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PREVALENCE OF DYSLIPIDEMIA AND HYPERGLYCEMIA AND ASSOCIATED FACTORS AMONG ADULT PEOPLE LIVING WITH HIVON ART AT ASELLA REFERRAL AND TEACHING HOSPITAL,SOUTH-EAST ETHIOPIA.

BY: ALAZAR TAMIRAT AYELE

A THESIS SUBMITTED TO THE COLLEGE OF HEALTH AND MEDICAL SCIENCES, SCHOOL OF GRADUATE STUDIES, HARAMAYA UNIVERSITYIN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OFMASTER OF SCIENCE IN CLINICAL CHEMISTRY

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I hereby certify that I have read and evaluated this thesis entitled, "Prevalence of dyslipidemia and hyperglycemia and associated factors among adult peoples living with HIV on ART at Asella Referral and Teaching Hospital, South-East Ethiopia''Prepared under my guidance by Alazar Tamirat. I recommend that it will be submitted as fulfilling the thesis requirement.

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BIOGRAPHICAL SKETCH

My name is Alazar Tamirat Ayele I am a male Ethiopian national born in 1983 E.C. I have married and currently reside in Arsi Asella. I have attended Abomsa Primary School for grades 1-8 and Abomsa Secondary School for grades 9-10. I pursued a diploma in Medical Laboratory Technician from Rift Valley University College in 2005 E.C. and later completed a degree program in the same field from Arsi University in 2011 E.C. I have an experience of more than five year on clinical part at Asella Hospital and latter I was joined Arsi University in the position of Graduate assistant.

Currently I have learning my second degree in Haramaya University in the field of Clinical chemistry by obtaining sponsorship from my university.

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LIST OF ACRONYMS/ABBREVIATIONS

ADP	Adenosine Diphosphate
AOR	Adjusted Odds Ratio
Apo B	Apolipoprotein B
BMI	Body Mass Index
CI	Confidence Interval
COR	Crude Odds Ratio
CRABP-1	Cellular Retinoic Acid Binding Protein
DM	Diabetes Mellitus
G-6-PD	Glucose-6-Phosphate Dehydrogenase
GLUT4	Glucose Transporter Type 4
HDL-C	High-Density Lipoprotein Cholesterol
HK	Hexokinase
LDL-C	Low-Density Lipoprotein Cholesterol
LRP	LDL Receptor-Related Protein
NAD	Nicotinamide Adenine Dinucleotide
TASH	Tikur Anbessa Specialized Hospital
TC	Total Cholesterol
TG	Triglycerides

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ABSTRACT

Background: The use of highly active antiretroviral therapy has significantly reduced morbidity and mortality associated to Human Immunodeficiency Virus infection and Aquired Immune Defficency Syndrome. However, acluster of metabolic derangements such as dyslipidemia and hyperglycemia is increasing, for patients onantiretroviral therapy. The prevalence of dyslipidemia and hyperglycemia and associated factors among adult patients on antiretroviral therapy in Ethiopia including the current study areawere not well explored.

Objective: To determine the prevalence and associated factors of dyslipidemia and hyperglycemia among adult peopleliving with Human Immunodeficiency Virus on antiretroviral therapyat Asella Referral and Teaching Hospital, South-east Ethiopiafrom 20, November, 2023 to 30, January,2024.

Methods: Institution-based cross-sectional study was employed.Convenient sampling was used to select 388 individuals on antiretroviral therapy. Stepwise approach of the World Health Organization questionnaire, document review, anthropometric measurements, and laboratory analysis (total cholesterol, triglycerides, low density lipoprotein,high density lipoprotein and fasting blood sugur) were used to collect data on different variables under the study. Collected data were entered in Epidata version 3 and analyzed by STATA version 17.0.Binary and multivariate logistic regression analysis was used to identify independently associated factors of dyslipidemia and hyperglycemia. Statistical significance was set at $p<0.05$.

Results: A total of 388 human immunodeficiency virus patients onantiretroviral therapy were enrolled;mean age of 43.9 ±4.7years. The overall prevalence of dyslipidemia and hyperglycemia was 72.7%[95% CI: 68.0% - 76.9%] and 16.2%[95% CI: 12.9% – 20.3%], respectively. The prevalence of total cholesterol (≥200mg/dl) was 12.9%, triglycerides (≥ 150 mg/dl) was 28.4 %, low density lipoprotein (≥130 mg/dl) was (8.2%) and the predominant abnormality was high density lipoprotein (<40 mg/dl) was 50.8%. Older age ≥54(AOR: 1.7[95% CI: 1.1, 2.7]P= 0.03) were significantly associated with dyslipidemia. Khat chewing (AOR: 0.1[95% CI: 0.01, 0.9] P= 0.04)was associated with a decreased likelihood of hyperglycemia andraw meat consumption (AOR: 1.8[95% CI: 1.1,3.4] P= 0.04)was significantly associated with hyperglycemia.

Conclusion: In this study, the proportion of patients with dyslipidemia and hyperglycemia was high compared to different studies conducted in Ethiopia. Older age showed a positive correlation with dyslipidemia.Khatwas associated with a decreased likelihood of hyperglycemia and row meat consumptionwaspositively associated with hyperglycemia. These results indicate the need to regularly monitor lipid profile in older age people and glucose level those who were consumed row meat and khat chewers patients on antiretroviral therapy and provide lipid lowering drugs for older age and raw meat consummers where required.

Keywords: Antiretroviral therapy, Human Immunodeficiency Virus, Dyslipidemia, Hyperglycemia, Aquired Immune Defficency Syndrome, Asella.

1. INTRODUCTION

1.1. Background

Dyslipidemia was defined according to national cholesterol education program adult panel III (NCEP-ATP III) guidelines, cut-off points that place an individual at risk for cardiovascular disease is: Total cholesterol $\geq$ 200 mg/dl, high density lipoprotein cholesterol $<$ 40 mg/dl, low-density lipoprotein cholesterol $\geq$ 130 mg/dl and triglycerides $\geq$ 150 mg/dl(Thomas et al., 2005).It presents either as an elevation of one of the lipids or high levels of a combination of the lipids (De Backer et al., 2019).

Hyperglycemia was defind as a fasting plasma glucose concentration $\geq$ 126mg/dl (whole blood $\geq$ 110mg/dl) or two hour plasma glucose concentration $\geq$ 200mg/dl and two hours after 75g anhydrous glucosein an oral glucose tolerance test (OGTT) (Doi et al., 2008). Factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production. Glucose homeostasis is a balance between hepatic glucose production and peripheral glucose uptake and utilization. Insulin is the most important regulator of glucose homeostasis(Röder et al., 2016).

Non-communicable diseases, especially metabolic disorders are developed among HIV infected individuals on ART(Borkowska et al., 2022). It has been shown that HIV infection and ART increase the risk of metabolic disorders, abnormal glucose metabolism, and type 2 diabetes (T2D). The development of hyperglycemia and T2D during Humman Immunodeficency Virus depends on many factors, such as HIV infection's duration, degree of immunosuppression, and exposure to antiretroviral medicaments(Duncan et al., 2018).

Sub-Saharan Africa, home of 12% of the global population, resides disproportionately 70% of the global burden of HIV infection while only 79% had access to Antiretroviral therapy (Kharsany and Karim, 2016).Even thoughantiretroviral treatment has improved and prolonged life, it has been associated with a cluster of metabolic derangements. These abnormalities include dyslipidemia, hyperglycemia, atherosclerosis, and insulin resistance(Adnan Kemal, 2020).

Dyslipidemia on ART taking HIV patients can be caused through four mechanisms; viral particle competition on lipid metabolism receptors including CRABP-1—cellular retinoic acid binding protein and LDL receptor-related protein (LRP), inhibition of the activity of the plasmatic lipoprotein lipase, upsurge the levels of liver Apolipoprotein B (Apo B) and deterring the function of glucose transporter type 4(GLUT4)(Troll, 2011). The possible mechanisms for HIV-induced dyslipidemia are increased cytokine levels (TNF and IL-6), decreased lipid clearance, and increased hepatic synthesis of very low-density lipoprotein (VLDL) (Husain and Ahmed, 2015).

Several studies showed that different associated factors contributed for dyslipidemia and includes, duration on ART, age, sex, high BMI, low CD4 counts, cigarette smoking, alcohol consumption, physical inactivity, dietary habits, and depression are the major associated factors (Kuti et al., 2015).

Antiretroviraltherapy regimens typically include a combination of at least three drugs, such as different association of protease inhibitors (PI), non-nucleoside reverse transcriptase inhibitors (NNRTI) and nucleoside reverse transcriptase inhibitors (NRTI)(Gsponer et al., 2012)Antiretroviral drugs increase biosynthesis and reduce hepatic clearance of serum cholesterol. It is thus important to evaluate the impact of antiretroviral treatment on serum lipoprotein levels and the associated dyslipidemia(Nduka et al., 2015).

Assessment and early detection of these lipid changes is, therefore, crucial during ART use to facilitate intervention (changes in diet and lifestyle, treatment switching, and pharmacotherapy) and to prevent adverse outcomes related to dyslipidemia among patients with HIV(da Cunha et al., 2015).

1.2. Statement of the problem

Globally, the occurrence of dyslipidemia in HIV-seropositive patients receiving ART has been estimated to be between 20% and 80%(Adnan Kemal, 2020).The highest incidence was hypertriglyceridemia, which is seen in the majority of HIV cases (40–80%), followed by hypercholesterolemia (10–60%), low HDL level (20–40%), and hyperglycemia (5–30%)(Hejazi and Rajikan, 2015).Dyslipidemia associated with cardiovascular disease occurs in about 70% of HIV infected patients receiving antiretroviral therapy, it is a powerful associated factor for coronary heart disease and patients with established coronary heart disease have a 10-year association of having a coronary heart disease event such as cardiac death or myocardial infarction that is >20% (>2%/year)(Jacobson et al., 2014).

Dyslipidemia was responsible for an estimated 4.5% of the total global mortality and 2% of the total disability- adjusted life years worldwide (Mahmoud and Sulaiman, 2019).Presence of dyslipidemia then causes heart disease, heart attack and stroke by increasing the risk of blood clots which have a strong impact on mortality rates (Achila et al., 2022).

The prevalence of metabolic disorders in HIV population in Africa was estimated to range from 2.1% to 26.5% for diabetes and 20.2% to 43.5% for pre-diabetes, 13% to 58% for metabolic syndromeand 13% to 70% for dyslipidemia(Husain et al., 2017).Furthermore, lipid abnormalities associated with ART use and are suggested to contribute to increased cardiovascular association among patients with HIV/ AIDS in sub-Saharan Africa (SSA) (Dimala et al., 2018).

Another study was done in Blackline hospital, Addis Ababa, Ethiopia, also showed that higher proportion of dyslipidemia among antiretroviral treatment group (80%) compared to antiretroviral treatment naïve groups (57.7%) (Belay et al., 2014).

Despite these facts, the prevalence of dyslipidemia and hyperglycemia in resource-limited settings has not been well characterized and the current World Health Organization (WHO) Antiretroviral therapy (ART) guidelines do not include lipid monitoring and glucose test in patients on ART. Also in our countries, lipid profile and glucose measurementsat baseline currently not part of routine care which is an important parameter to increase survival and improve treatment outcome(Belay et al., 2014).

Even though, limited data were available, currently, there is no study showing the prevalence and factors associated with dyslipidemia and hyperglycemia among adult HIV patients on ART in Arsi zone Asella City, Ethiopia.

In addition to this diagnosis of dyslipidemia is challenged in a resource-limited setting like Ethiopia, especially in health center facilities. The magnitude of dyslipidemia and hyperglycemia may vary from region to region and even with time and culture of the community.

Therefore this study wasdetermined the prevalence of dyslipidemia and hyperglycemia and identify the associated factors among adult people living with HIV on ART at Asella Referral and Teaching Hospital, South-East Ethiopia.

1.3. Significance of the study

Understanding the context-specific factors for ART-associated dyslipidemia and hyperglycemia and its potential implications for HIV-infected patients is critical to the design of effective interventions to combat the metabolic and cardiovascular disease's effects of dyslipidemia and hyperglycemia.

The study findingswere fundamental, for Patients weregot better and regular management by monitoring of blood lipid levels and glucose concentration, Health planners and caregivers for evidence-based intervention, Physicians will getbetter tools in decision making process and For the health professional's work in health facilities creating awareness by preparing short term training on the current objectives and Researchers will getbaseline information for further large-scale study.

1.4. OBJECTIVES

1.4.1. General objective

- To determine the prevalence of dyslipidemia and hyperglycemia and associated factors among adult people living with HIV on antiretroviral therapy at Asella Referral and Teaching Hospital from November,20, 2023 to January,30, 2024 GC.

1.4.2. Specific objectives

- To determine the prevalence of dyslipidemia among adult people living with HIV on ART at Asella Referral and Teaching Hospital.
- To determine the prevalence of hyperglycemia among adult people living with HIV on ART at Asella Referral and Teaching Hospital.
- To identify factors associated with dyslipidemia among adult people living with HIV on ART at Asella Referral and Teaching Hospital.
- To identify factors associated with hyperglycemia among adult people living with HIV on ART at Asella Referral and Teaching Hospital.

2. LITERATURE

2.1. Prevalence of Dyslipidemia in HIV patients on ART

Fifty-one observational studies comprising 37,110 patients were included in the meta-analyses. The prevalence of Dyslipidemia was higher in ART-initiated patients and had significantly higher concentrations of total cholesterol 82.2%, low-density lipoprotein-cholesterol 86.1%, and triglycerides 97.1% (Nduka et al., 2015).

A cross-sectional study design was conducted in the Regional Hospital of São José Doutor Homero de Miranda Gomes during the period of July 1st to December 31st, 2018, a six months period.The study population consisted of patients with HIV who were under medical follow-up, either on or off-drug treatment.And showedlipid abnormalities were observed in 78.9% of individuals who received ART. Of the 308 subjects on ART, 59.1%, 41.9%, and 33.1% had TG, TC and low-density lipoprotein (LDL) abnormalities, respectively. The prevalence of LDL changes was 2.57-fold higher in individuals who had been using ART for more than 12 months, compared to those using ART for 6 to 12 months (Limas et al., 2014). patients followed at the Sylvanus Olympio University Hospital's infectious diseases department for six months showed the prevalence of dyslipidemia was 72.5% (Moukaila et al., 2019).

A cross-sectional study was performed using 333 patient records from the Regional Hospital of São José Doutor Homero de Miranda Gomes. Theprevalence of dyslipidemiawas 77.2% of individuals whoreceived ART. Of the 308 subjects on ART, 59.1%, 41.9%, and 33.1% had TG, TC and low-density lipoprotein (LDL) abnormalities, respectively (Limas et al., 2014).

The prevalence of dyslipidemia in South AfricanHIV-Infected Patients 406 ART-naive and 551 participants on ART was 90.0% and 85%, respectively. Low HDL-cholesterol (HDLC) was the most common abnormality (71%) of ART-naïve and (43%) ART-participants](Dave et al., 2016).

A cross-sectional study was conducted in South Africa – Johannesburgand 304 HIV positive patients enrolled between January 2009 and March 2009, including patients aged 18 to 45 years, on ART for more than one year.And it showedthat prevalence of Hypertriglyceridemia (>40.5 mg/dl in 15.8%, hypercholesterolemia (TC >90.1mg/dl) in 32.2%, low HDL-c (<21.6mg/dl) in 45.7% and elevated LDL-c (>73.9mg/dl) in 9.5% (Julius et al., 2011)

According to the study conducted atKenyatta national hospital in Kenya, between January and April 2006, 295 HIV adult patients; 134 (45%) were on ART, 82% of whom were on stavudine, lamivudine and either nevirapine or efavirenz. The Overall prevalence of dyslipidemia was 63.1%. High TC occurred in 39.2% of ART and 10.0% ART naïve patients, whereas high LDL-c occurred in 40.8% and 11.2%, respectively. HDL levels were low in 14.6% and 51.3% among ART and ART-naïve patients, respectively, while high TG occurred in 25.6% and 22.5%, respectively (Manuthu et al., 2008).

A cross sectional study was conducted in Halibet National Referral Hospital and Orotta National Medical Surgical Referral Hospital, in Asmara, Eritrea from March to June, 2018.The prevalence of dyslipidemia in HIV infected individual who were initiated to ART was 331 (86.6%) (Achila et al., 2022). Increased Low Density Lipoprotein-C (LDL-C) 213(55.8%) was the major abnormality.

A hospital-based observational prospective cohort study was conducted on HIV infected patients in Tenofovir Disoproxil Fumarate -based regimen in Tikur Anbessa Specialized Hospital (TASH) from January to September 2019 in Ethiopia. The overall prevalence of dyslipidemia was 73% and 77.8% at baseline and six months, respectively. The prevalence of total cholesterol (TC) ≥200 mg/d, triglyceride (TG) ≥150 mg/dL, low density lipoprotein cholesterol (LDL-c) ≥130 mg/dL, and high density lipoprotein cholesterol (HDL-c) <40 mg/dL was 38.1% vs 42.9%, 23.8% vs 31.7%, 17.5% vs 22.2%, and 41.3% vs 41.3% at baseline and six month follow-up, respectively (Yazie, 2020).

