SOM
Principal - CHS Dean - SON Dean - SOD

Appendix 10: IREC Amendment Letter



INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET
Tel: 33471/2/3

Reference: IREC/2015/123
Approval Number: 0001466

4th November, 2015

Mr. Victor Kiplagat Sang,
Jomo Kenyatta University of Agriculture & Technology,
P.O. Box 62000-00200,
NAIROBI-KENYA.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
04 NOV 2015
APPROVED
P. O. Box 4606-30100 ELDORET

Dear Mr. Kiplagat,

RE: APPROVAL OF AMENDMENT

The Institutional Research and Ethics Committee has reviewed the amendment made to your proposal titled:-

"Prevalence and Patterns of Dyslipidemia and the Associated Factors among Type 2 Diabetes Patients attending Chronic Diseases Management Clinics in Turbo Sub-County".

We note that you are seeking to make amendments as follows:-

1. To change the title as above from "Prevalence and Patterns of Dyslipidemia and the Associated Factors among Type 2 Diabetes Patients attending Level 3 Hospitals in Uasin Gishu County.

The amendment has been approved on 4th November, 2015 according to SOP's of IREC. You are therefore permitted to continue with your research.

Note that this amendment approval will expire on the date of expiry of your Formal Approval. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change(s) or amendment(s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

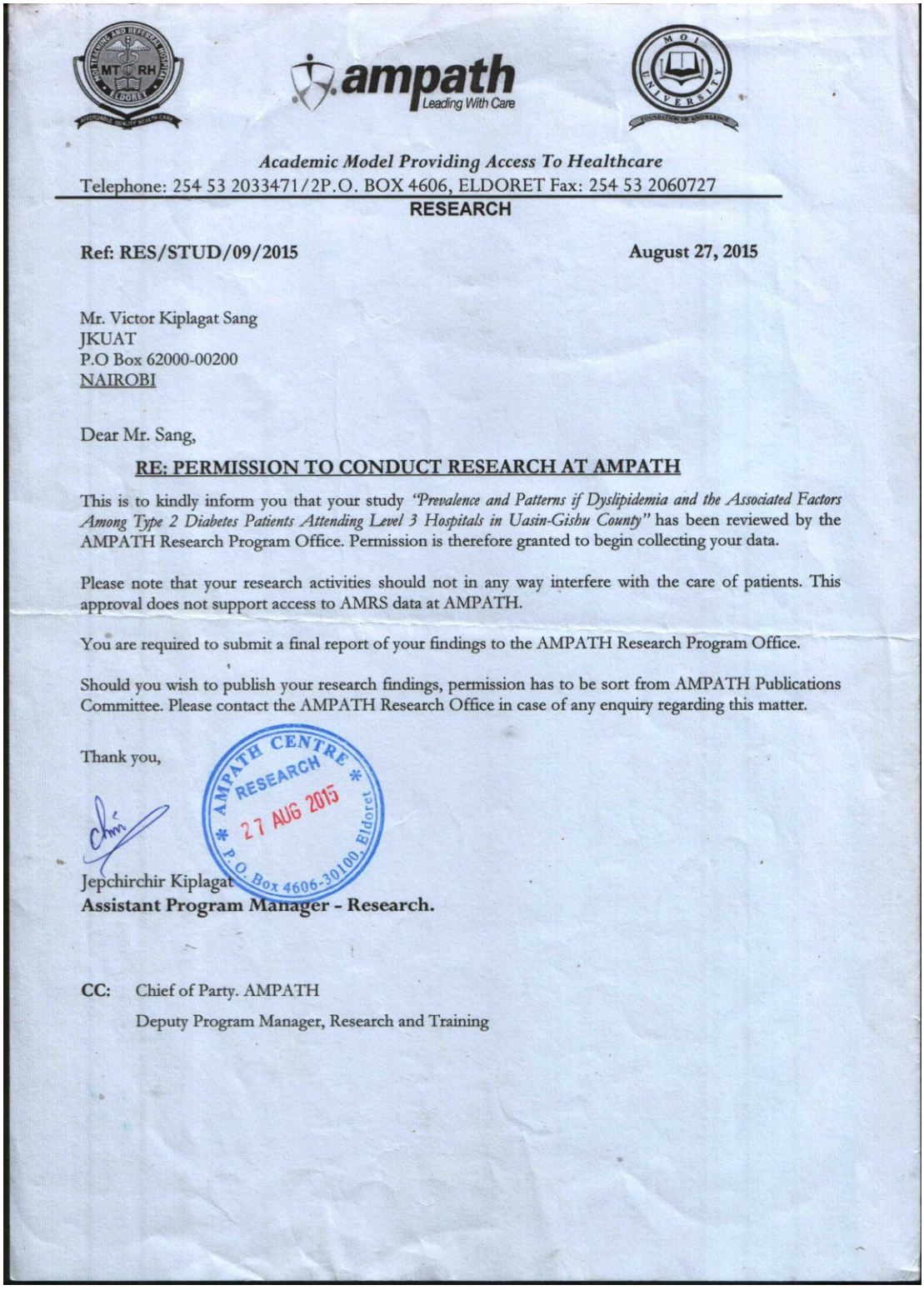
Sincerely,

For

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc:	Director -	MTRH	Dean	-	SPH
	Principal-	CHS	Dean	-	SOD
	Dean -	SOM	Dean	-	SON

Appendix 11: AMPATH Permission Letter To Conduct Research



Academic Model Providing Access To Healthcare

Telephone: 254 53 2033471/2P.O. BOX 4606, ELDORET Fax: 254 53 2060727

RESEARCH

Ref: RES/STUD/09/2015 **August 27, 2015**

Mr. Victor Kiplagat Sang
JKUAT
P.O Box 62000-00200
NAIROBI

Dear Mr. Sang,

RE: PERMISSION TO CONDUCT RESEARCH AT AMPATH

This is to kindly inform you that your study *"Prevalence and Patterns if Dyslipidemia and the Associated Factors Among Type 2 Diabetes Patients Attending Level 3 Hospitals in Uasin-Gishu County"* has been reviewed by the AMPATH Research Program Office. Permission is therefore granted to begin collecting your data.