According to the study conducted in Ethiopia Addis Ababa from July 2007 to January 2008,356 HIV adult patients on ART for 1 year or more. 209 (59.7%) patients were on stavudine- based ART therapy and 135 (41.3%) were on zidovudine-based ART therapy. Prevalence of hyperlipidemia, hypercholesterolemia, high LDL-c, hypertriglyceridemia and fasting hyperglycemia was 56.9%, 38.2%, 54.2%, 15.2%, and 17.8%, respectively (Feleke et al., 2012).

Institutional-based cross-sectional study design was conducted among 353 HIV patients who were on ART from March to April 2018 at Armed Force Comprehensive and Specialized Hospital, Addis Ababa, Ethiopia.Two hundred sixty-four (74.8%) of study participants had at least one laboratory abnormality, which is compatible with a diagnosis of dyslipidemia. From

those who had dyslipidemia, 105 (29.7%) of them had single lipid abnormality, 92 (26.1%) had double lipid abnormality, 57 (16.1%) had triple lipid abnormality and 10 (2.8%) had quadruple lipid abnormality. From the total participants, the prevalence of TC ≥ 200 mg/dl were 162 (45.9%), LDL-c ≥130 mg/dl was 110 (31.2%), TG ≥150 mg/dl was 102 (28.9%) and the prevalence of HDL-c <40 mg/dl for males and <50 mg/dl for female, was 126 (35.7%). (Adnan Kemal, 2020).

A Hospital based comparative cross-sectional study among 228 HIV positive patients was conducted in Debre Tabor Hospital, Debre Tabor, Ethiopia from July to August 2020. Prevalence of dyslipidemia in ART naive and ART treated patients was 61 (53.5%) and 84 (73.7%), respectively. The prevalence of Total Cholesterol ≥200 mg/dl was 50% and 30%; High density lipoprotein cholesterol <40 mg/dl was 43.8% and 36%; Low density lipoprotein cholesterol ≥130 mg/dl was 48.3% and 28.1%; and Triglyceride ≥ 150 mg/dl 59.6% and 39% among ART treated and ART naive, respectively(Tilahun et al., 2022).

2.2. Prevalence of Hyperglycemia in HIV patients on ART

A cross-sectional study was conducted in Beijing Ditan Hospital, Capital Medical University, China on prevalence of hyperglycemia and its associated factors in AIDS patients receiving antiretroviral therapy (ART). A total of 504 AIDS patients participated in the surveys, who have received ART for at least three months. The prevalence of hyperglycemia was 15.7%(Cheng et al., 2014).

A cross-sectional comparative study was conducted among HIV infected adults at Burayu Health Center, Addis Ababa, Ethiopia from September, 2011 to May, 2012. Equal number of ART naïve and ART initiated patients (n = 126 each) were included in the study.The prevalence of hyperglycemia, increased LDL-C hypercholesterolemia, hypertriglyceridemia and decreased HDL-C were 7.9%, 23%, 42.1%, 46.8% and 50.8% in ART and 5.6%, 7.1%, 11.1%, 31% and 73% in non-ART groups, respectively(Abebe et al., 2014). A cross-sectional study was conducted among HIV infected patients on ART for one year or more, attending the ART clinics of Tikur Anbessa Specialized hospital in Addis Ababa, Ethiopia. A total of consecutive 356 HIV infected patients volunteered to participate in the study from July 2007 to January 2008.Prevalence of fasting hyperglycemia was 17.8% (Impaired Fasting Glucose in 10.9% and overt diabetes in 6.9%)(Feleke et al., 2012).

A cross-sectional study was conducted from February to April, 2017 among adult 375 HIV positive patients taking antiretroviral therapy at Jugal Hospital, Harar, and eastern Ethiopia. The prevalence of high serum glucose level based on international diabetes federation and joint interim statement criteria was 25.1% (Ataro and Ashenafi, 2020).

2.3. Associated Factors for dyslipidemia and Hyperglycemia in HIV Patients on ART

2.3.1. Socio demographic Factors

2.3.1.1. Age

According to the study conductedin Debre Tabor Hospital, Debre Tabor, Ethiopia from July to August 2020, among 228 HIV positive patients on ART, age greater than 40 years (AOR = 3.27, 95% C.I: 1.47–7.25) was identified as a contributing factor to dyslipidemia(Tilahun et al., 2022).

According to the study conducted in China,a total of 504 AIDS patients participated in the survey, who have received ART for at least three months, older age (OR = 1.03, 95%CI 1.00-1.05)was found to be significantly associated with hyperglycemia(Cheng et al., 2014).The study conducted in Uganda on HIV positive patients who visited Voluntary Counseling and Testing (VCT) center of Imam Khomeini Hospital, Tehran, Iran (2004-2013).And showed that higher frequency of hyperglycemia, was found to be significantly associated with older age (OR for patients #131;40 years old, 2.260; 95% CI, 1.491, 3.247)(Rasoolinejad et al., 2019).

2.3.1.2. Sex

A study conducted in Asmera, Eritiria on HIV/AIDS patients in two national referral hospitals showed that femaleswere present with higher proportions of TG (aOR = 2.89, 95% CI: 1.65–5.05) and TC/HDL ratio (aOR: 2.33, 95% CI: 1.4–3.9) and lower proportion of HDL-C (aOR: 2.16, 95% CI: 1.34–3.48) compared tomales (Achila et al., 2022).

According the study conducted inArmed force comprehensive and Specialized Hospital, Addis Ababa, Ethiopia, between March and April 2018 among adult patients on antiretroviral therapy,the odds of dyslipidemia was nearly twice and half (AOR: 2.38[95% CI: 1.07, 5.28]) among females compared with male participants(Adnan Kemal, 2020).

2.3.1.3. Education Status

According to the study conducted in Gondar Hospital Northwest Ethiopia,among HIV-infected adults who visited the HIV clinic from December 2013 to the end of February 2014, showed that, tertiary-level education (AOR 11.8; 2.28 to 61.4) was associated with DM(Abebe et al., 2016).

2.3.2. Clinical Variables

2.3.2.1. Antiretroviral Thearapy Initiation

A cross-sectional study was performed using 333 patient records from the Regional Hospital of São José Doutor Homero de Miranda Gomes. The study population consisted of patients with HIV who were under medical follow up.In this study lipid change was 1.26 times higher in individuals who used ART compared to those off therapy. Subjects on ART showed abnormal TG, TC and LDL were 2.67, 2.33 and 2.57 times higher in individuals who used ART for more than 12 months, compared to those who did not use ART and using ART between 6 and 12 months, respectively. Individuals on treatment for over 12 months, there was a lower rate of change in the HDL level when compared to individuals who did not use HIV drugs (Limas et al., 2014).

Across sectional comparative study was conducted in Kenyatta national hospital, Kenya among HIV patients on ART and naive. ART was associated with high total cholesterol, LDL-c and high triglyceride levels. However, ART was not associated with low HDL-c and had no effect on dysglycemia (Manuthu et al., 2008).In a single reference health center in Malaysia, 2739 adult HIV positive patients on antiretroviral therapy (ART) were studied cross-sectionally using medical records.I t was showed that medication with protease inhibitor (PI) was a potential associated for elevated triglyceride, high TC and low HDL (Hejazi et al., 2013).

2.3.2.2. Duration of Antiretroviral (ARV) Drug

Different types of ART regimen were significantly associated with increased TG, High HDL and High TC/ HDL ratios. A cross sectional study was conducted on HIV/AIDS patients on ART in two national referral hospitals in Asmara, Eritrea. The finding was increased duration of ART use was also noted to be related with poor lipid profiles (Achila et al., 2022). Institution-based cross-sectional study design was employedamong adult patients on antiretroviral therapy in Armed Force Comprehensive and Specialized Hospital Addis Ababa, Ethiopia. Duration on ART increase by 1 month, the associated of dyslipidemia increased by 1%(Adnan Kemal, 2020). A

Hospital based comparative cross-sectional study was conducted among HIV positive patients on ART in Debre Tabor Hospital, Debre Tabor, Ethiopia. Being on ART for more than 12- 24 months had 2.73 times higher than those who did not use ART(Tilahun et al., 2022).

A cross-sectional study was conducted among HIV infected patients on HAART for one year or more, attending the ART clinics of Tikur Anbessa Specialized hospital in Addis Ababa and showed that, Duration of ART treatment > or = 1 year was significantly associated with hypertriglyceridemia (Feleke et al., 2012).

According to a cross-sectional study was conducted in lipid profile associated with the use of HAART regimens among people living with HIV/AIDS in Fako Division of the South West Region of Cameroon. It showed that receiving ART and HIV duration of 42 months and more were independently associated with total cholesterol ≥ 200 mg/dL. Receiving ART was independently associated with raised LDL-cholesterol and TG values (Nsagha et al., 2015). Across-sectional study was conducted among people living with HIV on anti-retroviral treatment followed at the Sylvanus Olympio University.Being exposed to Nucleoside reverse transcriptase inhibitors (NRITs) were found to be factors associated to dyslipidemia (Moukaila et al., 2019).

Hospital-based cross-sectional study was conducted among HIV-infected adults who visited the HIV clinic in University of Gondar Hospital, Ethiopia.Longer duration of ART was associated with the presence of diabetes (Diouf et al., 2014) and Hospital-based cross-sectional study was conducted among HIV-infected adults who visited the HIV clinic in University of Gondar Hospital, Ethiopia. Duration of ART was associated with diabetes (AOR = 2.67, 95% CI 1.16–6.17, $P = 0.021$) (Abebe et al., 2016).

2.3.2.3. CD4

According to a cross-sectional survey was conductedin China among HIV patients on ART, CD4 cell counts 50-199 cells/µl (OR = 1.95, 95%CI 1.08-3.51) and less than 50 cells/µl (OR = 2.95, 95%CI 1.47-5.91) was relevant factors associated with hyperglycemia(Cheng et al., 2014).Another cross sectional study was conducted among HIV patients on ART and naivein Kumasi Metropolis and showed CD4 count between 500 to 1500 cells/mm³ was (AOR =4.7(2.5-9.1)(Ngala and Fianko, 2013).

2.3.2.4. Nutritional Status

A cross sectional study was conducted on HIV/AIDS patients on ART in two national referral hospitals in Asmara, Eritrea. Over weight (COR 3.21(95% CI 1.61-6.42)wassignificantly associated with raised TC and obese participants had a remarkable increase in TC, TG and TC/HDL ratios (Achila et al., 2022).

Institution-based cross-sectional study design was employed among adult patients on antiretroviral therapy in Armed Force Comprehensive and Specialized Hospital Addis Ababa, Ethiopia.When BMI increases by 1 kg/m², the associated of dyslipidemia increased by 13%(Adnan Kemal, 2020).Cross-sectional study was conducted in lipid profile associated with the use of HAART regimens among people living with HIV/AIDS in Fako Division of the South West Region of Cameroon.The adjusted odds ratio (95 % CI) of BMI ≥ 25.0 kg/m²versus BMI < 25.0 kg/m²was 3.25 (1.44–7.34) for triglycerides ≥ 150 mg/dL (Nsagha et al., 2015).

According to a cross-sectional survey was conducted in China among HIV patients on ART, overweight was associated with hyperglycemia (OR = 2.13, 95%CI 1.24-3.67)(Cheng et al., 2014).According to the study conducted in Gondar Hospital Northwest Ethiopia Obesity was positively and significantly associated with diabetes (adjusted OR (AOR) 6.55; 1.20 to 35.8) (Abebe et al., 2016).

2.3.2.5. WHO Clinical stage

According to institution-based cross-sectional study design was employed among adult patients on antiretroviral therapy in Armed Force Comprehensive and Specialized Hospital Addis Ababa, Ethiopia.The study showed that, WHO clinical stage II (AOR= 0.35; 95%CI: 0.14, 0.92) and stage III (AOR=0.25; 95% CI:0.10,0.64)were significantly associated with dyslipidemia (Adnan Kemal, 2020). According to a Hospital-based cross-sectional study was conducted from December to January 2019 at selected Jimma zone hospitals and it showed that WHO clinical stage III and above [AOR = 0.04, 95% CI (0.002, 0.6), p = 0.02]were significantly associated with dyslipidemia (Yitbarek et al., 2020)

2.3.3. Family history of diabetes and hypertension

According to a cross-sectional survey was conducted to obtain the prevalence of hyperglycemia among patients on ART in a single centerin China, family history of diabetes were relevant factors associated with hyperglycemia (OR = 2.70, 95%CI 1.55-4.69)(Cheng et al., 2014). And Another cross sectional study was conducted among HIV patients on ART and naive in Kumasi Metropolis, showed that family history of diabetes and family history of hypertension were associated with hyperglycemia (OR =7.0, 95%CI 1.6-63.8, 0.0034) and 3.4(1.2-11.8), respectively(Ngala and Fianko, 2013). According Hospital-based cross-sectional study was conducted among HIV-infected adults who visited the HIV clinic in University of Gondar Hospital, Ethiopia. Family history of diabetes and hypertension were relevant factors associated with diabetes(AOR = 6.46, 95% CI 3.36–21.29, P < 0.001) and (AOR = 2.62, 95% CI 1.20–5.72, P = 0.016) ,respectively(Abebe et al., 2016).

2.3.4. Life style factors

In a single reference health center in Malaysia, 2739 adult HIV positive patients on antiretroviral therapy (ART) was studied cross-sectionally using medical records,alcohol consumption wasassociated factor for raised TG, on the other hand smoking was not associated with high TG level significantly ($p > 0.05$). Smoking, and alcohol consumption were not significant associated factor for high LDL, low level of HDL and TC ($p > 0.05$) (Hejazi et al., 2013).

According to a cross-sectional study was conducted among HIV patients on ART followed at the Sylvanus Olympio University Hospital's Togo, showed that smoking was found to be factors associated with dyslipidemia (Moukaila et al., 2019).A facility based comparative cross-sectional study was conducted among HIV positive persons on ART and naïve in Defense Hospital, Addis Ababa-Ethiopia.The study showe that, blood pressure ≥ 140/90 was identified as determinants of dyslipidemia(AOR = 16.13, 95% C.I: 5.81 - 44.75)(Bayenes et al., 2014). An institutional based cross-sectional study design was conducted among patients living with HIV/AIDS receiving care at referral hospitals of Northwest Ethiopia, and identified monthly incomes of moderate and high level have shown statistically significant association with dyslipidemia (Gebrie et al., 2020).

2.4. ConceptualFramework

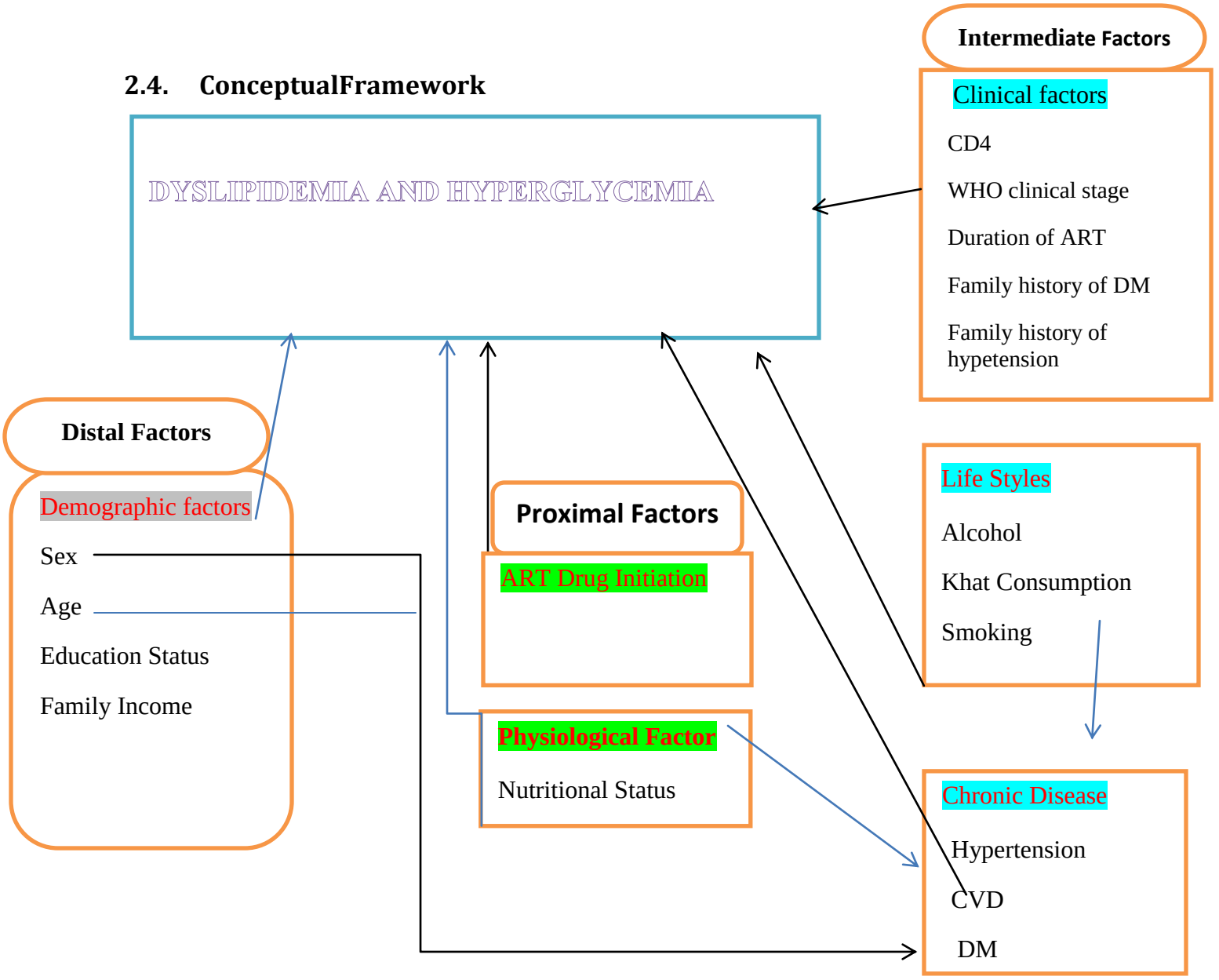

Figure 1 Conceptual frameworkfor the factors associated with dyslipidemia and hyperglycemia among adult people living with HIV on ART at Asella Referral and Teaching Hospital. (Constructed by the investigator after reviewing different literature)

3. MATERIALS AND METHODS

3.1. Study Area and Period

This Study was conducted at Asella Referral and Teaching Hospital, which is located in Asella town, Oromia region, Ethiopia. It is located southeast at 175 km away from the capital city of Ethiopia. The 2007 national census reported a total population for Asella of 67,269, of whom 33,826 were men and 33,443 were women. This city has a latitude and longitude of 7°57′N 39°7′E, with an elevation of 2,430 meters(Population and Commission, 2008) The health care coverage of this town is one governmental referral Hospital,two private general Hospitals, two health centers and more than fifteen private clinics available in Asella town. All Hospitals and health centers have ART centers and they provide services which are important to the HIV patients. The total numbers of ART patients are around three thousand eight hundred sixtyseven (3867) (Asella referral and teaching hospital ART clinic).The study was conducted from November, 20, 2023 to January, 30, 2024 GC.

3.2. Study design

- Institutional based cross sectional study was conducted.

3.3. Population

3.3.1. Source Population

- The source population were all adult people living with HIV atAsella Referral and Teaching Hospital.

3.3.2. Study Population

- The study population wereadult people living with HIV on ART who were visisting ART clinicat Asella Referral and Teaching Hospital during the study period.

3.4. Inclusion and exclusion criteria

3.4.1. InclusionCriteria

- HIV patients on ART for 6 months and above
- Adult aged 15 years and above (adult for HIV patient is above 15)

3.4.2. Exclusion Criteria

- Well-prepared checklist were used to exclude participants who did not fulfill the criteria."such as: -

- Uses of drugs other than ART like IFN-α therapy, beta-blockers, prednisone, cyclosporine, anabolic steroids, diuretics and others may affect the blood lipid concentration(Feeney and Mallon, 2011).
- Pregnant women and the first 6 months of lactating mothers.
- Patients with known history of metabolic syndrome and other chronic illnessesbefore begning of ART.

3.5. Sample size determination

3.5.1. Sample size calculation for prevalence of dyslipidemia on ART patients

Sample size was calculated by using single population sample calculation formula by taking the prevalence rate (p= 0.748 %) taken from a previous study conducted in Armed Force Comprehensive and Specialized Hospital, Addis Ababa, Ethiopia(Adnan Kemal, 2020)with the precision of 5% because when prevalence of the disease is going to be below 10% or more than 90% ,d=marginal error between sample and population (0.05); Zα/2= critical value at 95% confidence interval (1.96).

So, sample size was calculated as follows including 10% non respondent rate:

$$n = \frac{Z^2_{1-\alpha/2}(p)(1-p)}{d^2}$$

n= (1.96)2x 0.748 (1-0.748)

(0.05)2

n = **290**

10% contingency =29

n = **290+29=319**

n=319

Where as n = required sample size

Zα/2 = critical value for normal distribution at 95% confidence interval which equals to 1.96 (Z value at alpha=0.05).

P = proportion of prevalence of dyslipidemia in adult HIV patient on ART.

d2 = marginal error= 5%

3.5.2. Sample size calculation for prevalence of hyperglycemia on ART patients

Sample size was calculated by using single population sample calculation formula by taking the prevalence rate (p= 0.178 %) taken from a previous study conducted in Tikur Anbessa Specialized Hospital (TASH) in Addis Ababa, Ethiopia (Feleke et al., 2012). with the precision of 5% because when prevalence of the disease is going to be below 10% or more than 90% ,d=marginal error between sample and population (0.05); Zα/2= critical value at 95% confidence interval (1.96).

So, sample size was calculated as follows including 10% non-respondent rate:

$$n = \frac{(1.96)2 \times 0.178\ (1-0.178)}{(0.05)2}$$

$n = 224.8 = 225$

10% contingency =23

$n = 225+23=248$

n=248

3.5.3. Sample size Calculation for associated factors of dyslipidemia among HIVpatients on ART

Table 1 Sample size determination summary of dyslipidemiaassociated factors among people living with HIV on ART at Asella Referral and Teaching Hospital, Asella, Southeast, Ethiopia, 2024.

S.N	Associated Factors	AOR/Beta (95% C.I)	P-value	Power	Total Sample size	P1	P2	References
1	BMI	6.0	0.001	80%	344	87.8	91.1	(Achila et al., 2022)
2	Female sex	2.3	0.03	80%	308	79.5	71.3	(Adnan Kemal, 2020).
3	ART Initiated	3.9	0.001	80%	182	23	7.1	(Abebe et al., 2014)
4	CD4 <500	2.2	0.02	80%	388	87	76	(Assefa et al., 2023)

3.5.4. Sample size Calculation for associated factors of hyperglycemiaamong HIV patients on ART

Table 2 Sample size determination summary of hyperglycemia associated factors among people living with HIV on ART at Asella Referral and Teaching Hospital, Asella, Southeast, Ethiopia, 2024.

S.N	Associated Factors	AOR/Beta (95% C.I)	P-value	Power	P1	P2	Total Sample size	References
1	Alcoholism	4.7	0.04	80%	88.9	62.3	98	(Yahaya et al., 2023)
2	Educational status(degree& above	11.8	0.02	80%	27.8	72.2	82	(Abebe et al., 2016)

The sample size for associated factors was determined by selection of each associated factors adjusted odd ratio, P-value, power, then calculate the total sample size by using STATA software. The appropriate sample size calculation formula was this one, n = (Zα/2+Zβ)2 * (p1(1-p1)+p2(1-p2)) / (p1-p2)2.

After calculated, the appropriate sample size was selected. The largest sample size was the choice to inference the population and increase quality of result. Based on this the total sample size was 388.

3.6. Sampling technique and procedure

Participants were selected using convenient sampling method from a study population.

3.7. Data collection Method

3.7.1. Data collection tool

Data were collected through a pretested, validated structured questionnaire which is adapted from several related literatures(WHO, 2010). It comprises behavioral factors, socio-demographic factors, anthropometric and clinical variables. Data on behavioral characteristics werecollected using the World Health Organization Step wise approach for chronic disease associated factor surveillance questionnaire(Hyder et al., 2017). And by using well prepared cheklist document review were performed for WHO stage during ART initiation, baseline CD4 count, viral load

count, type of ART regimen and duration on ART. The questionnaire were first written in English, and then translated into Amharic and Afaan Oromo by language experts, and it was tested prior to use.

3.7.2. Data collectros

A supervisory team (1 medical doctor and 1 lab technologist) including the principal investigator werein place during the data collection. Both the interviewers and supervisors were trained for two days on objective of the study, methods on how to collect data and interviewing approach, anthropometric measurement, biochemical measurement, and blood pressure measurement.

3.7.3. Data collection procedures

3.7.3.1. Anthropometric Measurements

The anthropometric measurements of each participant were performedusing a standardized protocol(WHO, 2011). Participants' weight weremeasured in kilograms (kg) to the nearest 0.1 kg with light clothing and shoes off, and height was measured to the nearest 0.1 cm using stadiometer, and body mass index (BMI) was calculated by dividing weight in kg by the square of height andWaist circumference was measured by measuring tape at the horizontal plane that corresponds with the mid-point between the anterior superior iliac spine and the lower costal margin at the midclavicular line. .

3.7.3.2. Blood pressure Measurements

Blood pressure (BP) was measured using a standard adult arm cuff of mercury type sphygmomanometer after 5 min rest in the clinic by the nurses working in the ART clinic. To improve the reliability of measurement, three readings were taken with5 min interval and the average of the three readings was recorded as the final BP of the patient.

3.7.3.3. Biochemical measurement

Four milliliter of fasting blood sample was collected and analyzed by qualified laboratory technologists for biochemical measurements. The study subjects were requested to return to the clinics to provide fasting blood samples for blood glucose and lipid profile measurements in the next day in case if they have eaten and the test were done in next morning. Once sufficient blood (4 mL) was collected,the blood samples wereleft at room temperature to allow clotting for 20–30 min and centrifuged at 3000 rpm for 10 min.

The level of triglyceride, cholesterol and glucose were determined by using the enzymatic method(lipoprotein lipase, cholesterol esterase and Hexokinase) respectivly ,. HDL-C was measured using selective precipitation of the low and very-low-density lipoproteins (LDL and VLDL). LDL cholesterol was measured using the preparative ultracentrifuge. After centrifugation, LDL was measured in the supernatant, using the enzymatic method and glucose was determined by hexokinase enzymatic method which is specific for glucose in the blood. All measurements were analyzed in the COBAS c 311chemistry analyzer (Roche Diagnostic Hitachi, Germany) spectrophotometer equipped with calibration filters and DIASYS serum control.

3.8. Variables of the study

3.8.1. Dependent variables

- Prevalence of dyslipidemia
- Prevalence of hyperglycemia

3.8.2. Independent variables

- **socio-demographic: -**

Age, Sex, Residence, Occupational status, Educational status, Marital status and
Household monthly income

- **Life Style: -**

Smoking Experience, Khat Consumption, Formal exercise , Living with smoker and Alcohol consumption

- **Nuitritional Variable: -**

Meat Consumption,Fruit intake …

- **Clinical Variable: -**

On treatment for hypertension, , On treatment for diabetes , ART type (NNRTI, NRTI, PI and duration of ART, CD4 Count, Viral Load, WHO clinical stage,Family history of DM, Family history of hypertension and opportunistics infection.

- **Anthropometric Variable**

weight, height and waist circumference

3.9. OPERATIONAL DEFINITIONS

- **Dyslipidemia** is defined as lipid profile that consists of the following abnormalities either singly or in combination. These include TC ≥ 200 mg/dl, TG levels ≥ 150 mg/ dl, HDL-C < 40 mg/dL, and LDL-C ≥ 100 mg/dl(Addisu et al., 2023).
- **Hypertension** is defined as a blood pressure recording of >120/80 mmHg.
- The term "**hyperglycemia"** is high blood sugar. Hyperglycemia is blood glucose level ≥126 mg/dl while fasting.(Veras-Estévez and Chapman, 2018).
- **Physical activities** encompass a diverse range of movements and exercises that promote health, fitness, and well-being.
- **Nutritional status** refers to the objective measurement and assessment of an individual's overall health and well-being in relation to their diet, nutrient intake, and body composition
- An individual was considered **overweight** if their BMI falls within the range of 25 to 29.9Kg/m²,.
- An individual was considered to be in the **obesity** range if their BMI falls within the range of 30 Kg/m², or higher
- **Waist circumference**is a measurement taken around the narrowest part of the torso, typically at the level of the belly button (umbilicus) or just above the hip bones

  For Men:
- - Increased Risk: Waist circumference greater than 102 cm (about 40 inches)

  For Women:
- - Increased Risk: Waist circumference greater than 88 cm (about 35 inches)

3.10. Data quality assurance

The qualities of data wereassured by properly designing the tool, training of data collectors and close supervision during data collection. The collected data were checked on a daily basis for accuracy. Two days' training was given to the data collector on objectives of study, ways of approaching respondents and on the data-collection tool. Pretest on 5% of the sample was conducted in Arsi University Asella Referral and Teaching Hospital to check consistency and applicability and after analyzing pretest results, necessary adjustments were made.

International guidelineswere used for all laboratory analysis of blood samples(WHO, 2011).The Internal quality control materials for each lipoproteins (HDL-C, LDL-C, TG, and TC) and glucose were included during running each test. The tests wereconducted based on the manufacturers' instruction. The quality assurance principles for pre-analytical (Sample collection, Patient identification and coding), analytical (Quality control and analysis of tests) and post-analytical stages (Reporting, recording, interpretation and documentation)were applied to assure the quality of result. Those in-between resultsfor lipid profile (TC <200 mg/dL, TG <150mg/dL ,HDL >60 mg/dL and LDL <100 mg/dL (For people with diabetes: Below 70 mg/dL)and for glucose (100 to 125 mg/dL) werecheckedthree times before analysis. There were properly recording of the daily result and daily follow up by principal investigator. The results were recorded in a questioner with the individual's bar-code in daily work. In order to avoid the errors in the results of the test, the reporting wererepeatedly check.

3.11. Data Analysis

The data were collected, cleaned, checked for completeness and consistency manually. It was coded and entered into Epi-data Version 3.1. It was exported to STATA (Version 17.0) for further cleaning and statistical analysis. After the completion of the data collection, the questionnaires were checked for its completeness, unrecorded values and unlikely responses and then were manually clean up on such indication. The test resultswere written on the laboratory data collection format sheet. Means, standard deviation (SD), median (range), and frequencies (%) were used to describe participant's characteristics. Bivariate and multivariable logistic regressions were used to determine the associated factors of dyslipidemia and hyperglycemia.Multivariable logistic regressions was done for variables with a P value of < 0.25 in univariate analysis to identify independently associated factors of

dyslipidemiaSignificance level and association of variables were tested using 95% confidence interval (C.I) and odd ratio. P-value less than 0.05 were taken as statistically significant. All analyses were performed using the epi-data version 3 for data entry and STATA version 17.0 programs for data analysis.

3.12. Ethical considerations

Ethical Clearance was received from Institutional Health Research and Ethics Review Committee of the College of Health and Medical Sciences, Haramaya University.Informed, Voluntary, Written and signed consentwas taken from study participants and head of Hospital.The participants recruited into this study after patient confidentiality,benefits and risks to participating patients, justice, rights, and respect were addressed. When they were willing to participate in the studywassigned an informed consent. A thumbprint or signature was used on the consent form. If the participants were diagnosed with dyslipidemia, fasting glucose impairment and increased blood pressure, he/she was linked to the hospital for chronic care, proper treatment and follow up of this disease as well coincide with ART. Every laboratory investigationsweredone according to the requirement of the patient. In collaboration with Hospital management and laboratory professionals, Health education on associated factors, consequences and complications were provided to all of the participants after the compilation of data collection.

3.13. DISSEMINATION OF RESULTS

The result of this study will be disseminated or communicated to Haramaya University Collage of Health and Medical Science, Asella Referral and Teaching Hospital, zonal, regional and federal health bureaus and other stake holders and the findings will be presented in seminars and also will be published on scientific journals.

4. Results

4.1. Socio-Demographic Characteristics of Study Subjects

A total of 388 HIV-infected patients who were on ART enrolled in the study, yielding a response rate of 100%. The age range of participants spans from 15 to 90 years. The mean age was 43.8(± 4.7) years. The major age group was 31–46 years old 174 (44.7%). Majority of the particiants were female 239(61.6%) and married 249(64.2%). Regarding residence, 195(50.3%) of participants were live in rural. Considering education, 216(55.7%) of them attended primary school. As regards to occupation, 138(35.6%) of the participant were merchant(Table 3).

Table 3 Socio-Demographic Characteristics of adult people living with HIV on ART at Asella Referral and Teaching Hospital Asella, South-east Ethiopia, 2024 (n=388).

Variables	Category	Total (%)
Sex	Female	239 (61.6)
	Male	149 (38.4)
Age	Mean Age: 43.8 (± 4.7)	
	15–30 years	66 (16.9)
	31–46 years	174 (44.7)
	47–62 years	118 (30.3)
	>62 years	30 (7.7)
Residence	Rural	195(50.3)
	Urban	193(49.7)
Education Level	Can not read and write	44 (11.3)
	Can read and write	14 (3.6)
	1-8	216 (55.7)
	9-12	88 (22.7)
	TVET diploma	15 (3.9)

	University degree & above	11 (2.8)
Occupation	Merchant	138 (35.6)
	House wife	74(19.1)
	Employed	51(13.1)
	Daily labourer	49 (12.6)
	Farmer	30 (7.7)
	Un employed	29 (7.5)
	Student	17(4.4)
Marital Status	Married	249 (64.2)
	Divorced	57(14.7)
	Single	52 (13.4)
	Widowed	30(7.7)
Average Monthly Income	2000-3000 ETB	304(78.3)
	4000-7000 ETB	59(15.2)
	7000-10000 ETB	9(2.3)
	>10000 ETB	4 (1.0)
	None	12 (3.1)

4.2. Clinical Characteristics

During ART initiation, the most predominant percentage of WHO clinical stage was stage I272 (70.1%). Duration on ART among participants ranged from 6 up to 60 months with a mean monthsof 27 (±0.13). Most of the study participants used a combination of TDF+3TC+DTG regimen 347(89.4%). For about half of the study participants, the baseline CD4 count was between 200-400 cells/mm^3205(52.8%) and Majority of the study participants, 364 (93.8%) had viral load count <200 copies/mlwere found.(Table 4).