Please note that your research activities should not in any way interfere with the care of patients. This approval does not support access to AMRS data at AMPATH.

You are required to submit a final report of your findings to the AMPATH Research Program Office.

Should you wish to publish your research findings, permission has to be sort from AMPATH Publications Committee. Please contact the AMPATH Research Office in case of any enquiry regarding this matter.

Thank you,

AMPATH CENTRE RESEARCH 27 AUG 2015 P.O Box 4606-30100 Eldoret

Jepchirchir Kiplagat
Assistant Program Manager - Research.

CC: Chief of Party. AMPATH
Deputy Program Manager, Research and Training

Appendix 12: Publication

Symbiosis

www.symbiosisonline.org
www.symbiosisonlinepublishing.com

Research Article | Journal of Endocrinology and Diabetes | Open Access

Prevalence of Dyslipidemia and The Associated Factors Among Type 2 Diabetes Patients in Turbo Sub- County, Kenya

Sang Victor Kiplagat[1*], Kaduka Lydia[2], Kamano Jemimah[3] and Makworo Drusilla[1]

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[2]*Centre for Public Health Research, Kenya Medical and Research Institute (KEMRI).*

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Abstract

Background: A large number of deaths worldwide are attributed to non-communicable diseases (NCDs). Diabetes, an important NCD, contributes to this large mortality mainly through cardiovascular complications. Cardiovascular disease in diabetes is caused by multiple co-morbid conditions; key of which is dyslipidemia.

Objectives: This study aimed to determine prevalence of dyslipidemia and its associated factors among patients with type 2 diabetes mellitus attending Chronic Disease Management clinics (CDM) in Turbo sub-county, Kenya.

Methodology: This was a cross sectional study conducted between 2015 and 2016 at Huruma County hospital and Turbo health centre CDM clinics. Data was collected from 208 randomly selected fasting participants using: structured questionnaires; laboratory investigations (lipid profile and fasting blood sugar); and health records. Data was analyzed using SAS 9.2. All variables at $p \leq 0.2$ level of significance in the univariate analysis were included in the multivariate model. Using backward elimination criteria, variables that had a p value of <0.05 were retained.

Results: A total of 179 out of 208 (86.1%) patients had dyslipidemia. Employment status [OR 3.1; (95% CI 1.3-7.5); p=0.01], BMI [OR 2.7; (95% CI 1.3-5.9); p=0.0007], FBS [OR 3.4; (95% CI 1.6-7.1); p=0.001] and physical activity [OR 4.8; (95% CI 1.1-21.2); p=0.04] were significantly associated with dyslipidemia. Surprisingly, age and being hypertensive were not associated with occurrence of dyslipidemia although the condition was more prevalent in elderly patients and those with elevated blood pressure.

Conclusion: There is a high prevalence of dyslipidemia amongst patients with T2DM in the two CDM clinics studied. Employment status, BMI, FBS and physical activity are important factors associated with dyslipidemia in these patients.There is need to prioritize research driven control and management of dyslipidemia, diabetes and related CVD risk factors plus more vigorous patient education on importance of physical activity. This should be done at both the national level and county level with government and society playing the role.Given the failure to show any association of dyslipidemia with historical CVD risk factors such as age and blood pressure, it is imperative that screening for lipids be done in all diabetes patients routinely.

Keywords: Dyslipidemia ; Type 2 Diabetes;

Abbreviations: AMPATH: Academic Model Providing Access To Healthcare; BMI: Body mass index; BP: Blood pressure; CDM: Chronic diseases management; CVDs: Cardiovascular diseases; HbA1c: Glycated hemoglobin; HDL-C: High density lipoprotein cholesterol; JKUAT: Jomo Kenyatta University of Agriculture and Technology; LDL-C: Low density lipoprotein cholesterol; MET: Metabolic equivalent; MI: Myocardial infarction; MOH-K: Ministry of Health-Kenya; MTRH: Moi Teaching and Referral Hospital; NCDs: Non-Communicable Diseases; T2DM: Type 2 diabetes mellitus; TC: Total cholesterol; TG: Triglycerides; WHO: World Health Organization

Introduction

A large number of deaths worldwide are attributed to non-communicable diseases (NCDs) [1]. Diabetes, an important NCD, contributes to this large mortality mainly through cardiovascular complications [2, 3]. Type 2 diabetes mellitus (T2DM) is the most common form of diabetes and makes up about 90% of global diabetes cases, with the other 10% due primarily to type 1 diabetes mellitus and gestational diabetes. The burden of diabetes in the world is estimated to be 9% among adults aged 18 years and above [4]. A healthy diet, regular physical activity, maintaining normal body weight and avoiding tobacco use can prevent or delay the onset of type 2 diabetes [5]. Cardiovascular disease in Diabetes is caused by multiple co-morbid conditions; key of which is Dyslipidemia. Other cardiovascular diseases that include coronary heart diseases, stroke, and peripheral vascular diseases account for the majority of deaths in diabetic patients [6]. It is noted that most people with diabetes do not die of causes uniquely related to diabetes, but to cardiovascular complications that are caused by risk factors including Dyslipidemia. Dyslipidemia

Appendix 13: Map Showing the Two Cdm Clinics in Turbo Sub-County5.