Table 4 Clinical Characteristics of adult people living with HIV on ART at Asella Referral and Teaching Hospital,Asella, Southeast Ethiopia, 2024 (n=388).

Variables	Category	Total (%)
Treatment on hypertension	No	351 (90.5)
	Yes	37 (9.5)
Treatment on Diabetes	No	370 (95.4)
	Yes	18 (4.6)
Basline CD4 (cells/mm^3)	<100cells/mm^3	113 (29.1)
	200-400 cells/mm^3	205 (52.8)
	500 to 1500 cells/mm^3	60 (15.5)
	>1500 cells/mm^3	10 (2.6)
Current Viral Load Count/ copies/ml	75-100	326 (84.0)
	100-500	34 (8.8)
	500-2000	24 (6.2)
	>2000	4 (1.0)
ART Drug Type	TDF+3TC+DTG	347 (89.4)
	TDF+3TC+ATV/r	27 (7)
	AZT+3TC+EFV	7 (1.8
	AZT+3TC+ATV/r	7 (1.8)
Duration of ART/month	6	7 (1.8)
	6-24	48(12.3)
	24-48	36 (9.3)
	48-60	297(76.5)
WHO Clinical stage	Stage I	272 (70.1)
	Stage II	73(18.8)
	Stage III	34(8.8)
	Stage IV	9(2.3)
Family history of Diabetes	No	335 (86.3)
	Yes	53 (13.7)
Family history of Hypertension	No	342 (88.1)

	Yes	46 (11.9)

Note:
ART: -Antiretroviral Treatment, ATV/r: - Atazanavir boosted with Ritonavir, AZT: - Zidovudine, CD4 Cluster of Differentiation 4, DTG: - Dolutegravir, EFV: -Efavirenz,TDF :- Tenofovir Disoproxil Fumarate, 3TC:- Lamivudineand WHO: - World Health Organization

4.3. Behavioral- and Metabolic-Related Factors

The proportions of cigarette smoking 22 (5.7%), alcohol intake 63 (16.2%), coffee intake 359 (92.5%), fruit consumption 195 (50.3%), raw meat consumption 248 (63.9%), and khat chewing 30 (7.7%) were reported.A proportion of hypertension andwaist circumferences above normal among participants were 76 (19.6%) and 66 (17.0%) correspondingly. The proportion of overweight and obese were 28 (7.2%) and 11 (2.8%), respectively, with the mean BMI 22.2 (± 4.1) kg/m2 and physical exercise was 140 (36.1%)(Table5).

Table 5 Behavioral- and Metabolic characteristics of adult people living with HIV on ART at Asella Referral and Teaching Hospital, Asella, Southeast Ethiopia, 2024 (n=388).

Variables	**Category**	**Total (%)**
Smoking cigarette	Yes	22 (5.7)
	No	366 (94.3)
Living with smoker	Yes	36 (9.3)
	No	352(90.7)
Alcohol consumption	Yes	63 (16.2)
	No	325(83.8)
Drinking Coffee	Yes	359 (92.5)
	No	29 (7.5)
khat chewing	Yes	30 (7.7)
	No	358 (92.3)
Physical exercise	Yes	140 (36.1)
	No	248 (63.9)
Walking per week in minutes	>150 min	210 (54.1)
	<150min	178 (45.9)
Activity of daily work	Vigorous	55 (14.2)
	Moderate	162 (41.8)

		Low	171 (44.1)
fruit consumption		Yes	195 (50.3)
		No	193 (49.7)
Raw meat		Yes	248 (63.9)
		No	140 (36.1)
Weight (Mean±SD)		61.4 (± 9.1)	
Height (Mean±SD)		162.9 (±1.8)	
	Male	Normal (<94cm (37in))	125 (32.2)
Central Obesity		Abnormal (>94cm (37in))	24 (6.2)
	Feamle	Normal (<80cm (31.5in))	197 (50.8)
		Abnormal (>80cm (31.5in))	42 (10.8)
BMI (kg/m²)		<18.5 (underweight)	32 (8.2)
		18.5-24.99 (normal)	317 (81.7)
		25-30(over weight)	28 (7.2)
		>30(obese)	11 (2.8)
Blood Pressure		Normal	312 (80.4)
		Abnormal	76 (19.5)

4.4. Prevalence of Dyslipidemia and Hyperglycemia

Two hundred eighty-two (72.7%),[95% CI: 68.0% - 76.9%]) of study participants had at least one laboratory abnormality, which is compatible with a diagnosis of dyslipidemia.From the study participants out off 388 study participants 63 (16.2%), [95% CI: 12.9% – 20.3%]) of them had hyperglycemia.

From those who had dyslipidemia, 202 (52.1%) of them had single lipid abnormality, 52 (13.4%) had double lipid abnormality, 20 (5.2%) had triple lipid abnormality and 8 (2.1%) had quadruple lipid abnormality.From the total participants, the prevalence of TC ≥200 mg/dl who had dyslipidemia were 49 (12.6%) with mean TC 199.3(± 46.3), LDL-c ≥130 mg/dl was 32 (8.3%) with mean LDL-c 117.6 (± 56.4), TG ≥150 mg/dl was 110 (28.4%) withmean TG 165.4 (± 79.0) and the prevalence of HDL-c <40 mg/dl, was 197 (50.8%) (Table 6).

Table 6 Prevalence of dyslipidemia among people living with HIV on ART at Asella Referral and Teaching Hospital, Asella, Southeast, Ethiopia, 2024.

Lipid parameter	**Prevalence of each**	**Overall Prevalence**
TC >200 mg/dl	49 (12.6%)	72.7%
LDL-c >130 mg/dl	32 (8.3%)	
TG >150 mg/dl	110 (28.4%)	
HDL-c <40 mg/dl	197 (50.8%)	
Combination of dyslipidemia		
Single lipid abnormality	289 (74.5%)	
Double lipid abnormality	62(16.0%)	
Triple lipid abnormality	25(6.4%)	
Quadruple lipid abnormality	12(3.1%)	

4.5. Factors associated with dyslipidemia

Bivariate and multivariable logistic regression analyses on the associated factors of dyslipidemia are shown in the table below (Table 7). From bivariate analysisthosevariableswhich had a P value of less than 0.25 were fit for multiple logistic model. Accordingly, age, chewing khat, fruit consumption, on treatment for hypertension, opportunistic infection, WHO clinical stage, baseline CD4 count, ART duration and BMI were included.

The multivariable logistic regression analysis showed that onlyolder age was significantly associatiated with dyslipidemia.The odds of dyslipidemia wasone point seven times higherin older aged ≥54 years,for developingdyslipidemia (AOR: 1.7 [95% CI: 1.1, 2.7] P= 0.03), when compared with <54 years.

Table 7 Bivariate and multivariable analyses for factors associated with Dyslipidemia among peopleHIV patients on ART at Arsi University Asella Referral and Teaching Hospital, Asella, Southeast, Ethiopia, 2024.

Variables	**Category**	**Dyslipidemia**		**COR(95%CI)**	**p-value**	**A0R(95%CI)**	**p-value**
		Yes,n(%)	**No,n(%)**				
Age/year	<54	127(60.0)	57(40.0)	1.0			
	≥54	155(76.0)	49(24.0)	1.4(0.9, 2.2)	0.12	1.7(1.1, 2.7)	0.03
Chewing Khat	Yes	25(83.3)	5(16.7)	2.0(0.7, 5.3)	0.18	1.7(0.6, 4.8)	0.28
	No	257(71.8)	101(28.2)	1.0			
Fruit consumption	Yes	147(75.4)	48(24.6)	1.0			
	No	135(69.9)	58(30.1)	0.8(0.5, 1.2)	0.23	0.7(0.5, 1.2)	0.21
On treatment for	Yes	30(81.1)	7(18.9)	1.7(0.7, 4.0)	0.23	1.4(0.6, 3.4)	0.44
hypertension	No	252(71.8)	99(28.2)	1.0			
Opportunistic	Yes	32(82.1)	7(17.9)	1.8(0.8, 4.2)	0.17	2.0(0.8, 4.7)	0.12
infection	No	250(71.6)	99(28.4)	1.0			
ART	<48	85(77.3)	25(22.7)	1.0			
duration/month	≥48	197(70.9)	81(29.1)	0.7(0.4, 1.2)	0.20	0.7(0.4, 1.2)	0.21
Baseline CD4	<600	211(74.3)	73(25.7)	1.3(0.8, 2.2)	1.18	1.4(0.8, 2.3)	0.21
Count(cells/mm3)	.≥600	71(68.3)	33(31.7)	1.0			
WHO clinical	I	202(74.3)	70(25.7)	1.0			
stage	II	52(71.2)	21(28.8)	0.9(0.5, 1.5)	0.60	0.9(0.5, 1.7)	0.81
	III	23(67.6)	11(32.4)	0.7(0.3, 1.6)	0.41	0.6(0.3, 1.4)	0.28
	IV	5(55.6)	4(44.4)	0.4(0.1, 1.7)	0.22	0.4(0.1, 1.6)	0.19
BMI/ kg/m2	<18.5	53(67.9)	25(32.1)	0.7(0.4, 1.2)	0.22	0.7(0.4,1.3)	0.29
	18.5-24.99	171(75)	57(25.0)	1.0			
	>25	58(70.7)	24(29.3)	0.8(0.4, 1.4)	0.45	0.8(0.5, 1.4)	0.52

4.6. Factors associated with hyperglycemia

Bivariate and multivariable logistic regression analyses on the associated factors of hyerglycemia are shown in the table below (Table 8).From bivariate analysis those variables which had a P value of less than 0.25 were included for multivariable logistic regression analysis.

Thesevariables includeage, sex, smoking cigarette, chewing khat, physical activities, raw meat consumption, baseline CD4 count, ART drug type and BMI. The analysis showed that khat chewingand row meat consumption had a significant association with hyperglycemia at p-value <0.05.

The odds of hyperglycemia were lower for individuals who chewkhat compared to those who do not (AOR: 0.1[95% CI: 0.01,0.9] P= 0.04)andraw meat consumption hadhigher odds of experiencing hyperglycemia than those who do not consume raw meat (AOR: 1.8 [95% CI: 1.1,3.4] P=0.04)were associated with hyperglycemia.

Table 8 Bivariate and multivariable analyses for factors associated with Hyperglycemia among people living with HIV on ART at Asella Referral and Teaching Hospital, Asella, Southeast, Ethiopia, 2024.

Variables	**Category**	**Hyperglycemia**		**COR(95%CI)**	**p-value**	**A0R(95%CI)**	**p-value**
		Yes,n(%)	**No, n (%)**				
Age	≥54	20(13.1)	133(86.9)	0.7(0.4, 1.2)	0.17	1.4(0.8, 2.6)	0.26
	<54	43(18.3)	192(81.7)	1.0			
Sex	Female	34(14.2)	205(85.8))	1.0			
	Male	29(19.5)	120(80.5))	1.5(0.8, 2.5)	0.17	1.4(0.8, 2.5)	0.25
Smoking	Yes	1(4.5)	21(95.5)	0.2(0.03, 1.8)	0.15	0.7(0.1, 8.3)	0.80
Cigarette	No	62(16.9)	304(83.1)	1.0			
Chewing Khat	Yes	2(6.5)	29(93.5)	0.2(0.02, 1.2)	0.07	0.1(0.01, 0.9)	0.04
	No	62(17.4)	295(82.6)	1.0			
Physical activities	Yes	17(12.1)	123(87.9)	1.0			
	No	46(18.5)	202(81.5)	1.6(0.9, 3.0)	0.10	1.6(0.8, 2.9)	0.15

Raw meat consumption	Yes	47(19.0)	201(81.0)	1.8(1.0, 3.3)	0.05	1.8(1.1, 3.4)	0.04
	No	16(11.4)	124(88.6)	1.0			
Baseline CD4 Count(cells/mm3)	<600	7(9.6)	66(90.4)	0.5(0.2, 1.1)	0.09	0.5(0.2, 1.2)	0.13
	>600	56(17.8)	259(82.2)	1.0			
ART drug type	TDF+3TC+DTG	59(17.0)	288(83.0)	1.0			
	TDF+3TC+ATV/r	2(28.6)	5(71.4)	2.0(0.4, 10.3)	0.43	2.5(0.3.11.5)	0.44
	AZT+3TC+EFV	2(7.4)	32(92.6)	0.4(0.09, 1.7)	0.20	0.6(0.1, 2.5)	0.44
BMI/ kg/m2	<18.5	12(15.4)	66(84.6)	0.9(0.4, 1.6)	0.49	0.9(0.4, 1.7)	0.65
	18.5-24.99	43(18.9)	185(81.1)	1.0			
	>25	8(9.8)	74(90.2)	0.5(0.2, 1.0)	0.06	0.5(0.2, 1.1)	0.07

Note:

ART: -Antiretroviral Treatment, ATV/r: - Atazanavir boosted with Ritonavir, AZT: - Zidovudine, BMI Body Mass Index, CD4 Cluster of Differentiation 4, DTG: - Dolutegravir, EFV: - Efavirenz, TDF: - Tenofovir Disoproxil Fumarate, 3TC:- Lamivudine and WHO: - World Health Organization

5. Discussion

The prevalence of dyslipidemia found in the present study was in line with the previous studies at Burayu Health Center, Addis Ababa, Ethiopia 72.2%(Abebe et al., 2014), Armed Force Comprehensive and Specialized Hospital,Addis Ababa, Ethiopia 74.8%(Adnan Kemal, 2020), Debre Tabor Hospital, Debre Tabor, Ethiopia 73.7% (Tilahun et al., 2022).And lower than those reported in HIV-infected patients receiving ART inSouth African 85%(Dave et al., 2016) andBrazil 78.9% (Limas et al., 2014)but higher than the studies conducted from Zewditu Memorial Hospital, Addis Ababa, Ethiopia55.2%(Assefa et al., 2023),north shewa Ethiopia 59.9% (Fiseha et al., 2021) and Northwest Ethiopia 63.9%(Gebrie et al., 2020).

The prevalence of high TC (13.0%) in our study was lower than the prevalence rate reported among HIV patients on ART from Addis Ababa (42.1%)(Abebe et al., 2014), Mehal Meda Hospital in North Shewa 47.3% (Fiseha et al., 2021), Zewditu Memorial Hospital, Addis Ababa, Ethiopia22.6%(Assefa et al., 2023),Armed Force Comprehensive and Specialized Hospital, Addis Ababa, Ethiopia 45.9% (Adnan Kemal, 2020)and Brazil 41.9% (Limas et al., 2014).

We found that the prevalence of high TG was (28.4%). This prevalence was lower than that reported from Addis Ababa, Ethiopia 46.8% (Abebe et al., 2014), Brazil 59.1% (Limas et al., 2014), but comparable to that of reported fromArmed Force Comprehensive and Specialized Hospital, Addis Ababa, Ethiopia 28.9% (Adnan Kemal, 2020) and north shewa Ethiopia 30.9% (Fiseha et al., 2021) but higher than from that of reported in Zewditu Memorial Hospital 18.8% (Assefa et al., 2023).

The prevalence of raised LDL-c in our patients receiving ART (8.3%) was lower than those reported fromAddis Ababa, Ethiopia (23%) (Abebe et al., 2014), north shewa Ethiopia 29.6% (Fiseha et al., 2021), Brazil 33.1% (Limas et al., 2014) and Armed Force Comprehensive and Specialized Hospital, Addis Ababa, Ethiopia 31.2% (Adnan Kemal, 2020). But comparable to that of reported fromZewditu Memorial Hospital 4.9% (Assefa et al., 2023).

The prevalence of low HDL-c in our study was 50.8%, and this is comparable with the prevalence reported from Addis Ababa (50.8%)(Abebe et al., 2014), Zewditu Memorial Hospital 46.9% (Assefa et al., 2023) and Armed Force Comprehensive and Specialized Hospital, Addis Ababa, Ethiopia 35.7% (Adnan Kemal, 2020).It was; however, higher than the prevalence reported from north shewa Ethiopia 19.4% (Fiseha et al., 2021).The discrepancy with our study may be due to socio-economiccharacteristics, dietary habit and sample size variation; all these possibilities may be increase the prevalence compared with the studies which had low prevalence.

The prevalence of hyperglycemia found in the present study was in line with the previous studies in Tikur Anbessa Specialized hospital in Addis Ababa, Ethiopia 17.8% (Feleke et al., 2012)and Beijing Ditan Hospital, Capital Medical University, China 15.7%(Cheng et al., 2014). However it was higher than the prevalence of hyperglycemia reported fromBurayu Health Center, Addis Ababa, Ethiopia 5.6% (Abebe et al., 2014), but lower than the prevalence reported fromJugal Hospital, Harar, eastern Ethiopia 25.1% (Ataro and Ashenafi, 2020).The variation may be due to the length of time individuals has been on ART, dietary habit and sample size variation. The direct effects of ART on lipid and carbohydrate metabolism, endothelial and adipocyte cell function, and mitochondria have been suggested for altered lipid profiles and glucose concentration(Tang, 2011).

In this study being female or male were not associated with dyslipidemia but the study conducted in Asmara, Eritrea,females had substantially higher proportions of TG and TC/HDL ratio than male(Achila et al., 2022), but similar with the study conducted in Mehal Meda Hospital in North Shewa, Ethiopia(Fiseha et al., 2021).

Older age was significantly and positively associated with dyslipidemia among HIV patients on ART. This finding was in agreement with the findings from Asmara, Eritrea(Achila et al., 2022), St. Paul's hospital millennium medical college HIV treatment clinic in Addis Ababa, Ethiopia(Woldeyes et al., 2022), Zewditu Memorial Hospital,Ethiopia(Assefa et al., 2023) Debre Tabor Hospital, Debre Tabor, Ethiopia(Tilahun et al., 2022).Aging can lead to reduced activity of lipoprotein lipase, the enzyme crucial for lipid metabolism and Insulin resistance increases with age, leading to hyperglycemia and dyslipidemia(Liu and Li, 2015)

The current study showed that khat chewing was associated with lower occurrence of high blood sugar levels (hypoglycemic effect)compared to non-khat chewers.The hypoglycemic effect of khat in khat chewer groups due to the presence of detectable amount of Mg, Zn, Fe, Ch, Pb, Cu, in khat leaves in which their presence at desirable physiological concentration is very important for glucose hemostasis (Mg) and insulin synthesis, storage, and release (Zn)(Eliud and Peter, 2012).Another possible explanation for this could be the presence of ascorbic acid which present on khat leaves (150 mg/100 mg of khat)(Hassan et al., 2007)has an anti-oxidant role and combats the destructive effects of free radicals in diabetic patients(Ting et al., 1996).

In this study also raw meat consumption was positively associated with hyperglycemia. This might may be due to the contribution of high energy and saturated fat content of red meat for weight gain, insulin resistance, and high blood cholesterol level. A study also suggested that heme iron from red meat had a greater risk for metabolic syndrome(de Oliveira Otto et al., 2012)

The limitation of the study was due to cross-sectional nature of the study. Finally, our sampling technique was convenient; therefore, our sample cannot be considered representative of all HIV-infected patients receiving treatment in the study area. However, the study has provided some data to inform decision-makers to improve current care and management of HIV-infected persons on ART.

6. Conclusions

This study identified a high prevalence of dyslipidemia (72.7%) and hyperglycemia (16.2%) among adult people living with HIV on ART at Asella Referral and Teaching Hospital in Southeast Ethiopia.Factor such as, older age groupwas found to be associated with dyslipidima and khat chewingand raw meat consumption were associatedwith hyeperglycemia.

7. Recommendations

From these findings, serum fasting glucose and lipid profile levels needs to be monitored regularly in HIV infected patients on antiretroviral therapy to rule out complication that can be optimally managed. Specialy clinicians should increase the frequency of lipid profile monitoring in older ART patients to promptly identify and manage dyslipidemia. In addition to this implement targeted diet and lifestyle modification programs for older ART patients.

Provide dietary counseling for ART patients to educate them about the risks associated with raw meat consumption, including the potential for hyperglycemia, encourage patients to adopt safe cooking practices, emphasizing the importance of thoroughly cooking meat to reduce the risk of infections that could exacerbate hyperglycemia. Finally support further research to understand the relationship between raw meat consumption and blood glucose control in ART patients, including any potential interactions with ART medications.

For patients who chew khat and are on ART, regular monitoring of blood glucose levels is recommended to ensure that any protective effect against hyperglycemia is consistent and not leading to hypoglycemia.Evaluate the long-term impact of khat chewing on overall health and its potential interactions with ART medications to ensure that any benefits regarding hyperglycemia do not come at the expense of other health complications.Further investigation or phytochemical analysis is needed to identify khat ingredient which caused the hypoglycemic effect

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9. APPENDIX

9.1. INFORMATION SHEET AND INFORMED VOLUNTARY CONSENT FORM FOR HEAD OF THE HOSPITAL

1. Introduction:

My name is [Alazar Tamirat Ayele]. I am the Principal Investigator of the study to be conducted in (Arsi University Asella Referral and Teaching Hospital). I am studying for my Master's degree at Haramaya University, the College of Health and Medical Sciences. I kindly request you to lend me your attention to explain you about the study and your institution being selected as the study setting.

2. The study/project title:

Prevalence of dyslipidemia and hyperglycemia and associated factors among adult people living with HIV on ART at Asella Referral and Teaching Hospital, South-east ethiopia.

3. Purpose/aim of the study:

The findings of this study can be of a paramount importance for the Hospital to plan intervention programs to prevent dyslipidemia and hyperglycemia in the community; thereby improve health and survival in general. Moreover, the aim of this study is to write a thesis as a partial requirement for the fulfillment of a Master's Program in Clinical chemistry for the principal investigator.

4. Procedure and duration:

I will be interviewing adult HIV patients on ART using a questionnaire to provide me with pertinent data that is helpful for the study. There are 35 questions to answer where I will fill the questionnaire by interviewing the study participants. The interview on each study participants will take about 20 minutes.

5. Risks and benefits:

The risk of participating in this study is very minimal, but only taking few minutes from the study participant time. There would not be any direct payment for participating in this study. But the findings from this research may reveal important information for the local health planners.

6. Confidentiality:

The information that we will be provided will be kept confidential. There will be no information that will identify the participants in particular. The findings of the study will be general for the study community and will not reflect anything particular of individual persons. The questionnaire will be coded to exclude showing names. No reference will be made in oral or written reports that could link participants to the research.

7. Rights:

Participation for this study is fully voluntary. The participants have the right to declare to participate or not in this study. If they decide to participate, they have the right to withdraw from the study at any time and this will not label them for any loss of benefits which they otherwise are entitled. They do not have to answer any question that they do not want to answer. The Hospital has also the right to stop this study from being conducted if any misdeeds and unethical procedures are observed during the data collection process in the Hospital's premises.

8. Contact address:

If there are any questions or enquires any time about the study or the procedures, please contact: -

Principal Investigator: Alazar Tamirat Ayele

Mobile phone: (+251) 912311058

Email address: alazarenken@gmail.com

Contact address of the responsible Institutional Health Research Ethics Review Committee (IHRERC) at office phone 0254662011 or P.O.Box 235, Harar, Ethiopia].

9. Declaration of informed voluntary consent:

I have read the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that participants have the right to withdraw from the study at any time or not to answer any question that they do not want. I am also informed that the Hospital has the right to stop this study from being conducted if any misdeeds and unethical procedures are observed during the data collection process in the Hospital's premises. Therefore, I declare my voluntary consent on behalf of Arsi University Asella Referral and Teaching Hospital management to allow this study to be conducted in the Hospital with my initials (signature).

Name and Signature of Head of the Hospital:_____ _____ Date _____

Name and Signature of the PI:_____ _____ Date _____

N.B

This is signed face to face in the presence of the PI.

Please provide a copy of this signed consent to the responsible head.

9.2. ENGLISH VERSION OF PARTICIPANT INFORMATION SHEET AND INFORMED VOLUNTARY CONSENT FORM (For competent adults: Ages ≥ 15 years)

(to be translated as well to applicable/appropriate local languages)

1. Introduction:

My name is (_____). I am working as a data collector for the study being conducted in this community by (_____) who is studying for his/her Master's degree at Haramaya University, the College of Health and Medical Sciences. I kindly request you to lend me your attention to explain you about the study and being selected as the study participant.

2. The study/project title:

Prevalence of dyslipidemia and hyperglycemia and associated factors among adult people living with HIV on ART at Asella Referral and Teaching Hospital, South-east ethiopia.

3. Purpose/aim of the study:

The findings of this study can be of a paramount importance for the zone health office to plan intervention programs to prevent dyslipidemia and hyperglycemia in your community; thereby improve your health and survival in general. Moreover, the aim of this study is to write a thesis as a partial requirement for the fulfillment of a Master's Program in Clinical chemistry for the principal investigator.

4. Procedure and duration:

I will be interviewing you using a questionnaire to provide me with pertinent data that is helpful for the study. There are 35 questions to answer where I will fill the questionnaire by interviewing you. The interview will take about 20 minutes, so I kindly request you to spare me this time for the interview.

5. Risks and benefits:

The risk of being participating in this study is very minimal, but only taking few minutes from your time. There would not be any direct payment for participating in this study. But the findings from this research may reveal important information for the local health planners.

6. Confidentiality:

The information you will provide us will be confidential. There will be no information that will identify you in particular. The findings of the study will be general for the study community and will not reflect anything particular of individual persons or housing. The questionnaire will be coded to exclude showing names. No reference will be made in oral or written reports that could link participants to the research.

7. Rights:

Participation for this study is fully voluntary. You have the right to declare to participate or not in this study. If you decide to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefits which you otherwise are entitled. You do not have to answer any question that you do not want to answer.

8. Contact address:

If there are any questions or enquires any time about the study or the procedures, please contact:

Principal Investigator: Alazar Tamirat Ayele

Mobile phone: (+251) 912311058

Email address: alazarenken@gmail.com

Contact address of the responsible Institutional Health Research Ethics Review Committee (IHRERC) at office phone 0254662011 or P.O.Box 235, Harar, Ethiopia].

9. Declaration of informed voluntary consent:

I have read/ was read to me the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to withdraw from the study at any time or not to answer any question that I do not want. Therefore, I declare my voluntary consent to participate in this study with my initials (signature).

Name and signature of participant:_____ _____ Date _____

Name and signature of Data Collector:_____ _____ Date _____

N.B

- This is signed face to face in the presence of the data collector.
- Please provide a copy of this signed consent to the participant.
- If the participant is a lay person and cannot sign initials, can put his/her thumb print in front of a competent witness; and the witness has to sign alongside (with his/her name and address).

9.3. ENGLISH VERSION OF PARTICIPANT INFORMATION SHEET AND INFORMED VOLUNTARY CONSENT FORM FOR MINORS

(Age < 15 years) /VULNERABLE INDIVIDUAL TO BE SIGNED BY THEIR LEGAL COMPETENT ADULT REPRESENTATIVE (e.g.-PARENT/LEGAL GUARDIAN)

1. Introduction:

My name is (_____). I am working as a data collector for the study being conducted in this community by (_____) who is studying for his/her Master's degree at Haramaya University, the College of Health and Medical Sciences. Your child is randomly selected to be participant in this study. I kindly request you to lend me your attention to explain you about the study and the child's participation.

2. The study/project title:

Prevalence of dyslipidemia and hyperglycemia and associated factors among adult people living with HIV on ART at Asella Referral and Teaching Hospital, South-east ethiopia.

3. Purpose/aim of the study:

The findings of this study can be of a paramount importance for the Asella woreda health office to plan intervention programs to prevent dyslipidemia and hyperglycemia in your community; thereby improve child health and survival in general. Moreover, the aim of this study is to write a thesis as a partial requirement for the fulfillment of a Master's Program in Clinical Laboratory Sience speciality in Clinical chemistry for the principal investigator.

4. Procedure and duration:

I will be measuring the lipid profile test and Glucose concentration of your child using a standard measuring instrument as well I will ask you 35 questions about your child that will help us to know the health status of the child. This procedure will take you about 20 minutes. Therefore, I kindly request you to spare me this time and allow me perform this procedure on your child.

5. Risks and benefits:

The risk of being participating for your child in this study is very minimal; but only taking few minutes from your time. There would not be any direct payment for participating in this study. But the findings from this research may reveal important information for the local health planners.

6. Confidentiality:

The information that we will collect from this study will be confidential. There will be no information that will identify your child or yourself in particular. The findings of the study will be general for the study community and will not reflect anything particular of individual persons or housing. The data that we gather from the measurements will exclude showing names. No reference will be made in oral or written reports that could link participants to the research.

7. Rights:

Participation for this study is fully voluntary. You have the right to declare to allow your child to be involved in this study or not. If you would allow your child for this study, you have the right to withdraw him/her from the study at any time and this will not label you/your child for any loss of benefits which you/your child otherwise are entitled. You do not have to answer any question that you do not as well.

8. Contact address:

If there are any questions or enquires any time about the study or the procedures, please contact: Please enter here the contact address of the Principal Investigator: at mobile phone,_0912311058 office phone,_____ postal address_____ and email address as appropriate;__alazarenken@gmail.com as well as contact address of the responsible Institutional Health Research Ethics Review Committee (IHRERC) at office phone 0254662011 or P.O.Box 235, Harar, Ethiopia].

9. Declaration of informed voluntary consent:

I have read/ was read to me the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to withdraw my child from the study at any time or not to answer any question that I

do not want. Therefore, I declare my voluntary consent to allow my child to participate (be involved) in this study with my initials (signature).

Name of the participant: _____ (Assent affirmed if a minor age of 12-17 years

Name and signature of parent/legal guardian: _____ _____

Date: _____

Name and signature of Data Collector: _____ _____

Date: _____

N.B

- This is signed face to face in the presence of the data collector.
    - Please provide a copy of this signed consent to the participant's legal representative.
- If the representative (parent/guardian) is lay person and cannot sign initials, can put his/her thumb print in front of a competent witness; and the witness has to sign alongside (with his/her name and address).
- If the participant is in the age range of 12-17 years, an assent (oral or written) may also be required from the minor on top of the parental/guardian consent.

9.4. AMHARIC VERSION OF PARTICIPANT INFORMATION SHEET AND INFORMED VOLUNTARY CONSENT FORM (For competent adults: Ages ≥ 15 years)

1 መግቢያ:

የኔስም (_____).

በዚህማህበረሰብውስጥእየተካሄደላለውጥናትመረጃሰብሳቢሆኜእየሰራሁነው

(_____)

በሀሮማያዩኒቨርሲቲ፣በጤናእናህክምናሳይንስኮሌጅሁለተኛዲግሪውንእየተማረነው።ስለጥናቱእናየጥናት ተካፋይሆኖመመረጥዎንለማስረዳትትኩረትዎንእንዲሰጡኝበአክብሮትእጠይቃለሁ።

2. የጥናቱ/የፕሮጀክቱ ርዕስ፡-

በአርሲ ዩኒቨርሲቲ አሰላ ሪፈራል እና ማስተማሪያ ሆስፒታል ውስጥ በአዋቂ የኤችአይቪ ታማሚ ሆነው የፀረ ኤችአይቪ መዳኒት እየወሰዱ ካሉት መካከል የዲስሊፒዲሚያ እና ሃይፐርግላይሴሚያ በሽታ ስርጭትን እና ተጋላጭነት ለመገምገም::

3. የጥናቱ ዓላማ/ዓላማ፡-

የዚህ ጥናት ግኝቶች በማህበረሰብዎ ውስጥ ዲስሊፒዲሚያ እና ሃይፐርግላይሴሚያ ን ለመከላከል የጣልቃ ገብነት መርሃ ግብሮችን ለማቀድ ለዞኑ ጤና ጥበቃ ጽህፈት ቤት ከፍተኛ ጠቀሜታ ሊኖረው ይችላል. በዚህም ጤናዎን እና በአጠቃላይ ህልውናዎን ያሻሽሉ. ከዚህም በላይ የዚህ ጥናት ዓላማ ለዋና መርማሪው በክሊኒካል ኬሚስትሪ ውስጥ የማስተርስ ፕሮግራምን ለማሟላት እንደ ከፊል መስፈርት ሆኖ **ተሲስ** መጻፍ ነው።

4. ሂደት እና ቆይታ:

ለጥናቱ አጋዥ የሆኑ ተዛማጅ መረጃዎችን ለመስጠት መጠይቁን ተጠቅሜ ቃለ መጠይቅ አደርግልዎታለሁ። እርስዎን በመጠየቅ መጠይቁን የምሞላበት 35 ጥያቄዎች ለመመለስ አሉ። ቃለ-መጠይቁ 20 ደቂቃ ያህል ይወስዳል፣ስለዚህ ለቃለ መጠይቁ በዚህ ጊዜ እንድትቆጥቡልኝ በአክብሮት እጠይቃለሁ።

5. አደጋዎችእናጥቅሞች:

በዚህጥናትውስጥየመሳተፍአደጋበጣምአናሳነው፣ነገርግንጊዜያችሁጥቂትደቂቃዎችንብቻነውየሚወስደ ው።በዚህጥናትውስጥለመሳተፍምንምአይነትቀጥተኛክፍያአይኖርም።ነገርግንየዚህጥናትግኝቶችለአካባ ቢውየጤናእቅድአውጪዎችጠቃሚመረጃንሊያሳዩይችላሉ.

6. ሚስጥራዊነት፡-

የምታቀርቡልንመረጃሚስጥራዊይሆናል።በተለይእርስዎንየሚለይመረጃአይኖርም።የጥናቱግኝቶችለጥና ትማህበረሰብአጠቃላይእናየግለሰብንወይምየመኖሪያቤትንምንምየሚያንፀባርቅአይሆንም።መጠይቂያ ውስሞችንከማሳየትእንዲገለሉኮድይደረጋል።ተሳታፊዎችንከጥናቱጋርሊያገናኙየሚችሉየቃልወይምየጽሁ ፍዘገባዎችማጣቀሻአይደረግም።

7. መብቶች፡-

የዚህጥናትተሳትፎሙሉበሙሉበፈቃደኝነትነው.
በዚህጥናትለመሳተፍምሆነላለመሳተፍየማወጅመብትአልዎት።ለመሳተፍከወሰኑበማንኛውምጊዜከጥናቱ የመውጣትመብትአልዎትእናይህእርስዎያለዎትንማንኛውንምየጥቅማጥቅምኪሳራአይገልጽልዎትም. መመለስየማትፈልገውንማንኛውንምጥያቄመመለስየለብህም።

8. የመገኛአድራሻ፡-

ስለጥናቱወይምአካሄዶቹማናቸውምጥያቄዎችወይምጊዜየሚጠይቁከሆኑእባክዎያነጋግሩ፡-

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ኃላፊነትያለበትተቋምአድራሻ የጤና ጥናትና ምርምር ሥነ-ምግባር ግምገማ ኮሚቴ

የቢሮስልክ 0254662011

ፖ.ሳ. ቁ 235, ሀረርኢትዮጵያ

9. በመረጃላይየተመሰረተየፈቃደኝነትስምምነትመግለጫ፡-

የተሳታፊውንየመረጃወረቀትአንብቤአለሁ/

አንብቤያለሁ።የጥናቱንአላማ፣አካሄዶችን፣ስጋቶችንእናጥቅሞችን፣ሚስጥራዊነትንጉዳዮችን፣የመሳተፍመ
ብቶችንእናለማንኛውምመጠይቆችአድራሻውንበግልፅተረድቻለሁ።ግልጽባልሆኑጉዳዮችላይጥያቄዎችንእ
ንድጠይቅእድልተሰጥቶኛል።በማንኛውምጊዜከጥናቱየመውጣትወይምየማልፈልገውንማንኛውንምጥያ
ቄላለመመለስመብትእንዳለኝተነገረኝ።ስለዚህ፣በዚህጥናትየመጀመሪያሆኜ (ፊርማ)
ለመሳተፍበፈቃደኝነትመስማማቴንአውጃለሁ።

የተሳታፊውስምእናፊርማ፡-_____ _____ ቀን _____

የመረጃሰብሳቢውስምእናፊርማ፡-_____ _____ ቀን _____

ማሳሰቢያ

- ይህመረጃሰብሳቢውባሉበትፊትለፊትተፈርሟል።
- እባክዎየዚህንየተፈረመስምምነትቅጂለተሳታፊውያቅርቡ።
- ተሳታፊውያልተማረ
  ሰውከሆነእናየመጀመሪያፊደሎችንመፈረምየማይችልከሆነየአውራጣትአሻራውንብቃትባለውም
  ስክርፊትማድረግይችላል።እናምስክሩአብሮመፈረምአለበት (ስሙንእናአድራሻውንየያዘ)።

9.5. AMHARIC VERSION OFPARTICIPANT INFORMATION SHEET AND INFORMED VOLUNTARY CONSENT FORM FOR MINORS

(ዕድሜ<15አመት) / ተጋላጭግለሰብበህጋዊብቃትባለውየጎልማሳተወካይ (ለምሳሌ- ወላጅ/ህጋዊሞግዚት) መፈረምያለበት

1 መግቢያ: -

የኔ ስም (_____). በዚህ ማህበረሰብ ውስጥ እየተካሄደ ላለው ጥናት መረጃ ሰብሳቢ ሆኜ እየሰራሁ ነው (_____) በሀሮማያ ዩኒቨርሲቲ፣ በጤና እና ህክምና ሳይንስ ኮሌጅ ሁለተኛ ዲግሪውን እየተማረ ነው። ልጅዎ በዚህ ጥናት ውስጥ እንዲሳተፍ በዘፈቀደ ተመርጧል። ስለ ጥናቱ እና የልጁ ተሳትፎ ለእርስዎ ለማስረዳት ትኩረትዎን እንዲሰጡኝ በአክብሮት እጠይቃለሁ።

2. የጥናቱ/የፕሮጀክቱ ርዕስ፡-

በአርሲ ዩኒቨርሲቲ አሰላ ሪፈራል እና ማስተማሪያ ሆስፒታል ውስጥ በአዋቂ የኤችአይቪ ታማሚ ሆነው የፀረ ኤችአይቪ መዳኒት እየወሰዱ ካሉት መካከል የዲስሊፒዲሚያ እና ሃይፐርግላይሴሚያ በሽታ ስርጭትን እና ተጋላጭነት ለመገምገም::

3. የጥናቱ ዓላማ/ዓላማ፡-

የዚህ ጥናት ግኝቶች በአሰላ ወረዳ ጤና ጥበቃ ጽ/ቤት በአካባቢያችሁ ያለውን ዲስሊፒዲሚያ እና ሃይፐርግላይሴሚያ ለመከላከል የጣልቃ ገብነት መርሃ ግብሮችን ለማቀድ ከፍተኛ ጠቀሜታ ይኖረዋል። በዚህም የሕፃናትን ጤና እና አጠቃላይ ሕልውና ማሻሻል. ከዚህም በላይ የዚህ ጥናት ዓላማ በክሊኒካል ላቦራቶሪ ሳይንስ ስፔሻሊቲ በክሊኒካል ኬሚስትሪ ለዋናው መርማሪ የማስተርስ ፕሮግራምን ለማሟላት እንደ ከፊል መስፈርት ሆኖ ተሲስ መጻፍ ነው።

4. ሂደት እና የቆይታ ጊዜ፡-

መደበኛውን የመለኪያ መሣሪያ በመጠቀም የልጅዎን የሊፒድ ፕሮፋይል ምርመራ እና የግሉኮስ መጠንን እለካለሁ እንዲሁም የልጁን የጤና ሁኔታ ለማወቅ የሚረዱን ስለልጅዎ 35 ጥያቄዎችን እጠይቃለሁ። ይህ አሰራር 20 ደቂቃ ያህል ይወስዳል. ስለዚህ, በዚህ ጊዜ እንድትጠብቁኝ እና ይህን አሰራር በልጅዎ ላይ እንድፈጽም በትህትና እጠይቃለሁ::

5. አደጋዎች እና ጥቅሞች:

በዚህ ጥናት ውስጥ ለልጅዎ የመሳተፍ አደጋ በጣም አነስተኛ ነው; ግን ከእርስዎ ጊዜ ጥቂት ደቂቃዎችን ብቻ ይወስዳል። በዚህ ጥናት ውስጥ ለመሳተፍ ምንም አይነት ቀጥተኛ ክፍያ አይኖርም። ነገር ግን የዚህ ጥናት ግኝቶች ለአካባቢው የጤና እቅድ አውጪዎች ጠቃሚ መረጃን ሊያሳዩ ይችላሉ.

6. ሚስጥራዊነት፡-

ከዚህ ጥናት የምንሰበስበው መረጃ ሚስጥራዊ ይሆናል። በተለይ ልጅዎን ወይም እራስዎን የሚለይ መረጃ አይኖርም። የጥናቱ ግኝቶች ለጥናት ማህበረሰብ አጠቃላይ እና የግለሰብን ወይም የመኖሪያ ቤትን ምንም የሚያንፀባርቅ አይሆንም። ከመለኪያዎቹ የምንሰበስበው መረጃ ስሞችን ማሳየትን ያስወግዳል። ተሳታፊዎችን ከጥናቱ ጋር ሊያገናኙ የሚችሉ የቃል ወይም የጽሁፍ ዘገባዎች ማጣቀሻ አይደረግም።

7. መብቶች፡-

የዚህ ጥናት ተሳትፎ ሙሉ በሙሉ በፈቃደኝነት ነው. ልጅዎ በዚህ ጥናት ውስጥ እንዲሳተፍ ወይም እንዳይሳተፍ ለመፍቀድ የመግለጽ መብት አለዎት። ልጅዎን ለዚህ ጥናት ከፈቀዱ፣ በማንኛውም ጊዜ ከጥናቱ የማውጣት መብት አልዎት እና ይህ እርስዎ/ልጃችሁ ያለዎት ጥቅማጥቅም ማጣት እርስዎ/ልጃችሁ ላይ ምልክት አይደረግም። እርስዎም ለማይፈልጉት ማንኛውንም ጥያቄ መመለስ የለብዎትም።

8. የመገኛአድራሻ፡-

ስለጥናቱወይምአካሄዶቹበማንኛውምጊዜጥያቄዎችወይምጥያቄዎችካሉእባክዎንዋና መርማሪዉን ያነጋግሩ።በሞባይልስልክ፣_0912311058 ቢሮስልክ፣_____ የፖስታአድራሻ____ እናእንደአስፈላጊነቱየኢሜልአድራሻ፤__alazarenken@gmail..com

እንዲሁምኃላፊነትየሚሰማውየተቋማዊጤናጥናትናምርምርሥነምግባርገምጋሚ ኮሚቴአድራሻንበመሥሪያቤትስልክቁጥር 0254662011 ወይምፖ.ቁ 235, ሀረር, ኢትዮጵያ].

9. በመረጃላይየተመሰረተየፈቃደኝነትስምምነትመግለጫ፡-

የተሳታፊውንየመረጃወረቀትአንብቤአለሁ/

አንብቤያለሁ።የጥናቱንአላማ፣አካሄዶችን፣ስጋቶችንእናጥቅሞችን፣ሚስጥራዊነትንጉዳዮችን፣የመሳተፍመ
ብቶችንእናለማንኛውምመጠይቆችአድራሻውንበግልፅተረድቻለሁ።ግልጽባልሆኑጉዳዮችላይጥያቄዎችንእ
ንድጠይቅእድልተሰጥቶኛል።ልጄንበማንኛውምጊዜከጥናቱየማውጣትወይምየማልፈልገውንማንኛውን
ምጥያቄላለመመለስመብትእንዳለኝተነገረኝ።ስለዚህ፣ልጄበዚህጥናትየመጀመሪያሆሄያት (ፊርማ)
እንዲሳተፍ (እንዲሳተፍ) ለመፍቀድበፈቃደኝነትመስማማቴንአውጃለሁ።

የተሣታፊውስም፡- _____ (አካለመጠንከ12-17 ዓመትየሆነልጅከሆነየተረጋገጠስምምነት)

የወላጅ/ህጋዊአሳዳጊስምእናፊርማ፡- _____ _____ ቀን፡ _____

የመረጃሰብሳቢውስምእናፊርማ፡- _____ _____ ቀን፡ _____

ማሳሰቢያ

• ይህመረጃሰብሳቢውባሉበትፊትለፊትተፈርሟል።

• እባክዎየዚህንየተፈረመስምምነትቅጂለተሳታፊውህጋዊተወካይያቅርቡ።

•ተወካዩ(ወላጅ/አሳዳጊ)ያልተማሩሰውከሆኑእናየመጀመሪያፊደሎችንመፈረምየማይችሉከሆነየአውራጣ
ትአሻራውንብቃትባለውምስክርፊትማድረግይችላል።እናምስክሩአብሮመፈረምአለበት
(ስሙንእናአድራሻውንየያዘ)።

•ተሳታፊውከ12-
17አመትእድሜክልልውስጥከሆነ፣በወላጅ/አሳዳጊስምምነትላይለአካለመጠንላልደረሰውልጅፈቃድ
(በቃልወይምበጽሁፍ) ሊጠየቅይችላል።

9.6. AFAN OROMO VERSIONOF PARTICIPANT INFORMATION SHEET AND INFORMED VOLUNTARY CONSENT FORM (For competent adults: Ages ≥15 years)

1. Seensa:

Maqaan koo (_____). Qorannoo hawaasa kana keessatti (_____) Yunivarsiitii Haramayaa, Kolleejjii Saayinsii Fayyaa fi Meedikaalaatti Digrii Mastersii isaaf barachaa jiruuf qorannoo hawaasa kana keessatti gaggeeffamaa jiruuf daataa walitti qabaa ta'ee hojjechaa jira. Waa'ee qorannichaa fi hirmaataa qorannichaa ta'ee filatamuu kee akka siif ibsuuf xiyyeeffannoo keessan akka naaf liqeessitan kabajaan isin gaafadha.

2. Mata duree qo'annichaa/pirojektichaa:

Tatamsa'ina dhibee dhiibbaa dhiigaa fi sukkaaraa olka'iinsa dhiigaa fi sababoota kanaan walqabatan dhukkubsattoota HIV ga'eessota aartii irratti Hospitaala Rifaralaa fi Barumsaa Yunivarsiitii Arsii, kibba-baha, Itoophiyaa keessatti.

3. Kaayyoo/kaayyoo qorannichaa:

Argannoon qorannoo kanaa waajjirri fayyaa zoonii sagantaalee gidduu seensaa hawaasa keessan keessatti dhibee dhiitaa dhiigaa fi sukkaaraa olka'aa ittisuuf karoorfachuuf barbaachisummaa olaanaa qabaachuu danda'a; kanaanis fayyaa fi walumaa galatti lubbuun jiraachuu kee fooyyessa.Kana malees, kaayyoon qorannoo kanaa qorataa muummichaaf Sagantaa Maastarsii Keemistirii Kilinikaalaa galmaan ga'uuf akka barbaachisummaa gartokkeetti barruu qorannoo (thesis) barreessuudha.

4. Hojimaata fi yeroo:

Daataa barbaachisaa ta'ee fi qorannichaaf gargaaru naaf kennuudhaaf gaaffilee fayyadamee isin gaafadha.Gaaffilee 35 deebisuuf jiru keessatti gaaffii fi deebii isiniin godheen guuta. Gaaffii fi deebii gara daqiiqaa 20 waan fudhatuuf yeroo kana gaaffii fi deebii kanaaf akka na qusattan kabajaan isin gaafadha.

5. Balaa fi faayidaa:

Balaan qorannoo kana irratti hirmaachuu baayyee xiqqaadha, garuu yeroo keessan irraa daqiiqaa muraasa qofa fudhachuudha.Qorannoon kana irratti hirmaachuuf kaffaltiin kallattiin hin jiraatu ture.Garuu argannoon qorannoo kanarraa argamu karoorsitoota fayyaa naannoo sanaaf odeeffannoo barbaachisaa ta’e mul’isuu danda’a.

6. Iccitii:

Odeeffannoon isin nuuf kennitan iccitii ta'a.Odeeffannoon addatti si adda baasu hin jiraatu. Argannoon qorannichaa hawaasa qorannichaaf waliigalaa kan ta’u yoo ta’u, namoota dhuunfaa ykn mana jireenyaa adda ta’e kan hin calaqqisiifne ta’a. Gaaffiin maqaa agarsiisu akka hin dabalamneef koodii ni kennama. Gabaasa afaaniin ykn barreeffamaan hirmaattoota qorannicha waliin walqabsiisuu danda’u keessatti eeruun hin kennamu.

7. Mirgoota:

Qorannoon kanaaf hirmaannaan guutummaatti fedhii ofiitiin kan raawwatamudha. Qo’annoo kana irratti hirmaachuu fi dhiisuu kee labsuuf mirga qabda. Yoo hirmaachuuf murteessite yeroo barbaaddetti qo’annoo keessaa ba’uuf mirga qabda kunis kasaaraa kamiyyuu sitti hin mallatu

8. Teessoo quunnamtii:

Waa’ee qorannichaa ykn hojimaata yeroo kamiyyuu gaaffiin ykn gaaffii yoo jiraate:

Qorataan Muummee: Alazar Tamirat Ayele

Bilbila harkaa: (+251) 912311058

Teessoo iimeelii: alazarenken@gmail.com

Teessoo quunnamtii itti gaafatamummaa qabu koree gamaaggama naamusa qorannoo fayyaa dhaabbilee (IHRERC) bilbila waajjira 0254662011 ykn P.O.Box 235, Harar, Ethiopia].

9. Ibsa hayyama tola ooltummaa beekumsa qabu:

Waraqaa odeeffannoo hirmaattotaa dubbiseera/ naaf dubbifameera.Kaayyoo qorannichaa, hojimaata, balaa fi faayidaa, dhimmoota iccitii, mirga hirmaachuu fi teessoo quunnamtii gaaffii kamiifuu sirriitti hubadheera.Wantoota ifa hin taane ta'uu danda'aniif gaaffii akkan gaafadhu carraan naaf kennameera.Yeroo barbaadetti qo'annoo keessaa ba'uuf ykn gaaffii ani hin barbaanne kamiyyuu deebisuuf mirga akkan qabu naaf himameera. Kanaaf, qorannoo kana irratti hirmaachuuf fedhii kootiin hayyama koo qubee jalqabaa (mallattoo) kootiin nan ibsa.

Maqaa fi mallattoo hirmaataa:_____ _____ Guyyaa _____ .

Maqaa fi mallattoo Walitti qabaa Odeeffannoo:_____ _____ Guyyaa _____

Yadaachisaa

• Kunis bakka walitti qabaan daataa jirutti fuula fuulatti mallattaa'a.

• Maaloo waraabbii hayyama mallattaa'e kanaa hirmaataaf kenni.

• Hirmaataan nama laayyoo ta'ee fi qubee jalqabaa mallatteessuu kan hin dandeenye yoo ta'e, ragaa gahumsa qabu fuulduratti qubbee harkaa isaa kaa'uu kan danda'u yoo ta'e; akkasumas ragaan cinatti (maqaa fi teessoo isaa waliin) mallatteessuu qaba.

9.7. AFAN OROMO VERSIONOFPARTICIPANT INFORMATION SHEET AND INFORMED VOLUNTARY CONSENT FORM FOR MINORS

(umrii< waggaa 15) /namummaan isaa saaxilamummaa qabu bakka bu'aa ga'eessotaa seera qabeessa ta'een (fkn-warra/guddistuu seeraa)

1. Seensa

Maqaan koo (_____). Qorannoon hawaasa kana keessatti (_____) Yunivarsiitii Haramayaa, Kolleejjii Fayyaa fi Saayinsii Meedikaalaa keessatti digrii lammaffaa barachaa jiruun akka gaggeeffamuuf hojjechaa jira.Mucaan keessan qorannoo kana keessatti hirmaataa akka ta'uuf akka tasaa filatameera.Waa'ee qo'annoo fi hirmaannaa daa'imaa akka siif ibsitu xiyyeeffannoo kee akka naaf liqeessitu gaarummaadhaan si gaafadha.

2. Mata duree qo'annoo/pirojektii

Tatamsa'ina dhibee dhiibbaa dhiigaa fi sukkaaraa olka'iinsa dhiigaa fi sababoota kanaan walqabatan dhukkubsattoota HIV ga'eessota ART irratti Hospitaala Rifaralaa fi Barumsaa Yunivarsiitii Arsii, kibba-baha, Itoophiyaa keessatti.

3. Kaayyoo/kaayyoo qorannichaa:

Argannoon qorannoo kanaa waajjirri fayyaa kutaa Asellaa sagantaalee gidduu seensaa hawaasa keessan keessatti dhibee dhiitaa dhiigaa fi sukkaaraa olka'iinsa dhiigaa ittisuuf karoorfachuuf barbaachisummaa olaanaa qabaachuu danda'a; kanaanis fayyaa daa'immanii fi walumaa galatti lubbuun jiraachuu ni fooyyessa. Kana malees, kaayyoon qorannoo kanaa qorataa muummichaaf sagantaa Master's Program in Clinical Laboratory Sience specialty in Clinical chemistry guutuuf akka barbaachisummaa gartokkeetti barruu qorannoo barreessuudha.

4. Hojimaata fi yeroo:

Meeshaa safartuu sadarkaa isaa eeggate fayyadamuun qorannoo lipid profile fi Glucose concentration daa'ima keessanii akkasumas waa'ee daa'ima keessanii gaaffii 35 kan haala fayyaa daa'imaa beekuuf nu gargaaran isin gaafadha. Hojimaanni kun gara daqiiqaa 20 si

fudhata. Kanaaf yeroo kana na qusachuun adeemsa kana daa'ima keessan irratti akkan raawwadhu akka naaf hayyamtan kabajaan isin gaafadha.

5. Balaa fi faayidaa:

Balaan qorannoo kana irratti daa'ima keessaniif hirmaachuu baay'ee xiqqaadha; garuu yeroo kee irraa daqiiqaa muraasa qofa fudhachuudhaan.Qorannoon kana irratti hirmaachuuf kaffaltiin kallattiin hin jiraatu ture.Garuu argannoon qorannoo kanarraa argamu karoorsitoota fayyaa naannoo sanaaf odeeffannoo barbaachisaa ta'e mul'isuu danda'a.

6. Iccitii:

Odeeffannoon qorannoo kana irraa walitti qabnu iccitii ta'a.Odeeffannoon daa'ima keessan ykn ofuma keessan addatti adda baasu hin jiraatu. Argannoon qorannichaa hawaasa qorannichaaf waliigalaa kan ta'u yoo ta'u, namoota dhuunfaa ykn mana jireenyaa adda ta'e kan hin calaqqisiifne ta'a. Daataan safartuuwwan irraa walitti qabnu maqaa agarsiisuu ni hambisa. Gabaasa afaaniin ykn barreeffamaan hirmaattoota qorannicha waliin walqabsiisuu danda'u keessatti eeruun hin kennamu.

7. Mirgoota:

Qorannoon kanaaf hirmaannaan guutummaatti fedhii ofiitiin kan raawwatamudha. Mucaan keessan qorannoo kana keessatti akka hirmaatu hayyamuu fi dhiisuu isaa labsuuf mirga qabdu.Yoo daa'ima kee qorannoo kanaaf hayyamte, yeroo barbaaddetti qo'annoo keessaa baasuuf mirga qabda kunis faayidaa ati/mucaan kee karaa biraatiin mirga qabdu kamiyyuu si/mucaa kee irratti maqaa hin moggaasu.Gaaffii akkasuma hin kennine kamiyyuu deebisuu hin qabdu.

8. Teessoo quunnamtii:

Waa'ee qorannichaa ykn hojimaata yeroo kamiyyuu yoo gaaffiin ykn gaaffiin yoo jiraate quunnamtii: Maaloo teessoo quunnamtii Qorataa Muummee: bilbila harkaa,_0912311058 bilbila waajjira,_____ teessoo poostaa_____ fi teessoo imeelii akka barbaachisummaa isaatti;__alazarenken@gmail .com akkasumas teessoo quunnamtii itti gaafatamummaa qabu

koree gamaaggama naamusa qorannoo fayyaa dhaabbilee (IHRERC) bilbila waajjira 0254662011 ykn P.O.Box 235, Harar, Ethiopia].

9. Ibsa hayyama tola ooltummaa beekumsa qabu:

Waraqaa odeeffannoo hirmaattotaa dubbiseera/ naaf dubbifameera.Kaayyoo qorannichaa, hojimaata, balaa fi faayidaa, dhimmoota iccitii, mirga hirmaachuu fi teessoo quunnamtii gaaffii kamiifuu sirriitti hubadheera.Wantoota ifa hin taane ta'uu danda'aniif gaaffii akkan gaafadhu carraan naaf kennameera. Yeroo barbaadetti mucaa koo qo'annoo keessaa baasuu ykn gaaffii ani hin barbaanne kamiyyuu deebisuuf mirga akkan qabu naaf himameera. Kanaafuu, mucaan koo qorannoo kana irratti akka hirmaatu (hirmaatu) hayyama fedhii kootiin qubee jalqabaa (mallattoo) kootiin nan labsa.

Maqaa hirmaataa: _____ (Eeyyamni kan mirkanaa'e yoo umuriin isaa xiqqaan waggaa 12-17 ta'e

Maqaa fi mallattoo warraa/guddistuu seeraa: _____ _____ Guyyaa: _____

Maqaa fi mallattoo Walitti qabaa Odeeffannoo: _____ _____ Guyyaa: _____

<u>Yadaachisaa</u>

• Kun fuula mallattaa'eedha to face in the face in the data collector

• Maaloo waraabbii hayyama mallattaa'e kanaa bakka bu'aa seeraa hirmaataaf kenni

• Bakka bu'aan (warri/guddistuu) nama laayyoo ta'ee fi maqaa jalqabaa mallatteessuu yoo hin dandeenye, maxxansaa qubbee isaa keessa galchuu ni danda'a ragaa gahumsa qabu fuulduratti;akkasumas ragaan cinatti mallatteessuu qaba (maqaa fi teessoo isaa waliin)

• Hirmaataan umuriin isaa waggaa 12-17 yoo ta'e, hayyamni (afaaniin ykn barreeffamaan) irraas barbaachisuu ni danda'a daa'ima umriin isaa hin geenye hayyama warraa/guddistuu irratti.

9.8. English Version Questionnaire

Haramaya University College of Health and Medical Sciences School of Medical Laboratory Sciences

Questionnaire on the socio demographic and health condition of participant

To assess Prevalence of dyslipidemia and hyperglycemia and associated factors among adult people living with HIV on ART at Asella Referral and Teaching Hospital, South-east ethiopia.

Study number: _____ **Date of interview: _____/____/_____**

Lab number: _____ **DDMM YYYY**

APPENDIX 1*English Version of Research Questionnaire*

S.No	Questions	Response of categories	Remark
	Socio-demographic data		
1.	Can you tell me your age?	_____year	
2.	Sex	□ Male □ Female	
3.	Where do you live?	□ Urban □ Rural	
4.	What is your educational status?	□ Can not read and write □ Can read and write □ 1-8 □ 9-12 □ TVET diploma □ University degree & above	
5.	What is your occupational status?	□ Employed □ Un employed □ House wife/home activities	

		□ Daily labourer □ Merchant □ Student □ . Other Specify_____	
6.	Marital status ?	□ Single □ Married □ Divorce □ Widowed	
7.	Household monthly income (ranked)	□ 2000-3000 ETB □ 4000-7000 ETB □ 7000-10000 ETB □ >10000 ETB	
	Life style Data		
8.	Are you Smoking cigarette?	□ Yes □ No	
9.	How many times you smoke per day?	□ One times □ Two times □ Three times □ More than Three	
10.	Are you living with smoker?	□ Yes □ No	
11.	Are you drinking Alcohol?	□ Yes □ No	
12.	How Many bottles you drink alcohol per day?	□ Two to Three alcohol □ Three to Four alcohol □ Four to Six alcohol	

		□ >10 alcohol	
13.	Are you drinkingCoffee?	□ Yes □ No	
14.	Are you chewing khat?	□ Yes □ No	
15.	How many times you chewing khat per week?	□ One times □ Two times □ Three times □ >4 times	
	Clinical Data		
16.	Are you on treatment for hypertension?	□ Yes □ No	
17.	Are you on treatment for diabetes?	□ Yes □ No	
18.	Baseline CD4 Count	□ <150 cells/mm^3 □ 200-400 cells/mm^3 □ 500 to 1500 cells/mm^3 □ >1500 cells/mm^3	
19.	Viral Load Count	□ <20-75 copies/ml □ >200 copies/ml □ <200 copies/ml	
20.	ART Drugs type	□ NNRTI □ NRTI □ PI	
21.	Duration of ART	□ 6 month □ 12month □ 24 month □ >24 month	

22.	Clinical stage of HIV	□ Stage I □ Stage II □ Stage III □ StageIV	
23.	Family history of DM	□ Yes □ No	
24.	Family history of hypertension	□ Yes □ No	
25.	Opportunistic infection	□ Yes □ No	
	Behavioral Data		
26.	Are you performing Regular exercise?	□ Yes □ No	
27.	How many times you Walkingper week in minutes?	□ >150 min □ <150min	
28.	Intensity of activity of daily work?	□ Vigorous □ Moderate □ Low	
	Nuitrational Data		
29.	Are you consume fruit?	□ Yes □ No	
30.	Fruit intake per week?	□ one times □ Two times □ Four times	
31.	vegetable intake per week?	□ one times □ Two times □ Four times □ Never	

32.	Are you Consume row meat	□ Yes □ No		
33.	Row meat consumption per week?	□ one times □ Two times □ Four times		
	Anthropometric Data			
34.	Weight	_____kg		
35.	Height	_____m		
36.	Waist circumference	_____cm		
No	**DIFFERENT MEASUREMENTS And Laboratory tests**	**RESULT**	**UNIT OF MEASURMENT**	**Remarks**
	Laboratory tests			
1.	Total Cholesterol (TC)		Mg/dl	
2.	Triacylglyceride (TG)		Mg/dl	
3.	Low density lipoprotein (LDL-C)		Mg/dl	
4.	High density lipoprotein (HDL-C)		Mg/dl	
5.	Fasting blood sugar (FBS)		Mg/dl	
	Anthropometric Measurements			
6.	Body mass index (BMI)		kg/m^2	
7.	Blood pressure (BP)		(mmHg)	

8.	Waist circumference		Cm(inch)	

9.9. Amharic Version Questionnaire

የሐረማያዩኒቨርሲቲየጤናእናየህክምናሳይንስኮሌጅየህክምናላቦራቶሪሳይንስ

ትምህርትቤት

ስለተሳታፊውማህበራዊስነ-ሕዝብእናየጤናሁኔታመጠይቅ

በአርሲዩኒቨርሲቲአሰላሪፈራልእናማስተማሪያሆስፒታልውስጥአዋቂየኤችአይቪታማሚሆነውየፀረኤችአይ ቪመድሐኒትእየወሰዱካሉትመካከልየዲስሊፒዲሚያ እና ሃይፐርግላይሴሚያ በሽታስርጭትንእናተጋላጭነት ለመገምገም::

የጥናትቁጥር: _____ **የቃለመጠይቁቀን: _____/____/_____ ዓ.ም**

የላብራቶሪቁጥር: _____

APPENDIX 2Amharic Version ofResearch Questionnaire

የጥናቱጥያቄዎች

ተ፣ቁ	ጥያቄዎች	ምላሽ	አስተያየት
	ማህበረ-ሕዝብመረጃዎች		
1.	እድሜህንልትነግረኝትችላለህ?	_____አመት	
2.	ጸታ	☐ ወንድ ☐ ሴት	
3.	የትነውየምትኖረው?	☐ ከተማ ☐ ገጠር	
4.	የትምህርትደረጃዎምንያህልነው?	☐ ማንበብና መፃፍ አይችልም ☐ ማንበብናመፃፍ ይችላል	

		□ 1-8 □ 9-12 □ የቴክኒክናሙያትምህርትናሥልጠናዲፕሎማ □ የዩኒቨርሲቲዲግሪእናከዚያበላይ	
5.	የስራ ሁኔታ?	□ ተቀጣሪ □ ያልተቀጠረ □ የቤትእመቤት □ የቀንሰራተኛ □ ነጋዴ □ ተማሪ □ ሌላ _____	
6.	የጋብቻ ሁኔታ?	□ ያላገባ □ ያገባ □ የፈታ □ ባል/ሚስትየሞተበት	
7.	የቤተሰብወርሃዊገቢ	□ 2000-3000 ብር □ 4000-7000 ብር □ 7000-10000 ብር □ >10000 ብር	
	የእኗኗርዘይቤመረጃ		
8.	ሲጋራያጨሳሉ?	□ አዎ □ አይ	

9.	በቀን ስንት ጊዜ ታጨሳለህ?	□ አንድ ጊዜ □ ሁለት ጊዜ □ ሶስት ጊዜ □ ከ ሶስት በላይ □ ሶስትፓኬት	
10.	ከአጫሾችጋርነውየሚኖሩት?	□ አዎ □ አይ	
11.	አልኮልይጠጣሉ?	□ አዎ □ አይ	
12.	በቀንስንትጠርሙስአልኮልትጠጣለህ/ ትጠጫለሽ?	□ ከሁለትእስከሶስትአልኮል □ ከሶስትእስከአራትአልኮሆል □ ከአራትእስከስድስትአልኮሆል □ > 10 አልኮል	
13.	ቡና ትጠጣለህ?	□ አዎ □ አይ	
14.	በቀንስንትጊዜቡና ትጠጣለህ?	□ አንድጊዜ □ ሁለትጊዜ □ ሶስትጊዜ □ > 4 ጊዜ	
15.	ጫትትቅማለህ?	□ አዎ □ አይ	
16.	በሳምንትስንትጊዜጫትትቅማለህ	□ አንድጊዜ	

	?	□ ሁለትጊዜ □ ሶስትጊዜ □ > 4 ጊዜ	
	ክሊኒካዊመረጃ		
17.	ለደምግፊትህክምናላይነህ?	□ አዎ □ አይ	
18.	የስኪርህመም መዳኒት እየወሰድክ/ሽ ነው?	□ አዎ □ አይ	
19.	የ CD4 ቁጥር ብዛት	□ <150 cells/mm^3 □ 200-400 cells/mm^3 □ 500 to 1500 cells/mm^3 □ >1500 cells/mm^3	
20.	የ ኤች አይ ቪቫይረስቁጥር ብዛት	□ <20-75 copies/ml □ >200 copies/ml □ <200 copies/ml	
21.	የኤች አይ ቪቫይረስየመድኃኒቶችዓይነት	□ NNRTI □ NRTI □ PI	
22.	የኤች አይ ቪቫይረስመድኃኒትቆይታ	□ 6 ወር □ 12 ወር □ 24 ወር □ >24 ወራት	

23.	የዓለምጤናድርጅትየኤችአይቪክሊኒካዊደረጃ	□ ደረጃ I □ ደረጃ II □ ደረጃ III □ ደረጃ IV	
24.	ከቤተሰብ ውስጥየስኪር ህመም ያለበት አለ?	□ አዎ □ አይ	
25.	ከቤተሰብ ውስጥየደም ግፊት ህመም ያለበት አለ?	□ አዎ □ አይ	
26.	ኦፖርቹንስቲክኢንፌክሽን አለው?	□ አዎ □ አይ	
	የባህሪመረጃ		
27.	መደበኛየአካልብቃትእንቅስቃሴእ ያደረጉነው?	□ አዎ □ አይ	
28.	በደቂቃውስጥበሳምንትስንትጊዜበ እግርይራመዳሉ?	□ >150 ደቂቃ □ <150 ደቂቃ	
29.	የዕለትተዕለትሥራእንቅስቃሴጥን ካሬ?	□ ኃይለኛ □ መካከለኛ □ ዝቅተኛ	
	የአመጋገብመረጃ		
30.	ፍራፍሬ ትበላለህ?	□ አዎ □ አይ	

31.	የፍራፍሬአመጋገብበሳምንት?	□ አንድጊዜ □ ሁለትጊዜ □ አራትጊዜ		
32.	የአትክልትአመጋገብበሳምንት?	□ አንድጊዜ □ ሁለትጊዜ □ አራትጊዜ □ በጭራሽ		
33.	ጥሬ ስጋትበላለህ	□ አዎ □ አይ		
34.	ጥሬ ስጋበሳምንትፍጆታ?	□ አንድጊዜ □ ሁለትጊዜ □ አራትጊዜ		
	አንትሮፖሜትሪክ መረጃ			
35.	ክብደት	----------ኪግ		
36.	ቁመት	----------ሜትር		
37.	የወገብ ስፋት	----------ሴንቲ ሜትር		
No	**የተለያዩመለኪያዎች እናየላብራቶሪምርመራዎች**	**ውጤት**	**የመለኪያ SI ዩኒት**	**አስተያየቶች**
	የላብራቶሪምርመራዎች			
1.	Total Cholesterol (TC)		Mg/dl	
2.	Triacylglyceride (TG)		Mg/dl	

3.	Low density lipoprotein (LDL-C)		Mg/dl	
4.	High density lipoprotein (HDL-C)		Mg/dl	
5.	Fasting blood sugar (FBS)		Mg/dl	
	አንትሮፖሜትሪክመለኪያዎች			
6.	Body mass index (BMI)		kg/m^2	
7.	Blood pressure (BP)		(mmHg)	
8.	Waist circumference		Cm(inch)	

9.10. Afaan Oromo Version Questionnaire

Yuunivarsiitii Haramaya Kolleejjii Fayyaa fi Saayinsii Meedikaalaa Mana Barumsaa Saayinsii Laaboraatoorii Meedikaalaa

Gaaffii haala hawaas-dimoogiraafii fi fayyaa hirmaataa irratti

Dhukkubsattoota HIV ga'eessota ART fudhatan Yunivarsiitii Arsii Hospitaala Rifaralaa fi Barsiisaa Asellaa keessatti tatamsa'ina dhibee dyslipidemia fi hyperglycemia fi wantoota kanaan walqabatan madaaluuf 2023 GC.

Lakkoofsa qo'annoo: _____ Guyyaa af-gaaffii: _____/____/_ .

Lakkoofsa mana yaalaa: _____ DDMM YYYY

APPENDIX 3Afaan Oromo of Version Questionnaire

Gaaffilee qorannoo

L.T	Gaaffiiwwan	Deebii gosoota	Yaadannoo
	Daataa hawaas dimoogiraafii		
1.	Umurii kee natti himuu dandeessaa?	_____waggaa	
2.	Saala	☐ DHIIRAA ☐ DUBARTII	
3.	Ati eessa jiraatta?	☐ Magaalaa ☐ Baadiyyaa	
4.	Haalli barnootaa keessan maali?	☐ Dubbisuu fi barreessuu kan hin dandeenye ☐ 1-8 ☐ 9-12 ☐ Dippiloomaa TVET ☐ Digirii Yuunivarsiitii & sanaa ol	

5.	Haalli hojii kee maali?	□ Qaxarrii □ Hin qacaramne □ Haadha manaa manaa/sochiiwwan manaa □ Hojjetaa guyyaa guyyaa □ Daldalaa □ Barataa □ Kan biroo Ifa_____ .	
6.	Fuuteettaa?	□ Tokkicha □ Mared ta'e □ Wal hiikuu □ Dubartii abbaan manaa irraa du'e	
7.	Galii maatii ji'aa ?	□ 2000-3000 ETB □ 4000-7000 ETB □ 7000-10000 ETB □ >10000 ETB	
	Akkaataa jireenyaa Daataa		
8.	Sigaaraa Xuuxaa jirtaa?	□ Eeyyee □ Lakki	
9.	Guyyaatti yeroo meeqa tamboo xuuxa?	□ Yeroo tokko □ Yeroo lama □ Yeroo sadii □ Sadii ol	
10.	Nama tamboo xuuxu waliin jiraachaa jirtaa?	□ Eeyyee □ Lakki	
11.	Alkoolii dhugaa jirtaa?	□ Eeyyee □ Lakki	

12.	Guyyaatti qaruuraa meeqa alkoolii dhugda?	□ Alkoolii Lama hanga Sadii □ Alkoolii Sadii hanga Afur □ Alkoolii Afur hanga Jahaa □ >10 alkoolii	
13.	Buna dhugaa jirtuu?	□ Eeyyee □ Lakki	
14.	Khaat daakuun jirtaa?	□ Eeyyee □ Lakki	
15.	Torbanitti yeroo meeqa khat daaku?	□ Yeroo tokko □ Yeroo lama □ Yeroo sadii □ >yeroo 4	
	Daataa Kilinikaalaa		
16.	Dhiibbaa dhiigaatiin wal'aansa argachaa jirtuu?	□ Eeyyee □ Lakki	
17.	Dhukkuba sukkaaraa qabdaa	□ Eeyyee □ Lakki	
18.	Lakkoofsa CD4	□ <150 cells/mm^3 □ 200-400 cells/mm^3 □ 500 to 1500 cells/mm^3 □ >1500 cells/mm^3	
19.	Lakkoofsa Fe'umsa Vaayirasii	□ <20-75 copies/ml □ >200 copies/ml □ <200 copies/ml	
20.	ART Gosa qoricha	□ NNRTI □ NRTI □ PI	

21.	Turtii ART	□ Ji'a 6 □ Ji'a 12 □ Ji'a 24 □ >ji'a 24	
22.	WHO Sadarkaa kilinikaa HIV	□ Sadarkaa I □ Sadarkaa II □ Sadarkaa III □ Sadarkaa IV	
23.	Seenaa maatii Dhukkuba Sukkaaraa?	□ Eeyyee □ Lakki	
24.	Seenaa maatii dhiibbaa dhiigaa?	□ Eeyyee □ Lakki	
25.	Infeekshinii carraa argate	□ Eeyyee □ Lakki	
	Daataa Amala		
26.	Sochii qaamaa Formal raawwachaa jirtuu?	□ Eeyyee □ Lakki	
27.	Torbanitti yeroo meeqa Daqiiqaa keessatti Deemsa?	□ >150 daqiiqaa □ <150 daqiiqaa	
28.	Cimina sochii hojii guyyaa guyyaa?	□ Cimina kan qabu □ Giddu galeessa □ Gadi aanaa	
	Daataa Nyaata Nyaataa		
29.	Fuduraa nyaachaa jirtuu?	□ Eeyyee □ Lakki	
30.	Torbanitti fuduraalee fudhachuu?	□ yeroo tokko □ Yeroo lama □ Yeroo afur	

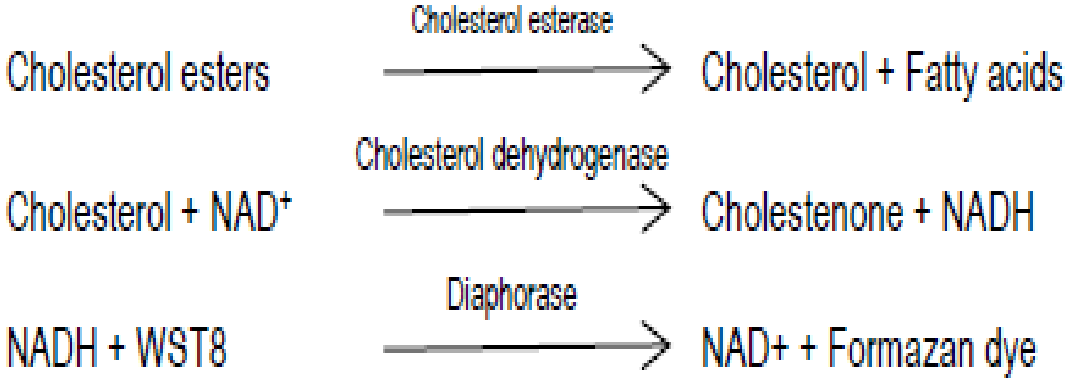
31.	torbanitti kuduraalee fudhachuu?	□ yeroo tokko □ Yeroo lama □ Yeroo afur □ Gonkumaa		
32.	Foon tarree Nyaachuu	□ Eeyyee □ Lakki		
33.	Torbanitti foon tarree fayyadamuu?	□ yeroo tokko □ Yeroo lama □ Yeroo afur		
	Daataa antiroopoomeetrikii			
34.	ulfaatina	----------kiloo giraama		
35.	olka'iinsa	---------- meetira,		
36.	naannoo mudhii	----------seentimeetira		
Lak	**SAFARRAA ADDAA** **Akkasumas qorannoo Laaboraatoorii**	**BU'AA**	**YUNII SAFARRAA**	**Yaada**
	Qormaata laabraatoorii			
1.	Total Cholesterol (TC)		Mg/dl	
2.	Triacylglyceride (TG)		Mg/dl	
3.	Low density lipoprotein (LDL-C)		Mg/dl	
4.	High density lipoprotein (HDL-C)		Mg/dl	

5.	Fasting blood sugar (FBS)		Mg/dl	
	Anthropometric Measurements			
6.	Body mass index (BMI)		kg/m^2	
7.	Blood pressure (BP)		(mmHg)	
8.	Waist circumference		Cm(inch)	

9.11. Principles of tests

- **CHOLESTEROL AND HDL-C**

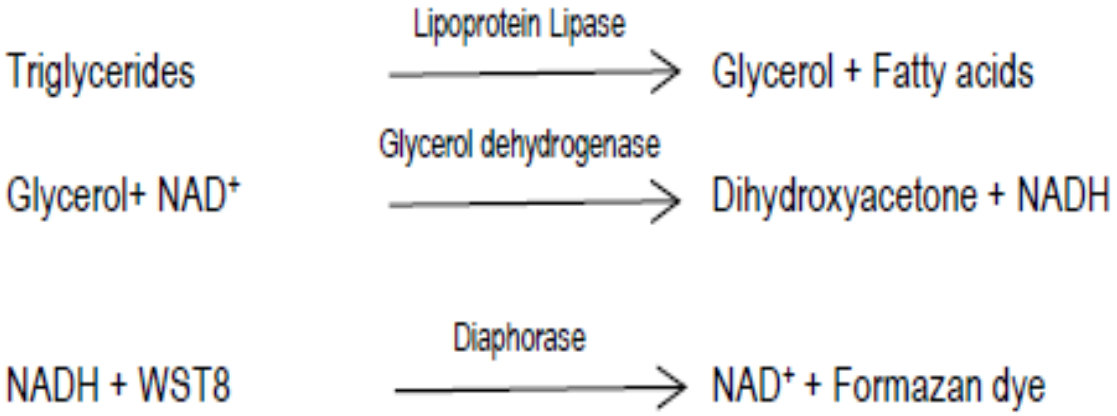
The venous blood samples are separated from the plasma by centrifugation. In the next step, the plasma sample is diluted with phosphate buffer. The HDL test uses a precipitation method with Mg2+ and phosphotungstic acid as a precipitant reagent. The components except for HDL-cholesterol are precipitated and removed. The **cobas c**311systems determine total cholesterol and HDL-cholesterol by an enzymatic method. Cholesterol esters in the sample are hydrolyzed to cholesterol and fatty acids. Cholesterol and NAD+ generate cholestenone and NADH in the presence of cholesterol dehydrogenase. WST8 is reduced to formazan dye by diaphorase and NADH through oxidation-reduction reaction. The color intensity of formazan is measured at a specific wave length of 460 nm and is directly proportional to the concentration of HDL-cholesterol and total cholesterol in the sample.



Appendix figure 1 Principle of Cholesterol esters

- **TRIACYLGLYCERIDE**

The triglycerides test is an enzymatic method. Triglycerides in the sample are hydrolyzed to glycerol and fatty acids by lipoprotein lipase. Glycerol and NAD+ generate dihydroxyacetone and NADH in the presence of glycerol dehydrogenase. WST8 is reduced to formazan dye by diaphorase and NADH through oxidation-reduction reaction. The color intensity of the formazan is proportional to triglyceride concentration and calculated by measuring at a wavelength of 460 nm.



Appendix figure 2Principle of Triglycerides

- **Low density lipoprotein (calculated)**

Where the concentration of triglycerides is < 400 mg/dL (4.52 mmol/L), the LDL cholesterol is calculated using the Friedewald formula. **LDL = TC - HDL – TG/5** (measured in mg/dL). Where the concentration of triglycerides is ≥ 400 mg/dL (4.52 mmol/L), the calculated LDL-cholesterol is not reported. The formula is also not valid for non-fasting patients and patients with Type III hyperlipoproteinemia (dysbetalipoproteinemia).

Total Cholesterol/HDL ratio and Non-high density lipoprotein

The **cobas c** 311 instruments calculate the TC/HDL ratio as well as the non-HDL cholesterol (TC - HDL) from the measured values. Where the measured values data are not available, the TC/HDL ratio or non-HDL-cholesterol values are not reported.

- **Reagents**

One test contains:

- Dilution buffer: potassium dihydrogenphosphate 57 µg, dipotassium hydrogenphosphate 0.3 mg, potassium chloride 2.2 mg, sodium azide 42 µg (≤ 0.02 %)
- Precipitant: magnesium sulfate heptahydrate 48 µg, sodium phosphotungstate n-hydrate 24 µg

- Lipoprotein-lipase 0.096 U, cholesterol esterase 0.5 U, diaphorase 0.77 U, nicotinamide adenine dinucleotide 51 µg, tetrazolium salt 38 µg, glycerol dehydrogenase 0.75 U, cholesterol dehydrogenase 0.84 U

Precautions and warnings

For in vitro diagnostic use. Exercise the normal precautions required for handling all laboratory reagents. Disposal of all waste material should be in accordance with local guidelines. Safety data sheet available for professional user on request.

Handling

- Carefully tear open the foil pouch at the tear notch until one side is open.
- Discard the disc if the foil pouch is found open or damaged, or if the disc is damaged, or the desiccant is missing, or loose desiccant particles or any other dirt or particles especially at the blood application zone are found.
- Use **cobas** Lipid Control in the same way as a blood sample.

Storage and stability

Store at 2-30 °C until the expiration date printed on the pouch. Do not freeze. If stored in a refrigerator, allow the test to warm up in the closed pouch for at least 20 minutes before use. Once the pouch is opened, use the test within 20 minutes. Protect the disc from direct sunlight. Do not store opened pouches in a refrigerator.

TEST PROCEDURE

Draw Volume: 1.5 mL (Minimum: 0.6 mL) blood
Processed Volume: 0.5 mL (Minimum: 0.2 mL) plasma/serum
Special Processing: Lab Staff: Centrifuge specimen, remove plasma/serum aliquot into a plastic sample cup. Sample to be run within 2 hours.
Patient Preparation: Patient should be on a stable diet for 3 weeks, and fast 8-12 hours before collection, recommended.
Sample Rejection: Mislabeled or unlabeled specimen and hemolyzed blood.

APPENDIX 4Reference Range for lipid profile

Analytes	All Ages	Range
Total cholesterol	Normal	42-199
	Abnormal	≥200
HDL-Cholesterol	Normal	<40
	Abnormal	≥40
LDL-Cholesterol	Normal	<130
	Abnormal	≥130
TG	Normal	<200
	Abnormal	>200

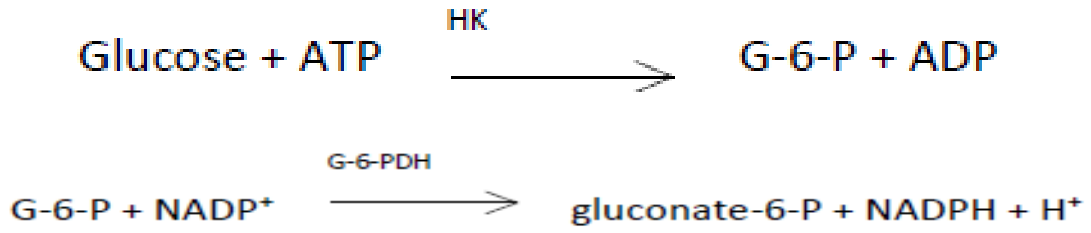
Hexokinase

Purpose

This method is intended for the in vitro test for the quantitative determination of glucose in human serum and plasma. It is performed on the **Roche Cobas C311** system in the Diagnostic Laboratory.

Principle

The cobas c311 performs a UV test to detect glucose in blood serum and plasma. The enzyme hexokinase (HK) catalyzes the reaction between glucose and adenosine triphosphate (ATP) to form glucose-6-phosphate (G-6-P) and adenosine diphosphate (ADP). In the presence of nicotinamide adenine dinucleotide (NAD), G-6-P is oxidized by the enzyme glucose-6-phosphate dehydrogenase (G-6-PD) to 6-phosphogluconate and reduced nicotinamide adenine dinucleotide (NADH). The increase in NADH concentration is directly proportional to the glucose concentration and can be measured spectrophotometrically at 340 nm.



Appendix figure 3Principle of Glucose

Handling

1. **Patient Preparation**

- Patients should be fasting.
- Patient's status should be recorded when specimen is drawn.

2. **Specimen Type**

- Collect blood by venipuncture from individuals using an evacuated tube system
- The minimum volume required for analysis directly from collection tube is 200 µL.

Reference Ranges:

1. Reference ranges for fasting individuals: Normal: < 100 mg/dL
2. Pre-diabetic (impaired fasting glucose): 100-125 mg/dL
3. Diabetic: ≥ 126 mg/dL

Procedures for Abnormal Results:

1. Critical Value Adults and Children: < 40mg/dL or > 400mg/dL
2. Critical results must be repeated and verified.

Reporting Format:

i. Results are expressed on the report as mg/dL

ii. Measuring range for Plasma: 2-600 mg/dL without dilution

1. Reanalyze samples containing more than 600 mg/dL by diluting the specimen two-fold (1+1) with distilled water. The result output must then be multiplied by 2 to account for the dilution.
2. Lower detection limit: 2 mg/dL